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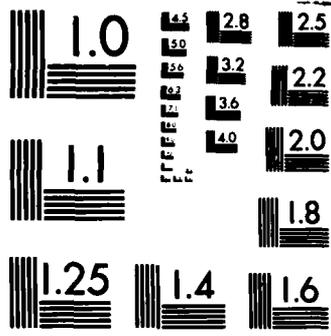
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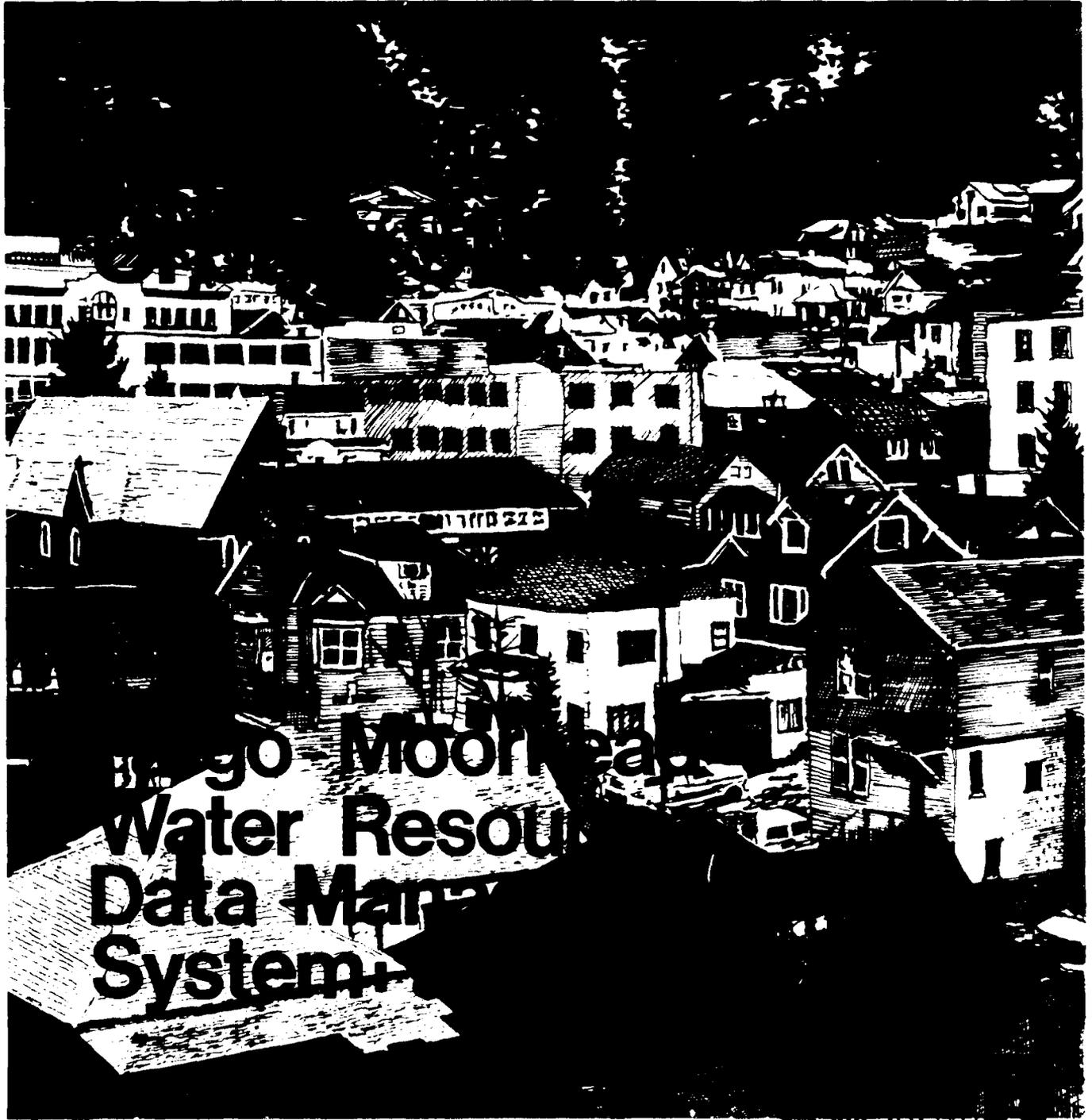
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the online management system and the off-line management programs. Using the online system, you can manipulate the database through commands that perform a variety of functions, including correlation analysis, statistical tables, and plots. The off-line (batch-type) programs, can convert data from magnetic tape format to online database formats and vice versa.

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**THE FARGO-MOORHEAD WATER RESOURCE DATA
MANAGEMENT SYSTEM:
A USER'S MANUAL**

St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101-1479

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PREFACE

The Fargo-Moorhead Urban Study was sponsored by the St. Paul District, Corps of Engineers, as a cooperative effort of local, State, and Federal agencies. The results of this study are contained within the following documents:

- o Summary Report
- o Background Information Appendix
- o Water Supply Appendix (3 Volumes)
- o Water Conservation Appendix
- o Energy Conservation Appendix
- o Flood Control Appendix
- o Fargo-Moorhead Water Resource Data Management System Appendix (3 Volumes)

The Summary Report contains a brief, non-technical overview of the results of the overall study. Only readers desiring additional detailed information should review the appropriate technical appendixes.

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I. THE FARGO-MOORHEAD WATER RESOURCES DATA MANAGEMENT SYSTEM

INTRODUCTION

The Fargo-Moorhead Water Resources Data Management System (FMWRDMS) has two major parts: the on-line management system and the off-line management programs. Using the on-line system, you can manipulate the database through commands that perform a variety of functions, including correlation analysis, statistical tables, and plots. With the off-line management (batch-type) programs, you can convert data from magnetic tape format to on-line database formats and vice versa. Using a number of auxiliary programs, you can also create plots and monthly statistical tables of any data stored off-line.

The following lists show all the programs and files that you can use to create, back up, and run the on-line system along with all the auxiliary programs associated with the system. These lists also show the number of lines of code and the storage size for each program and data file of the system. Note: the system is already set up and ready for data manipulation (section II). These programs are listed for a general overview of the FMWRDMS, not necessarily for your specific use.

ON-LINE SYSTEM PROGRAMS AND FILES

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
1. A1	Source code for interactive management system (P4 is compiled version of A1)	4,000	163,000
2. MAKDBS	Converts sequential files into direct access	18	270
3. PLOT	Creates plots from on-line data	111	3,600

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
4. PLOTVIEW	Command list that allows viewing of off-line tables	21	600
5. PLT,PLT1	Loads plot, merges data on the end, and then submits the plot job	10	200
6. RDB	Initiates execution of the compiled system	2	30
7. SET1	Allocates and defines space for direct access file	35	1,200
8. TABGEN	Creates statistical tables from on-line data	370	14,000
9. FW01	Direct access file - contains daily precipitation	--	88,000
10. FW02	Direct access file - contains daily temperatures	--	121,000
11. FW03	Direct access file - contains monthly precipitation	--	6,300
12. FW04	Direct access file - contains daily streamflow	--	250,000
13. FW05	Direct access file - contains monthly streamflow	--	24,000
14. FW06	Direct access file - contains monthly dam elevations	--	6,000

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
15. FW07	Direct access file - contains monthly water use	--	22,000
16. FW08	Direct access file - contains monthly water forecasts	--	30,000
17. ASH1	TAPE 1 output file - contains daily precipitation	--	90,000
18. ASH2	TAPE 2 output file - contains daily precipitation	--	120,000
19. ASH3	TAPE 3 output file - contains monthly precipitation	--	6,000
20. ASH4	TAPE 4 output file - contains daily streamflow	--	250,000
21. ASH5	TAPE 5 output file - contains monthly streamflow	--	23,000
22. ASH6	TAPE 6 output file - contains monthly dam elevation	--	6,000
23. ASH7	TAPE 7 output file - contains monthly water use	--	21,000
24. ASH8	TAPE 8 output file - contains monthly water forecasts	--	280,000
25. TABLES	Lists all available tables	--	275,000

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
26. FWDICT	Contains data dictionary	--	1,200
27. ME YOU CORDTA CORDTB TABFILE	Output files used by A1	--	--
28. TABRUN1 TABRUN2	Command list to run TABGEN	--	90

SET-UP/BACK-UP PROGRAMS

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
1. DISK1	Backs up daily precipitation files from on-line back to tape	122	4,200
2. DISK2	Backs up daily temperature files from on-line back to tape	124	4,300
3. DISK3	Backs up monthly precipitation files from on-line back to tape	111	4,000
4. DISK4	Backs up daily streamflow files from on-line back to tape	147	5,300
5. DISK5	Backs up monthly streamflow files from on-line back to tape	183	7,200
6. DISK6	Backs up the dam elevation files from on-line back to tape	108	4,000
7. DISK7	Backs up various water use files from on-line back to tape	175	2,000
8. DISK8	Backs up the future supply files from on-line back to tape	205	8,200
9. TAPE1	Converts daily precipitation files to on-line database format	263	11,000
10. TAPE2	Converts daily temperature files to on-line database format	274	12,000

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
11. TAPE3	Converts monthly precipitation files to on-line database format	272	11,000
12. TAPE4	Converts daily streamflow files to on-line database format	288	12,000
13. TAPE5	Converts monthly streamflow files to on-line database format	353	15,000
14. TAPE6	Converts the dam elevation files to on-line database format	251	11,000
15. TAPE7	Converts various water usage files to on-line database format	340	14,000
16. TAPE8	Converts the future supply files to on-line database format	382	16,000
17. IN1-IN8	Command list - runs TAPE1 - TAPE8	--	60
18. OUT1-OUT8	Command list - runs DISK1 - DISK8	--	90

AUXILIARY PROGRAMS

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
1. NEWSTRMD	Generates daily streamflow table	209	9,200
2. STATGEN	Generates statistical tables for monthly datatypes	375	16,300
3. STATTEMP	Generates statistical tables for monthly temperature datatypes	253	10,000

<u>Name</u>	<u>Description</u>	<u>Lines</u>	<u>Size (Bytes)</u>
4. STRMMNMX	Generates daily MIN/MAX streamflow table	257	11,000
5. PLOTDF	Creates plots from statistical data	111	3,800
6. PRCPNEW	Generates statistical tables for daily precipitation data	229	11,000

UTILITY PROGRAMS

1. HARDCOPY	Sends library file to computer center printer	15
2. IMPORT	Reads file from tape	16
3. EXPORT	Writes a file to tape	23

AVAILABLE DATATYPES

<u>Datatype code</u>	<u>Datatype</u>
PRCP	Daily precipitation
TMAX	Daily maximum temperature
TMIN	Daily minimum temperature
EVAP	Monthly evaporation
SNOF	Monthly snowfall
PRCM	Monthly precipitation
STFD	Daily streamflow
STRM	Monthly streamflow
DMEL	Dam water elevation
RWPM	River water pumped
WWPM	Well water pumped

MUND	Municipal water use
RESD	Residential water use
COMD	Commercial water use
FDEM	Forecast water demand
FSUP	Forecast water supply

STATIONS FOR WHICH DATA ARE AVAILABLE

Station Code	Station Abbreviation	Station Name
1	FARG	Fargo
2	MRHD	Moorhead, MN
3	WFAR	West Fargo
4	ASHT	Lake Ashtabula
5	BUFF	Buffalo Reservoir
6	RRFG	Red River, Fargo
7	RRWP	Red River, Wahpeton
8	RRHD	Red River, Halstad
9	SHWF	Sheyenne River, West Fargo
10	SHAS	Sheyenne River, Ashtabula
11	MPLE	Maple River, Enderlin
12	WRAC	Wild Rice River, Abercrombie
13	BUFD	Buffalo River, Dilworth, MN
14	RUSH	Rush River, Amenia
15	WRTV	Wild Rice River, Twin Valley, MN

DATA AVAILABILITY MATRIX

	PRCP	TMAX	TMIN	EVAP	SNOF	PRCM	STFD	STRM	DMEL	RWPM	WWPM	MUND	RESD	COMD	FDEM	FSUP
FARG	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y
MRHD	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
WFAR	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
ASHT	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
BUFF	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
RRFC	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
RRWP	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
RRHD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
SHWF	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
SHAS	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
MPLF	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
WRAC	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
BUFD	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
RUSH	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
WRTV	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N

This matrix is supplied for your reference since it is important that each user knows what data are available for which stations and datatypes.

