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A COMPUTER PROGRAM FOR SIMULATING SALINITY LOADS IN STREAMS

By Kent C. Glover

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A COMPUTER PROGRAM FOR SIMULATING SALINITY LOADS IN STEAMS

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ABSTRACT

A FORTRAN IV program that simulates salinity loads in streams is described. Daily values of stream-discharge in cubic feet per second, or stream-discharge and specific conductance in micromhos, are used to estimate daily loads in tons by one of five available methods. The loads are then summarized by computing either total and mean monthly loads or various statistics for each calendar day. Results are output in tabular and, if requested, punch card format. User selection of appropriate methods for estimating and summarizing daily loads is provided through the coding of program control cards. The program is designed to interface directly with data retrieved from the U.S. Geological Survey WATSTORE Daily Values File.

INTRODUCTION

A common problem facing the water planner is the estimation of stream-salinity loads from limited water-quality data. These data usually consist of analyses of the major inorganic constituents from discrete samples collected at monthly intervals. Estimation of loads directly from these data will not account for the natural variability in composition of streamflow between sample collections. Numerous techniques have been described to estimate daily loads indirectly from some relationship of concentration to mean daily discharge or specific conductance (DeLong, 1977; Steele, 1973). By using one of these techniques, it is possible to obtain fairly accurate estimates of salinity loads. The large number of calculations involved in estimating daily loads over several years indicates the need for a digital computer program. This is even more apparent if the daily loads are to be summarized in a useful form. The purpose of this report is to document a FORTRAN IV program that computes and summarizes daily salinity loads in tons from daily values of stream-discharge in cubic feet per second, or stream-discharge and specific conductance in micromhos. The program is called DVLOAD.

PROGRAM DESCRIPTION

The purpose of program DVLOAD is to produce a useful summary of daily salinity loads in tons. This is accomplished by the inclusion of numerous computational and output options that the user can specify through program control cards. These options are described in the following sections. A program flow chart is given in figure 1.

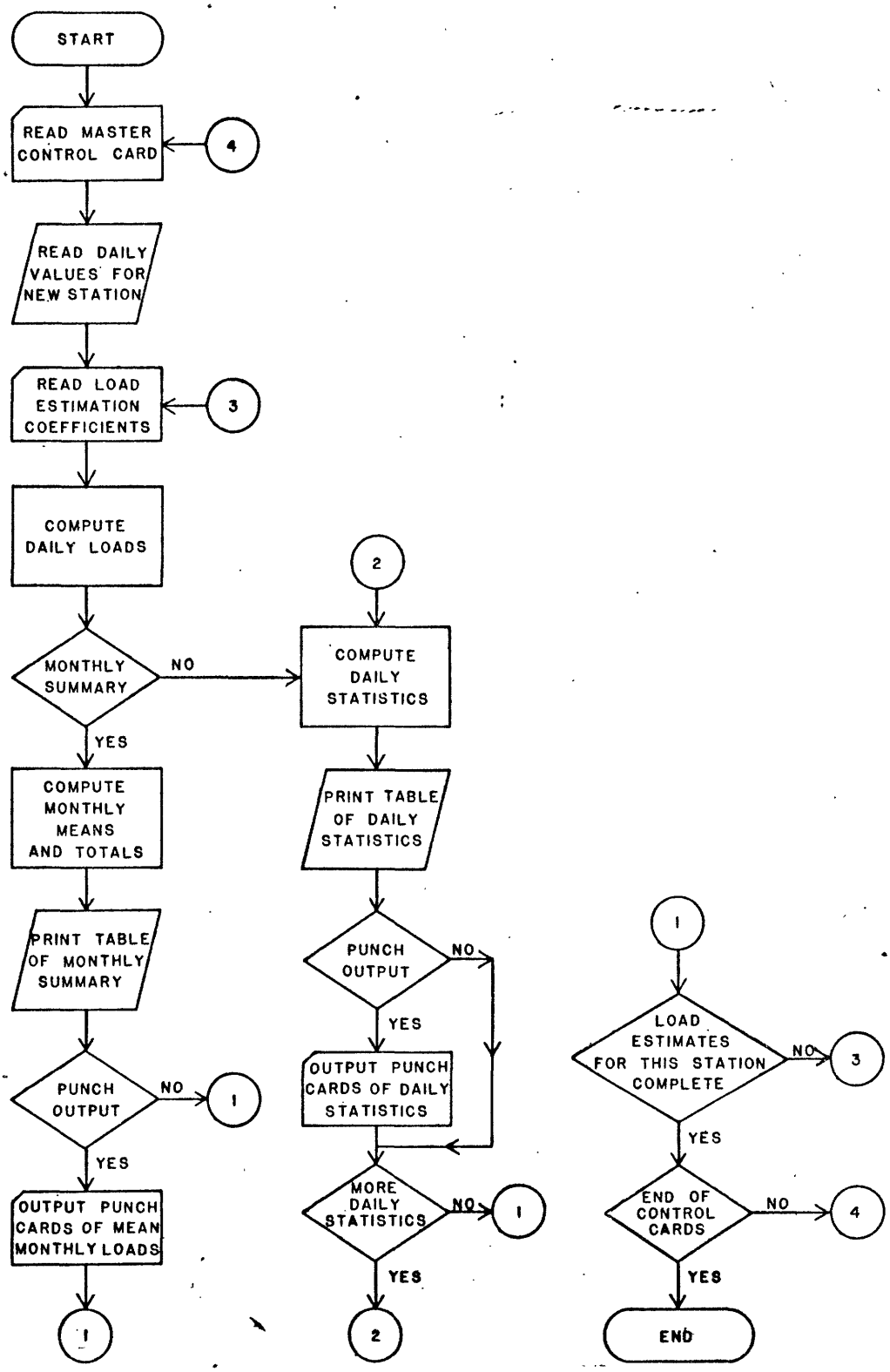

Figure 1.--Flow chart for DVLOAD program

Data Requirements

Data requirements include a record of daily values of stream-discharge in cubic feet per second, or stream-discharge and specific conductance in micromhos. The record format is the U.S. Geological Survey WATSTORE Daily Values monthly character format (Hutchison, 1975). This allows the user to retrieve data from the WATSTORE system and compute stream loads in a single job without reformatting the data.

Program DVLOAD has been written to allow wide variations in the length of record retrieved from the Daily Values File and is tolerant of large periods of missing data. Program options allow for the estimation of loads for any number of different sites with as many as forty years of record for each site. If more than 40 years of record are required the computer program must be modified. If a period of missing data is encountered, DVLOAD will not estimate loads for the period. The load summaries produced by DVLOAD will not be based on this period. Water years with greater than 20 percent missing data are flagged by DVLOAD.

Daily Load Estimation

The selection of a method for estimating daily loads is left as a user option. One or more of the available methods can be applied to data at a single site. In this manner, comparisons of different estimation techniques can be made. The five procedures are:

Option no. 1--useable only if discharge and specific conductance data are available.

$$C = E + F\,K$$

$$L = 0.0027\,C\,Q$$

Option no. 2

$$\log(C) = B_0 + B_1 \sin(at) + B_2 \cos(at) + [B_3 + B_4 \sin(at) + B_5 \cos(at)] \log(Q)$$

$$L = 0.0027\,C\,Q$$

Option no. 3

$$\log(K) = B_0 + B_1 \sin(at) + B_2 \cos(at) + [B_3 + B_4 \sin(at) + B_5 \cos(at)] \log(Q)$$

$$C = E + F\,K$$

$$L = 0.0027\,C\,Q$$

Option no. 4

$$C = B_0 + B_1 \sin(at) + B_2 \cos(at) + [B_3 + B_4 \sin(at) + B_5 \cos(at)]/Q$$

$$L = 0.0027\,C\,Q$$

Option no. 5

$$K = B_0 + B_1 \sin(at) + B_2 \cos(at) + [B_3 + B_4 \sin(at) + B_5 \cos(at)]/Q$$

$$C = E + F\,K$$

$$L = 0.0027\,C\,Q$$

Where B_o through B_5, E and F = regression coefficients, supplied by the user

C = concentration, in milligrams per liter

K = specific conductance, in micromhos per centimeter at 25°C

Q = daily mean discharge, in cubic feet per second

t = water-year day (table 1)

a = 0.0172 radians per day

L = daily load, in tons per day

One commonly used technique for estimating loads from values of discharge is to use the equation

$$\log (C) = B_o + B_3 \log (Q)$$

where the variables are defined as above. This can be accomplished by using option number 2 and setting B_1, B_2, B_4, and B_5 to zero. The affect of using the more complex equation with all coefficients nonzero is to introduce a harmonic function that describes seasonal trends (DeLong, 1977).

