Environment Canada Environnement Canada

FLOW File Operations Manual

Fourth Edition

INLAND WATERS DIRECTORATE
WATER RESOURCES BRANCH
OTTAWA, CANADA, 1983

Canada

CONTENTS

1. INTRODUCTION

This manual was prepared by Mr. D.R. Swan, Programmer-Analyst, Mr. J.L.P. McIlhinney, Programmer-Analyst, and Mr. M. Krol, Systems Analyst, and approved by Mr. R.G. Boals, Head, Data Control Section, Water Survey of Canada Division. It contains a detailed description of the FLOW magnetic tape file of historical daily discharges and also detailed instructions and an explanation of the computer programs for the storage and retrieval of these data on the CDC CYBER 730 computer at the Department of Energy, Mines and Resources, Ottawa.

The Water Survey of Canada has been collecting and publishing hydrometric data since 1908. In 1966, it was decided to automate hydrometric computations using digitizers and also to store historical hydrometric data on magnetic tape. Streamflow data to 1968 were keypunched by contract using copies of original computation forms or the data publications as source documents. Most of the input data are now obtained directly as card output from the STREAM and MANUAL computer programs and are submitted annually to Ottawa by the Regions on punched cards or card images on magnetic tape for the automated preparation of camera-ready manuscripts for the eight annual Surface Water Data Publications. The historical FLOW file is then updated to include these annual data along with any corrections, revisions or additions for earlier years. The FLOW file now contains some 66 000 station-years of daily discharges to December 1981 on 8 reels of tape (some 191 million characters of data are stored at 6250 cpi); data are stored by Region and by station number order within each Region. To facilitate the retrieval and publication of monthly and annual mean discharges and total dam^3, a TOTALS file is created from the FLOW file and contains the monthly totals in m^3/s days for all stations on one reel of tape. The TOTALS, PEAKS, REMARKS and HYDEX files are then used for the automated preparation of camera-ready manuscripts for the eight Historical Streamflow Summary publications which are published every five years.

Historical daily, monthly and annual streamflow data can be supplied to users on punched cards or magnetic tape for computer processing. This manual also contains instructions for plotting annual daily discharge hydrographs using the CYBER 730 computer and CALCOMP plotter at EMR.

The master file format was altered to handle the change in data units from imperial to metric. This required modification of computer programs in varying degrees. At this time additional features were incorporated, such as the ability of the FLOW file to flag revised data (explained in section 1.1).

This is the forth edition of a "FLOW File Operations Manual" and supersedes the third edition (1981). This will be updated as further new and improved procedures are developed.

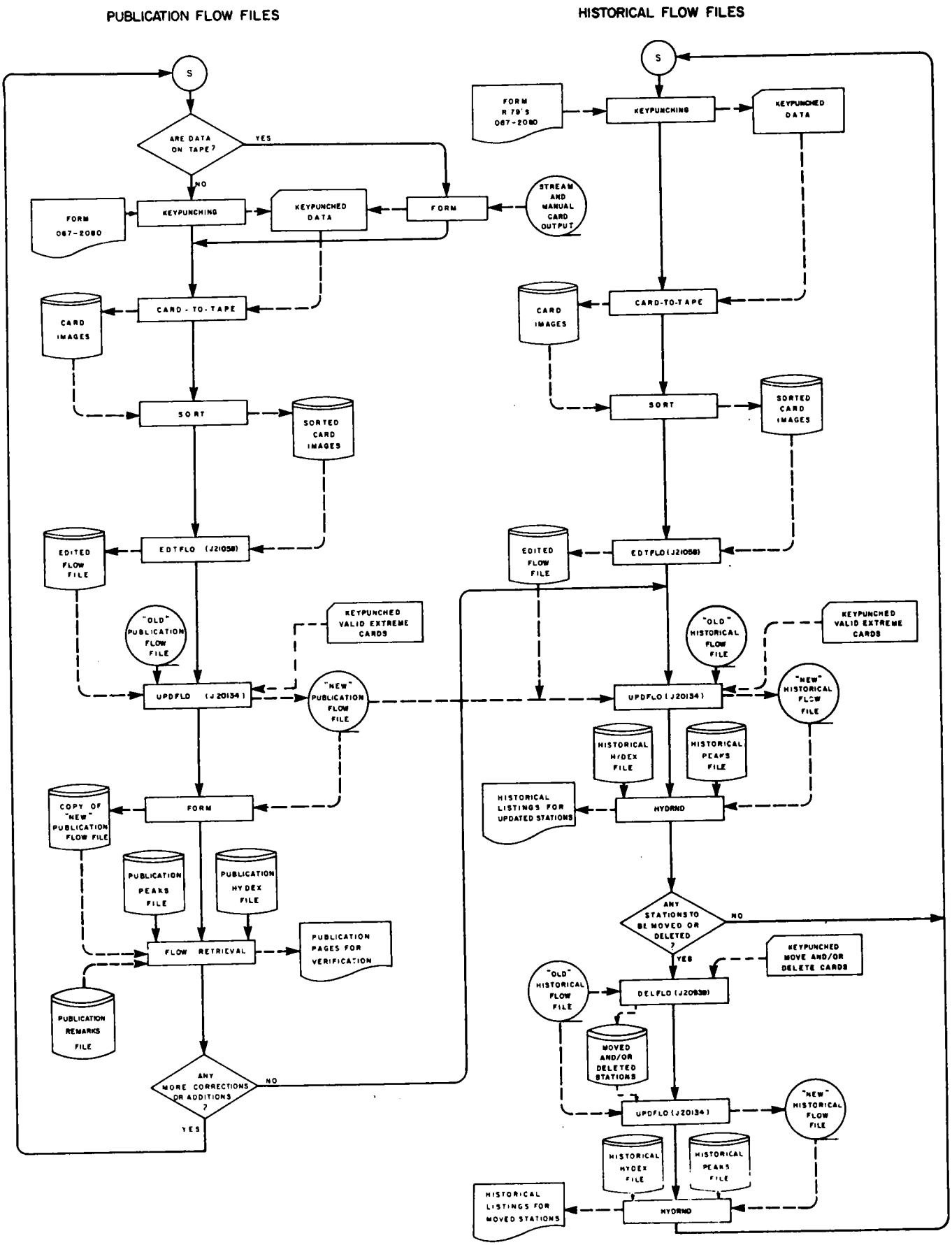
1.1 Revisions

A number of corrections or revisions have been made to previously published data. Many of these were required because of typographical or computational errors which were exposed when daily discharges were stored on magnetic tape and monthly means were re-calculated by computer. Other errors were discovered or different interpretations of basic data were made during the systematic review of historical streamflow data now underway, for example, these revisions may have been justified because a more reliable stage-discharge relationship had been developed; also, short periods of missing records may have been estimated. Those stations where a systematic review of hydrometric data has been conducted are identified in the Surface Water Data Reference Index publication.

All revisions, changes or additions made to the daily values on the master data files since January 1980, except data for the current year until it is published, will be identified by the symbol "R" following the value. However, to conserve space, the symbols S, T and W are used in combination with an A - Manual Gauge, B - Ice Conditions or E - Estimated to indicate revisions for those days. Changes to only the daily symbol field will not be considered a revision.

Detailed information on revisions to historical data is available from the appropriate Regional Chief.

2. FLOW FILE SYSTEM FLOWCHART



3. KEYPUNCHING INSTRUCTIONS

3.1 Daily Discharges in Card Format 71-102

Both current data and historical corrections are keypunched from form 067-2080M (3.1.1) (or equivalent) in the following format:

Column(s)	Length	Description
1	1	code for type of data and unit: Q - discharges in cubic metres per second
2	1	Region code: 2 - Vancouver 3 - Calgary 4 - Winnipeg 5 - Guelph 6 - Longueuil 7 - Dartmouth 8 - Regina 9 - Yellowknife
3-9	7	station number, e.g. 05AB003
10-12	3	last three digits of the year, e.g. "969" for 1969
13-15	3	first three letters of the month, e.g. "JAN" for January
16-17	2	day corresponding to the first data field, e.g. "08" for January 8
18-20	3	blank
21-80	60	numeric and/or alphabetic "free form" data fields; the only permissible characters are the letters A, B, E, N, R, X or an asterisk (*).

This format is identical to the one used as input to the LEVELS file and is also identical to the card output of daily discharges from the STREAM and MANUAL computer programs.

A new card is started for each month and the data for the month are punched on successive cards working down each column of the source documents. For a month with either full or partial records, the punching is started on the first day for which a figure (including a minus sign, is applicable) and/or a symbol is shown and punching stops on the last day of the month for which a figure and/or symbol is shown. The data fields are punched "free form", without right or left justification or padding. For each day, the figure is punched first, then the symbol (if any) followed by a plus sign to indicate the end of the field. All digits (including zero) in the data field for each day are punched with the decimal point (if any) but commas or blanks are not punched.

For months which are incomplete, a plus sign is entered only for the missing days between the terminal days for which there is a record. For example, if discharge values of 1.23E are shown only for March 4, 7 and 9 enter 04 in column 16-17, then starting in column 21 the data is entered as follows: 1.23E+++1.23E+1.23E+ (no blanks).

The last field on any card should not overflow column 80. Digits or letters after the last plus sign on that card will be ignored. Therefore, if the plus sign indicating the end of the last field was not entered, then the last data field must be completely repunched starting in column 21 of the next card.

The following symbols are valid when updating the FLOW file (all other symbols will be ignored):

A - manual gauge
B - ice conditions
E - estimated
R - to indicate revised data
N - for deletion of symbol only
X - for deletion of both value and symbol
* - for deletion of revision code

All of the above symbols may appear alone in the data field followed by a plus (+) sign. Numeric values in the data field may be entered alone or with symbols A, B or E. Changes to only the daily symbol field will not be considered a revision.

An entire month's data may be deleted, revised or revision symbols deleted by entering 00 in columns 16-17, and X+, R+ or *+ in columns 21-22 respectively.

3.1.1 Daily Data File Updating Form 067-2080M

Environment Canada / Environnement Canada
Environmental Conservation / Conservation de l'environnement

DAILY DATA FILES UPDATING
MIS À JOUR DES FICHIERS DE DONNÉES QUOTIDIENNES

Type of Record / Type de donnée | Region / Région | Station number / Numéro de la station

1	2	3	4	5	6	7	8	9
Q	3	0	5	A	B	0	0	3

Station name/Nom de la station: TROUT CREEK AT LOCKWOOD'S RANCH

Year / Année	969	969	
Month / Mois	JAN	MAR	
Day/Jour 1			
2			
3			
4		1.23E	
5			
6			
7		1.23E	
8	10.1B		
9		1.23E	
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Coding Instructions/Instructions sur le codage

Type of record/Type de donnée

7 - Concentration in mg/L
Concentration en mg/L
8 - W.L. in thousandths of metres
Niveau en millièmes de mètres
9 - W.L. in hundredths of metres
Niveau en centièmes de mètres
C - Temperature in Celsius
Température en Celsius
T - Bedload in tonnes
Charriage de fond en tonnes
Q - Discharge in m^3/s
Débit en m^3/s

Symbols/Symboles

A - Manual gauge/Jauge manuelle
B - Ice conditions/Conditions des glaces
D - Dry (W.L. only)/Taris (Niveau d'eau seulement)
E - Estimated/Estimatif
N - Delete symbol only/Supprimer symbole seulement
S - Sediment sample collected this day
Échantillon prélevé en ce jour
X - Delete value & symbol /Supprimer valeur-symbole

Region codes/Codes des régions

1 -
2 - Vancouver
3 - Calgary
4 - Winnipeg
5 - Guelph
6 - Longueuil
7 - Dartmouth
8 - Regina
9 - Yellowknife

Identification of valid daily extremes/Valeurs quotidiennes extrêmes valides

Type of Record / Type de donnée | Region / Région | Station number / Numéro de la station | Blank / En blanc | Year / Année | Blank / En blanc | Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Q	6	0	3	A	C	0	0	7		1	9	7	7		H

Codes for valid max and/or min. daily extreme for the year or standard period.

B- Both max. and min. are valid
H- Maximum only is valid
L- Minimum only is valid
N- Neither max. nor min. is valid
X- Delete any previously entered code

Codes des valeurs quotidiennes extrêmes valides pour l'année ou la période normale.

B- Max. et min. valides
H- Max. valide seulement
L- Min. valide seulement
N- Max. et min. non valides
X- Supprimer tout code déjà inscrit

Note: Indicate if discharge revisions will necessitate a new sediment tons listing.
Indiquer si les révisions du débit obligeront à des modifications du nombre de tonnes de matières solides.

REMARKS/REMARQUES

Prepared by/Préparé par _____ Date _____

067-2080M (02/82) R296

WATER RESOURCES BRANCH/DIRECTION DES RESSOURCES EN EAU

3.1.2 Drum Card for the Packed Format 71-102

Column(s)	Length	Punches	
1	1	0-1	(slash "/")
2-4	3	12	(+ sign)
5-6	2	12-1	(letter A)
7-12	6	12	(+ sign)
13-15	3	12-1	(letter A)
16-17	2	blank	
18	1	11	(- sign)
19-20	2	12	(+ sign)
21-80	60	blank.	

Thus using this drum card all the information in the first 15 columns including the year and the month is duplicated automatically. Only the day of the month must by keypunched manually.

3.2 Valid Extreme Codes in Card Format 74-103

Valid extreme codes for incomplete years or incomplete standard periods or complete years with bracketed means stored as daily discharges are keypunched from form 067-2080M in the following format:

Column(s)	Length	Description
1	1	type of record (Q for discharges)
2	1	Region code, 2 to 8
3-9	7	station number, e.g. 03AC007
10	1	blank
11-14	4	year, e.g. 1977
15	1	blank
16	1	valid extreme code for an incomplete year or an incomplete standard period or a complete year with bracketed means: L - only the minimum is to appear in the summary H - only the maximum is to appear in the summary B - both the minimum and the maximum are to appear in the summary X - the original entry was incorrect and the L, H or B is to be deleted
17-80	64	blank.