For further explanation of the FMWRDMS and the datatypes and stations used within it, you can obtain a brief description of the system by entering "RUN RDB" and then the "HELP" command. You should also review section III of this manual.

FURTHER COMMENTS

Because a complete listing with documentation of the above programs is in volume 4 of the FMWRDMS study reports, no additional explanation is given in this manual.

The principal program of the management system is A1. It is also the largest program, with about 4,000 lines. Program A1 requires almost 160,000 bytes of memory. The compiled version of the FORTAN program A1, designated P4, becomes the interactive database management system. The object code P4 requires a work space of about 110,000 bytes. By using the system commands, you can retrieve, store, tabulate, plot, and analyze historical water resources data in the specific direct access files of the system.

So that you may have a better feel for the design of program A1, an index to A1 is provided at the back of this manual. Program A1 has two principal sections: (1) main program and (2) commands and functions code. The contents of the program can be further subdivided into numerous components within these sections. Appendix A of this report lists the steps taken to set up the FMWRDMS and its database. Appendix B of this report lists these components and the range of lines of code in A1 that these components occupy to express their respective functions. This appendix, in conjunction with A1 in its complete form in volume 4 of FMWRDMS study reports, may help you more clearly understand the program's structure. This understanding, in turn, may help you expand and modify the system. Expansion and modification are inevitable if the system is to have a purposeful and enduring life.

ACCESSING THE SYSTEM

When accessing the Fargo-Moorhead Water Resources Data Management System, you must know some vital information. Before you even reach the terminal, you need to know at least four basic things. Since you are linking into the mainframe at North Dakota State University (NDSU), you need to know (1) NDSU's baud speed or speed of transmission, (2) the kind of duplex used, (3) the password, and (4) your user id number.

Once you know these four fundamental bits of information, you can access the system. Go to a terminal with a modem hookup and turn it on. Set the modem for the current baud speed (because the Corps terminals use a high-speed, 1200-baud transmission, set the modem for high-speed transmission by pushing in "HS" on the modem). Now dial the FTS operator for Fargo, North Dakota, and request to be linked into the system through the number 701-232-2523. (This number is specifically for 1200-band transmissions. There are other numbers to call for other bauds.) Once you hear the tone, push in "ORG" on the modem and hang up the phone. The system will now ask you to enter a class number: enter "CLASS 1". After you do so, the computer will give three or four lines of comments, then ask for your sign-on or i.d. number. After receiving a valid sign-on number, the system will request the password. At this time, the password is "HYDRO". After the system accepts the password, you are ready to use the Fargo-Moorhead Water Resources Data Management System. If you have any questions about this procedure, call the computer center at NDSU at 701-237-8661.

Caution - It is essential to know some safety-related cautions when you use the FMWRDMS. The system is already set up and ready for use -- it requires no additional steps before you can manipulate the data. Never try to set up the database because it is already set up. If you try to set up the data base, it will erase what data it has, reinitialize the data, and set all the data at zero. Such a series of steps would result in the loss of data, not to mention the extra labor and money necessary to retrieve it.

Therefore, never try to set up the existing database. If, however, you foresee an important need to set up a database, contact either the Corps of Engineers in St. Paul or the Computer Center at North Dakota State University. Execution of the proper and correct steps when dealing with the FMWRDMS will give you a profitable, versatile, and lasting experience with this system.

II. DATA MANIPULATION OF THE ON-LINE SYSTEM

Data manipulation of the on-line system is one of the most practical and informative aspects of the FMWRDMS. It allows you, the user, to view tables, plots, or specific information quickly and easily. To use this important part of the FMWRDMS, read on.

Once the on-line database has been established, as it has already been for the period 1963 to 1992, you can manipulate it by using the on-line commands available in FMWRDMS. To initiate the processing of the on-line system, you should enter the VSPC (virtual storage personal computer) command by typing in: "RUN RDB". This command will initiate access to the system; and, once access is achieved, you can begin processing on the system.

DICTIONARY

The first task that the system does once you have entered in "RUN RDB" is to load into the system the database dictionary. This dictionary allows access to the physical database by acting as a central common storage area where all functions can use the stored information. Currently, the dictionary contains the following information:

1. The number of commands.
2. A list of all the commands.
3. The number of datatypes.
4. A list of all datatypes.
5. The number of stations.
6. A list of all the stations.

7. The data availability matrix that contains information on which datatype is available for which station.
8. The years for which data are available in the on-line system.
9. The number of on-line files.
10. The names of the on-line files.
11. Description of each database file, i.e., which file contains which datatype.
12. The system password.
13. Offsets of data within a file and the multiplication factor.
14. The available range of the numbers in each datatype.
15. An indicator telling which files are daily and which are monthly.
16. A variable that indicates if any update was performed.

A copy of the dictionary is on the next page. Identification of each of the 16 items listed above is provided in a column on the right of the dictionary.

After the dictionary is loaded and all other set-up procedures are completed, the system will ask you to enter a command. At present, 13 commands are available for your use. A summary of these commands is below, followed by instructions for the use of each specific command.

COMMAND SUMMARY

1. GETD - Retrieves daily data from the database.
2. GETM - Retrieves monthly data from the database.
3. UPTD - Updates daily data entries
4. UPTM - Updates monthly data entries.
5. PLOT - Creates statistical plots of on-line data.
6. EXIT - Permits user to get outside of specified command mode.
7. DSPY - Displays data or results of analysis.
8. PASS - Security password that prevents unauthorized user from altering database.
9. STAT - Generates statistical tables for specified datatype, interval, and location; also permits viewing of off-line tables and plots.

FMWRDMS DICTIONARY

ITEM ID

13 NYDGLNUPADUPN PLOFENITDSPIPASSSTATHELPCHEKWRCORR (1)

15 PROPTWANNINEVAPS.NOFPRCMTFDSTR DNELR/PMLNPHJJDRESDCO:DFDMLFSUP (2)

15 (3)

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10. HELP - An on-line manual that provides examples for unfamiliar users.
11. CHEK - Informs user about previously executed updates.
12. AVER - Generates statistics of specified records.
13. CORR - Allows user to do correlation analysis on data.

Examples of nearly all of these commands are included for your help in section III of this report.

COMMANDS AND THEIR USE

1. GETD - Retrieves daily data from the database.

Instructions

You enter GETD command to retrieve daily data from the database. You must enter the GETD command in the following format:

GETD D1 COND1,D2 COND2 ... OFS1,S2 ... FOR DATE

Where: D1,D2 and S1,S2 are specific datatypes and stations, respectively, for which information is desired.

As an example, to retrieve daily streamflow data for stations 6, 9, and 13 for the month of January 1976, you would enter the following:

GETD STFD OF 6,9,13 FOR 760101-760131

Where: STFD represents daily streamflow, and the date is written in the following form: year/month/day.

Other conditions that can be used in the GETD command follow:

x N Select values less than x
x N Select values greater than x
x = N Select values equal to x
M x N Select values of x between M and N

An example of a query with conditions is:

```
GETD STFD x = 2 OF 6,9,13 for 760101-760131
```

2. GETM: Retrieves monthly data for the database.

Instructions

You enter the GETM command in the following format:

```
GETM D1 COND1,D2 COND2 ... OFS2,S2 ... FOR DATE
```

Where: D1,D2 and S1,S2 are specific datatypes and stations, respectively, for which information is desired.

As an example, to retrieve streamflow data for stations 6,9, and 13 for the month of January 1976, you would enter the following:

```
GETM STRM OF 6,9,13 FOR 760100
```

Note the day is 00. In all monthly functions, the day is ignored and is reset to 99 by the system when it is passed from one procedure to another.

Conditions for each datatype can be specified as:

```
x N Select values less than x  
x N Select values greater than x  
x = N Select values equal to x  
M x N Select values of x between m and n
```

Another example of a query with conditions is:

```
GETM STRM x = 2 OF 6,9,13 for 760100
```

Remember that 6,9,13 are the stations for the daily streamflow data and that 760100 represents January 1976.

3. UPTD: Allows the user to make changes to the daily datatypes.

Instructions

To run the UPTD, you must know the password. After you enter the UPTD command and hit the return key, the system will request you to enter the password. If you enter a valid password (which at this time is "JOE") the system will request that you perform an update. If your password is not valid, the system will not let you use the UPTD command. Once the system accepts your password, you can perform as many updates as you wish. To get out of the update mode, just enter "#" when update is requested by the system. You enter the UPTD command in the following format:

UPTD DTYPE OF SN FOR DATE FROM VAL1 TO VAL2

Where: DTYPE is the data type you want to update SN, is the station number, and VAL1 is the original value changed to VAL2.

4. UPTM: Allows the user to make changes to monthly datatypes.

Instructions

To run the UPTM command, you must know the password. After you enter the UPTM command and hit the return key, the system will request that you enter the password. If you enter the valid password (which at this time is "JOE") the system will request that you perform an update. If your password is not valid, the system will not let you use the UPTM command. Once you have entered the password and you are in, you can perform as many updates as you wish. To get out of the update mode, you enter "#" when the system requests an update.

You enter the UPTM command, like the UPTD command, in the following format:

UPTM DTYPE OF SN FOR DATE FROM VAL1 TO VAL2

Where DTYPE is the datatype you want to update. SN is the station number, and VAL1 and VAL2 are the values you are updating.

An example of UPTM follows:

UPTM PRCM OF 01 FOR 760100 FROM 002500 TO 003000

To complete the update commands successfully, you must have two things: (1) have the correct initial value of the data that is to be changed and (2) have all fields completely specified. Thus, station 1 must be represented as "01" and data values must be stated in six digits. The latter requirement prevents on-line records from being altered inadvertently.

5. PLOT: Allows the user to create statistical plots of on-line data.

Instructions

When you want a statistical plot, just type in "PLOT" and press the return key. The system will request the file name of the file to be plotted. You should then enter the file name that you want to be plotted. This file must have previously been created by the GETD or GETM command. The PLOT command has the following limitations:

1. Only one datatype can be plotted at a time.
2. A maximum of only three stations are allowed.

In addition, if the file is not in the proper format, the PLOT command will not plot it. You can specify two destinations for the plot output: (1) the terminal and (2) the printer for a hard copy at the Computer Center.