Table 1.--Sequence number conversion, date to water-year day

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
1	1	32	62	93	124	152	183	213	244	274	305	336
2	2	33	63	94	125	153	184	214	245	275	306	337
3	3	34	64	95	126	154	185	215	246	276	307	338
4	4	35	65	96	127	155	186	216	247	277	308	339
5	5	36	66	97	128	156	187	217	248	278	309	340
6	6	37	67	98	128	157	188	218	249	279	310	341
7	7	38	68	99	130	158	189	219	250	280	311	342
8	8	39	69	100	131	159	190	220	251	281	312	343
9	9	40	70	101	132	160	191	221	252	282	313	344
10	10	41	71	102	133	161	192	222	253	283	314	345
11	11	42	72	103	134	162	193	223	254	284	315	346
12	12	43	73	104	135	163	194	224	255	285	316	347
13	13	44	74	105	136	164	195	225	256	286	317	348
14	14	45	75	106	137	165	196	226	257	287	318	349
15	15	46	76	107	138	166	197	227	258	288	319	350
16	16	47	77	108	139	167	198	228	259	289	320	351
17	17	48	78	109	140	168	199	229	260	290	321	352
18	18	49	79	110	141	169	200	230	261	291	322	353
19	19	50	80	111	142	170	201	231	262	292	323	354
20	20	51	81	112	143	171	202	232	263	293	324	355
21	21	52	82	113	144	172	203	233	264	294	325	356
22	22	53	83	114	145	173	204	234	265	295	326	357
23	23	54	84	115	146	174	205	235	266	296	327	358
24	24	55	85	116	147	175	206	236	267	297	328	359
25	25	56	86	117	148	176	207	237	268	298	329	360
26	26	57	87	118	149	177	208	238	269	299	330	361
27	27	58	88	119	150	178	209	239	270	300	331	362
28	28	59	89	120	151	179	210	240	271	301	332	363
29	29	60	90	121	(152)	180	211	241	272	302	333	364
30	30	61	91	122	---	181	212	242	273	303	334	365
31	31	--	92	123	---	182	---	243	---	304	335	---

Note: For months of March through September add one (1) to number in table for sequence conversion of days for leap years.

Statistics Computation

Once a set of daily load estimates is completed for a site DVLOAD will summarize it by one of two user specified procedures. The first procedure computes total and mean loads for each month of record. Days for which no load is computed, because of missing discharge or specific conductance record, are not used in calculating mean monthly loads. Total monthly load is determined by assuming that the mean load extends over the entire month. A similar procedure is followed to determine annual loads. Mean and total loads are computed regardless of the amount of missing data.

The second method available to summarize daily loads is to compute various statistical parameters for each water year day. This option allows the user to obtain an idea of how load varies seasonally over the entire period of record. The statistics that the user may select are the maximum daily load, minimum daily load and the mean daily load. If three or more years of data are available, the user may also request the variance, standard deviation, coefficient of variation, and skewness coefficient for each day. As with the monthly summaries, statistics are not based on periods of missing data.

Program Output

DVLOAD produces output in two forms. Printed tables of the appropriate load summary are output. Examples of line printer output are given in a later section (tables 5 and 6). An option is also available to produce punch cards of statistics in a format suitable for use in other FORTRAN programs or with off-line equipment.

The format of punch card output shown in figure 2 is described below:

Columns	Description
1 - 15	Station indentification number, right justified.
16, 28, 40, 52	Blank
17 - 27, 29 - 39, 41 - 51, 53 - 63	Monthly or daily statistics using a G11.4 FØRTRAN format specification.
64 - 80	Blank

If a monthly summary is requested, the four values represent mean monthly loads. A combination of three cards, therefore, represents the mean monthly loads over a single water year. Each group of three cards is preceded by a card indicating the load estimation technique used and the water year. If a daily statistic summary is requested, then eight punch cards are used to represent the daily statistic for a month. Depending upon the month, values for days 29 through 32 may have no meaning. To denote this, negative values are punched. Each card deck representing the range of a statistic over the water year is preceded by a title card. An example of punch card output is presented in a later section (table 7).

PROGRAM USE

Program DVLOAD is intended for use by hydrologists and water planners and involves a minimum of effort in data input preparation. For this reason, it was designed to interface directly with output from the Geological Survey WATSTORE Daily Values File retrieval program (Hutchison, 1975). By doing this, the user of Geological Survey data need only be concerned with obtaining estimates for the equation coefficients used in calculating daily loads, retrieving the proper daily values, and applying the load program. For the purpose of this discussion, it is assumed that the equation coefficients have been estimated by the least squares technique, Newton's method, or another appropriate procedure.

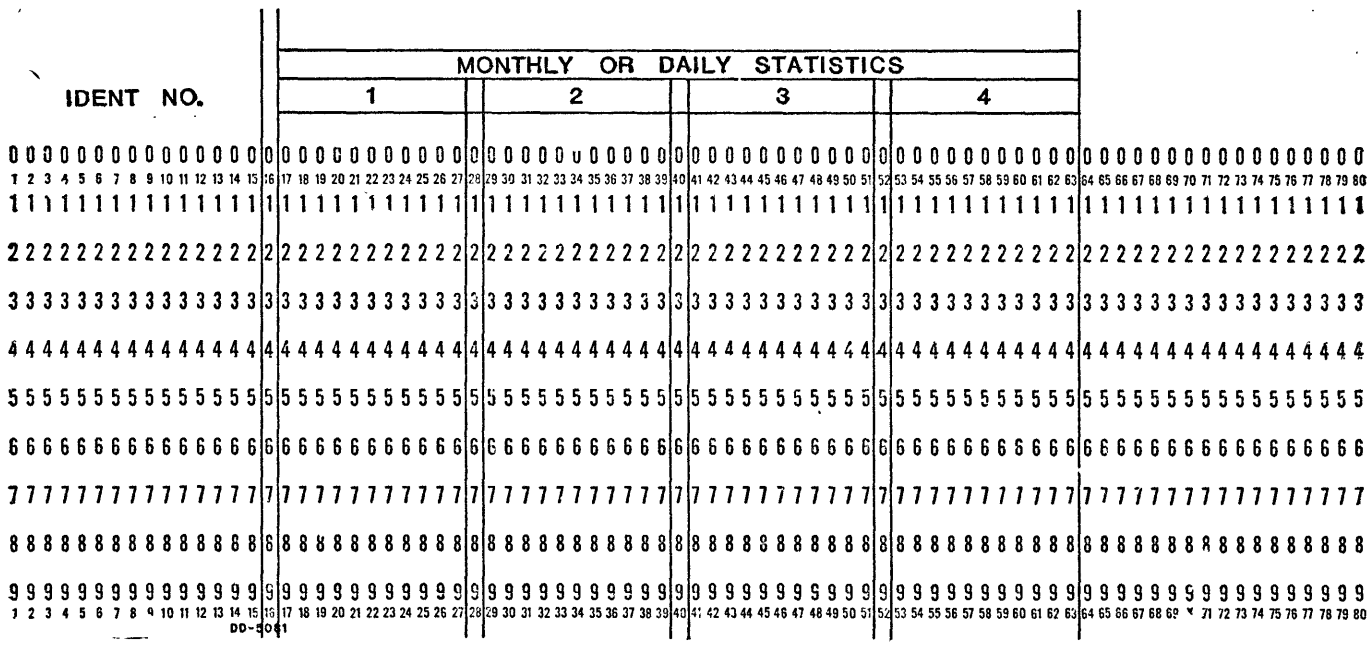

Figure 2.--Format of punch card output

Retrieval of Daily Values

The Daily Values File retrieval program has been well documented (Hutchison, 1975). Application of DVLOAD requires that several additional restrictions be placed on the retrieval process. Data retrieved from the Daily Values File must be passed to the load program in the monthly character format (table 2). As many stations as desired may be processed in a single job. If more than 40 years of data are retrieved for a station the computer program must be modified. Care must be taken to insure that the order of stations retrieved from the Daily Values File corresponds with the DVLØAD program control cards described below. If they do not correspond, an error message will be printed and program execution will stop.

Program Control Cards

The program control cards allow the user to select options described previously. Two types of control cards must be coded for each station that is to be processed. The master control card contains information about a particular station and describes the type of load summary to be used for the station. Only one master control card per station is coded. The load estimation control card is used to define the procedure followed in computing daily loads and to define the equation coefficients used in the procedure. It follows the master control card and may be repeated as often as desired for each station and parameter. The sets of master and load estimation control cards must be ordered to correspond with the order of sites on the monthly character file of daily values described previously. A detailed discussion of the control card formats is presented in a later section.

Table 2.--Monthly character format

Byte position	Format	Name	Description
9 - 23	3A4, A3	ID	Station identification number
38 - 42	I5	ITEST	STORET EPA parameter code
43 - 46	I4	K	Calendar year
47 - 48	I2	J	Month number
61 - 277	31A7	VALUE(31)	Thirty-one daily values (7 characters each). Decimal point is included when applicable. A blank field indicates no value stored.