3.2.1 Drum Card for the Valid Extreme Codes in Format 74-103

Column(s)	Length	Punches	
1	1	0-1	(slash "/")
2	1	12	(+ sign)
3-4	2	blank	
5-6	2	1	
7-9	3	blank	
10	1	11	(- sign)
11-14	4	blank	
15	1	11	(- sign)
16	1	1	
17	1	11	(- sign)
18-80	63	12	(+ sign).

Thus using this drum card the type of data and the Region code in columns 1 and 2 are automatically duplicated, columns 10, 15 and 17 to 80 are automatically skipped and alphabetic characters will be entered in columns 5, 6 and 16 without suppressing the ALPHA key.

4. FILE SPECIFICATIONS

This is the master file (format 79-600) containing historical daily discharges in cubic metres per second on magnetic tape. The historical data to 1964 were keypunched onto cards from the Surface Water Data publications. From 1965 to 1970 the data were keypunched onto cards from R79's or equivalent. Subsequent data will usually be obtained in card format 79-102 from the STREAM or the MANUAL computer programs in the Regional Offices. If the volume of data is significant, each Regional Office will store the card images on a tape and send the tape to Ottawa for processing.

The historical FLOW tape file for all of Canada is contained on nine 9-track, 6250 bpi tapes with a blocking factor of 15, i.e. 4500 characters per block. With the inclusion of 1981 data, the historical FLOW file contains approximately 759 000 station-months of data with an annual growth of approximately 5%.

The letter "b" in all record descriptions represents a blank. All records except the "Padding" records are numbered sequentially in positions 295-300 starting at 1 for the "Tape Header" record. The five record formats which describe the master file (format 79-600) are described below.

4.1 Record Descriptions

4.1.1 Tape Header Record (Format 75-401)

There is only one per reel and it is always the first record on the tape.

Position(s)	Length	Description
1-12	12	"000HD00000bb"
13-16	4	"bbb1"
17-24	8	blank
25-32	8	"FILEbEMR"
33-44	12	file number, e.g. "-WSC-4201-b1"
45-52	8	"bbSERIAL"
53-54	2	blank
55-58	4	always "9999"
59-61	3	blank
62-67	6	name of the program that created the tape, e.g. "UPDFLO"
68	1	blank
69-79	11	date on which the tape was written, in the form: (first 3 letters of the month)-(day)-(year), e.g. "JANb31b1983" for January 31, 1983
80-81	2	blank
82-99	18	range of station numbers, e.g. "01AE003bT0b01MN124"
100-288	189	blank
289-294	6	date on which tape was written, in the form: 289-290 Year (last two digits) 291-292 Month (numeric) 293-294 Day
295-300	6	record sequence number, "bbbbb1".

4.1.2 Data Record (Tape Format 79-501)

This tape format is designed to store one month of daily discharges per record. The monthly total discharge and the first day of occurrence of both the minimum and maximum daily discharges for that month are also stored.

Position(s)	Length	Description
1	1	Region code: 2 - Vancouver 3 - Calgary 4 - Winnipeg 5 - Guelph 6 - Longueuil 7 - Dartmouth 8 - Regina 9 - Yellowknife
2-8	7	station number, e.g. 01AB003
9-11	3	year, e.g. "982" for 1982
12-13	2	month, e.g. "10" for October or "b7" for July
14-15	2	type of data, e.g. "b1" for daily discharges
16	1	status code
17	1	month code, a digit 1-8
18	1	valid extreme code desired within an incomplete year or incomplete standard period or a complete period with bracketed means in the publications; only the symbols L, H, B and blank are allowed as follows: blank - the HYDEX file may contain the standard period and the valid extreme code L - only the minimum is to appear in the summary H - only the maximum is to appear in the summary B - both the minimum and the maximum are to appear in the summary
19-21	3	blank
22	1	revision code will contain an R if at least one daily value has been revised otherwise blank
23-24	2	blank (not used at this time)
25-272	248	31 8-digit fields for daily figures and symbol codes
273-284	12	monthly total in m^3/s-days
285-286	2	day on which the minimum daily discharge first occurred for this month
287-288	2	day on which the maximum daily discharge first occurred for this month
289-294	6	date on which this record was last updated in the form: 289-290 Year (last two digits) 291-292 Month (numeric) 293-294 Day
295-300	6	sequence number of this record.

The MONTH code in position 17 is as follows:

1, 2, 3, 4 for an incomplete month of 28, 29, 30, 31 days respectively.
5, 6, 7, 8 for a complete month of 28, 29, 30, 31 days respectively.

The DAILY figures and codes in positions 25-272 are as follows:

characters 1-6: daily dischages in m^3/s, right justified with leading blanks, in Fortran F-type format (to be read as F6.0). The decimal point, if present, is stored as a character.

character 7 : figure code as follows:

1 for no data
2 for a figure with no decimal (includes "0")
3 for a figure with one decimal place
4 for a figure with two decimal places
5 for a figure with three decimal places
9 for a deleted figure and symbol. This occurs only on a correction tape.

character 8 : symbol code as follows:

1 for no value and symbol	R for revised since January 1980
A for Manual Gauge	S for revised (and Manual Gauge)
B for Ice Conditions	T for revised (and Ice Conditions)
E for Estimated	W for revised (and Estimated)

The MONTHLY TOTAL in positions 273-284 is stored in Fortran F-type format as F12.3 with leading blanks. The decimal point is always stored in position 281.

4.1.3 End-of-Data Record (Tape Format 75-404)

There is only one per reel and it follows the last "Data" record (79-501).

Position(s)	Length	Description
1-12	12	"999ZZ9999999"
13-288	276	blank
289-294	6	date on which the tape was written in the form: 289-290 Year (last two digits) 291-293 Month (numeric) 293-294 Day
295-300	6	record sequence number

4.1.4 Tape Trailer Record (Format 75-403)

There is only one per reel and it follows the "End-of-Data" record (75-404).

Position(s)	Length	Description
1-12	12	"000TR00000bb"
13-16	4	"bbb9"
17-288	272	blank
289-294	6	date on which the tape was written in the form: 289-290 Year (last two digits) 291-293 Month (numeric) 293-294 Day
295-300	6	record sequence number

4.1.5 Padding Record (Tape Format 75-405)

These records follow the "Tape Trailer" record (75-403) and are used if it is necessary to pad the last tape block to 4500 characters (15 records).

Position(s)	Length	Description
1-12	12	"999ZZ9999999"
13-288	276	blank
289-300	12	"999999999999"

5. FILE MAINTENANCE PROGRAMS

This section will explain the functions of the file maintenance programs and utilities. Data can be stored on the FLOW master file in four steps: CARD-TO-TAPE, SORT (utility), EDIT and UPDATE. These programs and utilities can be run individually or as one complete job submission. When these four steps have been completed the data will reside on either the FLOW master file or the FLOW publication file.

To facilitate rapid processing of a large amount of data it is advantageous to submit each job individually following successful completion of the previous job. In this fashion it is possible to run each job with a smaller time limit and thus have them completed during prime time, rather than one long job with a large time limit, which would not be processed until the evening shift.

Occasion may arise when data for a certain station number on the master file has to be moved or renamed under a different station number. When this occurs the MOVE-and-DELETE program may be used along with the SORT and UPDATE to produce a new master file.

Other programs covered in this section are RETDAT and SYMCHK.

Each program and utility is described in detail giving the program description, the computer control card setup, and the quality control checks.

All FORTRAN and COBOL source programs and object modules of all COBOL programs covered in this manual are stored on disk on Indirect Permenant Files (IPF). The IPF facility allows more efficient use of disk space and greater ease for modifying and updating programs.

All the programs covered in this manual are stored on the following IPF's:

Source programs: Permenant file name: FLOW, ID = SOURCE
COBOL object modules: Permenant file name: FLOW, ID = OBJECT

Object modules of FORTRAN programs are stored in a library using the EDITLIB utility. This library has the permanent file name FLOW, ID = METLIB.

5.1 CARD-to-TAPE Program

The purpose of this program is to read 80-character records containing daily discharge data (in card format 71-102) and create a tape. The program converts the 3-character month field to a 2-digit numeric month field, to be used in the SORT utility. If the month is not valid the record is written to the output tape but the month assigned is 00. The core required is 35 000 octal words of central memory and the time to process one thousand cards or card images is eight (8) seconds. The input can be either punched cards or card images blocked 1 on tape. The output is an 80-character record, blocked 10, and can be either on tape or on disk. The last block of the output file is padded to fill the block, in the form "9999Z9999" and seventy blanks for each record.

5.1.1 Control Card Set-up

```
K2000,CM50000,P2,T100,NT1.
ACCOUNT,XXXXX.  CARD-TO-TAPE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
REQUEST(TAPE1,PE,S,SV,EB,VSN=XXXXXX,NORING)          See Note 1
REQUEST,TAPE2,SN.                                    See Note 2
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
```

```
CARD.
CATALOG,TAPE2,ID=DATA,OR=INFINITE,RP=30.                    See Note 2
7/8/9                                                       multi-punch in col. 1
DATE JUN 30 1983                                            See Note 3
   WSC-1000-51  9999                                        See Note 4
DATA CARDS ARE INCLUDED HERE IF REQUIRED
6/7/8/9                                                     multi-punch in col. 1
```

Note 1: "Request" card. This card is required only if there is an unlabelled input tape. "XXXX" is the visual reel number to be mounted.

Note 2: The REQUEST,TAPE2,SN. card reserves space on disk. After the CARD-TO-TAPE Program has finished execution, the output file (TAPE2) is saved on disk for 30 days ready for input to the SORT utility.

Note 3: Standard "Date" card. When input is card images on tape, column 21 must be any non-zero numeric character, usually 1.

Note 4: "Output File Identification" card.
"WSC-1000-" is the file identification.

"51" is the file sequence number. This must be greater than 50 for files which are to be sorted.

"9999" Serial number printed on program listings. (see Quality Control Checks).

5.1.2 Quality Control Checks

From page one of the program listing compare the following:

(a) The date printed on the output to the date on the "Date" card.

(b) The listing header file EMR-WSC-1000-51 serial 9999 to the "Output File Identification" card. The letters EMR are supplied by the computer program.

(c) The number of stations processed to the number of station numbers printed.

(d) The total number of cards processed to the number of cards or card images supplied as input.

To find the number of cards processed for a particular station, after the first, substract the previous number of cards from the accumulated total. In the following example the first two stations are from Region 8, Regina, and the last two are from Region 6, Montreal.

```
805MB006      86
805BF005      87
6020J007     102
6020J003     124
```

For station number 020J007 the number of cards is 102-87=15.

For station number 05MB006 the number of cards is 86.

On the last page of the program listing there should be the message "*END OF RUN*". If this message is not present, check the dayfile for the control card or system errors.

5.2 SORT Utility

The card images after being processed by the CARD-to-TAPE program are sorted on a 15-character field which contains a 1-character Region code, a 7-character station number, a 3-character year, a 2-character month and a 2-character day. After sorting, the card images are in sequential order by Region number, station number, year, month and day respectively. The core required is 40 000 octal words of central memory and the time to sort one thousand card images is five seconds. The sorted output can now be used by the EDIT program. When the input for the CARD-to-TAPE program is from one of the Regions, the sorted output tape should be saved as it may contain two types of data, i.e. daily discharge and/or water levels.

5.2.1 Control Card Set-up

```
K2001,CM60000,P2,T100.
ACCOUNT,XXXXX.  SORT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH,TAPE2,ID=DATA,MR=1.                                  See Note 1
REQUEST,TAPE3,SN.                                           See Note 2
FILE(TAPE2,RT=F,BT=C,FO=SQ,FL=80,CM=YES)
FILE(TAPE3,RT=F,BT=C,FO=SQ,FL=80,CM=YES)
SORTMRG.
CATALOG,TAPE3,ID=DATA,OR=INFINITE,RP=30.                    See Note 2
7/8/9                                                       multi-punch in col. 1
SORT                                                        See Note 3
FILE,INPUT=TAPE2(C),OUTPUT=TAPE3(R).                        See Note 4
FIELD,IDENT(2,15,DISPLAY)                                   See Note 5
KEY,IDENT(A,DISPLAY)                                        See Note 6
EQUATE,DISPLAY( ,0)                                         See Note 7
END                                                         See Note 8
6/7/8/9                                                     multi-punch in col. 1
```

Note 1: The ATTACH card attaches the input file from disk created by Step 1, CARD-to-TAPE Program.

Note 2: The REQUEST,TAPE3,SN. card reserves space on disk for output. When the SORT is finished the output file (TAPE3) is catalogued and saved on disk for 30 days ready for input to the EDIT program.

Note 3: "SORT" control card. This directive is required to specify the kind of sort only or sort/merge processing.

```
SORT,VAR=type
type=DISK is for mass storage sort/merge processing and is the default if nothing is
specified.
```

Note 4: "File" control card. A "File" directive is required to specify all input and output files to be used during a sort/merge run.

```
FILE,type=name(action),name(action),type=name(action)
FILE,INPUT=TAPE2(C),OUTPUT=TAPE3(R)
type File type identifier, all files of a particular type must be specified.
INPUT     Sort input files
MERGE     Merge input files
OUTPUT    Sort merge output file
name File name of 1 to 7 characters
action    Specifies system action to be performed after file processing is complete
     C      Close the file
     R      Rewind the file
     U      Unload the file
     N      No action is to be taken
```

Note 5: "Field control card. The "Field" directive defines all potential sort key fields within logical records that can be sorted and/or merged during a sort/merge run. At least one "Field" directive must be included in a sort/merge run; but there is not practical limit on the number of sort keys or "Field" directives that can be specified for a single sort/merge run.

Any sort key can be defined or referenced more than once during a single sort/merge run providing a new keyname is specified each time the sort key is defined.

The user also may change the collating sequence of a sort key according to the requirements of any number of runs within a sort/merge job. He simply changes the "Key" directive reference for each run.