6. EXIT: Terminates execution of the system.

Intructions

To terminate processing of the on-line system, just type in "EXIT" and press the return key. This command will stop the execution of the system.

7. DSPY: Allows the user to view files from the on-line system.

Intructions

You can use the DSPY command in the following way. If you want to view files, type in "DSPY" and hit the center key. The system will ask you the name of the file that you want displayed. This file must have been created by a GETD or GETM command before you issue the DSPY command. If the file is in proper format, the system will display it; otherwise, it will print an error message and will not display the file.

8. PASS: Allows the user to change the system password.

Intructions

To run the PASS command, you must know the old password. After you type in "PASS" and hit the return key, the system will request the old password. You should enter the old password at this time. The system will then request the new password. If you do not know the old password, the system will not allow you to change the password.

9. STAT: Allows the user to view or create plots and tables from off-line or on-line sources.

Instructions

You can use the STAT command as follows. To begin, you should type in "STAT" and press the enter key. The system will ask if you desire to create a table or view an off-line table. The system will give you this choice and display the two alternatives on the system's screen. Respond by pressing the appropriate key.

If you choose to create a table, you are required to generate a file using GETM. This file has already been created by the system: it is called TABFILE.

Run STAT again, and the system will submit a batch job for you. To understand the following steps for the STAT command, you should refer to the example of obtaining an on-line table given in section III of this manual. The system will ask whether you want the output displayed on the screen or sent to the printer. After you enter your choice, the computer will give you the code number under which the job was just submitted. You must now exit the system and load the completed output independent of the system. To do so, type in "EXIT". The computer will then print STOP and your time period of use. At this time, ask for the status of the completed job by typing "STA##", where ## is the job number. The system will tell you the job is completed. Now load the table back into the system by typing in "LOAD## DS###". The computer will respond by telling you it is ready. Now ask for a listing of the table by typing in "LIS NOLIN".

If you wish to view an off-line table, then enter the table number of the off-line table you wish to view. If you do not know this table number, then enter the word "LIST" and press the return key. This command will display all the table numbers that are available on-line. To terminate this command, just enter # when the system asks for the table number to be displayed.

The last section of the list includes data plots that have been previously created external to the database system. To view these plots, you must LOGON

to VSPC LIBRARY 2931 from a texttronix terminal and issue the following command: "RUNPLOTVIEW". The plot will take several minutes to form completely. You may view as many plots as you wish one at a time. The computer will display a list of all the plots. To view a specific plot, just type in the corresponding key for the desired plot. You must wait for each plot to finish before loading another. Repeat the above command for each plot you wish to view.

10. HELP: Allows the user to get on-line help in using the commands.

Instructions

To obtain information on how to use a particular command, you can use the HELP command. Type in "HELP ARG" and press the enter key. ARG can represent three different input statements:

1. A blank space: to obtain information on entire database.
2. All: to obtain information on how to use all commands.
3. Command name: to obtain information on how to use a command.
11. CHEK: Allows the user to determine if the system was updated.

Instructions

To check if the on-line database was updated after the last backup operation, type in "CHEK" and press the enter key. The system will then provide information on whether the back-up should be performed. This command will prevent you from changing recently inputted data and indicate to you that it has been updated.

12. AVER: Allows the user to get statistical data from on-line files.

Instructions

To use the AVER command, type in "AVER" and then press the return key. The system will then ask you for the file name. You then type in the file name. This file must be created by a GETD or GETM command before you issue the AVER command.

13. CORR: Allows the user to do correlation analysis on data.

Instructions

The CORR command allows you to make a straight-line regression analysis for two similar files created by GETD or a GETM command. One file is stored in each output. Through answering the computer's questions, you decide which output file is the independent variable and which is the dependent variable. You enter the file names as prompted by the command. It is important to note that you cannot use daily and monthly data types together. Both files must also be exactly the same length, i.e., if the independent variable file is 6 days, then the dependent variable file must also be 6 days. An error message will be displayed if the files are mismatched for data type or length.

These are the current 13 commands available for the user of the system. In order to attain a clearer understanding of the actual use of these commands, see section III of this report, which provides numerous examples of application of system commands.

III. SELECTED EXAMPLES OF APPLICATIONS OF THE FARGO-MOORHEAD WATER RESOURCES DATA MANAGEMENT SYSTEM (FMWRDMS)

The FMWRDMS is an on-line, interactive programming system capable of responding to a variety of data storage, retrieval, and data analysis needs of water resources management. The FMWRDMS is designed with particular concern for the water supply and demand needs of the Fargo-Moorhead metropolitan region.

COMPUTER CONVERSATIONS

Several examples below illustrate how you, as a typical user, can have an interactive dialogue with ease from a remote location. These examples of computer conversations are listed in the following format:

1. User Questions: These underlined statements form the basis of user queries at the computer terminal.
2. User Commands: A set of sample commands directs FMWRDMS to process the query. The uncapitalized (or lower case) text shows the specific commands transmitted for execution by the computer.
3. System Responses: Answers to the questions posed are sent to the screen monitor, the printer, or the plotter as required. This transmission is shown by capitalized (or upper case) text.

1. Give a brief description of the FMWRDMS.

```
run rdb
RDB 05/21/84 13:59:26
ENTER COMMAND
?help
IMPLEMENTED COMMANDS FOR DATA BASE
MANIPULATION ARE:
```

GETD GETM UPTD UPTM PLOT EXIT DSPY PASS STAT HELP CHEK AVER CORR

AVAILABLE DATA TYPES IN ON-LINE
DATA BASE ARE:

<u>DATA TYPE CODE</u>	<u>DATA TYPE</u>	<u>UNITS</u>
PRCP	DAILY PRECIPITATION	INCHES
TMAX	DAILY MAXIMUM TEMPERATURE	DEGREES F
TMIN	DAILY MINIMUM TEMPERATURE	DEGREES F
EVAP	MONTHLY EVAPORATION	INCHES
SNOF	MONTHLY SNOWFALL	INCHES
PRCM	MONTHLY PRECIPITATION	INCHES
STFD	DAILY STREAMFLOW	CFSD
STRM	MONTHLY STREAMFLOW	CFSD
DMEL	DAM WATER ELEVATION	FEET
RWPM	RIVER WATER PUMPED	1000 GALS
WWPM	WELL WATER PUMPED	1000 GALS
MUND	MUNICIPAL WATER USE	1000 GALS
RESD	RESIDENTIAL WATER USE	1000 GALS
COMD	COMMERCIAL WATER USE	1000 GALS
FDEM	FORECAST WATER DEMAND	1000 GALS
FSUP	FORECAST WATER SUPPLY	1000 GALS

PAUSE *** HIT RETURN TO CONTINUE ***
?

STATIONS FOR WHICH DATA IS AVAILABLE:

<u>STATION CODE</u>	<u>STATION ABBREVIATION</u>	<u>STATION NAME</u>
1	FARG	FARGO
2	MRHD	MOORHEAD, MN
3	WFAR	WEST FARGO
4	ASHT	LAKE ASHTABULA
5	BUFF	BUFFALO RESERVOIR
6	RRFG	RED RIVER, FARGO
7	RRWP	RED R., WAHPETON
8	RRHD	RED R., HALSTAD
9	SHWF	SHEYENNE R, W FARGO
10	SHAS	SHEYENNE R, ASHTABULA
11	MPL	MAPLE R, ENDERLIN
12	WRAC	WILD RICE R, ABERCROMBIE
13	BUFD	BUFFALO R, DILWORTH, MN
14	RUSH	RUSH RIVER, AMENIA
15	WRTV	WILD RICE R, TWIN VALLEY, MN

PAUSE *** HIT RETURN TO CONTINUE ***
?

FOLLOWING MATRIX DESCRIBES WHICH DATA
TYPE IS AVAILABLE FOR WHICH STATION:

	P	T	T	E	S	P	S	S	D	R	W	M	R	C	F	F
	R	M	M	V	N	R	T	T	M	W	W	U	E	O	D	S
	C	A	I	A	O	C	F	R	E	P	P	N	S	M	E	U
	P	X	N	P	F	M	D	M	L	M	M	D	D	D	M	P

FARG	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y
MRHD	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
WFAR	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
ASHT	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
BUFF	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
RRFG	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
RRWP	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
RRHD	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
SHWF	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
SHAS	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
MPLE	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
WRAC	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
BUFD	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N
RUSH	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
WRTV	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N

PAUSE *** HIT RETURN TO CONTINUE ***
?

ON-LINE DATA IS AVAILABLE FOR THE FOLLOWING DATES:

FROM 1/ 1/63 TO 12/31/92

OFF-LINE DATA IS AVAILABLE FOR FOLLOWING DATES:

FROM 1/ 1/63 TO 12/31/92

IF YOU NEED INFORMATION ON HOW TO USE
A SPECIFIC COMMAND: TYPE HELP ARG.
WHERE ARG IS THE COMMAND NAME.

ENTER COMMAND
?

2. How can one retrieve monthly data?

help getm

GETM COMMAND SHOULD BE ISSUED IN FOLLOWING FORMAT:

GETM D1 [COND1][,D2 [COND2]...] OF S1[,S2...] FOR DATE

AN EXAMPLE QUERY TO RETRIEVE STRM DATA FOR STATIONS
6,9 AND 13 FOR THE MONTH OF JANUARY, 1976 WOULD BE:

GETM STRM OF 6,9,13 FOR 760100

NOTE THE DAY IS 00 -- IN ALL MONTHLY FUNCTIONS
THE DAY IS IGNORED AND IS RESET TO 99 BY THE SYSTEM
WHEN IT IS PASSED FROM ONE PROCEDURE TO ANOTHER.

DO YOU NEED EXAMPLE FOR CONDITIONS IN QUERY?

ENTER Y/N

?y

CONDITIONS FOR EACH DATA TYPE CAN BE SPECIFIED AS:

X<N	SELECT VALUES LESS THAN X
X>N	SELECT VALUES GREATER THAN X
X=N	SELECT VALUES EQUAL TO X
M<X<N	SELECT VALUES OF X BETWEEN M AND N

AN EXAMPLE FOR QUERY WITH CONDITIONS IS:

GETM STRM X=2 OF 6,9,13 FOR 760100

ENTER COMMAND

?

3. Retrieve monthly precipitation of Fargo for the period from 1976 to 1977.

getm prcm of 1 for 760199-771299

ENTER FILE NAME FOR GET

?me

DO YOU WANT TO SEE OUTPUT? ENTER Y/N

?y

DATE	STATION	PRCM
76/ 1	FARG	0.90
76/ 2	FARG	0.30
76/ 3	FARG	0.80
76/ 4	FARG	1.10
76/ 5	FARG	0.40
76/ 6	FARG	2.30
76/ 7	FARG	0.60
76/ 8	FARG	0.40
76/ 9	FARG	0.40
76/10	FARG	0.10
76/11	FARG	0.20
76/12	FARG	0.20
77/ 1	FARG	0.60
77/ 2	FARG	1.20
77/ 3	FARG	1.70
77/ 4	FARG	0.80
77/ 5	FARG	7.30
77/ 6	FARG	1.60
77/ 7	FARG	5.30
77/ 8	FARG	2.50

PAUSE *** HIT RETURN TO CONTINUE ***

?