CONTROL CARD FORMATS

Master Control Card

Columns	Format	Name	Description
1-15	3A4, A3	SITEID(4)	Station identification number, right justified
17	I1	ITYPE	Code "1" to compute monthly summary. Leave blank for daily statistics.
19	I1	ISTAT(1)	Code "1" to compute maximum daily loads or card output of mean monthly loads, depending on the load summary requested.
20	I1	IPUNCH(1)	Code "1" for card output of maximum daily loads.
22	I1	ISTAT(2)	Code "1" to compute minimum daily loads.
23	I1	IPUNCH(2)	Code "1" for card output of minimum daily loads.
25	I1	ISTAT(3)	Code "1" to compute mean daily loads.
26	I1	IPUNCH(3)	Code "1" for card output of mean daily loads.
28	I1	ISTAT(4)	Code "1" to compute the variance of daily loads.
29	I1	IPUNCH(4)	Code "1" for card output of variance.
31	I1	ISTAT(5)	Code "1" to compute the standard deviation of daily loads.
32	I1	IPUNCH(5)	Code "1" for card output of standard deviations.
34	I1	ISTAT(6)	Code "1" to compute the coefficient of variation of daily loads.
35	I1	IPUNCH(6)	Code "1" for card output of coefficients of variation.

Master Control Card--continued

Columns	Format	Name	Description
37	I1	ISTAT(7)	Code "1" to compute the coefficient of skewness of daily loads.
38	I1	IPUNCH(7)	Code "1" for card output of coefficients of skewness.
39-43	I5	IPAR	EPA STORET code for specific conductance. If not needed, leave blank.

oad Estimation Control Card

olumns	Format	Name	Description
1	I1	IOPT	Option number for load estimates.
5-13	F9.4	CONST(1)	Coefficient B_o
14-22	F9.4	CONST(2)	Coefficient B_1
23-31	F9.4	CONST(3)	Coefficient B_2
32-40	F9.4	CONST(4)	Coefficient B_3
41-49	F9.4	CONST(5)	Coefficient B_4
50-58	F9.4	CONST(6)	Coefficient B_5
59-67	F9.4	CONST(7)	Coefficient E
68-76	F9.4	CONST(8)	Coefficient F
80	I1	IZ	Code "1" to indicate the last load estimation control card for a station. Otherwise leave blank.

Recommended Job Control Language

The following job control cards are recommended for running program DVLOAD with data stored in the WATSTORE daily values file. In addition to the following statements, the user must supply a JOB card and any applicable ROUTE or RELAY cards.

```
/*SETUP    tape no./9
/*PRØCLIB  WRD.PRØCLIB
// EXEC DVRETR,AGENCY=USGS,VØL1=tape no.
//HDR.SYSIN DD *
```

Retrieval Cards

```
/*
//DVR.TAPE7 DD DSN=&&TAPE,UNIT=SYSDK,DISP=(,PASS),SPACE=(TRK,(10,1)),
// DCB=(RECFM=FB,LRECL=408,BLKSIZE=8160,DEN=,TRTCH=),VØL=SER=,LABEL=
// EXEC FTG1CLG,REGIØN.GØ=250K
//FØRT.SYSIN DD *
```

DVLØAD Fortran Source Deck

```
/*
//GØ.FT01F001 DD DSN=&&TAPE,UNIT=SYSDK,DISP=(ØLD,PASS)
//GØ.FT02F001 DD DSN=&&WØRK,UNIT=SYSDK,DISP=(,DELETE),
// DCB=(RECFM=F,LRECL=220,BLKSIZE=220),SPACE=(TRK,(1,1))
//GØ.SYSIN DD *
```

Program Control Cards

```
/*
```

Program DVLOAD has been stored on SYS1.LOADLIB on the U.S. Geological Survey Reston 2 computer. This eliminates the need to compile the FORTRAN source deck with each computer run. To use this load module, remove the statements

```
//EXEC FTG1CLG,REGIØN.GØ=250K
//FØRT.SYSIN DD *
```

DVLØAD Fortran Source Deck

```
/*
```

from the above job control cards. Replace them with the statement

```
//EXEC FØRTRUN, PRØG=K344,REGIØN.GØ=230K
```

EXAMPLE

This example demonstrates the use of the load program to estimate and summarize daily loads of dissolved solids at two locations in the Green River Basin of southwestern Wyoming. The program options used at each location are shown in table 3. Equation coefficients used to estimate daily loads are provided by DeLong (1977 p 30.31). Control cards for both the WATSTORE daily values retrieval program and the load program are presented in table 4. Line printer output is shown in tables 5 and 6 while punch card output is presented in table 7. The program was run on the U.S. Geological Survey IBM 370-155 computer at Reston, Virginia, using the Job Control Language described in this report at a cost of approximately $12.

Table 3.--Program options used in example problem

	09188500 - Green River at Warren Bridge, near Daniel, Wyo.	09216000 - Big Sandy River below Eden, Wyo.
Period of record	1970-73	1955-75
Daily load estimate method	Option no. 2	Option no. 2.
Type of load summary	Monthly	Mean daily statistics.
Type of punch card output	No punch card output	Punch card output of means.

Table 4.--Listing of control cards for example problem

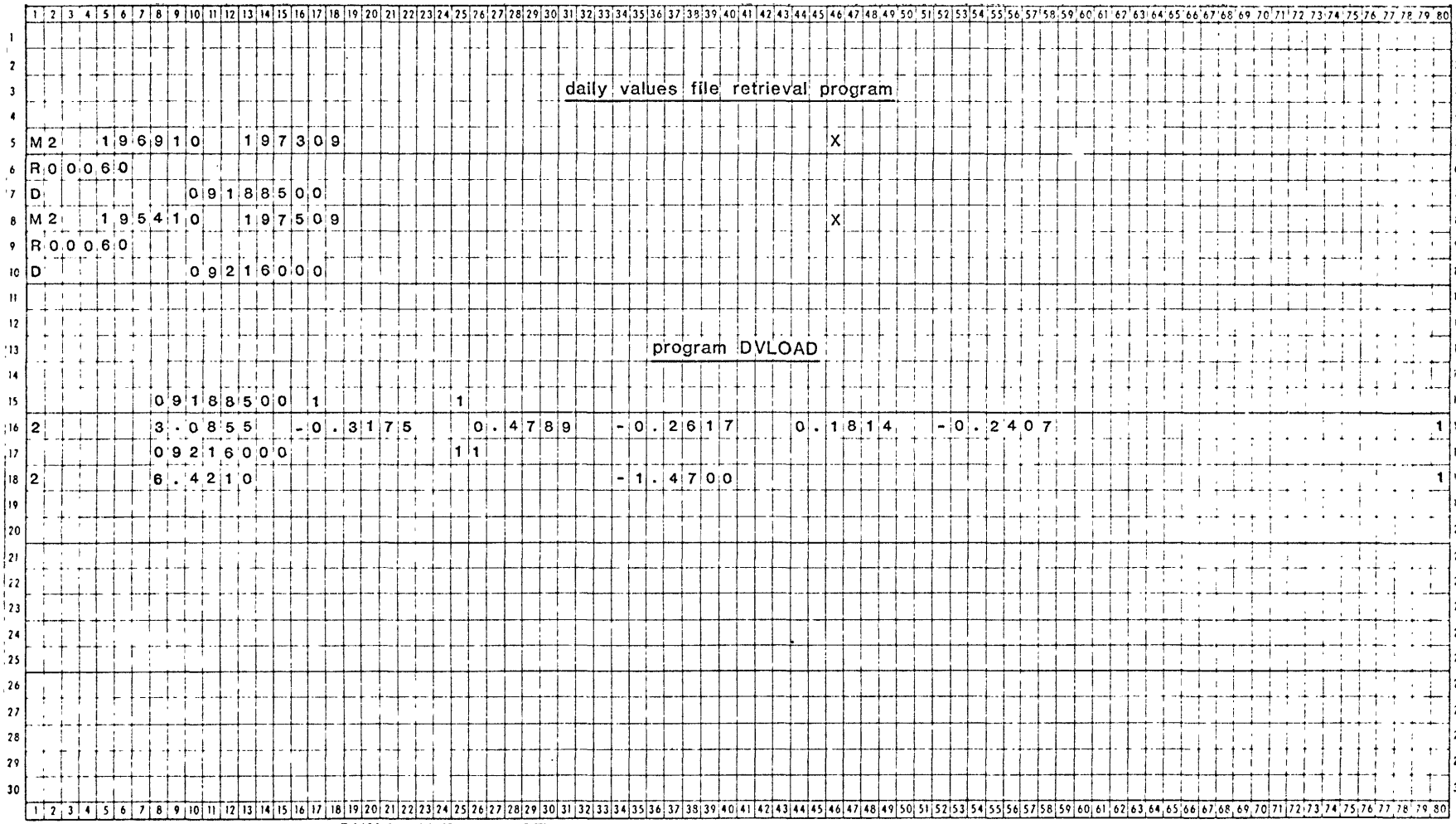

Table 5.--Line printer output for example problem, monthly summary

STATION NUMBER : 09188500
AVERAGES ARE COMPUTED FROM THE NUMBER OF DAYS OF RECORD
TOTALS ARE COMPUTED BY ASSUMING THE AVERAGE OVER THE ENTIRE MONTH