Sort keys of an individual record can be written in different coding formats; however, when sort key codes are mixed, the records containing them must be read in binary.

```
FIELD,keyname(start,length,code,sign),keyname(...)
FIELD,IDENT(2,15,DISPLAY)
```

keyname — Name assigned by user to a sort key; any number of letters and digits. The first seven characters must be unique and at least one must be alphabetic.

start — Starting position of the sort key as follows:
- byte — Byte number in the record in which the sort key first appears.
- .bit — Bit number within the first byte in which the sort key first appears. The system assumes a value of one for an unspecified byte position.
- byte.bit — combination of the byte number and the number of the first bit within that byte in which the sort key first appears.

length — Length of the sort key as follows:
- nbytes — Number of bytes in sort key. If integer or floating point code is specified, the length parameter must be equivalent to 60 bits.
- nbytes.nbits — Combination of the number of bytes and the number of bits contained in the sort key. A "." is required to separate the specifications. If integer or floating point code is specified, the length parameter must be equivalent to 60 bits.

code — Sort key code identifier as follows:
- DISPLAY — Internal display code
- FLOAT — Floating point data
- INTBCD — Internal BCD code
- INTEGER — Fixed point integer data
- LOGICAL — Unsigned integer data (assumed by system if parameter is omitted)

sign — Optical parameter, valid only for sort keys containing character coded numeric data. Indicates the sign represented by an overpunch on the lower order character of the sort key.

Note 6: "Key" control card. the "Key" directive is required to specify the order and collating sequence of 1 to 100 sort keys for a sort/merge run.

```
KEY,keyname(order,colseq),keyname(...)
KEY,IDENT(A,DISPLAY)
```

The left and right parentheses are required as shown for this direction; therefore, they may not be used in other positions.

keyname Name assigned to sort key; it must be specified in the "Field" directive.

order Specified the order in which keys are to be sorted and merged.
A = ascending order (assumed if parameter is omitted)
D = descending order

colseq Name of user specified collating sequence defined in the "Sequence" directive or one of the following standard collating sequence identifiers. These standard collating sequences are presented in Appendix B of the SORT/MERGE reference manual.

ASCII6	6-bit ASCII collating sequence
COBOL6	6-bit COBOL collating sequence
DISPLAY	Internal display collating sequence
INTBCD	Internal BCD collating sequence

If a collating sequence is not specified, the system assumed the 6-bit COBOL collating sequence for 6-bit character coded keys and the 8-bit ASCII collating sequence for 8-bit character coded keys. These default collating sequences can be replaced and respecified with an alternate collating sequence using the "Sequence" directive.

Note 7: "Equate" control card. The "Equate" directive specifies two or more characters already in the collating sequence as equal for comparison purposes.

```
EQUATE,colseq(c,c,c,c)(c,c,...)
EQUATE,DISPLAY( ,0)
```

colseq Collating sequence:
Name of a user collating sequence specified in the "Sequence" directive. 6-BIT or 8-BIT default specifications appearing in the "Sequence" directive. One of the standard collating sequence identifiers:

ASCII6	6-bit ASCII collating sequence
COBOL6	6-bit COBOL collating sequence
DISPLAY	Internal display collating sequence
INTBCD	Internal BCD collating sequence

c Characters to be equated. The collating value of the list of characters specified within the parentheses is equal to the value of the last character specified in the list. These characters also can be listed by their card code punch or equivalent two or three digit octal number.

Note 8: "End" control card. this card terminates the control cards to the sort/merge and must appear as the last sort/merge control card.

5.2.2 Quality Control Checks

The dayfile will contain a count of the total records sorted and the total output records, these figures should match. These totals will equal the number of cards read by the CARD-to-TAPE program plus one "Header" record, one "End-of-Data" record and one "Trailer" record. Also the file will have been padded to fill the last block and give a record count that is a multiple of 10.

5.3 EDIT Program - EDTFLO

This program reads the sorted card image output file written by the SORT program and creates an edit file in main file format of 300-character records, blocked 15. The Region code, station number, year, month, day and the data fields are all checked in the following manner:

a) the Region code must be a numeric digit from 2 to 9 inclusive.

b) The station number must contain 2 digits, followed by 2 alphabetic characters, followed by 3 digits.

c) The year must fall in the range from 1800 to the current year.

d) The month must not contain "00" since the month was checked by the CARD-to-TAPE program which inserts "00" for an invalid month.

e) The day may have the value "00" or a value between 1 and the number of days in the month. If the value of the day is "00" then position 21 must contain either of the symbols "X", "*", or "R" followed by a "+" sign.

Any errors found in these above-mentioned fields will cause the entire card or card image to be rejected. If daily discharge data are entered for more than the correct number of days for that month, for example 31 days for September, the extra days are ignored and this is not considered to be an error.

Each daily discharge value must not be longer than 6 digits, including the decimal point and/or minus sign, if present. If a field has more than 6 digits, the extra digits are dropped one at a time from the right until only 6 digits remain. This is not considered to be an error. Negative values must have a "-" sign in front of the first valid digit, or decimal point, if present.

There must be no imbedded blanks. Each daily discharge value is followed by a plus sign (+), and the last value entered on a card must be followed by a plus sign to be complete on that card. The daily values are rounded to 3 significant figures but not more than 3 decimal places. If the figure following the last significant figure is exactly 5, it is rounded up to the next digit, e.g. 6885 = 6890 and 0.0005 = 0.001. Values of zero are written on the output tape as "0" even if entered as "0.0", "0.00" or "0.000".

If symbols are entered, only the following characters may be used:

A - manual gauge
B - ice conditions
E - estimated
R - revised data
* - deletion of an existing revision code
N - deletion of an existing symbol
X - deletion of both value and symbol

More than one symbol may be entered for any one day but only the last one encountered will be written onto the edited output file. Further, if a discharge is revised but the symbol is valid, then both the discharge value and the symbol must be submitted as a correction. Therefore, a symbol may be added or revised without altering the discharge, but a revision to a discharge must include the symbol, if applicable.

Symbols entered by themselves (i.e. without a daily discharge value) are translated to a numeric code by the EDIT program so as to signal the UPDATE program to perform the required action. Symbol codes of A, B or E are translated to 3, 4 or 5 resp.; symbol code N is translated to 9 in the symbol

code field and a symbol code of X is translated to a 9 in both the symbol and figure code fields; symbols R and * remain unchanged. So that the Update program will detect these special codes, the status code of any record containing symbol codes of *,R,3,4,5, or 9 is set to 2.

There can be any number of records for the same station, year, month and day. These are counted as duplications rather than errors, but only one record per month, containing the last daily discharge data read, is written onto the edited output file. On the output file, 8 positions are reserved for each daily value. The first 6 positions contain the daily discharge including the minus sign and/or decimal point if present.

The 7th position is a figure code set as a result of the editing (see section 4.1.2 for description).

The 8th position is a symbol code set as a result of the editing as follows:

1 - indicates no data for that day
A - manual gauge
B - ice conditions
E - estimated
R - addition of the symbol R to indicate revised data
3 - addition of symbol A to existing value
4 - addition of symbol B to existing value
5 - addition of symbol E to existing value
9 - deletion of value and/or symbol
* - deletion of revision code
blank - no footnote

The first day on which the minimum and maximum daily discharges occur is stored in the output record. The monthly total is stored showing a decimal point and three decimal places, as F12.3.

A month code is generated and stored on the output tape as follows:

1 - 28 day incomplete month	5 - 28 day complete month
2 - 29 day incomplete month	6 - 29 day complete month
3 - 30 day incomplete month	7 - 30 day complete month
4 - 31 day incomplete month	8 - 31 day complete month

On reading the "End-of-Data" record, from the sorted input file the program writes onto the edited output file an "End-of-Data" record, a "Trailer" record and "Padding" records as required.

To monitor the execution of the EDIT Program 4 types of control pages are produced. These pages are further discussed in the Quality Control Checks section 5.3.2.

The output tape can be dumped onto the print file if there is a "1" punched in column 22 of the "Date" card. A station-year in this context means the data collected for one station during one year only. This could be an incomplete year.

5.3.1 Control Card Set-up

```
K2002,CM70000,P2,T200.
ACCOUNT,XXXXX.   F-EDIT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH,TAPE3,ID=DATA,MR=1.                          See Note 1
REQUEST,TAPE4,SN.                                   See Note 2
ATTACH(LIB,FLOW,ID=METLIB,MR=1).
LIBRARY(LIB)
EDTFLO.
CATALOG,TAPE4,ID=DATA,MR=1,RP=30.                   See Note 2
7/8/9                                               multi-punch in col. 1
DATE JUN 30 1983                                    See Note 3
A03WSC-1000-08 9999                                 See Note 4
J04WSC-1101-08 9999                                 See Note 5
6/7/8/9                                             multi-punch in col. 1
```

Note 1: The "ATTACH" card attaches the input file from disk created by the SORT utility.

Note 2: The "REQUEST" card reserves space on disk for output. When the EDIT program is finished execution, the output file (TAPE4) is catalogued and saved on disk for 30 days, ready for input to the UPDATE program.

Note 3: Standard "Date" card. If a printed copy of the output file is desired, then punch a numeric character (1-9) in column 22 of the "Date" card.

Note 4: "Input File Identification" card.

A	Input.
03	Unit number for the file called TAPE3.
WSC-1000-08	Tape label of the sorted card images.
"9999"	The visual reel number to be mounted.

Note 5: "Output File Identification" card.

J	Output.
04	Unit number for the file named TAPE4
WSC-1101	Tape label of the output file
08	One more than current master sequence number.
"9999"	Reel number. These figures will be printed in the tape summary.

5.3.2 Quality Control Checks

The dayfile should be checked for fatal system errors.

The EDIT program listing is made up of four types of control pages.

The first control page will indicate any problems with the "File Identification" control cards and if no errors are found a "NO ERRORS" message is printed. Errors will cause the job to terminate and the return code associated with the error will be listed in the tape summary.

The second control page contains a Region listing and summary. A sample Region listing as shown on the following page indicates a range of errors that may occur at some time while running the EDIT program.

```
EDTFLO                                                                    PAGE
(1000-                          WATER SURVEY OF CANADA          JUN  4 1983

STATION  RECORD  NO. OF  NO. OF
 NUMBER   COUNT  MONTHS  YEARS          ERROR DIAGNOSTICS

                                                    DISTRICT NO. 2 VANCOUVER, B.C.

                                IDENT ERROR          Q207EE008179 310
                                FIELD ERROR          Q207EE008979 101     0.001+0.002B+0.003E 0.004A+
                                IDENT ERROR          Q207EE008979 230
                                DUPLICATION ERROR    Q207EE008979 420     10.0+

07EE008        3       2       1      1 DUPLICATION ERRORS   2 IDENTIFICATION ERRORS   1 FIELD ERRORS   4 ERROR CARDS
                                      INVALID PLUS SIGN      Q207EE009979 101     100"200"300"400"500"

07EE009        3       0       2      0 DUPLICATION ERRORS   0 IDENTIFICATION ERRORS   0 FIELD ERRORS   1 ERROR CARDS
07FC005        5       2       3    NO ERRORS

                    SUMMARY FOR THE DISTRICT

                         3 STATIONS

                         3 STATION-YEARS

                         4 STATION-MONTHS
```

The left side of the sample listing gives the station number, the record sequence of the last data record output for that station, as well as the accumulative number of months and years of data.

The right side of the sample listing gives the error diagnostics for each station processed. Error diagnostics precede each line giving the station number, record count, etc. If no errors were detected for a given station, then the message "NO ERRORS" will be printed on the same line as the station number, otherwise a summary of the errors detected for that station is printed. Detailed descriptions of each error message follow.

Identification Errors:

An identification error indicates an error in columns 2-20 inclusive of the input card. If this type of error occurs, the data fields on this card are ignored. This type of error originates from an invalid district number (not between 2 and 9), or invalid station number (not between 01AA001 and 99ZZ999), or invalid year (less than 1800 or greater than the current year), or invalid month or invalid day. Note that the month code is set to zero if it was found erroneous by the CARD-to-TAPE program.

Field Errors:

Field errors can occur from either an illegal daily discharge value, such as 1A2, or an invalid symbol, such as P. The only valid symbols are A, B, E, N, X, R and *. The daily discharge value must appear first if one is present and followed by the symbol. Each daily discharge value cannot exceed 6 digits including the decimal point and minus sign. If more than 6 digits are entered with a decimal point the least significant digits after the decimal point are dropped until only 6 digits remain. If more than one symbol is punched, such as AB, the program will use the last symbol, B in this case.

Duplication Error:

If data for any day appear on more than one card each subsequent occurrence of any data for that day will cause the number of duplications to increase by one. The following two cards are an example of this:

```
Q202RB014972FEB15    170+180+190+200B+210B+230E+25IE+
Q202RB014972FEB15    170+180+190+200B+210B+230E+250E+260+270+300+
```

An error was made while punching the daily data for the seventh day on the first card. A second card was punched but the first one was not removed so that the same six valid days appeared on both cards. Thus the EDIT program will detect six duplications and one field error. When the first card was read the data for the six valid days, February 15 to February 20, would be stored correctly but there would be nothing stored for February 21 because of the field error. The data from the second card for February 15 to February 20 would then be stored over that from the first card and all remaining data on this card would be stored for February 21 to February 24.

Invalid Plus Sign:

The EDIT program scans each card for the presence of a valid "plus" sign. If the program does not find a valid "plus" sign on any given card, the message "Invalid Plus Sign" is printed along with the contents of the card and the data fields for that card are ignored. To allow for translation of code when going from 9-track to 7-track tapes and vice versa, the following are considered as valid "plus" signs: 12-punch, 12-8-6 punch, 11-3-8 punch, 11-8-6 punch and a 0-8-7 punch. More than one type of "plus" sign is allowed on one given card.

