A COMPUTER PROGRAM (FLOWSTAT) FOR SUMMARIZING DAILY AND PEAK STREAMFLOW STATISTICS

By Gary D. Rogers and Mark R. Werley

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ATTACHMENTS

ACRONYMS USED IN REPORT

CPL	Command Procedure Language
PRIMOS	Prime Operating System
WATSTORE	Water Data Storage and Retrieval System

The use of trade or product names is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

A COMPUTER PROGRAM (FLOWSTAT) FOR SUMMARIZING DAILY AND PEAK STREAMFLOW STATISTICS

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ABSTRACT

This report describes FLOWSTAT, a computer program that summarizes daily and peak streamflow statistics. The output of the program is a single-page summary of statistics describing monthly and annual discharges, magnitude and frequency of annual low flow, magnitude and frequency of annual high flow, magnitude and frequency of instantaneous annual peak flow, and duration of daily mean flow. FLOWSTAT primarily reformats data that have been produced by other statistical programs.

The streamflow statistics are derived from output of the U.S. Geological Survey's Headquarters mainframe computer in Reston, Virginia. The FLOWSTAT program prompts the user for the information necessary to produce a job for submittal to the mainframe computer. The job is submitted by the user by means of the U.S. Geological Survey's GEONET network, and the output is returned to the user over the same network. When the output has been returned, FLOWSTAT extracts the statistical data required, formats the extracted data, and prints the summary.

INTRODUCTION

The FLOWSTAT computer program was developed in the early 1980's in the Montana District office of the U.S. Geological Survey to eliminate much of the labor required to glean streamflow statistics from various sources and to summarize those statistics. This program, which was originally written in the BASIC language for use on the office's Datapoint 1174, was converted to Fortran 77 for use on the Prime mini-computer in 1984. Subsequently, the program was informally distributed to several other offices of the U.S. Geological Survey.

The Arizona District office, having streamflow conditions different from those in Montana, modified the program to deal with low-flow conditions. For this reason, and because many other offices were using the program, it became apparent that the program needed to be developed for general use and made available to all District offices of the U.S. Geological Survey.

This report describes FLOWSTAT, the computer program developed to summarize daily and peak streamflow statistics. Specifically, the report describes the summary of streamflow statistics, the functions of the FLOWSTAT program and installation procedures.

In addition to descriptions of the program, this report contains listings (attachments 1-5) as supplemental information at the back of the report. The listings describe samples of a job for submittal, the output returned, the extract file, the summary of statistics, and the post-processor files.

This software is written for use on a Prime computer. The user is assumed to have a working knowledge of the PRIMOS operating system of Prime computers.

SUMMARY OF STREAMFLOW STATISTICS

The summary consists of a single page of statistics describing monthly and annual discharges, magnitude and frequency of annual low flow, magnitude and frequency of annual high flow, magnitude and frequency of instantaneous annual peak flow, and duration of daily mean flow. Output values are formatted to conform with U.S. Geological Survey standards for rounding of discharge values.

Statistics Produced

FLOWSTAT primarily reformats data produced by other statistical programs that have been run on the U.S. Geological Survey's Headquarters mainframe computer in Reston, Virginia. The programs involved are:

G490 - Retrieves daily values data from the historical and current files.
W4422 - Calculates monthly and annual statistics.
A193 - Calculates low-flow and high-flow statistics (log-Pearson type III probability distribution).
E796 - Retrieves peak-flow statistics from the Streamflow/Basin Characteristics file.
A969 - Calculates flow-duration statistics and the n-day high and low flows, which are passed to Program A193 for frequency analysis.

These programs are documented in the WATSTORE User's Guide, compiled by Hutchison (1975).

These five programs are all executed in a single computer job created by FLOWSTAT based on variables supplied by the user. The first program, G490, retrieves the daily values data used by programs W4422, A193, and A969. Program G490 is documented in Volume 1, Chapter IV, Section G of the WATSTORE User's Guide.

Program W4422 is used to calculate the monthly and annual mean discharges from the daily values for the period selected. FLOWSTAT uses these mean values to calculate the maximum, minimum, mean, standard deviation, coefficent of variation, and percentage of annual runoff on a monthly and annual basis. Program W4422 is documented in Volume 1, Chapter IV, Section F of the WATSTORE User's Guide.