WATER YEAR 1970 TOTAL ANNUAL LOAD (TON) = 0.7402E+05 MEAN ANNUAL CONCENTRATION (MG/L) =0.1659E+03

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
AVERAGE (TON/D)	131.	105.	83.8	99.5	115.	124.	122.	451.	561.	307.	175.	156.
TOTAL (TON)	.406E+04	.316E+04	.260E+04	.309E+04	.321E+04	.383E+04	.367E+04	.140E+05	.168E+05	.952E+04	.541E+04	.467E+04

WATER YEAR 1971 TOTAL ANNUAL LOAD (TON) = 0.9508E+05 MEAN ANNUAL CONCENTRATION (MG/L) =0.1398E+03

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
AVERAGE (TON/D)	131.	133.	147.	129.	102.	118.	165.	643.	771.	374.	231.	171.
TOTAL (TON)	.406E+04	.399E+04	.456E+04	.400E+04	.285E+04	.367E+04	.496E+04	.199E+05	.231E+05	.116E+05	.718E+04	.512E+04

WATER YEAR 1972 TOTAL ANNUAL LOAD (TON) = 0.1024E+06 MEAN ANNUAL CONCENTRATION (MG/L) =0.1547E+03

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
AVERAGE (TON/D)	157.	157.	123.	129.	119.	168.	255.	723.	806.	326.	216.	179.
TOTAL (TON)	.486E+04	.472E+04	.381E+04	.400E+04	.346E+04	.522E+04	.765E+04	.224E+05	.242E+05	.101E+05	.668E+04	.536E+04

WATER YEAR 1973 TOTAL ANNUAL LOAD (TON) = 0.8123E+05 MEAN ANNUAL CONCENTRATION (MG/L) =0.1827E+03

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
AVERAGE (TON/D)	180.	168.	141.	131.	123.	120.	136.	565.	449.	292.	186.	170.
TOTAL (TON)	.559E+04	.504E+04	.436E+04	.405E+04	.345E+04	.373E+04	.408E+04	.175E+05	.135E+05	.904E+04	.577E+04	.511E+04

Table 6.--Line printer output for example problem, daily statistics

STATION NUMBER : 09216000
STATISTIC : MEAN
BASED ON WATER YEARS 1955 THRU 1975

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
1	1.49E+03	1.60E+03	1.79E+03	2.61E+03	2.87E+03	3.00E+03	1.00E+03	1.43E+03	1.43E+03	1.04E+03	1.26E+03	1.40E+03
2	1.50E+03	1.59E+03	1.79E+03	2.67E+03	2.88E+03	2.71E+03	988.	1.47E+03	1.39E+03	1.04E+03	1.28E+03	1.39E+03
3	1.49E+03	1.56E+03	1.81E+03	2.75E+03	2.85E+03	2.60E+03	1.01E+03	1.49E+03	1.38E+03	1.03E+03	1.29E+03	1.39E+03
4	1.50E+03	1.57E+03	1.82E+03	2.85E+03	2.99E+03	2.55E+03	1.06E+03	1.51E+03	1.39E+03	1.03E+03	1.28E+03	1.41E+03
5	1.50E+03	1.64E+03	1.85E+03	2.82E+03	3.01E+03	2.38E+03	1.07E+03	1.48E+03	1.36E+03	1.04E+03	1.27E+03	1.42E+03
6	1.51E+03	1.63E+03	1.85E+03	2.77E+03	2.82E+03	2.24E+03	1.06E+03	1.49E+03	1.34E+03	1.04E+03	1.28E+03	1.41E+03
7	1.50E+03	1.58E+03	1.92E+03	2.77E+03	2.75E+03	2.16E+03	1.05E+03	1.51E+03	1.31E+03	1.05E+03	1.27E+03	1.42E+03
8	1.51E+03	1.61E+03	2.00E+03	2.73E+03	2.63E+03	2.13E+03	1.01E+03	1.50E+03	1.27E+03	1.08E+03	1.29E+03	1.44E+03
9	1.48E+03	1.59E+03	2.02E+03	2.71E+03	2.66E+03	2.08E+03	1.05E+03	1.49E+03	1.18E+03	1.10E+03	1.30E+03	1.45E+03
10	1.48E+03	1.59E+03	2.02E+03	2.75E+03	2.69E+03	2.05E+03	1.06E+03	1.50E+03	1.21E+03	1.10E+03	1.29E+03	1.44E+03
11	1.49E+03	1.62E+03	2.12E+03	2.78E+03	2.73E+03	2.08E+03	1.06E+03	1.53E+03	1.22E+03	1.12E+03	1.31E+03	1.43E+03
12	1.53E+03	1.61E+03	2.13E+03	2.79E+03	2.91E+03	2.05E+03	1.08E+03	1.55E+03	1.20E+03	1.12E+03	1.31E+03	1.41E+03
13	1.53E+03	1.63E+03	2.14E+03	2.79E+03	2.79E+03	2.03E+03	1.09E+03	1.53E+03	1.16E+03	1.11E+03	1.31E+03	1.40E+03
14	1.53E+03	1.65E+03	2.16E+03	2.77E+03	2.78E+03	1.95E+03	1.10E+03	1.52E+03	1.12E+03	1.12E+03	1.30E+03	1.41E+03
15	1.53E+03	1.64E+03	2.17E+03	2.82E+03	2.82E+03	1.91E+03	1.14E+03	1.52E+03	1.09E+03	1.14E+03	1.30E+03	1.42E+03
16	1.53E+03	1.66E+03	2.15E+03	2.89E+03	2.95E+03	1.87E+03	1.16E+03	1.56E+03	1.05E+03	1.15E+03	1.31E+03	1.42E+03
17	1.53E+03	1.65E+03	2.13E+03	2.94E+03	2.94E+03	1.81E+03	1.16E+03	1.60E+03	1.04E+03	1.17E+03	1.32E+03	1.40E+03
18	1.54E+03	1.64E+03	2.15E+03	2.96E+03	2.89E+03	1.79E+03	1.17E+03	1.62E+03	1.05E+03	1.19E+03	1.32E+03	1.42E+03
19	1.54E+03	1.66E+03	2.16E+03	3.24E+03	2.90E+03	1.72E+03	1.21E+03	1.63E+03	1.05E+03	1.20E+03	1.30E+03	1.40E+03
20	1.52E+03	1.69E+03	2.15E+03	3.11E+03	2.90E+03	1.63E+03	1.24E+03	1.66E+03	1.08E+03	1.19E+03	1.29E+03	1.42E+03
21	1.52E+03	1.66E+03	2.19E+03	3.03E+03	2.78E+03	1.50E+03	1.27E+03	1.61E+03	1.10E+03	1.17E+03	1.28E+03	1.43E+03
22	1.51E+03	1.67E+03	2.24E+03	3.02E+03	2.91E+03	1.44E+03	1.28E+03	1.59E+03	1.11E+03	1.16E+03	1.29E+03	1.45E+03
23	1.59E+03	1.69E+03	2.25E+03	2.95E+03	2.86E+03	1.39E+03	1.30E+03	1.58E+03	1.11E+03	1.16E+03	1.29E+03	1.45E+03
24	1.56E+03	1.68E+03	2.25E+03	2.92E+03	3.12E+03	1.34E+03	1.28E+03	1.56E+03	1.08E+03	1.16E+03	1.30E+03	1.45E+03
25	1.55E+03	1.67E+03	2.21E+03	2.95E+03	2.81E+03	1.29E+03	1.30E+03	1.58E+03	1.08E+03	1.16E+03	1.30E+03	1.45E+03
26	1.52E+03	1.67E+03	2.25E+03	2.93E+03	3.10E+03	1.25E+03	1.33E+03	1.51E+03	1.07E+03	1.19E+03	1.33E+03	1.45E+03
27	1.53E+03	1.70E+03	2.29E+03	3.00E+03	3.09E+03	1.21E+03	1.34E+03	1.51E+03	1.06E+03	1.20E+03	1.35E+03	1.46E+03
28	1.54E+03	1.74E+03	2.36E+03	3.21E+03	3.05E+03	1.16E+03	1.36E+03	1.53E+03	1.05E+03	1.21E+03	1.35E+03	1.48E+03
29	1.58E+03	1.76E+03	2.41E+03	3.24E+03	5.77E+03	1.16E+03	1.38E+03	1.46E+03	1.04E+03	1.24E+03	1.36E+03	1.49E+03
30	1.60E+03	1.77E+03	2.47E+03	3.27E+03	-1.00E+20	1.15E+03	1.39E+03	1.45E+03	1.05E+03	1.25E+03	1.38E+03	1.48E+03
31	1.60E+03	-1.00E+20	2.57E+03	3.02E+03	-1.00E+20	1.11E+03	-1.00E+20	1.45E+03	-1.00E+20	1.24E+03	1.39E+03	-1.00E+20