Undetected Errors:

More than 6 digits for a daily discharge will cause the least significant digit(s) to be dropped until only 6 remain. This value is then rounded according to the rule for significant figures as described in the manual of "Hydrometric Data Computation and Publication Procedures" except for figures below 100 m^3/s (see section 5.3). Thus if a plus sign is missing between two discharges such as 1120 and 1150, these are recognized by the program as 11201150, the 50 is dropped and the value 112011 is rounded to 112000 m^3/s. But the number of days of data has been reduced by one so that this month will be incomplete and one daily discharge will be much larger than the others.

The day of the month for only the first daily discharge is punched on the card. The EDIT program assumes that this date is correct and thus if it is wrong, data can be lost. For example, if the day for March was entered as the 24th but should have been the 20th, the program would only expect data for eight days but there could be twelve daily discharges on the card. Thus the program will edit only the first eight values on this card and disregard the rest.

The third type of control page contains a job summary for all regions edited. This summary indicates the total number of stations, station-years, station-months and non-discharge cards.

The fourth type of control page is the Tape summary pape which gives information about the input and output files. The following information is given by the tape summary:

TAPE: each input or output tape is identified by the letters A, B or J, i.e. A and B are always input tapes, J will always by the output tape.

UNIT: a unit number is assigned corresponding to the tape number, i.e. TAPE3 has a unit number of 3.

FILE: indicates the internal label number of the tape.

RECORDS ON FILE: indicates the actual number of data records on the tape.

RECORDS PROCESSED: indicates the total number of records processed which include the Header, Trailer and End of Data records, therefore the number of records processed will always be 3 greater than the number of records on file.

I/O FAULTS: indicates the total umber of parity errors encountered during I/O operations for a specified tape.

TYPE:STATUS:ERROR: are numeric codes which indicate the status of the tape file when execution has completed. See section 8.1 for interpretation.

5.4 UPDATE Program - UPDFLO

The UPDATE program updates the historical FLOW file or annual FLOW file according to the revisions, additions and/or deletions on the edited tape or disk file. Input and output records are both 300 by 15. Updating is controlled by means of control cards. The core required is 60 000 octal words of central memory, and the processing time is 6 seconds for every 1000 records on the master input file plus 5 seconds for every 1000 records on the input EDIT file. Update is controlled by means of control cards. The principle updating control cards indicate the following:

(a) which of the two input types takes precedence

(b) whether or not this is a correction run, i.e. addition of annual data plus historical corrections to the master file

(c) whether all or just one Region is being updated

(d) whether this is to be a revision run, i.e. all stations updated or added will contain a revision code in the symbol field; or if this is a normal run, i.e. no revision codes added.

The "output file identification" card indicates the range of stations to be included on the output tape. Besides updating the daily discharges this program also inserts, changes or deletes the valid extreme codes as keypunched in card format 74-103.

The UPDATE program will replace any data on the old master with data found on the edit or annual tape for the same Region, station, year and month. The date used on the new record will be the run date if the code "1" is used on the "Updating Control" card. Any record on the input EDIT file which contains a "9" in the symbol field or just a symbol with no corresponding value on the main file will be dropped, unless the code "C" on the priority control cards indicates this is a corrections run then these records will be retained. The program recomputes the month code, the monthly total and the minimum and maximum for each month which is updated, and resets the status code to "1".

The overall updating process consists of decoding the identification of each data record from each of the two input files, comparing the identification of both records, and updating the two data records if they coincide. Records that do not coincide i.e. new data being added, are simply stored in a work buffer and transferred to the output file after the date and sequence number of the record have been re-calculated. Records that coincide are decoded, updated, and the total, minimum, maximum and month code are recalculated.

All data records transferred to the output file are of status 1, i.e. they do not contain symbol codes of 3, 4, 5, *, R or 9. When data records of status 2 are encountered on the input files, they are either updated with a corresponding record on the alternate input file or dropped if no corresponding data record is found. All data records which are updated are converted to status 1, i.e. the operations signalled by symbol codes of 3, 4, 5, *, R or 9 are performed. If in one given data record of status 2 for which a corresponding record exists and the corresponding daily fields are not found for fields whose symbol codes are 3, 4, 5, *, R or 9, then only these daily fields are dropped (i.e. symbol fields of 3, 4, 5, *, R or 9 replaced by a 1 or 2 code) and the data record is transferred to the output file, provided of course that some valid daily fields still exist on that record.

5.4.1 Control Card Set-up

```
K2003,CM70000,P2,T500,GE3.
ACCOUNT,XXXXX.  F-UPDATE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL(TAPE4,R,L=HISTFLOW,F=S,X=SV,N=EB,D=GE,VSN=ERXXXX)          See Note 1
LABEL(TAPE5,R,L=HISTFLOW,F=S,X=SV,N=EB,D=GE,VSN=ERXXXX)          See Note 2
LABEL(TAPE6,W,L=HISTFLOW,F=S,X=SV,N=EB,D=GE,T=XXX)               See Note 3
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
UPDFLO.
7/8/9                                                            multi-punch in col. 1
      .
      .
      CONTROL CARDS ARE INCLUDED HERE (see following examples)
      .
      .
6/7/8/9                                                          multi-punch in col. 1
```

Note 1: "Label" card for the input file created by the EDIT program, containing additions and/or corrections.
In many cases when the UPDATE program is being run by itself, the output file created by the EDIT program (TAPE4) will have been saved on disk if the file is not too large. In this case, the tape request parameter on the job card is changed from GE3 to GE2 and the "LABEL" card is replaced with the following:

```
ATTACH,TAPE4,ID=DATA,MR=1.
```

Note 2: "Label" card for the input file to be updated.
"XXXX" is the visual reel number.

Note 3: "Label" card for the output file.
T=XXX is the retention period, one to three digits.

Program control cards, for each requirement, i.e. Historical Update, Annual Update and corrections, are described below and are inserted in the Control Card set-up where indicated.

a) EXAMPLE 1 CORRECTING AN EDITED TAPE

```
DATE JUN 30 1983                                    standard "Date" card
A0B0C                                               See Note 4
A05WSC-3201-07 XXXX                                 See Note 5
B04WSC-1101-08 XXXX                                 See Note 6
J06WSC-3201-09 9999 01AA001-99ZZ999                 See Note 7
Q305CJ003 1970 B
9999ZZ999
```

Note 4: "Priority" control card
"A0B0" priority determined by the original date on each record.
"C" a correction run and all Regions will be updated.

Note 5: "Input File Identification" card.

"A05"	file name "TAPE5"
"WSC-3201-07"	tape lable of old master file to be updated
"XXXX"	visual reel number (Note 2).

Note 6: "Input File Identification" card

"B04"	file name "TAPE4"
"WSC-1101-08"	tape label of edit file containing corrections
"XXXX"	visual reel number (Note 1)

Note 7: "Output File Identification" card

"J06"	file name "TAPE6"
"WSC-3201-09"	tape label of corrected output file
"9999"	reference digits; any four
"01AA001-99ZZ999"	station range to be corrected.

b) EXAMPLE 2 UPDATING THE ANNUAL FILE

DATE JUNE 30 1983	standard "Date" card
A0B1	See Note 8
A05WSC-1201-07 XXXX	See Note 9
B04WSC-1101-08 XXXX	See Note 10
J06WSC-1201-08 9999 01AA001-99ZZ999	See Note 11
Q502BF010 1973 L	See Note 12
9999ZZ999	See Note 12

Note 8: "Priority" control card.

"A0B1"	input file with header card prefix "B" and priority "1" takes precedence. (Edited corrections file)

Note 9: "Input File Indentification" card.

"A05"	file name "TAPE5"
WSC-1201-07"	tape lable of old annual FLOW file
"XXXX"	visual reel number (Note 2)

Note 10: "Input File Identification" card.

"B04"	file name "TAPE4"
"WSC-1101-08"	tape label of corrected edit file
"XXXX"	visual reel number (Note 1)

Note 11: "Output File Identification" card

"J06"	file name "TAPE6"
"WSC-1201-08"	tape lable of new annual FLOW file Generation increased by one from seven to eight
"9999"	reference digits
"01AA001-99ZZ999"	station range

Note 12: The format for the "Valid Extreme" card(s) is given in section 3.2 under Keypunching Instructions. If for example a valid extreme code of B is to be changed to H it is only necessary to keypunch a card with the new code of H. It is not necessary to first delete the B and then add the H in the next run. These "Valid Extreme" cards must be in ascending order by Region, station number and year.

A type of record code of 9 with a Region code of 9 and a station number of 99ZZ999 is used to mark the end of this set of cards. If this last card is missing the job will abort before updating.

c) EXAMPLE 3 A REVISION RUN UPDATING THE HISTORICAL FILE CONTAINING ONE DISTRICT

```
DATE JUN 30 1983                                        Standard "Date" card
A0B1 3          R                                       See Note 13
A05WSC-3201-26 XXXX                                     See Note 14
B04WSC-1201-08 XXXX                                     See Note 15
J06WSC-3201-27 9999 01AA0001-08MH134                    See Note 16
Q306JA017 1942 B
9999ZZ999
```

Note 13: "Priority" control card

"A0B1"	corrections tape has priority. "B1" indicates priority tape
"3"	specific Region to be updated
"R"	The symbol R in column 21 will indicate a revision run. During a revision run a revision code is inserted in the symbol field for all daily values being added or updated.

Note 14: "Input File Identification" card

"A05"	file name "TAPE5"
"WSC-3201-26"	tape label of old historical FLOW file
"XXXX"	visual reel number (Note 2)

Note 15: "Input File Identification" card

"B04"	file named "TAPE4"
"WSC-1201-08"	tape label of annual FLOW file used to update
"XXXX"	visual reel number (Note 1)

Note 16: "Output File Identification" card

"J06"	file named "TAPE6", output
"WSC-	tape label (Water Survey of Canada)
"3201-"	"3" numeric Region identifier "2" numeric FLOW file identifier "01" number of reels in the specified Region
"27"	if you add fifty to the number then it shows up to what year you have stored on file.
"9999"	refernce digits
"01AA001-08MH134"	station range

5.4.2 Quality Control Checks

Check the dayfile for fatal system errors. The "Priority" control card and all "File Identification" cards are printed on page one of the program listing. There are messages associated with the different "Priority" control cards used. The "File Identification" cards are printed and checked; if correct a "No Errors" message is printed and processing continues, if they are incorrect processing terminates and the tape summary page is printed with condition codes printed in the errors column. These codes are interpreted in section 8.1 Tape Summary Codes of this publication.

If processing continues the UPDATE program will check the "Valid Extreme" card or cards to ensure the validity of the region, station-number, year and valid extreme code. These cards must also lie in ascending order by region, station-number and year. If any errors occur the card is rejected and an error message is printed under the heading "INCOMPLETE YEARS AND THEIR RESPECTIVE CODE".

Immediately following this listing the UPDATE program will print a period-of-record Summary which contains one line per station indicating the years from 1900 on which are missing, partial, partial with revisions, complete or complete with revisions and the cumulative number of records for that

station. If there are valid extreme codes for any of the partial years in that period-of-record a line is printed immediately after this line with the valid extreme code under the appropriate year. If there are any years containing data before 1900 a warning message is printed after this line which indicates the number of station-months before 1900.

After the period-of-record summary, a summary page is printed which indicates under a separate column for each region the total number of complete-months, incomplete-months, years before 1900, complete-years, incomplete-years and stations. The last column contains the total for all regions.

The Tape summary page follows the summary page and contains the error codes as outlined in section 5.3.2 Quality Control Checks for the EDIT program.

A sample listing of a complete update run as shown below indicates a range of errors that may occur while running this program.

```
                                                                                                        PAGE    5
     UPDFLO
(5201-31)(1101-27)                          WATER SURVEY OF CANADA                            JUN 30 1983

                                         SUMMARY OF DISCHARGE RECORDS

OUTPUT 1            1            1            1            1            1            1            1            1
 TAPE  9            9            9            9            9            9            9            9            9
RECORD 0            1            2            3            4            5            6            7            8      STATION
 COUNT 01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234    NO.   DIST.
11346  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- --PCC  CCCCC CCCCC  CC--*  02BF002 GUEL.
11430  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  -PCCC CCCP-  ----*  02BF003 GUEL.
                                                                                                    B
11454  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  CC--*  02BF004 GUEL.
11473  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ZC--*  02BF005 GUEL.
                                                                                                               L
11497  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  CC--*  02BF006 GUEL.
11504  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  -P--*  02BF007 GUEL.
                                                                                                                L
11523  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ZC--*  02BF008 GUEL.
11534  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  -P--*  02BF009 GUEL.
                                                                                                                B
12998  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC--*  02CA001 GUEL.
       NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NNNNN NNNNN  NN
          480 STATION-MONTHS BEFORE 1900
13129  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  -PCCC CCCCC  CC--*  02CA002 GUEL.
                                                                                                    B
13494  ----- -----  ----- -----  ----- -----  ----- -----  ----- -ZRRR  RZ--- -ZZZZ  ZZZZC CCCCC  CCCCC CCCCC  CC--*  02CB001 GUEL.
                                                                        H
13700  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  PCCCC CCCCC  CCCCC CCP--  ----- -----  ----*  02CB002 GUEL.
                                                                                              L
13716  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ZC--*  02CB003 GUEL.
13763  ----- -----  ----- PCCCP  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----*  02CC002 GUEL.
                              H
13775  ----- -----  ----- ----P  P---- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----- -----  ----*  02CC003 GUEL.
14135  ----- -----  ----- -----  PCRRC RRRRR  RRRRC RRRRR  RRRRR RRRRR  Z---- -----  ----- -----  ----- -----  ----*  02CC004 GUEL.
                                                                       H
14610  ----- -----  ----- -----  ----- -----  ----- -----  --ZRR RRRRR  RRRRR CCCCR  RRRRR RCCCC  CCCCC CCCCC  CC--*  02CC005 GUEL.
                                                             H
```

```
                                                                                                        PAGE   35
     UPDFLO
(5201-31)(1101-27)                          WATER SURVEY OF CANADA                            JUN 30 1983
```

	VANCOUVER	CALGARY	WINNIPEG	GUELPH	MONTREAL	HALIFAX	REGINA	YELLOWKNIFE	TOTAL
COMPLETE MONTHS				127476					127476
INCOMPLETE MONTHS				1835					1835
MONTHS BEFORE 1900(INCLUDED ABOVE)				1435					1435
COMPLETE YEARS				9964					9964
INCOMPLETE YEARS				1489					1489
STATIONS				589					589

```
                                                                                                        PAGE   36
     UPDFLO
(5201-31)(1101-27)                          WATER SURVEY OF CANADA                            JUN 30 1983
```

TAPE	UNIT	*	FILE	REEL	*	RECORDS ON FILE	RECORDS PROCESSED	*	I/O FAULTS	TYPE	STATUS	ERROR	*	STATIONS	*
INPUT A	5	*	WSC-5201-31	9999	*	129314	129314	*	0	3	3	0	*	-	*
INPUT B	4	*	WSC-1101-27	9999	*	4	4	*	0	3	3	0	*	-	*
OUTPUT J	6	*	WSC-5201-31	9999	*	129314	129314	*	0	6	3	0	*	02AA001-04MF001	*

END OF TAPE LIST

* END OF RUN *

Two types of warning messages can appear within the summary. These messages are as follows:

1. WARNING *** RECORD OF STATUS 2 WAS DROPPED FOR STATION xxxxxxx YEAR yyyy MONTH mm

where xxxxxxx is the station number, yyyy is the year and mm is the month. This indicates that a record containing symbol codes of 3,4,5, *, R or 9 was encountered and no corresponding record for the same station month was encountered on the alternate input file. In such a case the entire record is dropped.