Program A193 calculates log-Pearson type III statistics of low-flow and high-flow data. For low-flow data, annual n-day low flows (the smallest mean flow for a consecutive n-day period) are calculated for each year of record for consecutive n-day periods of 1, 3, 7, 14, 30, 60, 90, 120, and 183 days. From the annual series of n-day low flows, the log-Pearson type III probability distribution is used to calculate n-day low flows with non-exceedance probabilities ranging from 0.5 to 0.02 (recurrence intervals ranging from 2 to 50 years). If zero-values occur, adjusted probabilities are calculated, and FLOWSTAT uses the adjusted probabilities. For high-flow data, annual n-day high flows (the largest mean flow for a consecutive n-day period) are calculated for each year of record for consecutive periods of 1, 3, 7, 15, 30, 60, and 90 days. The log-Pearson type III distribution is then used on the annual series of n-day high flows to calculate n-day high flows with exceedance probabilities ranging from 0.5 to 0.01 (recurrence intervals ranging from 2 to 100 years). Program A193 is documented in Volume 1, Chapter IV, Section G of the WATSTORE User's Guide.

Program E796 retrieves peak-flow statistics from the Streamflow/Basin Characteristics file. Specifically, the following variables are retrieved and used by FLOWSTAT:

076 Annual flood peak for 2-year recurrence interval
077 Annual flood peak for 5-year recurrence interval
078 Annual flood peak for 10-year recurrence interval
079 Annual flood peak for 25-year recurrence interval
080 Annual flood peak for 50-year recurrence interval
081 Annual flood peak for 100-year recurrence interval
179 Weighted skew
180 Mean
181 Standard deviation
196 Number of years of systematic peak-flow record

(The numbers 076, 077, and so forth, are codes for each variable.) Program E796 is documented in Volume 4, Chapter II of the WATSTORE User's Guide.

Peak-flow statistics are computed by WATSTORE Program J407 and stored in the Streamflow/Basin Characteristics file using WATSTORE Program E772. Program J407 is documented in Volume 4, Chapter I of the WATSTORE User's Guide, whereas Progam E772 is documented in Volume 4, Chapter II. Peak-flow statistics are reviewed and commonly adjusted before being stored in the Streamflow/Basin Characteristics file. To ensure consistency with these adjusted values, FLOWSTAT retrieves the peak-flow data rather than invoking Program J407 to perform a new calculation.

Program A969 is used to calculate daily mean flow for various exceedance percentages to produce a flow-duration table. FLOWSTAT interpolates between exceedance percentages produced by A969 to obtain the exceedance percentages given in the flow-duration table in the summary of statistics. Program A969 is documented in Volume 1, Chapter IV, Section G of the WATSTORE User's Guide.

Interpretive Considerations

Peak-flow statistics and high-flow and low-flow frequency analysis results are interpretive information, which must be reviewed and possibly revised for reasonable hydrologic interpretation. As noted in the Water Resources Division Publications Guide, section 11.01.2, p. 382 (Alt and Iseri, 1986), such information must receive Director's approval before release. The author of each report is responsible for the adequacy of any hydrologic interpretive material included. In some instances, a warning about the interpretive nature of the data might need to be added.

FUNCTIONS OF FLOWSTAT PROGRAM

FLOWSTAT uses ANSI (American National Standards Institute) standard control sequences for cursor control on the user's terminal. For this reason, only terminals that comply with this standard (VT100, TAB, GraphOn, for example) can be used to run this program.

Build a Retrieval Job

To build a WATSTORE job to retrieve data, the program is invoked by entering "FLOWSTAT." The following illustrates the dialog. The italicized statements are those displayed by the computer.

OK, FLOWSTAT

The following menu and prompt appear:

FLOWSTAT - CONSOLIDATED FLOW STATISTICS

The following options are available:

(1) Build a WATSTORE job to retrieve data
(2) Extract data from the WATSTORE output
(3) Format the streamflow statistics
(4) Print the statistical summary

Enter option code (<CR> to exit): 1

In this example, the user selected option 1; that is, the option to build a WATSTORE job.

After selecting option 1, the user is prompted to specify the FLOWSTAT job sequence number to be used. This is an arbitrary number between 1 and 999 inclusive, which serves to identify a particular FLOWSTAT setup. This sequence number is used to name four FLOWSTAT files:

STATnnn.JOB - Job to be submitted to the Headquarters mainframe computer.
STATnnn.RET - Output returned from the mainframe computer.
STATnnn.XTR - Data extracted from STATnnn.RET by FLOWSTAT that are required for creating the statistical summary.
STATnnn.RPT - The statistical summary created by FLOWSTAT.