DATE	STATION	PRCM
77/ 9	FARG	3.00
77/10	FARG	2.40
77/11	FARG	4.50
77/12	FARG	0.70

ENTER COMMAND

?

4. Retrieve monthly precipitation greater than 1" of Fargo for the time period from 1976 to 1977.

getm prcm x>1 of 1 for 760199-771299

ENTER FILE NAME FOR GET

?me

DO YOU WANT TO SEE OUTPUT? ENTER Y/N

?y

DATE	STATION	PRCM
76/ 1	FARG	-9999.90
76/ 2	FARG	-9999.90
76/ 3	FARG	-9999.90
76/ 4	FARG	1.10
76/ 5	FARG	-9999.90
76/ 6	FARG	2.30
76/ 7	FARG	-9999.90
76/ 8	FARG	-9999.90
76/ 9	FARG	-9999.90
76/10	FARG	-9999.90
76/11	FARG	-9999.90
76/12	FARG	-9999.90
77/ 1	FARG	-9999.90
77/ 2	FARG	1.20
77/ 3	FARG	1.70
77/ 4	FARG	-9999.90
77/ 5	FARG	7.30
77/ 6	FARG	1.60
77/ 7	FARG	5.30
77/ 8	FARG	2.50

PAUSE *** HIT RETURN TO CONTINUE ***

?

DATE	STATION	PRCM
77/ 9	FARG	3.00
77/10	FARG	2.40
77/11	FARG	4.50
77/12	FARG	-9999.90

ENTER COMMAND

?

5. Retrieve monthly streamflow of Red River at Fargo for the five-year period from 1975 to 1979.

getm strm of 6 for 750199-791299

ENTER FILE NAME FOR GET

?me

DO YOU WANT TO SEE OUTPUT? ENTER Y/N

?y

DATE	STATION	STRM
75/ 1	RRFG	18.80
75/ 2	RRFG	26.80
75/ 3	RRFG	38.90
75/ 4	RRFG	320.10
75/ 5	RRFG	146.30
75/ 6	RRFG	243.00
75/ 7	RRFG	537.80
75/ 8	RRFG	70.80
75/ 9	RRFG	43.40
75/10	RRFG	35.80
75/11	RRFG	35.00
75/12	RRFG	21.60
76/ 1	RRFG	23.00
76/ 2	RRFG	29.00
76/ 3	RRFG	100.20
76/ 4	RRFG	104.00
76/ 5	RRFG	34.10
76/ 6	RRFG	16.70
76/ 7	RRFG	9.10
76/ 8	RRFG	3.50

PAUSE *** HIT RETURN TO CONTINUE ***

?

DATE	STATION	STRM
76/ 9	RRFG	1.20
76/10	RRFG	0.40
76/11	RRFG	1.20
76/12	RRFG	1.20
77/ 1	RRFG	1.50
77/ 2	RRFG	1.90
77/ 3	RRFG	8.50
77/ 4	RRFG	19.40
77/ 5	RRFG	7.70
77/ 6	RRFG	9.10
77/ 7	RRFG	7.50
77/ 8	RRFG	1.90
77/ 9	RRFG	17.80
77/10	RRFG	33.30
77/11	RRFG	31.10
77/12	RRFG	38.20
78/ 1	RRFG	40.60
78/ 2	RRFG	32.80
78/ 3	RRFG	129.30
78/ 4	RRFG	692.60

PAUSE *** HIT RETURN TO CONTINUE ***

?

DATE	STATION	STRM
78/ 5	RRFG	175.60
78/ 6	RRFG	123.90
78/ 7	RRFG	155.30
78/ 8	RRFG	36.40
78/ 9	RRFG	11.40
78/10	RRFG	15.50
78/11	RRFG	10.90
78/12	RRFG	10.00
79/ 1	RRFG	9.80
79/ 2	RRFG	9.30
79/ 3	RRFG	26.60
79/ 4	RRFG	676.80
79/ 5	RRFG	257.60
79/ 6	RRFG	193.80
79/ 7	RRFG	146.10
79/ 8	RRFG	101.20
79/ 9	RRFG	63.50
79/10	RRFG	41.30
79/11	RRFG	35.80
79/12	RRFG	30.80

PAUSE *** HIT RETURN TO CONTINUE ***
?

DATE STATION STRM
ENTER COMMAND
?

6. Obtain a statistical summary of the five-year (1975-79) monthly streamflow of Red River at Fargo derived in the previous query.

aver
ENTER FILE NAME
?me

STATION: RRFG

PERIOD: FROM 1/75 TO 12/79

	STRM
SUM	5066.68
MEAN	84.44
MAX	692.60
MIN	0.40
MNTH	60

IF MNTH ARE ZERO, THEN THE VALUES ABOVE ARE INVALID.

PAUSE *** HIT RETURN TO CONTINUE ***

?
ENTER COMMAND
?

7. Retrieve the maximum temperature of Fargo for July 10, 1975.

```
getd tmax of 1 for 750710
ENTER FILE NAME FOR GET
?me
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?y
  DATE      STATION      TMAX
75/ 7/10    FARG             81.00
ENTER COMMAND
?
```

8. Update the maximum temperature of Fargo for July 10, 1975 from its previous value of 80°F to 71°F.

```
uptd
ENTER PASSWORD
?joe
ENTER DESIRED UPDATE
?tmax of 01 for 750710 from 000081 to 000071
ENTER DESIRED UPDATE
?#
ENTER COMMAND
?
```

9. Display the result of the previous update.

```
getd tmax of 1 for 750710
ENTER FILE NAME FOR GET
?me
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?y
  DATE      STATION      TMAX
75/ 7/10    FARG             71.00
ENTER COMMAND
?
```

10. Display the list of on-line and off-line statistical tables and plots.

stat
YOU HAVE AN OPTION TO CREATE A TABLE
FROM ONLINE DATA OR VIEW AN OFFLINE TABLE
ENTER CHOICE 1: CREATE A TABLE 2: VIEW OFFLINE TABLE
?2

WHICH TABLE DO YOU WANT TO BE PRINTED ?
(ENTER TABLE NUMBER T01-T19C)

?list
THIS INDEX WILL LIST ALL CURRENT TABLES
AS WELL AS DATA PLOTS WHICH MAY BE VIEWED
BY FOLLOWING THE INSTRUCTIONS GIVEN IN HELP STAT

NUMBER	DESCRIPTION	LOCATION
T01	PRECIPITATION	FARGO, ND
T02	SNOWFALL	FARGO, ND
T03	TEMPERATURE(AVE)	FARGO, ND
T04	TEMPERATURE(EXTREMES)	FARGO, ND
T05	EVAPORATION	FARGO, ND
T06A	RED RIVER DIVERSION	FARGO, ND
T06B	TOTAL WATER USAGE	FARGO, ND
T07A	RED RIVER DIVERSION	MOORHEAD, MN
T07B	WELL WATER PUMPED	MOORHEAD, MN
T07C	TOTAL WATER PUMPED	MOORHEAD, MN
T07D	RESIDENTIAL WATER USAGE	MOORHEAD, MN
T07E	COMMERCIAL WATER USAGE	MOORHEAD, MN
T08	TOTAL WATER PUMPED	WEST FARGO, ND
T09A	LAKE ELEVATION, ASHTABULA	LAKE ASHTABULA, BALDHILL DAM
T09B	LAKE VOLUME, ASHTABULA	LAKE ASHTABULA, BALDHILL DAM
T10A	STREAMFLOW -- 24-HR MEANS	RED RIVER, FARGO ND
T10B	STREAMFLOW -- MAXIMUMS	RED RIVER, FARGO ND
T10C	STREAMFLOW -- MINIMUMS	RED RIVER, FARGO ND
T11A	STREAMFLOW -- 24-HR MEANS	RED RIVER, WAHPETON, ND
T11B	STREAMFLOW -- MAXIMUMS	RED RIVER, WAHPETON, ND
PAUSE	*** HIT RETURN TO CONTINUE ***	
?		

CONTINUE WITH LIST? (Y/N)

?y

NUMBER	DESCRIPTION	LOCATION
T11C	STREAMFLOW -- MINIMUMS	RED RIVER, WAHPETON, ND
T12A	STREAMFLOW -- 24-HR MEANS	RED RIVER, HALSTAD, MN
T12B	STREAMFLOW -- MAXIMUMS	RED RIVER, HALSTAD, MN
T12C	STREAMFLOW -- MINIMUMS	RED RIVER, HALSTAD, MN
T13A	STREAMFLOW -- 24-HR MEANS	SHEYENNE RIVER, WEST FARGO, ND
T13B	STREAMFLOW -- MAXIMUMS	SHEYENNE RIVER, WEST FARGO, ND
T13C	STREAMFLOW -- MINIMUMS	SHEYENNE RIVER, WEST FARGO, ND
T14A	STREAMFLOW -- 24-HR MEANS	SHEYENNE RIVER, BALDHILL DAM
T14B	STREAMFLOW -- MAXIMUMS	SHEYENNE RIVER, BALDHILL DAM
T14C	STREAMFLOW -- MINIMUMS	SHEYENNE RIVER, BALDHILL DAM
T15A	STREAMFLOW -- 24-HR MEANS	MAPLE RIVER, ENDERLIN, ND
T15B	STREAMFLOW -- MAXIMUMS	MAPLE RIVER, ENDERLIN, ND
T15C	STREAMFLOW -- MINIMUMS	MAPLE RIVER, ENDERLIN, ND
T16A	STREAMFLOW -- 24-HR MEANS	WILD RICE RIVER, ABERCROMBIE, ND
T16B	STREAMFLOW -- MAXIMUMS	WILD RICE RIVER, ABERCROMBIE, ND
T16C	STREAMFLOW -- MINIMUMS	WILD RICE RIVER, ABERCROMBIE, ND
T17A	STREAMFLOW -- 24-HR MEANS	BUFFALO RIVER, DILWORTH, MN
T17B	STREAMFLOW -- MAXIMUMS	BUFFALO RIVER, DILWORTH, MN
T17C	STREAMFLOW -- MINIMUMS	BUFFALO RIVER, DILWORTH, MN
T18A	STREAMFLOW -- 24-HR MEANS	RUSH RIVER, AMENIA, ND

PAUSE *** HIT RETURN TO CONTINUE ***

?

CONTINUE WITH LIST? (Y/N)

?y

NUMBER	DESCRIPTION	LOCATION
T18B	STREAMFLOW -- MAXIMUMS	RUSH RIVER, AMENIA, ND
T18C	STREAMFLOW -- MINIMUMS	RUSH RIVER, AMENIA, ND
T19A	STREAMFLOW -- 24-HR MEANS	WILD RICE RIVER, TWIN VALLEY, MN
T19B	STREAMFLOW -- MAXIMUMS	WILD RICE RIVER, TWIN VALLEY, MN
T19C	STREAMFLOW -- MINIMUMS	WILD RICE RIVER, TWIN VALLEY, MN

THE FOLLOWING FILES ARE PLOTS WHICH CAN BE VIEWED FROM LIBRARY
2931 BY LOGGING ON AND RUNNING PLOTVIEW FROM A TEXTRONIX TERMINAL.