Table 7.--Punch card output for example problem

```
09216000 / MEAN     LOAD OPTION =  2
09216000   1493.       1503.        1494.        1497.
09216000   1504.       1513.        1503.        1512.
09216000   1480.       1475.        1487.        1528.
09216000   1529.       1529.        1531.        1527.
09216000   1533.       1542.        1537.        1517.
09216000   1517.       1514.        1592.        1557.
09216000   1552.       1522.        1531.        1538.
09216000   1583.       1598.        1601.       -.1000E+21
09216000   1603.       1586.        1565.        1568.
09216000   1637.       1631.        1580.        1611.
09216000   1586.       1593.        1624.        1607.
09216000   1626.       1651.        1636.        1660.
09216000   1651.       1642.        1658.        1686.
09216000   1660.       1675.        1688.        1684.
09216000   1668.       1670.        1705.        1739.
09216000   1759.       1768.       -.1000E+21   -.1000E+21
09216000   1789.       1794.        1806.        1822.
09216000   1849.       1853.        1923.        1998.
09216000   2024.       2022.        2120.        2127.
09216000   2139.       2160.        2173.        2147.
09216000   2133.       2154.        2163.        2153.
09216000   2192.       2240.        2249.        2249.
09216000   2205.       2245.        2295.        2359.
09216000   2405.       2467.        2568.       -.1000E+21
09216000   2607.       2673.        2753.        2854.
09216000   2824.       2775.        2771.        2734.
09216000   2706.       2749.        2779.        2794.
09216000   2790.       2767.        2819.        2893.
09216000   2942.       2961.        3237.        3108.
09216000   3027.       3016.        2955.        2919.
09216000   2955.       2926.        2998.        3206.
09216000   3243.       3267.        3016.       -.1000E+21
09216000   2871.       2878.        2850.        2991.
09216000   3005.       2816.        2750.        2628.
09216000   2661.       2692.        2726.        2910.
09216000   2790.       2778.        2822.        2949.
09216000   2944.       2888.        2901.        2905.
09216000   2781.       2908.        2863.        3120.
09216000   2812.       3104.        3090.        3046.
09216000   5773.      -.1000E+21   -.1000E+21   -.1000E+21
09216000   3004.       2707.        2602.        2548.
09216000   2384.       2238.        2164.        2130.
09216000   2076.       2054.        2085.        2051.
09216000   2026.       1949.        1914.        1869.
09216000   1812.       1794.        1720.        1631.
09216000   1501.       1441.        1387.        1345.
09216000   1292.       1249.        1208.        1164.
09216000   1159.       1150.        1108.       -.1000E+21
09216000   1001.       988.3        1012.        1056.
09216000   1069.       1055.        1055.        1015.
09216000   1055.       1063.        1059.        1076.
09216000   1087.       1102.        1136.        1160.
09216000   1158.       1173.        1211.        1243.
09216000   1266.       1282.        1299.        1282.
09216000   1300.       1327.        1344.        1360.
09216000   1383.       1385.       -.1000E+21   -.1000E+21
```