2. DISTRICT n STATION xxxxxxx YEAR yyyy CODE OF z HAS NOT BEEN UPDATED

where n is the Region number, xxxxxxx is the station number, yyyy is the year and z is the incomplete year code. This message indicates that the specified incomplete year code was not updated because the corresponding record was not encountered on either of the input files.

5.5 Complete Job Submission

Control decks can be prepared to produce a combination of all 4 steps described in the preceding paragraphs. Files produced are in master file format (300-character records blocked 15) and can be listed for validity checking by the DAYFLO program. A Provisional (Dailies) listing of either the entire file or all corrections after a specified date can be printed. The retrieval section of this manual describes the DAYFLO program control cards required to print either the entire file or only the corrections.

5.5.1 Control Card Set-up to Produce an Edit File

```
K2004,CM70000,P2,T1000,NT1.
ACCOUNT,XXXXX.  FLOW C-T-T,SORT,EDIT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
CARD.
FILE(TAPE2,RT=F,BT=C,FO=SQ,FL=80,CM=YES)
FILE(TAPE3,RT=F,BT=C,FO=SQ,FL=80,CM=YES)
SORTMRG.
LABEL(TAPE4,W,L=HISTFLOW,F=S,X=SV,D=PE,N=EB,T=XXX)
FILE,TAPE3,RT=F,BT=C,FL=800,CM=YES.
EDTFLO.
7/8/9/                                          multi-punch in col. 1
DATE JUN 30 1983                                standard "Date" card
   WSC-1000-58 9999                             See CARD-to-TAPE notes
     DATA CARDS OF CORRECTIONS ARE INCLUDED HERE
7/8/9                                           multi-punch in col. 1
SORT                                            See SORT program notes
FILE,INPUT=TAPE2(C),OUTPUT=TAPE3(R).            See SORT program notes
FIELD,IDENT(2,15,DISPLAY)                       See SORT program notes
KEY,IDENT(A,DISPLAY)                            See SORT program notes
EQUATE,DISPLAY( ,0)                             See SORT program notes
END                                             See SORT program notes
7/8/9                                           multi-punch in col.1
DATE JUN 30 1983                                standard "Date" card
A03WSC-1000-08 9999                             See EDIT program notes
J04WSC-1101-08 9999                             See EDIT program notes
6/7/8/9                                         multi-punch in col. 1
```

5.5.2 Control Card Set-up to Update a File

```
K2004,CM70000,P2,T1000,GE2
ACCOUNT,XXXXX.  FLOW C-T-T,SORT,EDIT,UPDATE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
CARD.
FILE(TAPE2,RT=F,BK=C,FO=SQ,FL=80,CM=YES)
FILE(TAPE3,RT=F,BT=C,FO=SQ,FL=80,CM=YES)
SORTMRG.
FILE,TAPE3,RT=F,BT=C,FL=800,CM=YES.
EDTFLO.
LABEL(TAPE5,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX)
LABEL(TAPE6,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX)
UPDFLO.
7/8/9                                          multi-punch in col. 1
DATE JUN 30 1983                               standard "Date" card
   WSC-1000-59-9999
        .
        .
     DATA CARDS OF CORRECTIONS ARE INCLUDED HERE
        .
        .
7/8/9                                          multi-punch in col. 1
SORT                                           See SORT program notes
FILE,INPUT=TAPE2(C),OUTPUT=TAPE3(R).           See SORT program notes
FIELD,IDENT(2,15,DISPLAY)                      See SORT program notes
KEY,IDENT(A,DISPLAY)                           See SORT program notes
EQUATE,DISPLAY(  ,0)                           See SORT program notes
END                                            See SORT program notes
7/8/9/                                         multi-punch in col. 1
DATE JUN 30 1983                               standard "Date" card
A03WSC-1000-08-9999                            See EDIT program notes
J04WSC-1101-08 9999                            See EDIT program notes
7/8/9                                          multi-punch in col. 1
DATE JUN 30 1983                               standard "Date" card
A0B0                                           See UPDATE program notes
A05WSC-3201-07 XXXX                            See UPDATE program notes
B04WSC-1101-08 9999                            See UPDATE program notes
J06WSC-3201-08 8888 01AA001-99ZZ999            See UPDATE program notes
999ZZ999                                       See UPDATE program notes
6/7/8/9                                        multi-punch in col. 1
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
LABEL,TAPE3,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.  Input tape
LABEL,TAPE4,W,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.  Output tape
DELFLO.
7/8/9                                          multi-punch in col. 1
DATE JUN 30 1983                               standard "Date" card
A03WSC-4201-31                                 "Input File Identification" card
J04WSC-3201-31                                 "Output File Identification" card
67106 04 02DA003 JAN 01 1965 DEC 31 1965 N     See Notes 1 and 2
67105 06 10EC001 JAN 1950 MAR 1956 01EA002     See Notes 1 and 3
99999                                          See Note 4
6/7/8/9                                        multi-punch in col. 1
```

Note 1: There are two types of input cards to this program: the "Move and Delete" card (67105) and the "Move or Delete" card (67106). The "Move and Delete" card (67105) is used when modifications to the identification (i.e. Region, station number, year or month) of a "Data" record(s) are to be performed while "moving" the "Data" record(s) from the input file to the output file and when the existing "Data" record(s) are to be deleted. With this card, the program will generate record(s) under the new identification and will generate a delete record for each record under the old identification. The "Move or Delete" card (67106) is used when only one action is to be taken, i.e. a "Data" record(s) is to be "moved" (with or without modifications to the symbol fields or Region code) from the input file to the output file, or a delete record(s) is to be generted on the output file with the same identification as the record(s) on the input file.

These cards are as follows:

Note 2: "Move or Delete" card (67106)

Column(s)	Description
1-5	numbers "67106"
6-7	blank
8	Region number of the station on the input file which is to be "moved" or "deleted"
9	blank
10-16	station number of the station on the input file which is to be "moved" or "deleted"
17	blank
18-28	beginning date from which data on the input file are to be "moved" or "deleted", in the form MONTH-DAY-YEAR, e.g. JAN 01 1973
29	blank
30-40	ending date to which data on the input file are to be "moved" or "deleted", in the form MONTH-DAY-YEAR, e.g. JAN 30 1973
41	blank
42	one of the symbols A,B,E,N,X or blank
43-44	blank
45	only used when "moving" a "Data" record(s) from one Region to another; it contains the Region number that the old "Data" record(s) is to be "moved" to
46-80	blank

Columns 1-5 must always contain the digits "67106". Columns 8-16 identify the data on the input file and must always be present; all other columns are optional. If the "from-to" dates are not specified in columns 18-28 or 30-40, the program will supply its own "from-to" dates which will be that of the first and last data records found on the input files for the station specified in columns 8-16.

5.5.3 Control Card Modifications

When the input for the CARD-to-TAPE program is on tape a "Request" card must be inserted after the "Attach" card for the CARD-to-TAPE program and a numeric character must be punched in column 21 of the first "Date" card. The tape request parameter of the "Job" card must be modified according to the density of the input tape. A file card, describing the input file on tape may be required.

The intermediate files passed from the CARD-to-TAPE program to the SORT and between the EDIT program and the UPDATE program are on disk and exist only while the job is executing. The output from the SORT may be on tape or disk at the discretion of the user.

All control cards are described in detail in the single job descriptions.

5.5.4 Quality Control Checks

Quality control checks are carried out in sequence as described in the quality control checks for the individual jobs.

5.6 MOVE-and-DELETE Program - DELFLO

This program reads the main file and prepares a tape which will delete and/or move all or part of a station from the main file. Data under one station number can also be written under another station number. In this instance, records are also written which will delete the data under the original station number, and the tape must be sorted before being used as input to the UPDATE program which actually performs the deletions.

The "Move or Delete" control card, type 67106, contains the "from" and "to" dates for which data are to be deleted or moved. This control card also allows the symbol code to be changed for a specified period. The two dates are checked for validity and messages are printed if an error is found. If no dates are punched in the card the lowest possible and highest possible dates are supplied by the program and a message is printed to that effect. The program then reads the input tape until the station number requested is found. A message is printed if the station number is not found on tape. The figure and symbol codes are set to "9" if data are to be deleted and the status code is set to "2". But if only the symbol code is to be changed then only the symbol code is altered and the status code is set to "2". Several symbol changes, moves or deletions can be performed on one station in a single run. A separate control card is required for each range of dates.

The "Move and Delete" control card, type 67105, contains the from and to dates of the data to be moved, the new station number under which the data are to appear and the date the data is to begin under the new station number. Again the dates are checked for validity, and messages printed if an error is found, or if the lowest and highest dates possible are supplied by the program. If the third date is not punched on the card, the program uses the date from the tape record. As with the "Delete" control card, the program reads the input tape until the requested station number and date are found. Messages are printed if it is not on the tape and the program then reads the next control card. Two records are written for each "Data" record on the input tape, the first containing the new station number, with the remainder of the record unaltered, and the second record using the old station number adds a status code of "2" with figure and symbol codes set to "9". Using this control card, the output tape must be sorted before being used as input to the UPDATE program.

5.6.1 Control Card Set-up

```
K2005,CM70000,P2,T100,GE2.
ACCOUNT,XXXXX.  F-DELFLO.
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
```

The symbol in column 42 of this card controls the mode of operation of the program and is as follows:

blank	- the records specified in columns 8-40 will be copied onto the output file with delete codes in the figure and symbol fields for those days between the "from" date in columns 18-28 and the "to" date in columns 30-40.
X	- the records specified in columns 8-40 will be copied onto the output file exactly as found on the input file, unless a new Region code is indicated in column 45 in which case the Region code will be changed.
N	- the records specified in columns 8-40 will be copied to the output file with a "no symbol" code in the symbol field for those days between the "from" date in columns 18-28 and the "to" date in columns 30-40. If the symbol field being delete indicated revised data i.e. symbols R, S, T, and W; then the symbol field will be replaced with an R.
A, B or E	- the records specified in columns 8-40 will be copied to the output file with a code for the symbol A, B or E inserted in the symbol field for those days between the "from" date in columns 18-28 and the "to" date in columns 30-40. If the previous symbol field indicated revised data then the symbol S, T or W will be inserted accordingly.

Note 3: "Move and Delete" card (67105)

Column(s)	Description
1-5	numbers "67105"
6-7	blank
8	Region number of the station on the input file for which delete records are to be generated
9	blank
10-16	station number on the input file for which delete records are to be generated
17	blank
18-25	beginning or "from" date from which data on the input file are to be "deleted", in the form "month-year", e.g. JAN 1950
26	blank
27-34	ending or "to" date up to which data on the input file are to be "deleted", in the form "month-year", e.g. MAR 1956
35	blank
36-42	new station number under which the data are to be copied on the output tape
43	blank
44-51	date that the first "Data" record on the output file is to have, in the form "month-year", e.g. JAN 1951
52	blank
53-54	only used when moving a "Data" record(s) from one region to another; it contains the region number that the old "Data" record(s) is to be moved to
55-80	blank

Columns 1-5 must always contain the digits "67105". Columns 8-16 identify the data on the input file and must always be present. The "from" and "to" dates specified in columns 18-25 and 27-34 are optional. If these are omitted, the program will supply its own dates which will be that of the first and last records found on the input file for the station specified in columns 8-16.

Columns 36-42 identify the data on the output file and must always be present. The "from" date specified in columns 44-51 is optional. If it is omitted, the program will assume that the data are to be copied with the same dates as found on the input file. If specified, the month must be the same as that specified in the "from" date (columns 18-20) and the year must be greater than that specified in the "to" date (columns 31-34) so that the month codes will remain correct and the output file will not contain both a data and a deletion record for the same station-month.

Note 4: A card containing 9's in columns 1-5 is used to mark the end of the data and should always be inserted as the last data card. Omitting this card will cause an abnormal termination.

5.6.2 Examples for the "Move or Delete" card

(a) Copying all records for a given station:

```
67106  2 08LB001                          X
```

All records for station 08LB001 under Region 2 will be copied to the output file, exactly as found on the input file.

(b) Copying only some of the records for a given station:

```
67106  2 08LB001 JAN 01 1960 JUN 30 1960  X
or 67106  2 08LB001 JAN 15 1960 JUN 15 1960  X
```

The two cards above will produce the same results since the smallest unit copied is one record (i.e. one complete month). All records that fall between January and June, 1960 for station 08LB001 under Region 2 will be copied onto the output file.