P01	PRECIPITATION	GRAPH	FARGO ,ND
P02	SNOWFALL	GRAPH	FARGO ,ND
P03	TEMPERATURE (AVE)	GRAPH	FARGO ,ND
P04	TEMPERATURE (EXTREMES)	GRAPH	FARGO ,ND
P05	EVAPORATION	GRAPH	FARGO ,ND
P06	WATER USAGE	GRAPH	FARGO ,ND
P07A	WATER USAGE	GRAPH	MOORHEAD, MN
P07B	DISTRIBUTED WATER USAGE	GRAPH	MOORHEAD, MN
P08	WATER USAGE	GRAPH	WEST FARGO ,ND
P09A	LAKE ELEVATION, ASHTABULA	GRAPH	LAKE ASHTABULA, BALDHILL DAM
P09B	LAKE VOLUME, ASHTABULA	GRAPH	LAKE ASHTABULA, BALDHILL DAM

PAUSE *** HIT RETURN TO CONTINUE ***

?

Y NUMBER	DESCRIPTION	LOCATION
P10A	STREAMFLOW -- 24-HR (AVE) GRAPH	RED RIVER, FARGO ND
P10B	STREAMFLOW -- MAX/MIN GRAPH	RED RIVER, FARGO ND
P11	STREAMFLOW -- 24-HR (AVE) GRAPH	RED RIVER, WAHPETON, ND
P12	STREAMFLOW -- 24-HR (AVE) GRAPH	RED RIVER, HALSTAD, MN
P13A	STREAMFLOW -- 24-HR (AVE) GRAPH	SHEYENNE RIVER WEST FARGO ND
P13B	STREAMFLOW -- MAX/MIN GRAPH	SHEYENNE RIVER WEST FARGO ND
P14	STREAMFLOW -- 24-HR (AVE) GRAPH	SHEYENNE RIVER, BALDHILL DAM
P15	STREAMFLOW -- 24-HR (AVE) GRAPH	MAPLE RIVER, ENDERLIN, ND
P16	STREAMFLOW -- 24-HR (AVE) GRAPH	WILD RICE R. ABERCROMBIE ND
P17	STREAMFLOW -- 24-HR (AVE) GRAPH	BUFFALO RIVER, DILWORTH, MN
P18	STREAMFLOW -- 24-HR (AVE) GRAPH	RUSH RIVER, AMENIA, ND
P19	STREAMFLOW -- 24-HR (AVE) GRAPH	WILD RICE R. TWIN VALLEY MN

(ENTER TABLE NUMBER T01-T19C)

?

11. Obtain the off-line statistical table for the total water demand of Moorhead.

t07c

MONTHLY STATISTICAL SUMMARY
(1963-1982)

DATA TYPE: TOTAL WATER CONSUMPTION
LOCATION : MOORHEAD MN
INTERVAL : MONTHLY
GAGE # : 5401

YEAR	JAN JUL	FEB AUG	MAR SEP	APR OCT	MAY NOV	JUN DEC	MN_AVE
63	52370	47790	55030	49760	59740	68020	
	112120	73040	59970	68680	58580	57940	63587
64	65070	59920	56270	54400	75570	72840	
	106780	116100	58940	63500	58880	59520	70649
CONTINUE WITH LIST? (Y/N)							
?							
65	57400	52630	57110	57740	66790	71450	
	71320	74810	59310	62340	59470	58280	62388
66	63000	53850	59500	58150	66230	72870	
	97390	64300	72900	68470	62400	64140	66933
67	65740	57510	62390	60310	71610	74000	
	117800	124210	95160	78390	70410	64180	78476
68	66660	61460	64260	64700	73250	77890	
	104860	100120	73720	77460	72330	75050	75980
69	76840	68710	77400	73940	88250	82740	
	82540	133270	81050	74420	72510	68460	81678
70	73730	71030	74140	71060	75650	87380	
	170270	143800	98150	91480	75745	73880	92193
71	79820	75550	74900	78240	92660	81630	
	78270	123920	83270	82150	78900	71150	83372
72	78040	79570	77800	74820	78750	113250	
	101300	84450	79950	81390	76330	76650	83525
73	84730	71330	74880	76720	99500	96960	
	111930	94470	79120	81430	73620	73800	84874
74	77930	72990	80270	72080	69580	90350	
	112550	82990	81600	82140	74550	74390	80952
CONTINUE WITH LIST? (Y/N)							
?							

Y

75	78280	76360	68790	72950	76590	77770	
	95250	89720	79110	78190	74920	85650	79465
76	88060	80860	81060	77540	120140	121750	
	149890	157180	118140	102750	89870	88660	106325
77	99210	93860	91170	99680	112150	101190	
	107080	93110	84740	89150	80430	80970	94395
78	93000	85890	86500	87070	103060	106310	
	102660	115690	108500	95510	87180	86250	96468
79	104190	97920	111820	114930	105480	124360	
	121640	127200	135180	120580	107750	104810	114655
80	109680	107370	119040	134020	178850	126060	
	182650	125820	115210	118190	112510	114510	128659
81	116810	106390	110910	112220	134160	107090	
	127290	131840	116080	122900	115910	117300	118242
82	125630	113960	123650	111760	118300	127560	
	140420	155330	141830	128350	124240	122970	127833

MEAN	82810	76748	80345	80105	93316	94074	
	114701	110569	91097	88374	81327	80928	89532

CONTINUE WITH LIST? (Y/N)

?y

ST.DIV.	19998	19228	21121	23013	29119	20439	
	28381	27680	24251	20205	19412	19746	20170
MAX	125630	113960	123650	134020	178850	127560	
	182650	157180	141830	128350	124240	122970	128659
MIN	52370	47790	55030	49760	59740	68020	
	71320	64300	58940	62340	58580	57940	62388

* SOURCE: MOORHEAD FILTRATION PLANT

** UNIT : THOUSANDS OF GALLONS

NOTES:

(ENTER TABLE NUMBER T01-T19C)

?#

ENTER COMMAND

?

12. Obtain an on-line monthly table for the total water demand of Moorhead for the five-year period 1975-79.

```

getm mund of 2 for 750199-791299
ENTER FILE NAME FOR GET
?tabfile
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?n
ENTER COMMAND
?stat
YOU HAVE AN OPTION TO CREATE A TABLE
FROM ONLINE DATA OR VIEW AN OFFLINE TABLE
ENTER CHOICE 1: CREATE A TABLE 2: VIEW OFFLINE TABLE
?1
ENTER 1: PRINTER OUTPUT 2: SCREEN OUTPUT FORMAT
3: IF GETM HAS NOT CREATED A FILE "TABFILE" EXIT
AND PROCEED TO CREATE REQUIRED FILE,TABFILE
*** TABFILE MUST CONTAIN COMPLETE YEARS (12 MONTHS)
?2
130
JOB SUBMITTED AS E2215N95 7055
ENTER COMMAND
?exit
STOP
TIME 0.8 SECS
sta 95
E2215N95 7055 COMPLETED
loa o 95 ds 107
READY
lis nolin

```

MONTHLY STATISTICAL SUMMARY
(1975-1979)

DATA TYPE:MUND
LOCATION :MOORHEAD, MN
INTERVAL :MONTHLY
STATION #: 2

YEAR	JAN	FEB	MAR	APR	MAY	JUN	MN_AVE
	JUL	AUG	SEP	OCT	NOV	DEC	
75	78280	76360	68790	72950	76590	77770	79465
	95250	89720	79110	78190	74920	85650	
76	88060	80860	81060	77540	120140	121750	106325
	149890	157180	118140	102750	89870	88660	
77	99210	93860	91170	99680	112150	101190	94395
	107080	93110	84740	89150	80430	80970	
78	93000	85890	86500	87070	103060	106310	96468
	102660	115690	108500	95510	87180	86250	
79	104190	97920	111820	114930	105480	124360	114655
	121640	127200	135180	120580	107750	104810	
MEAN	92548	86978	87868	90434	103484	106276	98262
	115304	116580	105134	97236	88030	89268	
ST.DIV.	10048	8923	15786	17094	16431	18741	13278
	21599	27542	23326	15862	12476	9124	
MAX	104190	97920	111820	114930	120140	124360	114655
	149890	157180	135180	120580	107750	104810	
MIN	78280	76360	68790	72950	76590	77770	79465
	95250	89720	79110	78190	74920	80970	

UNITS: THOUSANDS OF GALLONS

13. Retrieve and correlate the 30-year period (1963-80), precipitation at Fargo with the corresponding streamflow of Red River at Fargo.

```
getm strm of 6 for 630199-821299
ENTER FILE NAME FOR GET
?me
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?n
ENTER COMMAND
?getm prcm of 1 for 630199-821299
ENTER FILE NAME FOR GET
?you
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?n
ENTER COMMAND
?
```

(The retrieved data files are correlated using the CORR command.)

```
corr
ENTER NAME OF FILE CONTAINING INDEPENDENT VARIABLE
?you
ENTER NAME OF FILE CONTAINING DEPENDENT VARIABLE
?me
```

STRAIGHT LINE REGRESSION ANALYSIS

```
Y-INTERCEPT : 49.53
SLOPE : *****
CORRELATION CO-EFFICIENT : 0.178007
```

```
ENTER COMMAND
?
```

14. Retrieve and correlate the streamflow of Red River at Fargo and that of
Sheyenne at West Fargo for the 50-year period from 1965 to 1982.

```
getm strm of 6 for 630199-821299
ENTER FILE NAME FOR GET
?me
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?n
ENTER COMMAND
?getm strm of 9 for 630199-821299
ENTER FILE NAME FOR GET
?you
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?n
ENTER COMMAND
?
```

```
COFF
ENTER NAME OF FILE CONTAINING INDEPENDENT VARIABLE
?me
ENTER NAME OF FILE CONTAINING DEPENDENT VARIABLE
?you
```

STRAIGHT LINE REGRESSION ANALYSIS

```
Y-INTERCEPT :      5.53
SLOPE          : 0.230094
CORRELATION CO-EFFICIENT : 0.803491
```

```
ENTER COMMAND
?
```

15. List the plots available to view on the screen monitor and to secure their hardcopies.

RU PLOTUIEN
PLOTUIEN 05/22/84 10:45:12

NAME	DESCRIPTION	LOCATION
P01	PRECIPITATION	FARGO ,ND
P02	SNOWFALL	FARGO ,ND
P03	TEMPERATURE (AVE)	FARGO ,ND
P04	TEMPERATURE(EXTREMES)	FARGO ,ND
P05	EVAPORATION	FARGO ,ND
P06	WATER USAGE	FARGO ,ND
P07A	WATER USAGE	MOORHEAD, MN
P07B	DISTRIBUTED WATER USAGE	MOORHEAD, MN
P08	WATER USAGE	WEST, FARGO ,ND
P09A	LAKE ELEVATION, ASHTABULA	LAKE ASHTABULA, BALDHILL DAM
P09B	LAKE VOLUME, ASHTABULA	LAKE ASHTABULA, BALDHILL DAM
P10A	STREAMFLOW -- 24-HR (AVE)	RED RIVER, FARGO ND
P10B	STREAMFLOW -- MAX/MIN	RED RIVER, FARGO ND
P11	STREAMFLOW -- 24-HR (AVE)	RED RIVER, WAHPETON, ND
P12	STREAMFLOW -- 24-HR (AVE)	RED RIVER, HALSTAD, MN