Table 7.--Punch card output for example problem--Continued

09216000	1432.	1465.	1494.	1507.
09216000	1484.	1495.	1513.	1499.
09216000	1488.	1500.	1533.	1551.
09216000	1535.	1523.	1517.	1563.
09216000	1596.	1622.	1635.	1660.
09216000	1613.	1587.	1583.	1562.
09216000	1579.	1510.	1511.	1527.
09216000	1464.	1454.	1451.	-.1000E+21
09216000	1426.	1394.	1383.	1390.
09216000	1358.	1336.	1312.	1272.
09216000	1181.	1210.	1224.	1200.
09216000	1165.	1119.	1089.	1053.
09216000	1038.	1050.	1050.	1076.
09216000	1101.	1114.	1110.	1084.
09216000	1077.	1077.	1064.	1049.
09216000	1041.	1049.	-.1000E+21	-.1000E+21
09216000	1039.	1044.	1026.	1030.
09216000	1040.	1039.	1053.	1079.
09216000	1098.	1100.	1117.	1122.
09216000	1111.	1124.	1143.	1154.
09216000	1166.	1192.	1200.	1194.
09216000	1171.	1161.	1161.	1160.
09216000	1164.	1190.	1198.	1209.
09216000	1236.	1247.	1244.	-.1000E+21
09216000	1261.	1276.	1292.	1283.
09216000	1269.	1284.	1274.	1291.
09216000	1295.	1285.	1309.	1310.
09216000	1310.	1298.	1302.	1315.
09216000	1315.	1318.	1297.	1289.
09216000	1284.	1290.	1290.	1301.
09216000	1297.	1326.	1348.	1346.
09216000	1357.	1375.	1390.	-.1000E+21
09216000	1397.	1390.	1393.	1410.
09216000	1418.	1408.	1424.	1440.
09216000	1450.	1436.	1428.	1408.
09216000	1396.	1405.	1420.	1418.
09216000	1404.	1418.	1403.	1422.
09216000	1429.	1453.	1454.	1455.
09216000	1451.	1447.	1463.	1477.
09216000	1487.	1479.	-.1000E+21	-.1000E+21

```
C                                                                       10
C     ************************************************************      20
C     ***********************       DVLOAD       ***********************  30
C     ************************************************************      40
C                                                                       50
C          PROGRAM TO ESTIMATE AND SUMMARIZE DAILY LOADS FROM           60
C          DAILY VALUES OF DISCHARGE OR DISCHARGE AND A SECOND          70
C          PARAMETER. ANY NUMBER OF STATIONS MAY BE PROCESSED           80
C          BY DVLOAD WITH UP TO 40 YEARS OF RECORD FOR EACH             90
C          STATION. DAILY OR MONTHLY STATISTICS ARE CALCULATED         100
C          AND OUTPUT IN TABULAR OR PUNCH CARD FORMAT. SEE THE         110
C          PROGRAM DOCUMENTATION FOR DETAILS ON INPUT FORMATS.         120
C          OPTIONS FOR ESTIMATING LOADS, COMPUTING STATISTICS AND      130
C          RECORDING RESULTS.                                          140
C                                                                      150
C     INPUT / OUTPUT                                                  160
C          UNIT 1 - DAILY VALUES MONTHLY TAPE FORMAT                  170
C          UNIT 2 - DIRECT ACCESS WORK FILE                           180
C          UNIT 5 - INPUT CONTROL CARDS                               190
C          UNIT 6 - LINE PRINTER OUTPUT                               200
C          UNIT 7 - CARD PUNCH OUTPUT                                 210
C                                                                     220
C     VARIABLES IN COMMON                                            230
C                                                                    240
C          Q       - ARRAY OF DISCHARGE                              250
C          P       - ARRAY OF SECOND PARAMETER USED IN LOAD          260
C                    COMPUTATION                                     270
C          LOAD    - ARRAY OF COMPUTED DAILY LOAD                    280
C          STAT    - ARRAY OF DAILY STATISTICS COMPUTED FROM LOAD    290
C          SITEID  - ARRAY OF STATION NUMBER                         300
C          IPAR    - STORET CODE OF SECOND PARAMETER USED IN LOAD    310
C                    COMPUTATION                                     320
C          IOPT    - OPTION NUMBER USED IN LOAD COMPUTATION          330
C          NYRS    - NUMBER OF YEARS OF RECORD RETRIEVED BY G490     340
C          INITYR  - INITIAL WATER YEAR RETRIEVED BY G490            350
C                                                                    360
C          PROGRAM DESIGNED FOR A MAXIMUM OF 40 YEARS OF             370
C          RECORD. TO INCREASE THIS CHANGE THE Q, P, LOAD, IYRRET AND 380
C          ISAVE ARRAYS, ADJUST THE CORE REQUIREMENTS AND REINITIALIZE 390
C          NYRMAX.                                                   400
C                                                                    410
      INTEGER SITEID(4),ISTAT(7),IPUNCH(7),IYRRET(40),ISAVE(40)      420
      REAL LOAD                                                      430
      DIMENSION CONST(8),Q(31,12,40),P(31,12,40),LOAD(31,12,40),     440
     $          STAT(31,12)                                         450
      COMMON Q,P,LOAD,STAT,SITEID,IPAR,IOPT,NYRS,INITYR,IYRRET       460
      DATA NYRMAX / 40 /                                             470
  100 DO 105 K=1,40                                                  480
      DO 105 J=1,12                                                  490
      DO 105 I=1,31                                                  500
      Q(I,J,K)=-99999.                                               510
      P(I,J,K)=-99999.                                               520
  105 CONTINUE                                                       530
      READ (5,10,END=600) SITEID,ITYPE,(ISTAT(I),IPUNCH(I),I=1,7),IPAR 540
      CALL STORE (NYRMAX)                                            550
  110 READ (5,11) IOPT,CONST,IZ                                      560
      WRITE (6,12) SITEID,IOPT,CONST                                 570
C                                                                    580
C     FILL LOAD ARRAY                                                590
C                                                                    600
```

```
      DO 121 K=1,NYRS                                                    610
      ISAVE(K)=IYRRET(K)                                                 620
      IF (IYRRET(K).EQ.0) GO TO 121                                      630
      MISS=0                                                             640
      LOADUM=0                                                           650
      DO 120 J=1,12                                                      660
      DO 120 I=1,31                                                      670
      CALL CONVRT (Q(I,J,K),P(I,J,K),LOAD(I,J,K),CONST,IOPT,I,J)         680
      IF (LOAD(I,J,K).GE.0.0) LOADUM=1                                   690
      IF (LOAD(I,J,K).LT.0.0) MISS=MISS+1                                700
  120 CONTINUE                                                           710
      IF (LOADUM.EQ.1) GO TO 122                                         720
      LOADUM=INITYR+K-1                                                  730
      WRITE (6,13) LOADUM,SITEID                                         740
      IYRRET(K)=0                                                        750
      GO TO 121                                                          760
  122 J=INITYR+K                                                         770
      I=365                                                              780
      IF (MOD(J,4).EQ.0) I=366                                           790
      J=J-1                                                              800
      IF ((MISS-372+I)/I.GT.0.2) WRITE (6,21) J                          810
  121 CONTINUE                                                           820
      IF (ITYPE.EQ.0) GO TO 200                                          830
      CALL MLOAD (ISTAT(1))                                              840
      GO TO 500                                                          850
  200 DO 201 K=1,NYRS                                                    860
      IF (IYRRET(K).EQ.1) GO TO 201                                      870
      J=INITYR+K-1                                                       880
      WRITE (6,20) J                                                     890
  201 CONTINUE                                                           900
      IF (ISTAT(1).EQ.0) GO TO 220                                       910
C                                                                        920
C     COMPUTE MAXIMUM DAILY LOADS                                        930
C                                                                        940
      DO 210 J=1,12                                                      950
      DO 210 I=1,31                                                      960
      STAT(I,J)=-1E20                                                    970
      DO 210 K=2,NYRS                                                    980
      IF (LOAD(I,J,K).GT.STAT(I,J)) STAT(I,J)=LOAD(I,J,K)                990
  210 CONTINUE                                                          1000
      CALL PRINT (1)                                                    1010
      IF (IPUNCH(1).EQ.1) CALL PUNCH (1)                                1020
  220 IF (ISTAT(2).EQ.0) GO TO 240                                      1030
C                                                                       1040
C     COMPUTE MINIMUM DAILY LOADS                                       1050
C                                                                       1060
      DO 230 J=1,12                                                     1070
      DO 230 I=1,31                                                     1080
      STAT(I,J)=1E20                                                    1090
      DO 230 K=1,NYRS                                                   1100
      IF (LOAD(I,J,K).LT.-1E19) GO TO 230                               1110
      IF (LOAD(I,J,K).LT.STAT(I,J)) STAT(I,J)=LOAD(I,J,K)               1120
  230 CONTINUE                                                          1130
      CALL PRINT (2)                                                    1140
      IF (IPUNCH(2).EQ.1) CALL PUNCH (2)                                1150
  240 IF (ISTAT(3).EQ.0) GO TO 280                                      1160
C                                                                       1170
C     COMPUTE MEAN DAILY LOADS                                          1180
C                                                                       1190
      DO 270 J=1,12                                                     1200
```

```
      DO 270 I=1,31                                                          1210
      NOCNT=0                                                                1220
      STAT(I,J)=0.0                                                          1230
      DO 260 K=1,NYRS                                                        1240
      IF (LOAD(I,J,K).GT.-1E19) GO TO 250                                    1250
      NOCNT=NOCNT+1                                                          1260
      GO TO 260                                                              1270
  250 STAT(I,J)=STAT(I,J)+LOAD(I,J,K)                                        1280
  260 CONTINUE                                                               1290
      OBS=FLOAT(NYRS-NOCNT)                                                  1300
      IF (OBS.GT.0.1) GO TO 265                                              1310
      STAT(I,J)=-1E20                                                        1320
      GO TO 270                                                              1330
  265 STAT(I,J)=STAT(I,J)/OBS                                                1340
  270 CONTINUE                                                               1350
      CALL PRINT (3)                                                         1360
      IF (IPUNCH(3).EQ.1) CALL PUNCH (3)                                     1370
  280 IF (ISTAT(4).EQ.0.AND.ISTAT(5).EQ.0.AND.ISTAT(6).EQ.0) GO TO 390       1380
C                                                                            1390
C     COMPUTE DAILY VARIANCE                                                 1400
C                                                                            1410
      DO 320 J=1,12                                                          1420
      DO 320 I=1,31                                                          1430
      NOCNT=0                                                                1440
      SUM=0.0                                                                1450
      DO 300 K=1,NYRS                                                        1460
      IF (LOAD(I,J,K).GT.-1E19) GO TO 290                                    1470
      NOCNT=NOCNT+1                                                          1480
      GO TO 300                                                              1490