(c) Copying records for a given station with some modifications to the symbol fields:

```
67106  2 08LB001 JAN 01 1960 MAR 18 1960  B
```

All records that fall between January and March, 1960 for station 08LB001 under Region 2 will be copied to the output file with a code for the symbol "B" inserted in the symbol field for those days between January 1, 1960 and March 18, 1960.

(d) Copying records for a given station under a new Region number:

```
67106  2 08LB001                      X  3
```

All records found on the input file under Region 2 for station 08LB001 will be copied to the output file under Region 3.

(e) Deleting all records for a given station:

```
67106  2 08LB001
```

The program will generate "Delete" records for all records found on the input file under Region 2 for station 08LB001. A "Delete" record is a "Data" record with all the figure and symbol codes equal to 9.

(f) Deleting only some of the records for a given station:

```
67106  2 08LB001 JAN 01 1960 DEC 31 1965
```

The program will generate "Delete" records for all those records that fall between January 1, 1960 and December 31, 1965 for station 08LB001 under Region 2.

(g) Deleting part of a record for a given station:

67016 2 08LB001 JAN 01 1960 JAN 15 1960

The program will generate delete codes, figure and symbol codes of 9, for those days beween January 1, 1960 and January 15, 1960 for station 08LB001 under Region 2. The remaining data fields for that record will be copied as found on the input file.

5.6.3 Examples for the "Move and Delete" card:

(a) Changing the station number:

67105 2 01EC001 01EC002

All records found on the input file under Region 2 for station 01EC001 will be copied onto the output file under station number 01EC002 and delete records will be generated for station 01EC001.

(b) Changing the date of the records:

67105 2 01EC001 JAN 1960 DEC 1960 01EC001 JAN 1961

All records found on the input file under Region 2 for station 01EC001 for 1960 will be copied to the output file with the year as 1961 and delete records will be generated for 1960.

5.6.4 Quality Control Checks

This program prints out the standard input and output file identification information. The output file will be of type 6 (output file in sequence) and have a status code of 3 if the job ran successfully. All control cards are printed out and are immediately followed by an error message if an error is found in the format number in columns 1-5. If the "from-to" dates were not specified on these cards, the program will supply its own dates and print out an informative message after each control card to show that it has done so.

If only the "Move or Delete" card (67106) is used, the output file can be used immediately as input into the FLOW UPDATE program provided that the output file is created in Region and station number sequence. If the output is not in sequence or if the "Move and Delete" card (67105) is used to manipulate more than one record (i.e more than one month of data), then the output file must be sorted before it can be used as input into the FLOW UPDATE program. It is to be noted here that with the "Move and Delete" card (67105), the program manipulates one record at a time and hence a "Delete" record follows each new data record generated. Thus the output file will have to be sorted when using the "Move and Delete" card (67105).

If the output file is to be sorted, then the file should be assigned a generation number greater than 50 (e.g. WSC-1201-51) to indicate to the FLOW UPDATE program that the file has been sorted and that the "Tape Trailer" record follows immediately after the "Tape Header" record.

The sort is done on the first thirteen characters of each record (Region number, station number, year and month). The sort can be run separately or can follow immediately after the MOVE-and-DELETE program. If both programs are run simultaneously, then the output file from the MOVE-and-DELETE program can be a disk file; only the input file and the output from the SORT need to be on tape. The deck set-ups for the SORT, run separately and combined with the MOVE-and-DELETE program follow:

5.6.5 Deck Set-up for a Main File SORT

```
K2006,CM70000,P2,T100,GE2.
ACCOUNT,XXXXX.  FLOW MAIN FILE SORT
LABEL,TAPE4,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.
LABEL,TAPE5,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,T=XXX.
FILE(TAPE4,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460)
FILE(TAPE5,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460)
SORTMRG.
7/8/9                                          multi-punch in col. 1
SORT                                           See Note 2
FILE,INPUT=TAPE4(C),OUTPUT=TAPE5(c)            See Note 3
FIELD,IDENT(1,13,DISPLAY)                      See Note 4
KEY,IDENT(A,DISPLAY)                           See Note 5
EQUATE,DISPLAY( ,0)                            See Note 6
END                                            "End of Sort" card
6/7/8/9                                        multi-punch in col. 1
```

5.6.6 Deck Set-up for the MOVE-and-DELETE program with SORT

```
K2007,CM70000,P2,T100,GE1.
ACCOUNT,XXXXX.  FLOW MOVE-AND-DELETE WITH SORT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
LABEL,TAPE3,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.
DELFLO.
UNLOAD,TAPE3.
LABEL,TAPE5,W,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,T=XXX.
FILE(TAPE4,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460)
FILE(TAPE5,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460)
SORTMRG
7/8/9                                          multi-punch in col. 1
DATE JUN 30 1983                               standard "Date" card
A03WSC-7201-31                                 "Input File Identification" card
J04WSC-6201-81                                 See Note 1
67106 07 02DA003 JAN 01 1965 DEC 31 1965 N
67105 06 01EC001 JAN 01 0950 MAR 1956 10EC001
99999
7/8/9                                          multi-punch in col. 1
SORT                                           See Note 2
FILE,INPUT=TAPE4(C),OUTPUT=TAPE5(R).           See Note 3
FIELD,IDENT(1,13,DISPLAY)                      See Note 4
KEY,IDENT(A,DISPLAY)                           See Note 5
EQUATE,DISPLAY( ,0)                            See Note 6
END                                            "End of SORT" card
6/7/8/9                                        multi-punch in col. 1
```

Note 1: The output file from the MOVE-and-DELETE program is assigned a generation number greater than 50 (81 in this example) to indicate to the FLOW UPDATE program that the file has been sorted (i.e. the "Tape Trailer" record follows the "Tape Header" record).

Note 2: The SORTMRG utility program can be used to sort a file(s) or merge two or more files. In this run it is used to sort a file (TAPE4).

Note 3: TAPE4 is the output file from the MOVE-and-DELETE program and the input to the SORT program. It does not have to be a physical tape reel when the MOVE-and-DELETE program and the SORT program are run simultaneously. TAPE4 is the sort input file. TAPE5 is the output file from the SORT program. It is EBCDIC recorded, 6250 bpi density with a block size of 4500 characters. The records for both the input file and the output file of the SORT program have a fixed length (300 characters per record).

Note 4: The sort is performed on a 13-character field of each 300-character record.

Note 5: The sort is done in ascending order, with a character mode key starting in position 1 of each record and ending in position 13.

Note 6: The standard collating sequence for DISPLAY in ascending order is the letters A to Z, the digits 0 to 9, some special characters, the blank and finally the remainder of the special characters. With the EQUATE directive in this sort the blank character is assigned the same sequence as the zero.

5.7 RETDAT Program

This program is used to help determine which station-years have recently been updated in order to bring listings up-to-date for both Ottawa and the regions.

The program compares the date at position 289-294 of the master file with a 6 digit date read in as input to the program.

If the date on the master file is on or after the requested date, the program will list the region, station number, year and date last updated.

A list of revised stations may be retrieved by adding an "R" in column 7 of the input.

In addition to the listing a corresponding list of WSC01 input cards for each station-year listed will be stored on disk. These cards are in the proper format ready for input to the historical listing program HISFLO (section 6.2).

Generally the RETDAT program will be run for each regional tape. As each tape is processed the list of WSC01 input cards stored on disk are added to and sorted in assending order by region, station number and year. When all the regional tapes have been processed a complete list of WSC01 input cards will be stored on disk ready for input to the flow listing program.

5.7.1 Control Card Set-up

```
ICPXX,CM70000,P2,T400,GE1.
ACCOUNT,XXXXX.  RETRIEVAL OF UPDATES BY DATE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,TAPE3,R,F=S,X=SV,D=GE,N=EB,L=HISTFLOW,VSN=ERXXXX
FILE,TAPE3,RT=F,BT=K,FL=300,RB=15,MBL=4500,CM=YES.
REQUEST,TAPE6,SN.
ATTACH,LIB,FLOW,ID=METLIB,MR=1.
LIBRARY,LIB.
RETDAT.
REWIND,TAPE4.
FILE,TAPE4,RT=Z,BT=C,FL=60,CM=YES.
FILE,TAPE6,RT=Z,BT=C,FL=60,CM=YES.
FILE,PRTEMP,RT=Z,BT=C,FL=60,CM=YES.
ATTACH,PRTEMP,FLOW,ID=LIST.  DELETE ON INITIAL RUN  See Note 1
SORTMRG.
CATALOG,TAPE6,FLOW,ID=LIST,RP=999,OR=INFINITE.      See Note 1
PURGALL,FLOW,ID=LIST,KP=2.
*EOR
820320                                               See Note 3
*EOR
SORT
FILE,INPUT=TAPE4(R),PRTEMP(R),OUTPUT=TAPE6(R)
FIELD,DIST(9,1,DISPLAY),STA(11,7,DISPLAY),YR(26,4,DISPLAY)
KEY,DIST(A,DISPLAY),STA(A,DISPLAY),YR(A,DISPLAY)
EQUATE,DISPLAY( ,0)
END
```

Note 1: A permanent file named FLOW,ID=LIST which contains the WSC01 input cards created from the previous run is attached as local file PRTEMP. This file will be sortmerged with the output from RETDAT (TAPE4) creating TAPE6 which is cataloged on disk as the next cycle of permanent file FLOW,ID=LIST.

Note 2: The input card contains the date which governs the program to list all station-years updated on or after that date. The card format is as follows:

Column(s)	Description
1-2	year, e.g. "76" for 1976
3-4	month, e.g. "01" for Jan
5-6	day, e.g. "01" for the first
7	revision, i.e. "R" if only revised records are to be listed or blank for all records to be listed
8-80	blank.

5.8 SYMCHK Program

This program checks to see that the valid extreme code (if any) is written on each monthly record of a year on the master file. If it is not, a warning message is printed and a valid extreme card (format 74-103) for that year is created. It also checks to see if the valid extreme code stored on the master file is needed. If it is not, then a valid extreme card (format 74-103) is created to delete the record, for that year, on the master file.

These cards which are created are either punched or stored on disk to be added as input on the next update.

5.8.1 Control Card Set-up

```
K1234,CM70000,P2,T400,GE1.
ACCOUNT,XXXXX.  FLOW-SYMBOL CHECK
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,FLOW,R,F=S,X=SV,D=GE,N=EB,L=HISTFLOW,VSN=ER1111.
ATTACH,HYDEX,ID=DATA,MR=1.
ATTACH,X,FLOW,ID=OBJECT,MR=1.
REQUEST,TAPE1,SN.
IGET,LGO=SYMCHK/X.
LGO.
RETURN,FLOW.
REWIND,PRTAPE.
FILE,PRTAPE,RT=Z,BT=C,FL=16,CM=YES.
FILE,PRTEMP,RT=Z,BT=C,FL=16,CM=YES.
FILE,TAPE1,RT=Z,BT=C,FL=16,CM=YES.
ATTACH,PRTEMP,PRTAPE,ID=TEMP,MR=1.  DELETE ON INITIAL RUN
SORTMRG.
CATALOG,TAPE1,PRTAPE,ID=TEMP,RP=5,DR=INFINITE.
PURGALL,PRTAPE,ID=TEMP,KP=2.
7/8/9                                                  multi-punch in col. 1
SORT
FILE,INPUT=PRTAPE(R),PRTEMP(R),OUTPUT=TAPE1(R)
FIELD,STA(2,14,DISPLAY)
KEY,STA(A,DISPLAY)
EQUATE,DISPLAY( ,0)
END
6/7/8/9                                                multi-punch in col. 1
```

6. RETRIEVAL PROGRAMS

Various types of programs have been written to extract data from the FLOW file. These include programs to give various listings of the daily discharges, to supply data to users on cards or tape and to plot annual and comparison hydrographs.

6.1 Provisional Listing Program - DAYFLO

This program produces a provisional listing of the daily discharge data and the symbols, one station-year per page, for checking by the Data Control section staff. One page is produced for each year in which at least one day was changed on or after the date shown on the "Select date" control card. Station-years in which there have been no changes are not printed. If all the data for any month have been deleted then there will be no record of this month on the FLOW file. Therefore, this deletion cannot be recognized as a change by this program and this station-year will not be printed. This retrieval program can read the output tape from either the EDIT Program or the UPDATE Program. Thus this program can read the historical or annual tape files as well as a corrections tape file. Data can be printed selectively by staion-year range within Region for all the changes made after a given date. These data are to be printed with one station-year per page.

These provisional listings are the only daily discharges listings which show those daily discharges which were revised (i.e. the symbol shows R,S,T, or W). These listings must be obtained for all changes to the master file. They are also the only listing which shows monthly totals for easing verification of data.

The core requirement for this program is approximately 42 000 octal words and the timing is one second per station-year (page) plus 2.6 seconds per thousand records read.

For each month of data, complete or partial, the monthly total in m^3/s-days is computed. For complete months, the monthly mean in m^3/s, the total discharge in dam^3 and the maximum and minimum daily discharges are also computed. The daily discharges on this page are not rounded but are printed exactly as they appear on the FLOW file. The last line printed is a revision line which indicates if any of the daily values in a month were revised by printing "REV" under the appropriate month. If daily data are missing but a symbol is present on the FLOW file, then only the symbol will be printed. The symbols A,B,E,N,X,R and * are the only valid symbols.

As the program reads through the input FLOW tape the pages of daily data are printed for all the station-years which have changed after a given date. Also a summary is prepared which contains the total number of complete and incomplete months, complete and incomplete years, months before 1900 and number of stations which have been printed for each Region and for the complete job. A standard tape summary is prepared giving the number of records processed on the FLOW tape, the number of I/O faults, and an error code is the job was terminated abnormally. This summary is normally created after the FLOW input tape has been processed but if for example more than 16 consecutive parity errors occurred on the FLOW tape then this tape summary is produced at the time the error condition is detected.