After specifying a sequence number, the user is prompted to specify the account number, job class, Amdahl logon identification (ID) and password, backfile cartridge number(s), and period of record to be processed. The dialog is as follows:

FLOWSTAT - BUILD A WATSTORE JOB TO RETRIEVE DATA
Enter FLOWSTAT job sequence number (1-999,<CR>=1): 3
Job STAT003.JOB will be created ...
Output will be returned to: FLOWTEST>STAT003.RET
Enter account number (<CR>=00100):
Enter job class (<CR>=E):
Enter right 0-7 characters of Amdahl LOGON ID (AG4XXXX):
Enter Amdahl PASSWORD: XXXXXXXX
Enter new backfile cartridge number(s), <CR> to accept default, or -- to delete:
Enter backfile cartridge number(s):
(1) 561576
(2) <CR>
Enter begin water year (<CR>:use all data): XXXX
Enter end water year: XXXX

In the above dialog, note the defaults available (<CR>=...). Also note that the output from the mainframe computer is returned to the directory in which the user is attached when FLOWSTAT is executed. This process requires that the file transfer phantom, usually FTS_PH1, have at least Use and Add access rights to this directory. The recommended access is DAUW.

The user is then prompted to indicate if the stations are to be processed as seasonal sites in WATSTORE program A969:

Process as seasonal stations (Y/N)? N

If the reply is Y, the user is prompted to specify the begin and end months desired for processing. In this example, the user indicated that the sites were not to be processed as seasonal sites.

Finally, the user selects the streamflow-gaging stations to be included in the reports:

Enter as many as 20 station numbers --

(01) 06291500
(02) <CR>

The user is notified when the file is complete:

Job STAT003.JOB is ready for submittal to the mainframe computer.

The job is submitted by issuing the DRJQ command to submit the job by means of the U.S. Geological Survey's GEONET network. The computer administrator in each Geological Survey office can provide information about using the DRJQ command.

Extract the Data

When the output has been returned from the Headquarters mainframe computer, FLOWSTAT is again invoked to extract the data necessary to create the statistical summary. The dialog appears as follows:

OK, FLOWSTAT
FLOWSTAT - CONSOLIDATED FLOW STATISTICS

The following options are available:

(1) Build a WATSTORE job to retrieve data
(2) Extract data from the WATSTORE output
(3) Format the streamflow statistics
(4) Print the statistical summary

Enter option code (<CR> to exit): 2
FLOWSTAT - EXTRACT DATA FROM THE WATSTORE OUTPUT
Enter FLOWSTAT job sequence number (1-999,<CR>=1): 3

The program scans the output in file STAT003.RET and extracts the data required for the statistical summary. The user is provided with a display of the WATSTORE output being scanned (programs W4422, A193, E796, or A969) as well as the 8-digit station number and current water year.

A file containing the extracted data is created. Attachment 3 provides a listing of the extract file, STAT003.XTR, produced in this example. This is a file that can be edited by the user to replace any values furnished by FLOWSTAT. Such editing may be necessary to ensure proper hydrologic interpretation of the computed statistics. Occasionally, data may not be available for a particular field. In this instance, "-1" is substituted to denote a missing value. The user can edit this file and replace these missing values with appropriate numbers.

Because the FLOWSTAT program extracts much of the data it requires from formatted print files, the program is dependent on an unchanging output format from the WATSTORE programs. These programs are stable; hence, the output format is not subject to change. However, if these WATSTORE programs are changed, or if the output is otherwise changed by editing before running the program, FLOWSTAT can fail.

FLOWSTAT will normally indicate an error condition by displaying something like "STOP nnnn" where nnnn is a 4-digit number. Should this occur during the extract phase (option 2 on the FLOWSTAT menu), please notify one of the authors of this report.

Format the Streamflow Statistics

To format the streamflow statistics from the extract file, FLOWSTAT is invoked, the format option is selected, and the job sequence number is specified; FLOWSTAT then formats the data. The dialog appears as follows:

OK, FLOWSTAT
FLOWSTAT - CONSOLIDATED FLOW STATISTICS

The following options are available:
(1) Build a WATSTORE job to retrieve data
(2) Extract data from the WATSTORE output
(3) Format the streamflow statistics
(4) Print the statistical summary

Enter option code (<CR> to exit): 3
FLOWSTAT - FORMAT THE STREAMFLOW STATISTICS
Enter FLOWSTAT job sequence number (1-999,<CR>=1): 3
06291500
TABLE IS READY IN THE FILE: STAT003.RPT
Enter <CR> to continue, "D" to display, or "S" to spool the output:

At this point the user can display the statistical summary or spool to the default system line printer. However, in most instances, publication-quality printing will be required and option (4) of the FLOWSTAT menu needs to be invoked to print the statistical summary.