HIT PAGE KEY ONCE, THEN HIT RETURN

NAME	DESCRIPTION	LOCATION
P13A	STREAMFLOW -- 24-HR (AVE) GRAPH	SHEYENNE RIVER WEST FARGO ND
P13B	STREAMFLOW -- MAX/MIN GRAPH	SHEYENNE RIVER WEST FARGO ND
P14	STREAMFLOW -- 24-HR (AVE) GRAPH	SHEYENNE RIVER, BALD HILL DAM
P15	STREAMFLOW -- 24-HR (AVE) GRAPH	MAPLE RIVER, ENDERLIN, ND
P16	STREAMFLOW -- 24-HR (AVE) GRAPH	WILD RICE R. ABERCROMBIE ND
P17	STREAMFLOW -- 24-HR (AVE) GRAPH	BUFFALO RIVER, DILWORTH, MN
P18	STREAMFLOW -- 24-HR (AVE) GRAPH	RUSH RIVER, AMENIA, ND
P19	STREAMFLOW -- 24-HR (AVE) GRAPH	WILD RICE R. TWIN VALLEY MN

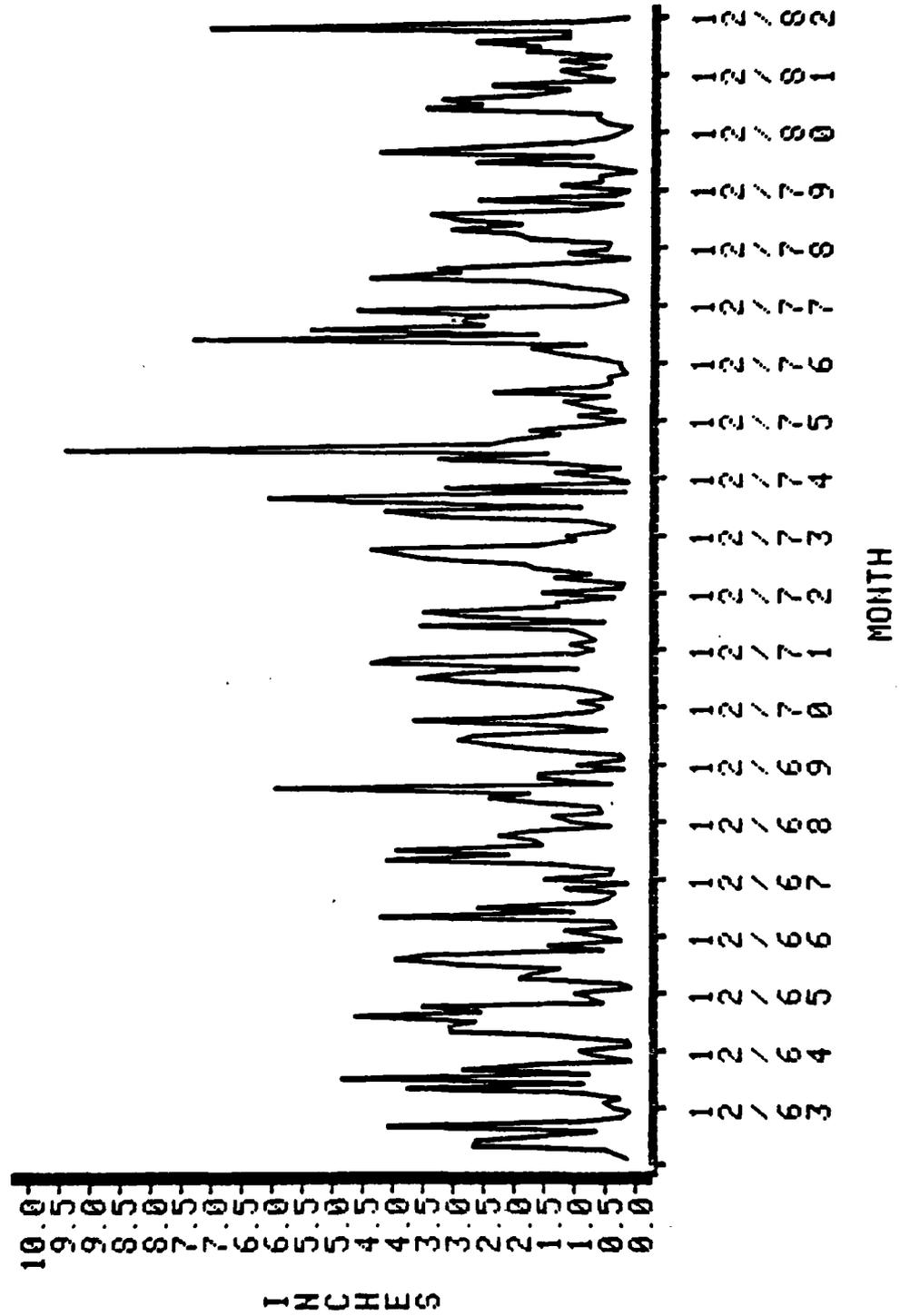
ENTER NAME OF PLOT YOU WISH TO VIEW:
HIT RETURN WHEN DONE VIEWING PLOT
P01

16. Display the following plots on the screen monitor:

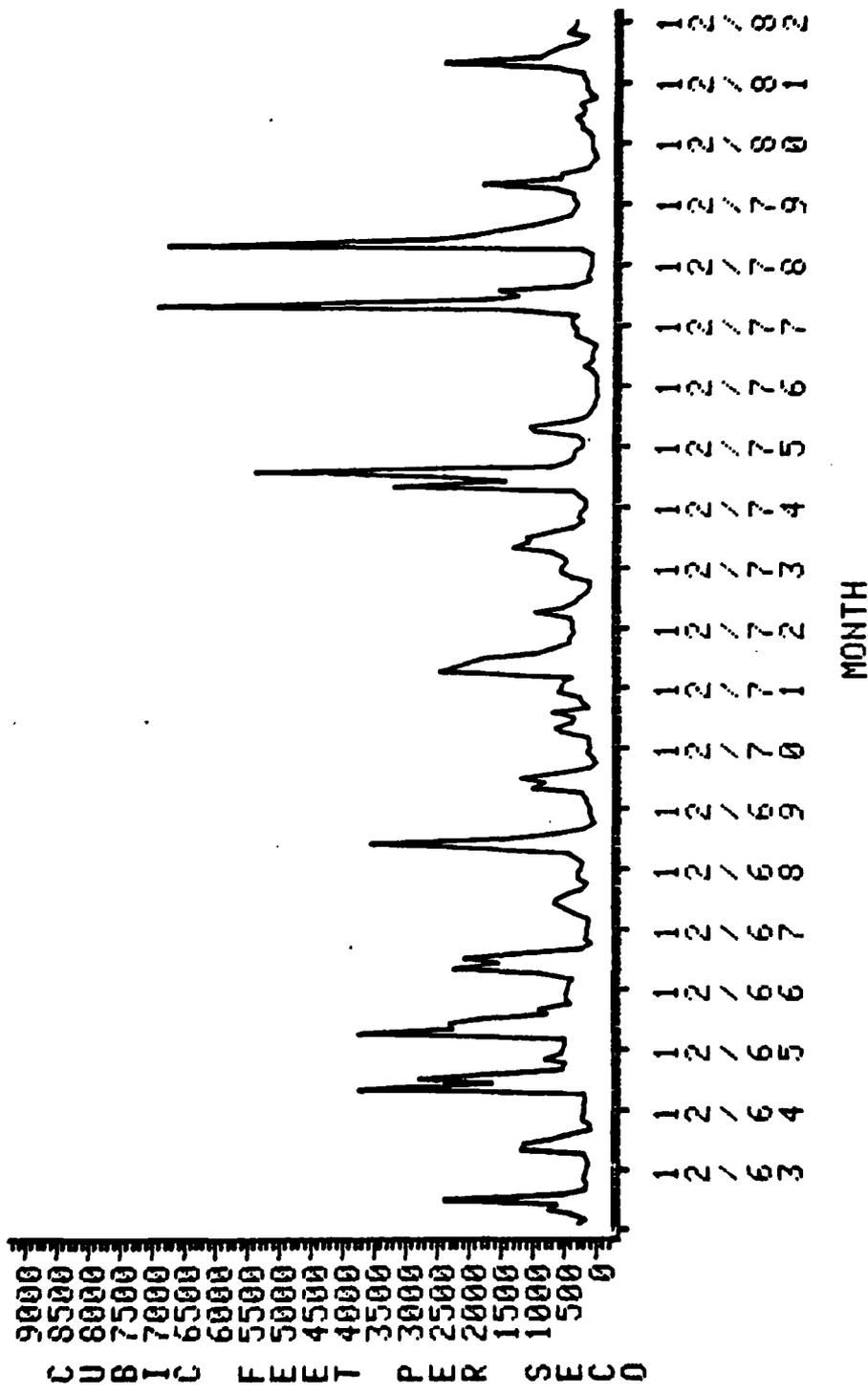
P01 Precipitation at Fargo
P10A Red River streamflow at Fargo
P13A Sheyenne River streamflow at West Fargo
P06 Fargo Water Usage
P07B Moorhead Distributed Water Usage

NOTE: By entering each of the above plot numbers one at a time, as indicated above for P01, the respective plots appear on the screen. Next five pages are the hardcopies of these plots.