6.1.1 Sample Listing of (Provisional) Daily Discharge and Summary

PAGE 6
DAYFLO
(9201-31) FEB 21 1983 WATER SURVEY OF CANADA STATION NO. 10G8005
YEAR 1981
YELLOWKNIFE, NWT

(PROVISIONAL) DAILY DISCHARGES IN CUBIC METRES PER SECOND FOR 1981

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	0 B	0 B	0 B	0 B	0.610 B	0.600	0.122	0.668 A	0.229 A	1.17	1.07 B	0.025 B	1
2	0 B	0 B	0 B	0 B	1.90 B	0.584	0.117	0.540 A	0.261 A	3.30	0.765 B	0.020 B	2
3	0 B	0 B	0 B	0 B	6.47 B	0.582	0.107	0.446 A	0.307 A	4.31	0.505 B	0.020 B	3
4	0 B	0 B	0 B	0 B	16.8	0.562	0.178	0.367 A	0.335 A	4.15	0.372 B	0.020 B	4
5	0 B	0 B	0 B	0 B	24.8	0.518	0.335	0.318 A	0.346 A	3.56	0.331 B	0.020 B	5
6	0 B	0 B	0 B	0 B	24.3	0.458	0.343	0.272 A	0.329 E	3.58	0.325 B	0.015 B	6
7	0 B	0 B	0 B	0 B	23.1	0.431	0.331	0.218 A	0.303 E	2.89	0.320 B	0.015 B	7
8	0 B	0 B	0 B	0 B	17.3	0.413	0.365	0.180 A	0.282 E	2.48	0.315 B	0.015 B	8
9	0 B	0 B	0 B	0 B	13.7	0.374	0.367	0.151 A	0.253 E	2.23	0.305 B	0.015 B	9
10	0 B	0 B	0 B	0 B	10.5	0.353	0.360	0.121 A	0.226 A	2.06	0.295 B	0.010 B	10
11	0 B	0 B	0 B	0 B	8.24	0.321	0.319	0.102 A	0.171 A	1.94	0.280 B	0.010 B	11
12	0 B	0 B	0 B	0 B	6.64	0.285	0.269	0.090 A	0.074 A	1.86	0.265 B	0.010 B	12
13	0 B	0 B	0 B	0 B	5.59	0.257	0.228	0.078 A	0.109 A	1.70	0.250 B	0.010 B	13
14	0 B	0 B	0 B	0 B	4.95	0.239	0.214	0.067 A	0.162 A	1.78	0.230 B	0.010 B	14
15	0 B	0 B	0 B	0 B	4.36	0.217	0.185	0.060 A	0.084 A	1.64	0.210 B	0.005 B	15
16	0 B	0 B	0 B	0 B	3.80	0.190	0.158	0.052 A	0.058 A	1.71	0.190 B	0.005 B	16
17	0 B	0 B	0 B	0 B	3.38	0.177	0.133	0.046 A	0.289 A	1.67	0.160 B	0.003 B	17
18	0 B	0 B	0 B	0 B	2.98	0.159	0.117	0.035 A	0.088 A	1.71	0.130 B	0.003 B	18
19	0 B	0 B	0 B	0 B	2.73	0.143	0.106	0.020 A	0.045 A	1.83	0.110 B	0.003 B	19
20	0 B	0 B	0 B	0 B	2.60	0.153	0.094	0.029 A	0.123 A	2.05	0.095 B	0.003 B	20
21	0 B	0 B	0 B	0 B	2.35	0.150	0.101	0.028 A	0.117 A	2.08	0.080 B	0.001 B	21
22	0 B	0 B	0 B	0.005 B	2.02	0.152	0.588	0.022 A	0.303 A	2.79 B	0.070 B	0.001 B	22
23	0 B	0 B	0 B	0.010 B	1.76	0.152	2.23	0.017 A	0.568 A	2.28 B	0.055 B	0 B	23
24	0 B	0 B	0 B	0.020 B	1.61	0.167	2.86	0.015 A	0.582 E	1.40 B	0.050 B	0 B	24
25	0 B	0 B	0 B	0.030 B	1.40	0.157	2.41	0.017 F	0.624 A	1.28 B	0.040 B	0 B	25
26	0 B	0 B	0 B	0.040 B	1.23	0.141	1.80	0.019 E	0.605	1.36 B	0.035 B	0 B	26
27	0 B	0 B	0 B	0.060 B	1.03	0.136	1.85	0.037 E	0.588	1.50 B	0.030 B	0 B	27
28	0 B	0 B	0 B	0.097 B	0.863	0.133	1.80	0.078 E	0.560	1.54 B	0.030 B	0 B	28
29	0 B		0 B	0.120 B	0.776	0.137	1.45 A	0.133 A	0.540	1.53 B	0.025 B	0 B	29
30	0 B		0 B	0.218 B	0.689	0.132	1.04 A	0.182 A	0.556	1.41 B	0.025 B	0 B	30
31	0 B		0 B		0.605		0.834 A	0.218 A		1.28 B		0 B	31
TOTAL	0	0	0	0.600	199.083	8.473	21.411	4.626	9.097	66.07	6.963	0.239	TOTAL
MEAN	0	0	0	0.020	6.422	0.282	0.691	0.149	0.303	2.13	0.232	0.008	MEAN
MAX.	0	0	0	0.218	24.8	0.600	2.86	0.668	0.624	4.31	1.07	0.025	MAX.
MIN.	0	0	0	0	0.605	0.132	0.094	0.015	0.045	1.17	0.025	0	MIN.
REVISED	---	---	---	---	---	---	---	---	---	---	---	---	REVISED

MAXIMUM INSTANTANEOUS DISCHARGE,
27.6 M3/S AT 12:03 MST ON MAY 5

6.1.2 Control Card Set-up

The following is the deck set-up to print all the changes which have been made on or after January 1, 1973 for the stations in Region 2, Vancouver, from 01AA001 to 07EA001 beginning in 1900 to 1969 and in Region 3, Calgary, from 06AA001 to 06ZZ999 beginning in 1900 to 1970.

```
K2008,CM70000,P2,T200,GE1.
ACCOUNT,XXXXX.  FLOW DAYLIES
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,TAPE6,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.
ATTACH,TAPE8,PEAKS,ID=DATA,MR=1.
FILE,TAPE8,RT=F,BT=C,FL=300,CM=YES.
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
DAYFLO.
7/8/9                                   multi-punch in col. 1
DATE JUN 30 1983
A06WSC-2201-03 XXXX
67108 JAN 01 1973                       See Note 1
67109 01AA001-07EA001 1900 1969 02      See Note 2
67109 06AA001-06ZZ999 1900 1970 03
99999                                   See Note 3
6/7/8/9                                 multi-punch in col. 1
```

Note 1: This "Select Date" control card in this example indicates to the program that only the station-years with changes made on or after January 1, 1973 are to be printed. If it is desired that every station-year in a Region or on a tape be printed, then a date such as January 1, 1900 can be used on this card. Only one of these cards is used within any job. The card format is as follows:

Column(s)	Description
1-5	"67108"
6	blank
7-17	date on which all changes on or after this date are to be printed, e.g. "JUL 09 1972" for July 9, 1972; note that the month is represented by its first three letters and that the day of the month and the year are right justified in columns 12 and 17, respectively
18-20	blank
21	revision, i.e. blank to obtain all records or "R" for only those revised
22-80	blank

Note 2: This "Station Range" card contains the Region, the station range and the years which are to be checked for changes. All of the data which is outside this range is ignored. Within one job it is possible to have several cards containing different station ranges within the same Region or within different Regions. The card format is as follows:

Column(s)	Description
1-5	"67109"
6	blank
7-21	first and last station to be checked, e.g. 01AA001-99ZZ999, if all the stations are to be considered
22	blank
23-26	year from which data are to be checked, e.g. 1965, if only data from 1965 are to be processed
27	blank
28-31	year up to which data are to be checked
32	blank
33-34	Region from which data are to be considered; this number is right justified; if data are to be printed from an input file containing more than one Region, then a "Station Range" card should be supplied for each Region from which data are desired
35-80	blank

Note 3: This "End of Job" card contains "9's" in columns one to five and signals the end of the job to the program. If this card is omitted the job will terminate abnormally.

6.1.3 Quality Control Checks

To ensure that this program has run properly the following checks should be made:

(a) The "dayfile" should be checked to be certain that the job had sufficient time to complete normally and that no other fatal system messages have been printed. The visual reel number printed within the dayfile should be the one which is desired.

(b) The standard tape summary for the input tape should have zero I/O faults and the error codes should be zero.

(c) The station ranges on the output listing should be checked against those desired.

(d) The cumulative total of the number of station-years with changes should agree with the total number of pages which were printed.

6.2 Historical Listing Program - HISFLO

The program reads the FLOW, PEAKS and HYDEX files and produces listings of the daily discharges with one calendar year per page as shown in the examples below. Two copies of this are always produced, one for the Regional Office involved and the other to be filed with the Data Control Section at Ottawa. The core requirement for this program is 60 000 octal words and the timing is 0.5 seconds per calendar year (page).

The station name is read from the HYDEX file. The daily discharge and corresponding symbol are read from the FLOW file and printed. The monthly: mean discharge, total discharge in m^3/s days, total discharge in dam^3 and extremes are shown only for the complete months. The mean for the year is only printed for those calendar years or standard periods that are complete. The maximum and minimum discharge for the year is guided by the following rules: the extremes are always shown for a complete year or standard period unless the code H, L or N is stored in field 46 on the HYDEX file, then respectively only the maximum, minimum or neither are printed; the extremes are not shown for incomplete years or standard period unless a code of L, H or B is present on the FLOW file, then respectively only the minimum, maximum or both are printed. The maximum instantaneous discharge and corresponding symbol is printed if present on the PEAKS file. Also if symbols such as A, B or E have appeared on this page, then a key is printed in the lower right hand corner which gives the meanings of these symbols.

Due to limitation for printing space, any monthly total discharge exceeding 9 characters including the triad seperator will have the right most character position truncated.

This program will not print symbols by themselves and thus this program should only be used with a master FLOW file and not a correction file because the correction file might contain symbols without daily data.

There are two versions of this program, an English version for all station except those in the province of Quebec, and a French version for all stations in the province of Quebec.

6.2.1 Sample of Historical Listing (English and French)

DIV. DES R. H. DU CAN.
17 FEV 1983 PAGE 45
MONTREAL, QUE.

RICHELIEU (RIVIERE) AUX RAPIDES FRYERS

STATION NO. 020J007

DEBITS QUOTIDIENS EN METRES CUBES PAR SECONDE - 1981

JOUR	JAN	FEV	MAR	AVR	MAI	JUN	JUL	AOU	SEP	OCT	NOV	DEC	JOUR
1	2358	1698	787	626	546	399	250	159	226	357	626	587	1
2	2558	1798	786	581	531	408	248	154	224	359	614	590	2
3	2608	1888	771	633	535	432	262	150	216	357	616	554	3
4	2768	1978	764	656	529	403	254	149	211	374	619	551	4
5	2848	2168	757	647	530	386	240	155	209	383	632	528	5
6	2818	2358	745	625	497	389	230	135	203	398	622	480	6
7	2818	2408	712	624	480	368	224	141	204	390	621	521	7
8	3018	2408	732	656	503	389	221	153	234	372	630	523	8
9	3018	2458	734	651	519	398	217	160	217	383	611	505	9
10	2968	2598	722	620	487	373	207	164	231	394	620	506	10
11	2768	2658	711	629	481	378	207	169	219	395	599	498	11
12	2658	2818	707	587	476	377	200	172	224	405	605	489	12
13	2458	2918	709	610	483	372	198	171	226	411	591	497	13
14	2408	3068	676	763	490	395	184	168	225	415	571	502	14
15	2408	3278	661	562	503	386	182	177	218	424	553	4508	15
16	2408	3448	6198	604	515	366	183	194	205	392	564	4378	16
17	2358	3618	6258	601	488	346	188	224	209	408	558	4248	17
18	2168	3728	6198	576	496	342	189	224	219	498	571	4058	18
19	1798	3898	6178	572	501	343	183	239	224	410	577	3948	19
20	1588	4118	600	560	505	306	189	239	222	455	597	3838	20
21	1468	477	575	545	506	301	183	244	225A	388	616	3778	21
22	1428	540	581	565	483	310	164	245	212	399	608	3728	22
23	1378	587	584	570	474	297	163	247	176	400	601	3728	23
24	1378	618	574	572	474	291	163	236	195	421	586	3618	24
25	1428	685	569	558	470	307	178	214	292	452	577	3558	25
26	1428	716	574	572	460	286	184	226	318	447	594	3498	26
27	1428	749	545	569	443	281	156	229	377	482	632	3388	27
28	1429	791	543	564	433	279	153	220	352	532	578	3338	28
29	1468		554	572	426	285	144	223	343	588	563	3228	29
30	1568		542	554	423	292	153	237	346	614	570	3228	30
31	1468		547		395		157	229		641		3178	31
TOTAL	6 653	10 674	20 237	18 024	15 082	10 485	6 054	6 047	7 202	13 334	17 922	13 642	TOTAL
MOY	215	381	653	601	487	350	195	195	240	430	597	440	MOY
MAX	301	791	787	763	546	432	262	247	377	641	632	590	MAX
MIN	137	169	542	545	395	279	144	135	176	357	553	317	MIN

SOMMAIRE POUR L'ANNEE 1981

DEBITS EN METRES CUBES PAR SECONDE

MOYEN, 398
MAXIMUM QUOTIDIEN, 791 LE 28 FEV
MINIMUM QUOTIDIEN, 135 LE 6 AOU
MAXIMUM INSTANTANE,
930 LE 14 AVR A 16h50 HNE

A = JAUGE MANUELLE
B = GLACES

DEBIT TOTAL MENSUEL
EN DECAMETRES CUBES

JAN	575 000	JUL	523 000
FEV	922 000	AOU	522 000
MAR	1 750 000	SEP	622 000
AVR	1 560 000	OCT	1 150 000
MAI	1 300 000	NOV	1 550 000
JUN	906 000	DEC	1 180 000