Print the Statistical Summary

To print the statistical summary, FLOWSTAT is invoked, option 4 is selected, and the job sequence number is specified; FLOWSTAT then submits the formatted summary for printing. The dialog appears as follows:

OK, FLOWSTAT
FLOWSTAT - CONSOLIDATED FLOW STATISTICS

The following options are available:
(1) Build a WATSTORE job to retrieve data
(2) Extract data from the WATSTORE output
(3) Format the streamflow statistics
(4) Print the statistical summary

Enter option code (<CR> to exit): 4
FLOWSTAT - PRINT THE STATISTICAL SUMMARY
Enter FLOWSTAT job sequence number (1-999,<CR>=1): 3
Where would you like your printout...
(1) PR0 High-speed line printer
(2) LSR Reports laser printer
Enter number of printer (<CR>=Quit): 1
SPOOL STAT003.RPT -NOF -AT PR0

FLOWSTAT uses an ASCII file called PRINTERS.DATA, which defines the available printers in each office, to display a menu of print options. FLOWSTAT first checks the user's current directory to see if a PRINTERS.DATA file exists there. If so, then FLOWSTAT uses that file. If not, then FLOWSTAT checks the upper-level directory called FLOWSTAT for the PRINTERS.DATA file and uses that file. This procedure allows users to override the system-wide print options with their own by creating a PRINTERS.DATA file at their current directory. If PRINTERS.DATA exists in neither location, FLOWSTAT terminates the option with an error message. An example of the PRINTERS.DATA file used in Arizona follows:

NAME	DESCRIPTION	COMMAND
PR0	High speed line printer	SPOOL -NOF -AT PR0
MAIL	Mail laser printer	STCONV1 -NOF -AT MAIL
LASER	Admin laser printer	STCONV1 -NOF -AT LASER
FLGLSR	Flagstaff laser printer	STCONV1 -NOF -AT FLGLSR
PHXLSR	Phoenix laser printer	STCONV1 -NOF -AT PHXLSR
PHX	Phoenix line printer	SPOOL -NOF -AT PHX
YUM	Yuma line printer	SPOOL -NOF -AT YUM

The first two lines are the header and need to remain unchanged. The equal signs (=) in the second line of the header show the widths of the data fields in the file.

The first field (columns 1-8) is the printer name--a name used to identify the print option to the user; the name generally is the same as the spool queue name. The second field (columns 10-41) is a description of the print option for the user.

The third field (columns 43-58) contains the PRIMOS command that FLOWSTAT will actually execute to print the file. The command field commonly is set to SPOOL to simply spool the statistical summary; however, it can be set to some other PRIMOS command. For example, a CPL program installed as a system command could be used to process the report by adding escape sequences for printing on a laser printer. Attachment 5 contains listings of two CPL programs, STCONV1.CPL and STCONV2.CPL, which are used to post-process the statistical summary for printing on a Hewlett Packard Laser-Jet printer and a Postscript printer, respectively.

The command field is a multi-line field. As many as three additional lines of the command field can contain options to the PRIMOS command. For the SPOOL command, these could be the "-AT" and "-NOF" options, or any other valid spooler options. FLOWSTAT builds the actual PRIMOS command by taking the first line in the command field, appending the file name of the statistical summary, and then appending as many as three lines of options from the command field. The second and third option lines of the command field (if present) are appended without a padding space, so a single space needs to precede the options in this field. So, for the following printer in the PRINTERS.DATA file,

```
NAME     DESCRIPTION                      COMMAND
======== ================================ ================
PR0      High speed line printer          SPOOL
                                          -NOF
                                           -AT PR0
```

the resulting PRIMOS command line would be:

```
SPOOL STAT003.RPT -NOF -AT PR0
```

Note the space before the "-AT PR0" in the PRINTERS.DATA file. Had that space not been included, the resulting PRIMOS command would have been:

```
SPOOL STAT003.RPT -NOF-AT PR0
```

and would have resulted in a PRIMOS error message.

INSTALLING THE PROGRAM

This software can be obtained by contacting the U.S. Geological Survey, Helena, Montana 59626. The software normally is distributed over the U.S. Geological Survey's GEONET network.

The software is installed by completing the following six steps:

1. Ensure that the following four files exist in the directory in which FLOWSTAT is to be installed:

   BUILD.CPL - CPL that compiles and BINDS the software.
   FLOWCOMM.INS - Insert file containing Fortran statements common to the subroutines in FLOWSTAT.
   FLOWSTAT.CPL - CPL to be placed in CMDNC0.
   FLOWSTAT.F77 - Fortran source code for the FLOWSTAT program.

2. Use any editor to build the file NODE.DATA in the FLOWSTAT directory. This file consists of three lines:

   The first line contains the default user identification in columns 1-7. The user ID is also the first seven characters of the job name on the Amdahl. For example, in Montana, assume the default user identification is AG4XXXX.

   The second line contains the cost center in columns 1-4. In Montana, the cost center is 4630.

   The third line contains as many as three default backfile cartridge tape numbers in columns 1-6, 8-13, and 15-20. The default backfile cartridge tape number in Montana is 561576.