  290 SUM=SUM+LOAD(I,J,K)**2.0                                               1500
  300 CONTINUE                                                               1510
      OBS=FLOAT(NYRS-NOCNT)                                                  1520
      IF (OBS.GT.1.1) GO TO 310                                              1530
      STAT(I,J)=-1E20                                                        1540
      GO TO 320                                                              1550
  310 STAT(I,J)=(SUM-(STAT(I,J)*OBS)**2.0*OBS)/(OBS-1.0)                     1560
      STAT(I,J)=ABS(STAT(I,J))                                               1570
  320 CONTINUE                                                               1580
      IF (ISTAT(4).EQ.1) CALL PRINT (4)                                      1590
      IF (IPUNCH(4).EQ.1) CALL PUNCH (4)                                     1600
  330 IF (ISTAT(5).EQ.0.AND.ISTAT(6).EQ.0) GO TO 390                         1610
C                                                                            1620
C     COMPUTE DAILY STANDARD DEVIATION                                       1630
C                                                                            1640
      DO 340 J=1,12                                                          1650
      DO 340 I=1,31                                                          1660
      IF (STAT(I,J).LT.-1E19) GO TO 340                                      1670
      STAT(I,J)=STAT(I,J)**0.5                                               1680
  340 CONTINUE                                                               1690
      IF (ISTAT(5).EQ.1) CALL PRINT (5)                                      1700
      IF (IPUNCH(5).EQ.1) CALL PUNCH (5)                                     1710
  350 IF (ISTAT(6).EQ.0) GO TO 390                                           1720
C                                                                            1730
C     COMPUTE DAILY COEFFICIENT OF VARIATION                                 1740
C                                                                            1750
      DO 380 J=1,12                                                          1760
      DO 380 I=1,31                                                          1770
      IF (STAT(I,J).LT.-1E19) GO TO 380                                      1780
      NOCNT=0                                                                1790
      SUM=0.0                                                                1800
```

```
      DO 370 K=1,NYRS                                                   1810
      IF (LOAD(I,J,K).GT.-1E19) GO TO 360                               1820
      NOCNT=NOCNT+1                                                     1830
      GO TO 370                                                         1840
  360 SUM=SUM+LOAD(I,J,K)                                               1850
  370 CONTINUE                                                          1860
  375 STAT(I,J)=STAT(I,J)/SUM/FLOAT(NYRS-NOCNT)                         1870
  380 CONTINUE                                                          1880
      CALL PRINT (6)                                                    1890
      IF (IPUNCH(6).EQ.1) CALL PUNCH (6)                                1900
  390 IF (ISTAT(7).EQ.0) GO TO 500                                      1910
C                                                                       1920
C     COMPUTE DAILY COEFFICIENT OF SKEWNESS                             1930
C                                                                       1940
      DO 420 J=1,12                                                     1950
      DO 420 I=1,31                                                     1960
      IF (STAT(I,J).LT.-1E19) GO TO 420                                 1970
      NOCNT=0                                                           1980
      SUM=0.0                                                           1990
      SUM2=0.0                                                          2000
      SUM3=0.0                                                          2010
      DO 410 K=1,NYRS                                                   2020
      IF (LOAD(I,J,K).GT.-1E19) GO TO 400                               2030
      NOCNT=NOCNT+1                                                     2040
      GO TO 410                                                         2050
  400 SUM=SUM+LOAD(I,J,K)                                               2060
      SUM2=SUM2+LOAD(I,J,K)**2.0                                        2070
      SUM3=SUM3+LOAD(I,J,K)**3.0                                        2080
  410 CONTINUE                                                          2090
      OBS=FLOAT(NYRS-NOCNT)                                             2100
      IF(OBS.GT.2.1) GO TO 415                                          2110
      STAT(I,J)=-1E20                                                   2120
      GO TO 420                                                         2130
  415 STAT(I,J)=(OBS-1.0)**2.0*(OBS**2.0*SUM3-3.0*OBS*SUM*SUM2+2.0*SUM**2140
     $          3.0)/((OBS-2.0)*(OBS*SUM2-SUM**2.0))                   2150
  420 CONTINUE                                                          2160
      CALL PRINT (7)                                                    2170
      IF (IPUNCH(7).EQ.1) CALL PUNCH (7)                                2180
  500 IF (IZ.EQ.1) GO TO 100                                            2190
      DO 510 K=1,NYRS                                                   2200
  510 IYRRET(K)=ISAVE(K)                                                2210
      GO TO 110                                                         2220
  600 STOP                                                              2230
   10 FORMAT (3A4,A3,1X,I1,7(1X,2I1),I5)                                2240
   11 FORMAT (I1,3X,8F9.4,3X,I1)                                        2250
   12  FORMAT ('1',10X,'SUMMARY OF FOLLOWING LOAD ESTIMATES'/'0STATION N2260
     1UMBER', 3A4,A3,' OPTION NUMBER ',I2/' CONSTANTS',2X,F9.4/7(12X,F9.2270
     24/))                                                              2280
   13 FORMAT (' ***** WARNING LOADS NOT COMPUTED FOR WATER YEAR ',I4,   2290
     1        ' AT STATION ',3A4,A3/7X,'CHECK COEFFICIENTS OR IF OPTION' 2300
     2     ,' 1 IS USED CHECK DATA RETRIEVAL OF SPECIFIC CONDUCTANCE'/)  2310
   20 FORMAT ('0     ***** WARNING - DATA NOT RETRIEVED FOR WATER YEAR ' 2320
     1,I4)                                                              2330
   21 FORMAT ('0NOTE -- NUMBER OF MISSING DAYS GREATER THAN 20 PERCENT F2340
     1OR WATER YEAR ',I4)                                               2350
      END                                                               2360
C                                                                       2370
C     ************************        STORE        ************************2380
C                                                                       2390
C     PURPOSE : TO FILL Q AND P ARRAYS FOR ONE STATION FROM DAILY       2400
```

```
C                VALUES STORED IN THE MONTHLY CHARACTER FORMAT.                2410
C                                                                              2420
      SUBROUTINE STORE (NYRMAX)                                                2430
      INTEGER SITEID(4),ID(4),IYRRET(40)                                       2440
      REAL LOAD                                                                2450
      DOUBLE PRECISION VALUE(31),BLANK,FILL                                    2460
      DIMENSION Q(31,12,40),P(31,12,40),LOAD(31,12,40),STAT(31,12)             2470
      COMMON Q,P,LOAD,STAT,SITEID,IPAR,IOPT,NYRS,INITYR,IYRRET                 2480
      DO 96 M=1,40                                                             2490
   96 IYRRET(M)=0                                                              2500
      DATA BLANK,FILL/'        ','-99999.'/                                    2510
      DEFINE FILE 2 (1,220,E,IR)                                               2520
      READ(1,10,END=999) ID,ITEST,INITYR,J,VALUE                               2530
      DO 97 M=1,4                                                              2540
      IF (ID(M).EQ.SITEID(M)) GO TO 97                                         2550
      WRITE (6,11) ID,SITEID                                                   2560
      STOP                                                                     2570
   97 CONTINUE                                                                 2580
   98 K=INITYR                                                                 2590
      IF (J.GE.10)INITYR=INITYR+1                                              2600
      NYRS=0                                                                   2610
      GO TO 101                                                                2620
   99 READ (1,10,END=999)ID,ITEST,K,J,VALUE                                    2630
      DO 100 M=1,4                                                             2640
      IF (ID(M).NE.SITEID(M)) GO TO 300                                        2650
  100 CONTINUE                                                                 2660
  101 IF (J.GE.10) J=J-12                                                      2670
      J=J+3                                                                    2680
      IF (J.LE.3) K=K+1                                                        2690
      K=K-INITYR+1                                                             2700
      IF (IYRRET(K).EQ.0) NYRS=NYRS+1                                          2710
      IF (NYRS.LE.NYRMAX) GO TO 109                                            2720
      WRITE (6,12) NYRMAX,SITEID                                               2730
      STOP                                                                     2740
  109 IYRRET(K)=1                                                              2750
      DO 110 M=1,31                                                            2760
      IF (VALUE(M).EQ.BLANK)VALUE(M)=FILL                                      2770
  110 CONTINUE                                                                 2780
      WRITE (2'1,20) VALUE                                                     2790
      IF (ITEST.EQ.IPAR) GO TO 200                                             2800
      READ (2'1,21) (Q(I,J,K),I=1,31)                                          2810
      GO TO 99                                                                 2820
  200 READ (2'1,21) (P(I,J,K),I=1,31)                                          2830
      GO TO 99                                                                 2840
  300 BACKSPACE 1                                                              2850
  999 RETURN                                                                   2860
   10 FORMAT (8X,3A4,A3,14X,I5,I4,I2,12X,31A7)                                 2870
   11 FORMAT ('1 ********** ERROR - STATION NUMBER OF DAILY VALUES DATA       2880
     1SET ',3A4,A3/22X,'DIFFERS FROM THE NUMBER ON THE PROGRAM CONTROL C       2890
     3ARD ',3A4,A3/22X,'CHECK YOUR PROGRAM CONTROL CARDS')                     2900
   12 FORMAT ('1 ********** ERROR - MORE THAN ',I3,' YEARS OF DATA RETRI      2910
     1EVED FOR STATION ',3A4,A3/21X,'INCREASE ARRAY DIMENSIONS AND RERUN       2920
     2')                                                                       2930
   20 FORMAT (31A7)                                                            2940
   21 FORMAT (31F7.0)                                                          2950
      END                                                                      2960
C                                                                              2970
C     ************************        CONVRT        ************************   2980
C                                                                              2990
C     PURPOSE : TO FILL LOAD ARRAY USING OPTION SPECIFIED ON CONTROL           3000
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C               CARD (SEE DOCUMENTATION FOR DETAILS).                   3010
C                                                                       3020
      SUBROUTINE CONVRT (A,B,ANS,C,IOPT,I,J)                            3030
      DIMENSION C(8),IDAY(12)                                           3040
      DATA IDAY /0,31,61,92,123,151,182,212,243,273,304,335 /           3050
      IF (A) 400,500,99                                                 3060
   99 GO TO (100,200,200,300,300),IOPT                                  3070