FARGO
PRECIPITATION
 PERIOD: 1963-1982

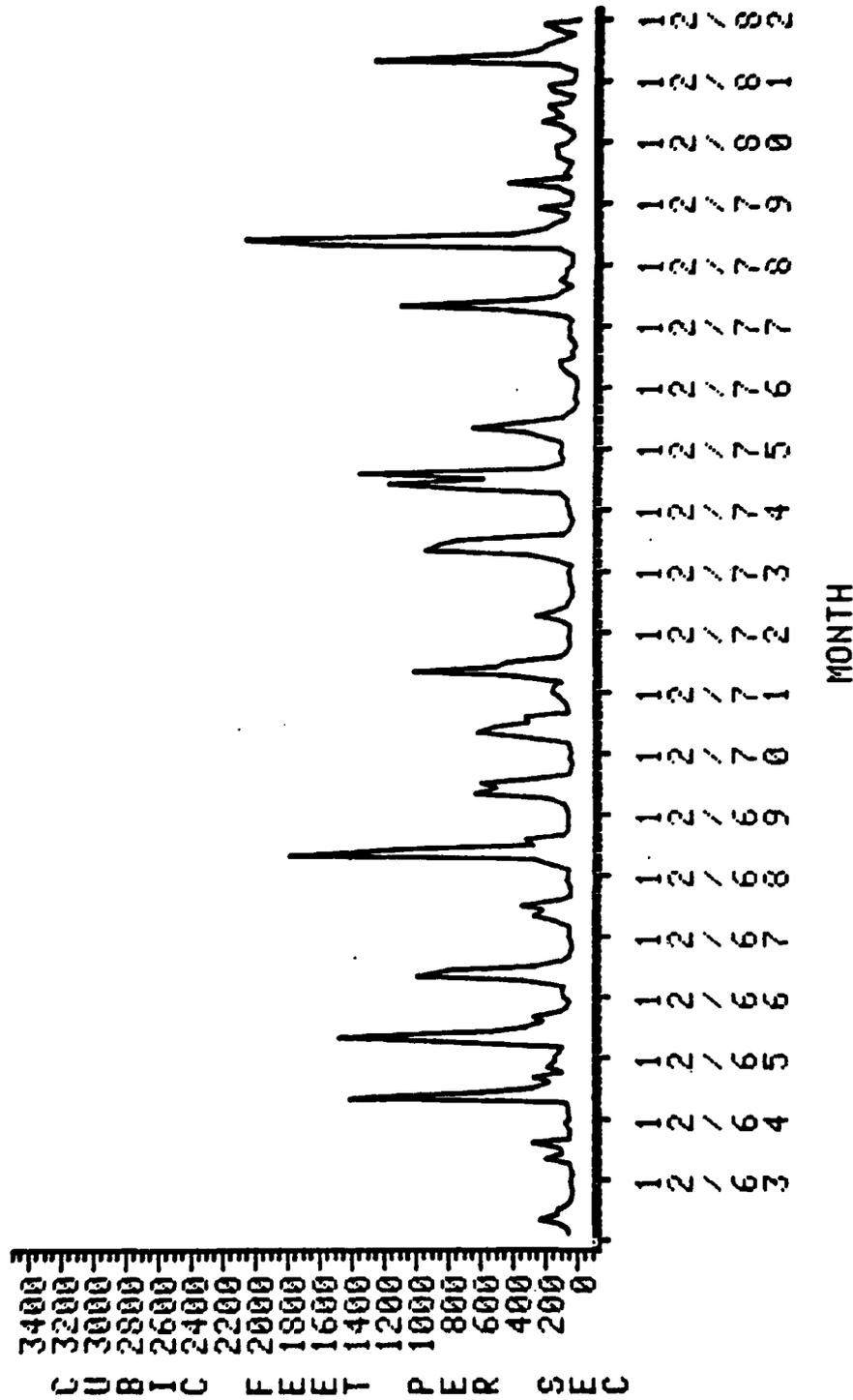


STREAMFLOW
RED RIVER AT FARGO, ND
PERIOD: 1963-1982



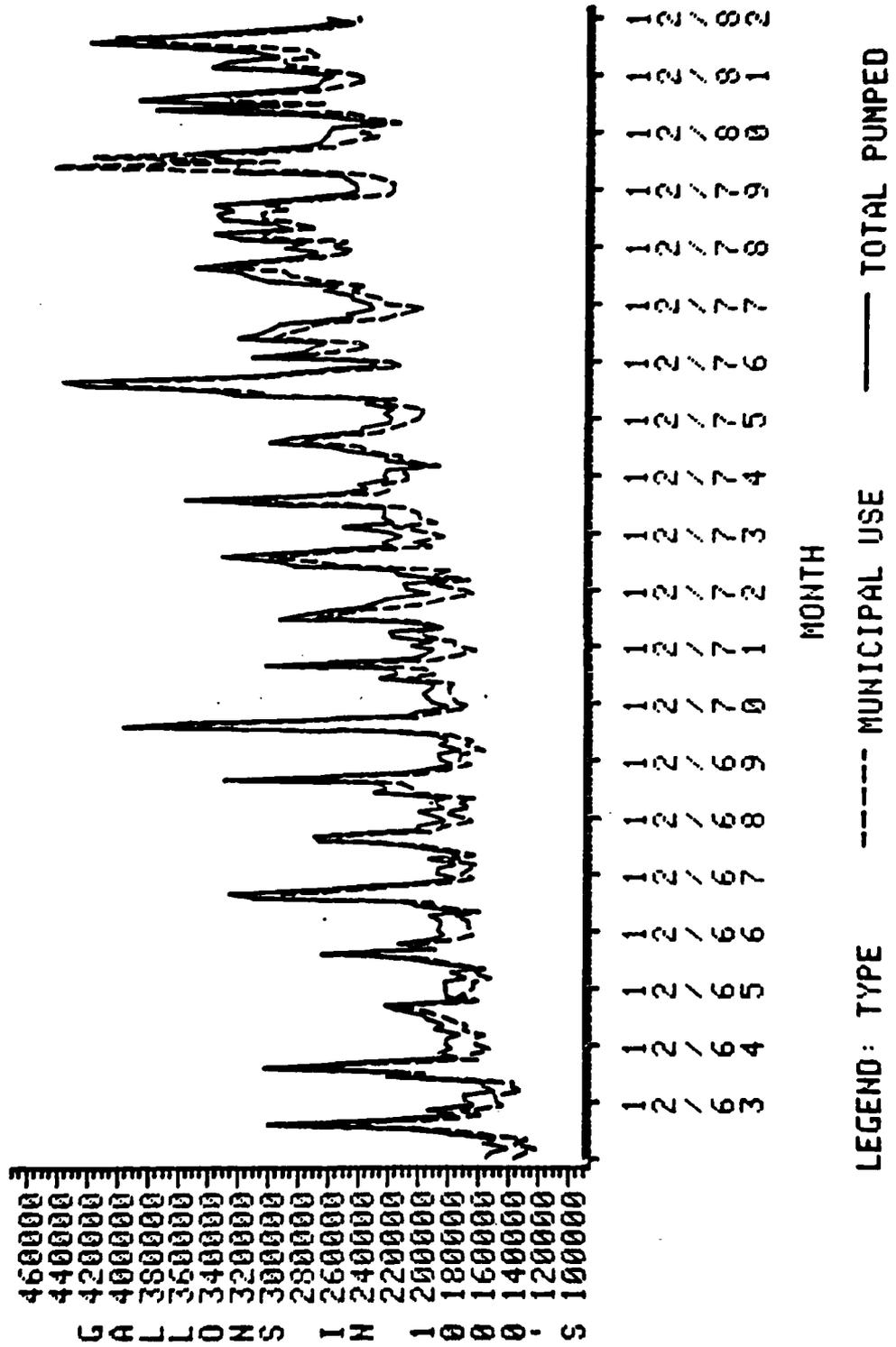
LEGEND: LINE — DAILY AVERAGE

STREAMFLOW
SHEYENNE RIVER AT WEST FARGO, ND
PERIOD: 1963-1982

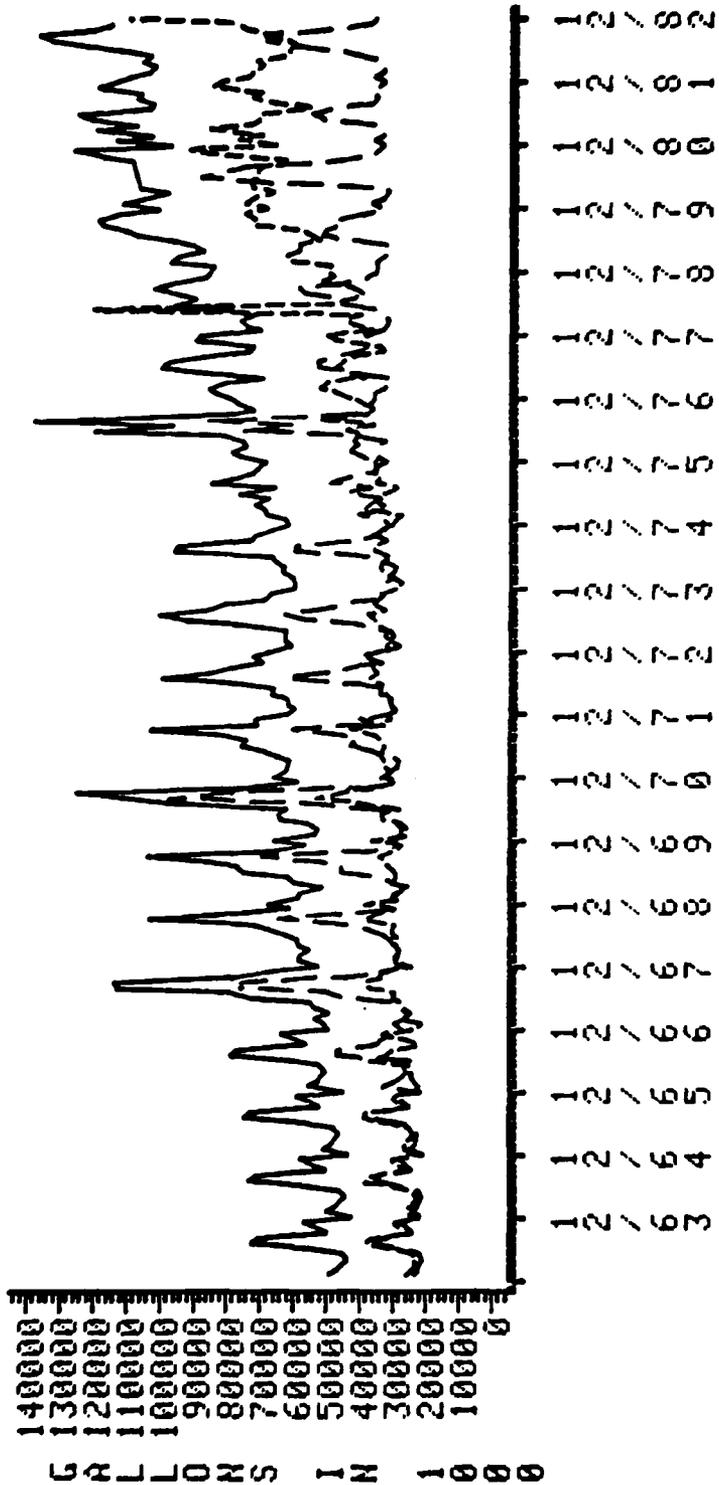


LEGEND: LINE — DAILY AVERAGE

RED RIVER WATER USAGE
CITY OF FARGO
 PERIOD: 1963-1982



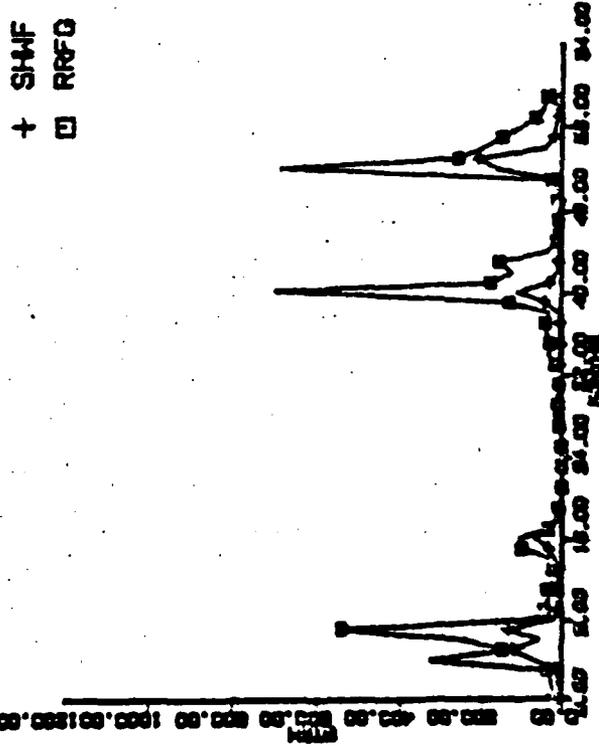
WATER USAGE
CITY OF MOORHEAD
PERIOD: 1963-1962