   So, for Montana, the NODE.DATA file would be:

   ```
   AG4XXXX
   4630
   561576
   ```

3. Edit the PRINTERS.DATA file for the office printers.

4. Copy the post-processing CPL (if any) to CMDNC0 so that it can be invoked as a system command.

5. Copy FLOWSTAT.CPL to CMDNC0. This file needs to be modified if the FLOWSTAT software is not installed in an upper-level directory named "FLOWSTAT."

6. Resume or phantom BUILD.CPL to install the software. Review the output file BUILD.COMO to ensure that the installation was successful.

REFERENCES CITED

Alt, D.F., and Iseri, K.T., 1986, Water Resources Division Publications Guide, Volume 1. Publications policy and text preparation: U.S. Geological Survey Open-File Report 87-205, 429 p.

Hutchison, N.E., comp., 1975, User's guide, WATSTORE (National Water Data Storage and Retrieval System of the U.S. Geological Survey): U.S. Geological Survey Open-File Report 75-426, 791 p.

SUPPLEMENTAL INFORMATION

Attachment 1.--*Sample job for submittal to Headquarters*

The following listing is of a job created by FLOWSTAT for submittal to the Headquarters mainframe computer:

```
//AG4XXXXF JOB (xxxxxxxxx,STAT,10,20),'STAT003  ',
//     MSGLEVEL=(1,1),CLASS=E
/*LOGONID AG4XXXX
/*PASSWORD xxxxxxxxxx
//*$$FILE <MTCMD4>FLOWTEST>STAT003.RET
/*SETUP    561576/C
//PROCLIB DD DSN=WRD.PROCLIB,DISP=SHR
//RT EXEC DVRETR,AGENCY=USGS,VOL1=561576
//HDR.SYSIN DD *
M3          19900930
XW4422                    1 1  11    1 1
XA969   MAIN0006000003  X    X  04031009
XA969   LGPR0006000003   1 3 7 14 30 60 90120183    1 3 7 15 30 60 90
R00060
F00003
D 06291500
//MASTAT EXEC DVMASTAT
//DVMAS.PUNCH DD SYSOUT=A
//DVSTAT EXEC DVSTAT,TIME1=10,REGION.LGPR=205K
//     EXEC RETRVLSB
//STEP1.CARDS DD SYSOUT=A
//STEP1.SYSIN DD *
STATRUN                        01100                                  003
075081179181196
 06291500
/*EOF
```

Attachment 2.--*Condensed sample of output returned*

The following is a much-condensed listing of the output returned from the Headquarters mainframe computer.

```
(JCL statements and HEADER processing)
                    .
                    .

STATION HEADER RETRIEVAL PROCESSING ENDED
WATSTORE DAILY VALUES FILE RETRIEVAL PROGRAM.
(PGM. NO. G490) - DATE OF LAST REVISION: 09/20/80.
                    .
                    .
   1 STATION(S) HAVE RECORDS
                    .
                    .
2 06291500                  00060000031939199000                          M
3 06291500      1939   1      *      *      *      *      *      *          M
3 06291500      1939   2   27.1    151    149   46.1   24.1   17.7          M
3 06291500      1940   1   17.8   15.3   12.8   10.9   9.00   12.3          M
3 06291500      1940   2   20.6   91.6    137   37.1   16.6   14.0          M
                    .
                    .
3 06291500      1990   1   13.0   12.8   10.7   16.5   11.2   13.2          M
3 06291500      1990   2   27.0   73.7    187   55.5   24.1   17.0          M
2 06291500                  00060000031939199000                          A
3 06291500      A      1      *   32.9   35.9   59.3   53.4   68.2   61.0   49.6
3 06291500      A      2   66.0   48.7   37.0   28.3   36.0   38.1   36.2   32.9
3 06291500      A      3   37.1   30.5   57.7   43.3   49.3   26.5   21.8   38.5
3 06291500      A      4   65.7   82.8   65.6   37.6   55.8   68.5   56.0   85.6
3 06291500      A      5   59.2   54.4   64.9   63.3      *   46.5   73.0   28.2
3 06291500      A      6   43.3   34.5   39.5   27.9   38.5
COMPUTATIONS COMPLETED - END OF JOB - PGM. W4422
DAILY VALUES STATISTICS PROGRAM (PGM. NO. A969) -- DATE OF LAST REVISION : 11 JUL 84 12.07.13
                    .
                    .
PROCESS STATION 06291500        *****
        PARMETER CODE =    60       STATISTIC CODE =     3
                    .
                    .
CLASS   VALUE   TOTAL   ACCUM   PERCT     CLASS   VALUE   TOTAL   ACCUM   PERCT     CLASS   VALUE   TOTAL   ACCUM   PERCT
  0       0.0       0   15706  100.00        12    20.0    2270    9515   60.58        24   160.0     219    1037    6.60
  1       3.0       7   15706  100.00        13    24.0    1407    7245   46.13        25   190.0     222     818    5.21
                    .
                    .
 10      14.0    2221   13682   87.11        22   110.0     311    1660   10.57        34   900.0       2       2    0.01
 11      17.0    1946   11461   72.97        23   130.0     312    1349    8.59
                    .
                    .
END OF PROGRAM A969.
```