  100 IF (B) 400,500,110                                                3080
  110 ANS=C(7)+C(8)*B                                                   3090
  120 IF (ANS) 400,500,130                                              3100
  130 ANS=0.0027*ANS*A                                                  3110
      RETURN                                                            3120
  200 T=0.0172*FLOAT(IDAY(J)+I)                                         3130
      ANS=C(1)+C(2)*SIN(T)+C(3)*COS(T)+(C(4)+C(5)*SIN(T)+C(6)*COS(T))*  3140
     $    ALOG10(A)                                                    3150
      ANS=10.0**ANS                                                     3160
      IF(IOPT.EQ.2) GO TO 120                                           3170
      ANS=C(7)+C(8)*ANS                                                 3180
      GO TO 120                                                         3190
  300 T=0.0172*FLOAT(IDAY(J)+I)                                         3200
      ANS=C(1)+C(2)*SIN(T)+C(3)*COS(T)+(C(4)+C(5)*SIN(T)+C(6)*COS(T))/A 3210
      IF (IOPT.EQ.4) GO TO 120                                          3220
      ANS=C(7)+C(8)*ANS                                                 3230
      GO TO 120                                                         3240
  400 ANS=-1E20                                                         3250
      RETURN                                                            3260
  500 ANS=0.0                                                           3270
      RETURN                                                            3280
      END                                                               3290
C                                                                       3300
C     *************************       PUNCH       *************************3310
C                                                                       3320
C     PURPOSE : TO PRODUCE CARD OUTPUT OF A DAILY STATISTIC.            3330
C                                                                       3340
      SUBROUTINE PUNCH (L)                                              3350
      INTEGER SITEID(4),IYRRET(40)                                      3360
      DOUBLE PRECISION LAB(7)                                           3370
      REAL LOAD                                                         3380
      DIMENSION Q(31,12,40),P(31,12,40),LOAD(31,12,40),STAT(31,12)      3390
      COMMON Q,P,LOAD,STAT,SITEID,IPAR,IOPT,NYRS,INITYR,IYRRET          3400
      DATA LAB /'MAXIMUM ','MINIMUM ','MEAN    ','VARIANCE','STD DEV ',3410
     $          'COEF VAR','SKEWNESS'/                                 3420
      DUMMY=-1E20                                                       3430
      WRITE (7,10) SITEID,LAB(L),IOPT                                   3440
   10 FORMAT (3A4,A3,' / ',A8,' LOAD OPTION = ',I2)                     3450
      DO 110 J=1,12                                                     3460
      DO 100 M=1,25,4                                                   3470
      N=M+3                                                             3480
  100 WRITE (7,11) SITEID,(STAT(I,J),I=M,N)                             3490
  110 WRITE (7,11) SITEID,(STAT(I,J),I=29,31),DUMMY                     3500
   11 FORMAT (3A4,A3,1X,4(G11.4,1X))                                    3510
      RETURN                                                            3520
      END                                                               3530
C                                                                       3540
C     *************************       PRINT       *************************3550
C                                                                       3560
C     PURPOSE : TO PRODUCE TABULAR OUTPUT OF A DAILY STATISTIC.         3570
C                                                                       3580
      SUBROUTINE PRINT (L)                                              3590
      INTEGER SITEID(4),IYRRET(40)                                      3600
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      REAL LOAD                                                          3610
      DOUBLE PRECISION LAB(7)                                            3620
      DIMENSION Q(31,12,40),P(31,12,40),LOAD(31,12,40),STAT(31,12)       3630
      COMMON Q,P,LOAD,STAT,SITEID,IPAR,IOPT,NYRS,INITYR,IYRRET           3640
      DATA LAB /'MAXIMUM ','MINIMUM ','MEAN    ','VARIANCE','STD DEV ',  3650
     $         'COEF VAR','SKEWNESS'/                                    3660
      M=INITYR+NYRS-1                                                    3670
      WRITE (6,10) SITEID,LAB(L),INITYR,M                                3680
      LINES=1                                                            3690
      DO 100 I=1,31                                                      3700
      WRITE (6,11) I,(STAT(I,J),J=1,12)                                  3710
      IF (LINES.LT.4) GO TO 100                                          3720
      LINES=0                                                            3730
      WRITE (6,12)                                                       3740
  100 LINES=LINES+1                                                      3750
      RETURN                                                             3760
   10 FORMAT ('1',41X,10('*'),' DAILY LOAD STATISTICS (TON/D) ',10('*')/ 3770
     1'0',15X,'STATION NUMBER : ',3A4,A3/16X,'STATISTIC : ',A8/16X,      3780
     2        'BASED ON WATER YEARS ',I4,' THRU ',I4/                    3790
     3                        /'0   DAY',6X,'OCT',7X,'NOV',7X,'DEC',7X,  3800
     4        'JAN',7X,'FEB',7X,'MAR',7X,'APR',7X,'MAY',6X,'JUNE',6X,    3810
     5       'JULY',7X,'AUG',6X,'SEPT'/)                                 3820
   11 FORMAT (5X,I2,3X,12(1PG9.3,1X))                                    3830
   12 FORMAT (133X)                                                      3840
      END                                                                3850
C                                                                        3860
C     *************************       MLOAD      *************************3870
C                                                                        3880
C     PURPOSE : TO COMPUTE AVERAGE AND TOTAL MONTHLY LOADS AND           3890
C               OUTPUT RESULTS.                                          3900
      SUBROUTINE MLOAD (L)                                               3910
      REAL LOAD,LSUM                                                     3920
      DIMENSION AVG(12),SUM(12),Q(31,12,40),P(31,12,40),LOAD(31,12,40),  3930
     $          STAT(31,12),DAYS(12)                                     3940
      INTEGER SITEID(4),IYRRET(40)                                       3950
      COMMON Q,P,LOAD,STAT,SITEID,IPAR,IOPT,NYRS,INITYR,IYRRET           3960
      DATA DAYS/31.0,30.0,31.0,31.0,28.0,31.0,30.0,31.0,30.0,31.0,31.0,  3970
     &   30.0/                                                           3980
      LINES=0                                                            3990
      WRITE (6,11) SITEID                                                4000
      DO 160 K=1,NYRS                                                    4010
      IF (IYRRET(K).EQ.1) GO TO 99                                       4020
      J=INITYR+K-1                                                       4030
      WRITE (6,13) J                                                     4040
      LINES=LINES+12                                                     4050
      GO TO 160                                                          4060
   99 LCNT=0                                                             4070
      QSUM=0.0                                                           4080
      LSUM=0.0                                                           4090
      N=INITYR+K-1                                                       4100
      DO 130 J=1,12                                                      4110
      SUM(J)=0.0                                                         4120
      NOCNT=0                                                            4130
      DO 120 I=1,31                                                      4140
      IF (LOAD(I,J,K)) 100,110,110                                       4150
  100 NOCNT=NOCNT+1                                                      4160
      LCNT=LCNT+1                                                        4170
      GO TO 120                                                          4180
  110 SUM(J)=SUM(J)+LOAD(I,J,K)                                          4190
      LSUM=LSUM+LOAD(I,J,K)                                              4200
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      QSUM=QSUM+Q(I,J,K)                                                4210
  120 CONTINUE                                                          4220
      OBS=FLOAT(31-NOCNT)                                               4230
      IF (OBS.GT.0.1) GO TO 125                                         4240
      AVG(J)=-1E20                                                      4250
      SUM(J)=-1E20                                                      4260
      GO TO 130                                                         4270
  125 AVG(J)=SUM(J)/OBS                                                 4280
      SUM(J)=AVG(J)*DAYS(J)                                             4290
  130 CONTINUE                                                          4300
      IF (MOD(N,4).EQ.0) SUM(5)=AVG(5)*29.0                             4310
      LSUM=LSUM/FLOAT(372-LCNT)                                         4320
      QSUM=QSUM/FLOAT(372-LCNT)                                         4330
      IF (MOD(N,4)) 133,132,133                                         4340
  132 LSUM=LSUM*366.0                                                   4350
      QSUM=QSUM*366.0                                                   4360
      GO TO 134                                                         4370
  133 LSUM=LSUM*365.0                                                   4380
      QSUM=QSUM*365.0                                                   4390
  134 QSUM=LSUM/(0.0027*QSUM)                                           4400
      WRITE (6,10) N,LSUM,QSUM,(AVG(J),J=1,12),(SUM(J),J=1,12)          4410
      LINES=LINES+12                                                    4420
      IF (LINES.LT.48) GO TO 140                                        4430
      WRITE (6,11) SITEID                                               4440
      LINES=0                                                           4450
      GO TO 145                                                         4460
  140 WRITE (6,12)                                                      4470
  145 IF (L.EQ.0) GO TO 160                                             4480
      WRITE (7,20) SITEID,IOPT,N                                        4490
      DO 150 M=1,9,4                                                    4500
      N=M+3                                                             4510
  150 WRITE (7,21) SITEID,(AVG(J),J=M,N)                                4520
  160 CONTINUE                                                          4530
      RETURN                                                            4540
   10 FORMAT ('0WATER YEAR ',I4,18X,'TOTAL ANNUAL LOAD (TON) = ',E10.4,  4550
     15X,'MEAN ANNUAL CONCENTRATION (MG/L) =',E10.4/'0',14X,'OCT',7X,'NO 4560
     2V',7X,'DEC',7X,'JAN',7X,'FEB',7X,'MAR',7X,'APR',7X,'MAY',6X,'JUNE' 4570
     3,6X,'JULY',7X,'AUG',6X,'SEPT'/'0AVERAGE',3X,12(1X,G9.3)/' (TON/D)' 4580
     4/'0 TOTAL',4X,12(1X,G9.3)/'  (TON)'/)                             4590
   11 FORMAT ('1',45X,10('*'),' COMPUTED MONTHLY LOADS ',10('*')/'0',5X,  4600
     $         'STATION NUMBER : ',3A4,A3/11X,                          4610
     $         'AVERAGES ARE COMPUTED FROM THE NUMBER OF DAYS OF RECORD'/ 4620
     $         11X,'TOTALS ARE COMPUTED BY ASSUMING THE AVERAGE OVER THE 4630
     $ENTIRE MONTH'///)                                                 4640
   12 FORMAT (41X,44('-'))                                              4650
   13 FORMAT ('0'/'0      ***** WARNING - DATA NOT RETRIEVED FOR WATER YE 4660
     1AR ',I4///////)                                                   4670
   20 FORMAT (3A4,A3,' / LOAD OPTION #',I2,' WATER YEAR ',I4)           4680
   21 FORMAT (3A4,A3,4(1X,E11.4))                                       4690
      END                                                               4700
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