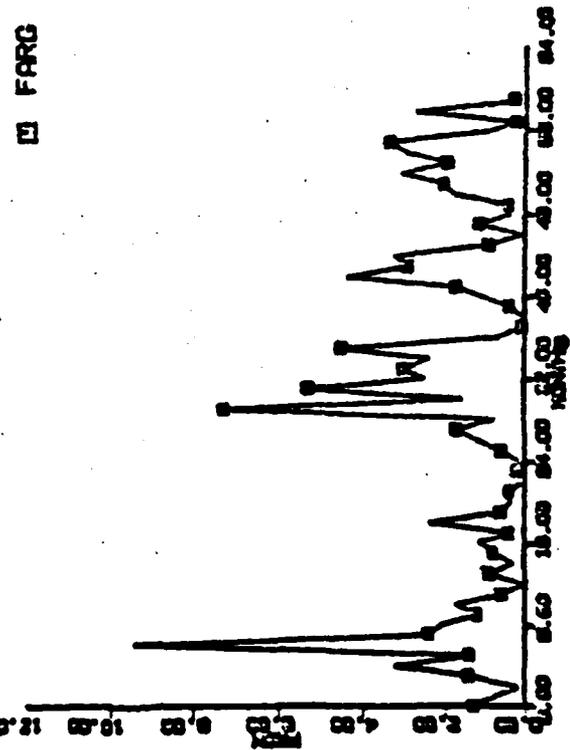
17. Obtain an on-line streamflow plot of Sheyenne River at West Fargo and Red River at Fargo for the 5-year period from 1975 to 1979.

```
RU R08
R08 05/22/84 10:32:42
ENTER COMMAND
?GETN STRM OF 6.9 FOR 750199-791299
ENTER FILE NAME FOR GET
?ME
DO YOU WANT TO SEE OUTPUT? ENTER Y/N
?N
ENTER COMMAND
?PLOT
ENTER FILE TO BE PLOTTED
?ME
DESTINATION: ENTER 1 FOR TERMINAL, 2 FOR COMP. CENTER
?1
20
530 564 570
520 580
890 990
690 710 720 740 750 770 780 800 810 830 840 860
JOB SUBMITTED AS E2215H17 0928
ENTER COMMAND
?EXIT
STOP
TIME 1.1 SECS
STA 17
E2215H17 0928 EXECUTING
STA 17
E2215H17 0928 COMPLETED
LOA 0 17 DS 110
READY
PUNCH CONTROL
READY
LIS NOL
```

PERIOD: 1 / 76 TO 12 / 79



PERIOD: 1 75 TO 12 79



IV. HOW TO BACK UP DATA OFF LINE

Originally, the data involved in the system were in off-line format. Thus, when backing up the data, you want to convert the on-line files to their original off-line format. One reason why you would want to perform this step is to eliminate possible data problems. The system was intended to handle a great deal of use; and to avoid storage foulups if the database is full, you can convert the files. Therefore, converting the files from on-line back to off-line is for security and for prevention of data problems.

DATA FORMATS

The monthly and daily data formats for off-line storage files have 80-character (byte) record length. Each record is divided into several data fields, as shown below:

Daily Data Card

<u>Column</u>	<u>Description</u>
1	Filler
2-5	Station number
6-7	Filler
8-9	Year
10-11	Month
12	Which part of month (1 - first part, 10 days) (2 - second 10 days) (3 - rest of month)
13-80	Data

Monthly Data Card

<u>Column</u>	<u>Description</u>
1	Filler
2-5	Station number
6	Filler
7-8	Year
9	Filler
10-80	Data

Using both the daily and monthly data cards, we have the following examples:

Daily Off-Line Format Example

_2859_631210.00_0.02_0.01_0.00_0.00_0.00_0.00_0.00_0.02_0.00

Col. 1

(*Note: _ represents one space.)

Monthly Off-Line Format Example

_6050_64_5670_3450_2890_2322_4235_9810_4640_7840_4350_3440_4889_394490

Col. 1

The data value for each datatype is different in the off-line files. The table below shows the data fields with their respective units.

<u>Datatypes</u>	<u>Data Value</u>	<u>Units</u>
Dam elevation	####.#	Feet above sea level
Evaporation (monthly)	#####	Hundredths of an inch
Precipitation (daily)	###.##	Inches
Precipitation (monthly)	###.##	Inches
Snowfall (monthly)	###.##	Inches
Streamflow (daily)		Cubic feet/second
Red River	#####.	
Sheyenne River	#####.	
Buffalo River	#####.	
Streamflow (monthly)	#####	Cubic feet/second
Temperature (daily)	###.###	Max and min degrees F
Water use (monthly)	#####	Thousands of gallons

STEPS TO BACKING UP DATA

As mentioned before, the CHEK command allows you to determine if the system has been updated. To avoid problems with the data, the CHEK command, when

necessary, will indicate that the database should be backed up onto magnetic tapes. This back up is for protection of the data and is usually not necessary, but the user can perform the following steps if indicated to do so.

1. The first step is to enter the following VSPC command to convert the data that is in on-line format back to off-line format. To do so, type in "RUN OUT1". OUT 1 submits the batch job DISK 1, which, when completed, will produce data sets that contain the on-line FW01 file in off-line format. OUT1 converts the entire range of years available in the design of the system (1963 to 1992).

2. The next step is to type in "LOAD OUTPUT##DS###". Remember tha the ## stands for the job number and that the ### or DS number is displayed on the screen. After doing this, type in "SAVE file name" where file name is whatever the name of the file is. The file is now in a VSPC library and can be altered if desired.

3. The third step in backing up the database onto magnetic tapes is to put the name of the saved and other required parameters into the utility program export and then submit it. The export will then write the file out to tape. Note the label number on the tape and make sure that a submittal card was submitted along with export. All batch jobs that write on tape require a submittal card.

4. The final step requires you to repeats steps 1-3 for all FW0# files in the system. Do so by using RUN OUT2 for the FW02 backup, RUNOUT3 for the FW03 backup, ... etc.

When you have completed all these steps and exported the file to tape, the entire system will be backed up on tape. This step is usually not necessary at this point in the system, but if it is required, you should note that it is difficult to perform.

APPENDIX A: HOW THE DATABASE WAS INITIALLY SET UP

So that you, the user of the FMWRDMS, may obtain a better knowledge of how the system was conceived and how to use it more effectively, we have included the process by which this database was initially set up.

The first step in setting up the on-line database was to submit the batch programs that convert data from magnetic tape to on-line disk format. We achieved this conversion by entering the following:

```
RUN IN1 YRFTYD
```

Where YF was the "year from"

YT was the "year to" and

YD was the last year actually recorded on tape

After this was completed, we had to enter the following:

```
LOAD OUTPUT ## DS ###
```

Where DS was the abbreviation for dataset

was the job number and

was the designated data set number

To locate which DS (dataset) the designated data was in, we simply entered:

```
LOAD OUTPUT ##
```

By executing this command, we obtained a list of JCL or Job Control Language. Once we received this list, the word SYSOUT (system output) appeared on the screen. The desired information was one of the last SYSOUT numbers listed.

Once, we obtained the desired data, we saved the desired file under the name ASH1 by entering:

SAVE ASH1

This command marked the conclusion of the first step in setting up the on-line database.

The second step required repeating the above steps seven times. The only difference between repetitions was the substitution of IN2 the second time, IN3 the third time, and so on, up to IN8, instead of entering IN1. Likewise, these files were saved under ASH2 for the second file, ASH3 for the third file, and so on, up to ASH8. ASH1 through ASH8 represented sequential data files that contain historical records.

The final set-up step involved the conversion of the sequential on-line data files into direct access on-line files. We accomplished this step by entering the following:

RUN MAKDBS

This command set up the on-line direct access database files. By successfully executing MAKDBS, you are now ready to activate the system with the use of the system commands found in section II of this report. Because the set-up steps have already been taken, you do not need to go through those steps. Those steps are explained in this report as a summary.

(1) MAIN PROGRAM

<u>Description</u>	<u>Statement Range</u>
1. Definition and initialization of common variables	10-670
2. Install dictionary	730
3. Reset common variables to initial values	740
4. Accept and verify a command	830-890
5. Setup for GETD	910-1090
6. Setup for GETM	1110-1290
7. Setup for UPTD	1310-1370
8. Setup for UPTM	1390-1450
9. Setup for PLOT	1470-1590
10. Setup for EXIT	1610-1630
11. Setup for DSPY	1650-1750
12. Setup for PASS	1770-1810
13. Setup for STAT	1830-1870
14. Setup for HELP	1890-1930
15. Setup for CHEK	1950-2030
16. Setup for AVER	2050-2150
17. Setup for CORR	2170-2380
18. Setup for any new command	2400-2420
19. Setup for ERROR	2440-2480

(2) COMMAND (C) AND FUNCTIONS (F)

	<u>NAME</u>	<u>TYPE</u>	<u>STATEMENT RANGE</u>
1.	GETD	C	2500-5470
2.	GETM	C	5490-8120
3.	PARSE	F	8140-10490
4.	PARCON	F	10510-11610
5.	SETIND	F	11630-12220
6.	SETINM	F	12240-12620
7.	CONVRT	F	12640-13290
8.	COMPAR	F	13310-13590
9.	CLEAR	F	13610-13700
10.	CHOP	F	13720-13860
11.	ERROR	F	13880-15490
12.	UPTD	C	15510-16930
13.	UPTM	C	16950-18340
14.	PLOT	C	18360-19820
15.	CLRIT	F	19840-20470
16.	CNVRT	F	20490-20810
17.	COVRT	F	20830-21470
18.	READIT	F	21490-21810
19.	SETUP	F	21830-22480
20.	WRITIT	F	22500-22810
21.	DSPY	C	22830-23950
22.	FREE	F	23970-24420
23.	PASS	C	24440-25020
24.	GETDIR	F	25040-26270
25.	PUTDIR	F	26290-27510
26.	STAT	C	27530-29100
27.	HELP	C	29120-30390

<u>NAME</u>	<u>TYPE</u>	<u>STATEMENT RANGE</u>
28. GETDH	F	30410-30790
29. GETMH	F	30810-31250
30. UPTDH	F	31270-31590
31. UPTMH	F	31610-31930
32. PLOTH	F	31950-32330
33. EXITH	F	32350-32460
34. DSPYH	F	32480-32710
35. PASSH	F	32730-33010
36. STATH	F	33030-33710
37. HELPH	F	33730-33980
38. CHEKH	F	34000-34170
39. AVERH	F	34190-34380
40. PASWRD	F	34400-34500
41. CORRH	F	34520-34910
42. DBSHLP	F	34930-36650
43. AVERAG	C	36670-37960
44. CLR	F	37980-38130
45. CORR	C	38150-39220
46. CRRDO	F	39240-39920
47. END OF PROGRAM A1		39920

NOTE: The successive program line numbers are separated in units of 10. Since the program A1 ends on line 39920, there are 3992 lines of code in A1.

END

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