Attachment 2.--*Condensed sample of output returned*--Continued

```
PROGRAM A193 (LOG-PEARSON TYPE III STATISTICS) - REVISED JAN. 1986
                    .
                    .
STATION - 06291500          LODGE GRASS CREEK AB WILLOW C DIV NEAR WYOLA MT          N =   42     NZI =    0
1940-1990,  12 MON PERIOD ENDING MARCH 31
  1-DAY LOW VALUE
                    .
                    .
NON EXCEED PROB     RECURRENCE INTERVAL    PARAMETER VALUE
     0.0100               100.00                2.547
     0.0200                50.00                3.018
                    .
                    .
     0.9800                 1.02               18.669
     0.9900                 1.01               20.169
STATION - 06291500          LODGE GRASS CREEK AB WILLOW C DIV NEAR WYOLA MT          N =   42     NZI =    0
                    .
                    .
  3-DAY LOW VALUE
                    .
                    .
NON EXCEED PROB     RECURRENCE INTERVAL    PARAMETER VALUE
     0.0100               100.00                2.948
     0.0200                50.00                3.463
                    .
                    .
     0.9800                 1.02               19.373
     0.9900                 1.01               20.828
STATION - 06291500          LODGE GRASS CREEK AB WILLOW C DIV NEAR WYOLA MT          N =   42     NZI =    0
                    .
                    .
 90-DAY HIGH VALUE
                    .
                    .
EXCEEDANCE PROB     RECURRENCE INTERVAL    PARAMETER VALUE
     0.9900                 1.01              107.594
     0.9500                 1.05              155.747
                    .
                    .
     0.0100               100.00              994.104
     0.0050               200.00             1098.628
END OF PROGRAM A193.
12/05/91                                    PROGRAM E796                                    PAGE    1
                                STREAMFLOW/BASIN CHARACTERISTICS FILE RETRIEVAL
END OF JOB - PROGRAM E796 --- CONDITION CODE =  0
1 06291500      3030LODGEGRASS CREEK AB WILLOW CR DIV NR WYOLA
2 06291500       75311.000 76435.000 77624.000 78760.000 79945.000 801090.00   1
2 06291500       811250.00179 0.2410180 2.6460181 0.1800196 37.000             2
```

Attachment 3.--*Sample extract file*

The following is a listing of the extract file created by FLOWSTAT. The user may edit this file to force changes in values in the final report. The line beginning with CORR is currently unused but must be present.

```
EXTRACT FILE STAT003.XTR
----MONTHLY AND ANNUAL DISCHARGES----
STATION 06291500
PER/REC (WY): 1940-74, 1983-90
ANNUAL HIGH FLOW-YEARS RECORD:  43
PER/REC (CY): 1940-74, 1984-90
ANNUAL LOW FLOW-YEARS RECORD:  42
OCT       35.50      11.50      20.86       5.68       0.27       3.60
NOV       28.00      10.70      18.87       4.78       0.25       3.30
DEC       25.00       8.58      16.69       4.38       0.26       2.90
JAN       30.30       4.87      16.85       5.75       0.34       2.90
FEB       32.00       9.00      16.96       5.42       0.32       2.90
MAR       36.90      10.40      20.58       6.65       0.32       3.50
APR       59.70      12.60      32.43      12.63       0.39       5.60
MAY      257.00      36.20     118.81      49.05       0.41      20.50
JUN      445.00      57.40     205.93     106.10       0.52      35.50
JUL      176.00      20.10      62.45      31.44       0.50      10.80
AUG       50.70      10.30      27.42       9.49       0.35       4.70
SEP       40.10       8.11      22.43       7.54       0.34       3.90
ANN       85.60      21.80      48.35      15.97       0.33     100.00
END MONTHLY/ANNUAL
----DURATION TABLE OF DAILY MEAN FLOW----
STATION 06291500
1       552.50     468.37     402.54     322.14     195.92     115.76
30       53.85      33.47      22.93      17.72      15.51      13.07
98     11.04       8.62       6.89       6.21       3.93
END DURATION
----ANNUAL LOW FLOW/HIGH FLOW----
STATION 06291500
  1       8.84       5.94       4.71       3.84       3.02       2.55
  3       9.58       6.57       5.28       4.36       3.46       2.95
  7      10.52       7.43       6.09       5.12       4.17       3.62
 14      11.74       8.55       7.12       6.06       5.01       4.38
 30      13.39       9.92       8.29       7.07       5.84       5.10
 60      14.70      11.28       9.66       8.42       7.15       6.36
 90      15.53      12.22      10.70       9.54       8.34       7.60
120      16.09      12.78      11.25      10.10       8.90       8.17
183      17.44      13.83      12.17      10.92       9.62       8.83
CORR -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00 -1.00
  1     356.82     527.16     640.71     783.65     889.32     994.10
  3     322.70     470.97     566.30     682.56     766.01     846.80
  7     292.28     426.52     511.92     615.08     688.43     758.88
 15     255.50     371.13     444.82     534.04     597.66     658.92
 30     214.98     310.25     372.42     449.47     505.67     560.84
 60     158.31     223.21     265.82     319.10     358.35     397.25
 90     122.97     172.43     204.57     244.39     273.50     302.16
END ANNUAL LOW FLOW/HIGH FLOW
----PEAK FLOW----

STATION 06291500
NAME: LODGEGRASS CREEK AB WILLOW CR DIV NR WYOLA
YEARS RECORD:  37
PEAK 80    311.00    435.00    624.00    760.00    945.00   1090.00   1250.00
SKEW        0.24
MEAN        2.65
STDEV       0.18
END PEAK FLOW
END OF EXTRACT FILE
```

Attachment 4.--*Sample summary of streamflow statistics*

06291500 LODGEGRASS CREEK AB WILLOW CR DIV NR WYOLA

Monthly and annual discharges 1940-74, 1983-90

Month	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation (ft^3/s)	Coefficient of variation	Percentage of annual runoff
October	36	12	21	5.7	0.27	3.6
November	28	11	19	4.8	0.25	3.3
December	25	8.6	17	4.4	0.26	2.9
January	30	4.9	17	5.8	0.34	2.9
February	32	9.0	17	5.4	0.32	2.9
March	37	10	21	6.6	0.32	3.5
April	60	13	32	13	0.39	5.6
May	257	36	119	49	0.41	20.5
June	445	57	206	106	0.52	35.5
July	176	20	62	31	0.50	10.8
August	51	10	27	9.5	0.35	4.7
September	40	8.1	22	7.5	0.34	3.9
Annual	86	22	48	16	0.33	100

Magnitude and frequency of annual low flow, based on period of record 1940-74, 1984-90

Period (consecutive days)	Discharge, in ft^3/s, for indicated recurrence interval, in years, and annual non-exceedance probability, in percent				
	2 50%	5 20%	10 10%	20 5%	50 2%
1	8.8	5.9	4.7	3.8	3.0
3	9.6	6.6	5.3	4.4	3.5
7	11	7.4	6.1	5.1	4.2
14	12	8.5	7.1	6.1	5.0
30	13	9.9	8.3	7.1	5.8
60	15	11	9.7	8.4	7.1
90	16	12	11	9.5	8.3
120	16	13	11	10	8.9
183	17	14	12	11	9.6

Magnitude and frequency of instantaneous annual peak flow based on period of record 1940-74, 1984-90

Discharge, in ft^3/s, for indicated recurrence interval in years, and annual exceedance probability, in percent					
2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
435	624	760	945	1,090	1,250

Weighted skew (logs)= 0.24
Mean (logs)= 2.65
Standard dev. (logs)= 0.18

Magnitude and frequency of annual high flow, based on period of record 1940-74, 1983-90

Period (consecutive days)	Discharge, in ft^3/s, for indicated recurrence interval, in years, and annual exceedance probability, in percent					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
1	357	527	641	784	889	994
3	323	471	566	683	766	847
7	292	427	512	615	688	759
15	256	371	445	534	598	659
30	215	310	372	449	506	561
60	158	223	266	319	358	397
90	123	172	205	244	274	302

Duration of daily mean flow for period of record 1940-74, 1983-90

Discharge, in ft^3/s, which was exceeded for indicated percentage of time																
.1%	.5%	1%	2%	5%	10%	20%	30%	50%	70%	80%	90%	95%	98%	99%	99.5%	99.9%
553	468	403	322	196	116	54	33	23	18	16	13	11	8.6	6.9	6.2	3.9

Attachment 5.--*Sample post-processor files*

The following are listings of two sample post-processor CPL's that are used for preparing the consolidated flow reports for use on laser printers. The first sample prepares output for an HP Laser Jet, whereas the second sample prepares output for a Postscript printer. Note that control characters in the files are denoted by ^nnn where nnn is the OCTAL value of the control character.

Sample 1 - Process for HP Laser Jet

```
/* CPL program to convert FLOWSTAT report files for printing on
/* the laser printer using the Math Elite (J) cartridge and the
/* internal line printer font.
/*
/*Written by Mark Werley (MRWERLEY@DAZTCN) 3/88
/*
&SEVERITY &WARNING &IGNORE
TYPE STCONV1 rev. 0.0
TYPE
/*
/* GET FILE NAMES
/*
&ARGS STATFILE;OPTIONS:REST
&S OUTFILE := %STATFILE%.LZR
&IF ^^ [EXISTS %STATFILE% -FILE -BRIEF] &THEN &DO
      TYPE
      TYPE 'REPORT FILE "'%STATFILE%'" WAS NOT FOUND'
      TYPE 'YOU MUST RUN OPTION (3) BEFORE YOU RUN THIS OPTION'
      TYPE
      &S OPT := [RESPONSE 'HIT <CR> TO CONTINUE']
      &RETURN
&END
TYPE
TYPE 'PROCESSING FILE: '%STATFILE%
TYPE
/*
/* STOP THE OUTPUT TO THE SCREEN
/*
COMO TEMP.COMO -NTTY -P
/*
/*THIS SECTION RUNS ONLY IF THERE IS A TABLE FILE
/*
/*
/*
/*
/* EDit THE MANUSCRIPT FILE
/*
&DATA ED %STATFILE%
BR
C/#/^233(1QN^233(8U/G30000
T
C/mi2/mi^233(0A2^233(8U/G30000
T
C/FT3/FT^233(0A^233&k7.2H^233&a+10V3^233(8U^233&a-10V/g30000
T
C/mi.2/mi^233(0A2^233(8U/G30000
T
C/FT.3/FT^233(0A^233&k7.2H3^233(8U/G30000
T
C.1/2.^233(0Ex^233(8U.G30000
T
C.1/4.^233(0Ew^233(8U.G30000
T
```

Attachment 5.--*Sample post-processor files*--Continued

```
C.1\2.^233(0Ex^233(8U.G30000
T
C.1\4.^233(0Ew^233(8U.G30000
T
;
^233&l0E^233&a0R
^233&l0O^233(8U^233(s0p16.66h8.5v0s0b0T
^233&l5.5C
;
B
;
^233E
;
FILE %OUTFILE%
&END
/*
/* RESTART THE SCREEN OUTPUT
/*
COMO -TTY
COMO -E
/*
/* DELETE THE TEMPORARY FILES
/*
DELETE TEMP.COMO -NQ -NO_VERIFY
/*
/*  SPOOL THE OUTPUT
/*
SPOOL [UNQUOTE %OUTFILE%] %OPTIONS%
DELETE %OUTFILE% -NQ -NO_VERIFY
&STOP
```

Attachment 5.--*Sample post-processor files*--Continued

Sample 2 - Process for Postscript printer

```
/* CPL program to convert FLOWSTAT report files for printing on
/* Postscript laser printer
/*
/*  Remove 8 spaces from left margin
/*  Insert control characters to provide superscript
/*  Spool using LASER command
/*
/* by Gary Rogers
/*
&SEVERITY &WARNING &IGNORE
TYPE STCONV2 rev. 0.0
TYPE
/*
/* GET FILE NAMES
/*
&ARGS STATFILE;OPTIONS:REST
&S OUTFILE := %STATFILE%.LZR
&IF ^^ [EXISTS %STATFILE% -FILE -BRIEF] &THEN &DO
      TYPE
      TYPE 'REPORT FILE "'%STATFILE%'" WAS NOT FOUND'
      TYPE 'YOU MUST RUN OPTION (3) BEFORE YOU RUN THIS OPTION'
      TYPE
      &S OPT := [RESPONSE 'HIT <CR> TO CONTINUE']
      &RETURN
&END
TYPE
TYPE 'PROCESSING FILE: '%STATFILE%
TYPE
/*
/* STOP THE OUTPUT TO THE SCREEN
/*
COMO TEMP.COMO -NTTY -P
/*
/* EDit THE MANUSCRIPT FILE
/*
&DATA ED %STATFILE%
BR
t
f          ;c/         //;*
t
f ^214;o 1;*
t
c/ft3/ft^2033^204/g9999
t
i ^001^001
FILE %OUTFILE%
&END
/*
/* RESTART THE SCREEN OUTPUT
/*
COMO -TTY
COMO -E
/*
/* DELETE THE TEMPORARY FILES
/*
DELETE TEMP.COMO -NQ -NO_VERIFY
/*
/*  SPOOL THE OUTPUT
/*
LASER [UNQUOTE %OUTFILE%] %OPTIONS%
DELETE %OUTFILE% -NQ -NO_VERIFY
&STOP
```


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