DEBIT TOTAL, 12 600 000 DAM3

WATER SURVEY OF CANADA
FEB 17 1983 PAGE 6
YELLOWKNIFE, NWT

UNNAMED TRIBUTARY TO WILLOWLAKE RIVER

STATION NO. 10GB005

DAILY DISCHARGE IN CUBIC METRES PER SECOND FOR 1981

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	CB	CB	CB	0 B	0.610B	0.600	0.122	0.668A	0.229A	1.17	1.07 B	0.0258	1
2	CB	CB	CB	0 B	1.90 B	0.584	0.117	0.540A	0.261A	3.30	0.7658	0.0208	2
3	CB	CB	CB	0 B	6.47 B	0.582	0.107	0.446A	0.307A	4.31	0.5058	0.0208	3
4	CB	CB	CB	0 B	16.8	0.562	0.178	0.367A	0.335A	4.15	0.3728	0.0208	4
5	CB	CB	CB	0 B	24.8	0.518	0.335	0.318A	0.346A	3.56	0.3318	0.0208	5
6	CB	CB	CB	0 B	24.3	0.458	0.343	0.272A	0.329E	3.58	0.3258	0.0158	6
7	CB	CB	CB	0 B	23.1	0.431	0.331	0.218A	0.303E	2.89	0.3208	0.0158	7
8	CB	CB	CB	0 B	17.3	0.413	0.365	0.180A	0.282E	2.49	0.3158	0.0158	8
9	CB	CB	CB	0 B	13.7	0.374	0.367	0.151A	0.253E	2.23	0.3058	0.0158	9
10	CB	CB	CB	0 B	10.5	0.353	0.360	0.121A	0.226A	2.06	0.2958	0.0108	10
11	CB	CB	CB	0 B	8.24	0.321	0.319	0.102A	0.171A	1.94	0.2808	0.0108	11
12	CB	CB	CB	0 B	6.64	0.285	0.269	0.090A	0.074A	1.86	0.2658	0.0108	12
13	CB	CB	CB	0 B	5.59	0.257	0.228	0.078A	0.109A	1.70	0.2508	0.0108	13
14	CB	CB	CB	0 B	4.95	0.239	0.214	0.067A	0.162A	1.78	0.2308	0.0108	14
15	CB	CB	CB	0 B	4.36	0.217	0.185	0.060A	0.084A	1.64	0.2108	0.0058	15
16	CB	CB	CB	0 B	3.80	0.190	0.158	0.052A	0.058A	1.71	0.1908	0.0058	16
17	CB	CB	CB	0 B	3.38	0.177	0.133	0.046A	0.289A	1.67	0.1608	0.0038	17
18	CB	CB	CB	0 B	2.98	0.159	0.117	0.035A	0.089A	1.71	0.1308	0.0038	18
19	CB	CB	CB	0 B	2.73	0.143	0.106	0.020A	0.045A	1.93	0.1108	0.0038	19
20	CB	CB	CB	0 B	2.60	0.153	0.094	0.029A	0.123A	2.05	0.0958	0.0038	20
21	CB	CB	CB	0 B	2.35	0.150	0.101	0.028A	0.117A	2.08	0.0808	0.0018	21
22	CB	CB	CB	0.005B	2.02	0.152	0.588	0.022A	0.303A	2.798	0.0708	0.0018	22
23	CB	CB	CB	0.010B	1.76	0.152	2.23	0.017A	0.549A	2.288	0.0558	0 B	23
24	CB	CB	CB	0.0208	1.61	0.167	2.86	0.015A	0.582E	1.408	0.0508	0 B	24
25	CB	CB	CB	0.0308	1.40	0.157	2.41	0.017E	0.624A	1.288	0.0408	0 B	25
26	CB	CB	CB	0.0408	1.23	0.141	1.80	0.019E	0.605	1.368	0.0358	0 B	26
27	CB	CB	CB	0.0608	1.03	0.136	1.85	0.037E	0.588	1.508	0.0308	0 B	27
28	CB	CB	CB	0.0978	0.863	0.133	1.80	0.078E	0.560	1.548	0.0308	0 B	28
29	CB		CB	0.1208	0.776	0.137	1.45 A	0.133A	0.540	1.538	0.0258	0 B	29
30	CB		CB	0.2188	0.689	0.132	1.04 A	0.182A	0.556	1.418	0.0258	0 B	30
31	CB		CB		0.605		0.834A	0.218A		1.288		0 B	31
TOTAL	0	0	0	0.600	199.083	8.473	21.411	4.626	9.097	66.07	6.963	0.239	TOTAL
MEAN	0	0	0	0.020	6.42	0.282	0.691	0.149	0.303	2.13	0.232	0.008	MEAN
MAX	0	0	0	0.218	24.8	0.600	2.86	0.668	0.624	4.31	1.07	0.025	MAX
MIN	0	0	0	0	0.605	0.132	0.094	0.015	0.045	1.17	0.025	0	MIN

SUMMARY FOR THE YEAR 1981

DISCHARGES IN CUBIC METRES PER SECOND

MEAN, 0.867
MAXIMUM DAILY, 24.8 ON MAY 5
MINIMUM DAILY, 0B ON JAN 1
MAXIMUM INSTANTANEOUS,
27.6 AT 12:03 MST ON MAY 5

A - MANUAL GAUGE
B - ICE CONDITIONS
E - ESTIMATED

MONTHLY TOTAL DISCHARGE
IN CUBIC DECAMETRES

JAN	0	JUL	1 850
FEB	0	AUG	400
MAR	0	SEP	786
APR	51.8	OCT	5 710
MAY	17 200	NOV	602
JUN	732	DEC	20.6

TOTAL DISCHARGE, 27 400 DAM3

6.2.2 Card Deck Set-up

A sample deck set-up to retrieve two copies of the historical listings for selected station-years is as follows:

```
K2009,CM70000,P2,T100,GE1.
ACCOUNT,XXXXX.  FLOW-HISTORICAL LISTING
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH,X,FLOW,ID=OBJECT,MR=1.
IGET,LGO=HISFLO/X.                                        See Note 3
LABEL,FLOW,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX     FLOW FILE
ATTACH(HYDEX,HYDEX,ID=DATA,MR=1)
ATTACH,PEAKS,ID=DATA,MR=1.
FILE,PEAKS,RT=F,BT=C,FL=300,CM=YES.
LGO.
REWIND,OUTPUT.                                            See Note 1
COPYCF(OUTPUT,DUM)                                        See Note 1
REWIND,DUM.                                               See Note 1
COPYCF(DUM,OUTPUT)                                        See Note 1
7/8/9                                                     mutli-punch in col. 1
DATE JUN 30 1983                                          standard "Date" card
WSC01 D02 08CF00408CG004 19701971 L                       See Note 2
WSC01 D02 08GA04708GA047 19691970 L
WSC01 D02 08HA00608HA010 19511966 L
6/7/8/9                                                   multi-punch in col. 1
```

Note 1: To obtain the second copy of the output listing each of the four cards with the Note 1 reference is required. Thus if only one copy is desired these four cards can simply be removed.

Note 2: The "Station Request" cards give the range of stations by province or Region and the years within this range which are to be retrieved either on listings (printouts) or tape.

The format for this card is the same as that used in the DAYFLO program (see Note 2, Section 6.1.2).

Note 3: To obtain two copies of the French historical listings for selected Quebec station-years, the following cards must be changed in the above deck:

```
change    IGET,LGO=HISFLO/X.
   to     IGET,LGO=HISFLOF/X.
change    DATE APR 25 1973
   to     DATE 25 AVR 1973
```

6.2.3 Quality Control Checks

To be certain that this program has executed properly the following checks should be made:

(a) Check the dayfile for fatal system messages such as time limit which will abort the job.

(b) Ensure that the "END OF JOB" message is printed on the last page of the output listing.

(c) Within the program, there is an error message which might be printed if the job aborts.

NO DATE CARD - JOB ABORTED

If the "Date" card is missing or the first four columns do not contain the letters "DATE" then this message is printed and the job stops.

6.3 Publication Listing Program - PUBFLO

The program reads the FLOW, HYDEX, REMARKS and PEAKS files and produces listings of the daily discharges with one calendar year per page as shown in the examples below. The listing produced is identical to the final annual publication pages except for a few differences as explained in section 2.2 of the "Publication Procedures for Surface Water Data" manual. This listing is used as a final check of the annual publications and thus this listing is sent to the Regional Office involved for verification prior to publication; a copy is filed with the Data Control Section at Ottawa.

The station name is read from the HYDEX file. The daily discharges are read from the FLOW file, rounded and then lined-up for printing on the page. For complete months a monthly summary is prepared with the total discharge in m^3/s-days, the mean discharge in m^3/s, the total discharge in dam^3, and the maximum and minimum daily discharges. For a complete year or standard period an annual mean is printed. The extremes for the year are printed, if valid (see section 6.2). Also if symbols such as A, B or E have appeared on this page, then a key is printed in the bottom center which gives the meanings of these symbols. Descriptive information is also extracted from HYDEX including the type of gauge, location, drainage area, data contributed by, international designator and regulated or natural flow. The maximum instantaneous discharge if available for this year is read from PEAKS and printed with its time and date of first occurrence. Textual information if available for this station is read from the REMARKS file and printed at the bottom of the page.

This program will not print symbols by themselves and thus this program should only be used with a master FLOW file and not a correction file because the correction file might contain symbols without daily data.

For each station or consecutive set of stations required, a "Station Request" card is keypunched giving the first and last station within the range and the first and last year to be printed for each of these stations. As this retrieval program reads through a master FLOW tape, the pages are prepared and printed immediately. The core requirement for this program is approximately 70 000 octal words and the timing is 1.5 seconds per station-year (page) plus 1 second per thousand records read.

There are two versions of this program, an English version used to retrieve all listings except Quebec listings and a French version used to retrieve only Quebec listings.

For a detailed description of these versions of the program along with its job set-up, the user is referred to the manual entitled "Publication Procedures for Surface Water Data".

6.3.1 Sample of Publication Listing (English and French)

24

RICHELIEU (RIVIERE) AUX RAPIDES FRYERS - STATION NO. 020J007

DEBITS QUOTIDIENS EN METRES CUBES PAR SECONDE - 1981

JOUR	JAN	FEV	MAR	AVR	MAI	JUN	JUL	AOU	SEP	OCT	NOV	DEC	JOUR
1	235B	169B	787	626	546	399	250	159	226	357	626	587	1
2	250B	179B	786	581	531	408	248	154	224	359	614	590	2
3	260B	188B	771	633	535	432	262	150	216	357	616	554	3
4	276B	197B	764	656	529	403	254	149	211	374	619	551	4
5	286B	216B	757	647	530	386	240	155	209	383	632	528	5
6	281B	235B	745	625	497	389	230	135	203	398	622	480	6
7	281B	240B	712	624	480	368	224	141	204	390	621	521	7
8	301B	240B	732	656	503	389	221	153	234	372	630	523	8
9	301B	245B	734	651	519	398	217	160	217	383	611	505	9
10	296B	255B	722	620	487	373	207	164	231	394	620	506	10
11	276B	265B	711	629	481	378	207	169	219	395	599	498	11
12	265B	281B	707	587	476	377	200	172	224	405	605	489	12
13	245B	291B	709	610	483	372	198	171	226	411	591	497	13
14	240B	306B	676	763	490	395	184	168	225	415	571	502	14
15	240B	327B	661	562	503	386	182	177	218	424	553	450B	15
16	240B	344B	619B	604	515	366	183	194	205	392	564	437B	16
17	235B	361B	625B	601	488	346	188	224	209	408	558	424B	17
18	216B	372B	619B	576	496	342	189	224	219	498	571	405B	18
19	179B	389B	612B	572	501	343	183	239	224	410	577	394B	19
20	158B	411B	600	560	505	306	189	239	222	455	597	383B	20
21	146B	477	575	545	506	301	183	244	225A	388	616	377B	21
22	142B	540	581	565	483	310	164	245	212	389	608	372B	22
23	137B	587	584	570	474	297	163	247	176	400	601	372B	23
24	137B	618	574	572	474	291	163	236	195	421	586	361B	24
25	142B	685	569	558	470	307	178	214	292	452	577	355B	25
26	142B	716	574	572	460	286	184	226	318	447	594	349B	26
27	142B	749	545	569	443	281	156	229	377	482	632	338B	27
28	142B	791	543	564	433	279	153	220	352	532	578	333B	28
29	146B		554	572	426	285	144	223	343	588	563	322B	29
30	156B		542	554	423	292	153	237	346	614	570	322B	30
31	160B		547		395		157	229		641		317B	31
TOTAL	6 653	10 674	20 237	18 024	15 082	10 485	6 054	6 047	7 202	13 334	17 922	13 642	TOTAL
MOY	215	381	653	601	487	350	195	195	240	430	597	440	MOY
MAX	301	791	787	763	546	432	262	247	377	641	632	590	MAX
MIN	137	169	542	545	395	279	144	135	176	357	553	317	MIN

SOMMAIRE POUR L'ANNEE 1981

DEBITS EN METRES CUBES PAR SECONDE

MOYEN, 398
MAXIMUM QUOTIDIEN, 791 LE 28 FEV
MINIMUM QUOTIDIEN, 135 LE 6 AOU
MAXIMUM INSTANTANE,
930 LE 14 AVR A 16:50 HNE

TYPE DE JAUGE - ENREGISTREUSE
EMPLACEMENT - LAT 45 23 54
LONG 73 15 32
BASSIN VERSANT, 22 000 km²
A - JAUGE MANUELLE
B - GLACES

DEBIT NATUREL

DEBIT TOTAL MENSUEL
EN DECAMETRES CUBES

JAN	575 000	JUL	523 000
FEV	922 000	AOU	522 000
MAR	1 750 000	SEP	622 000
AVR	1 560 000	OCT	1 150 000
MAI	1 300 000	NOV	1 550 000
JUN	906 000	DEC	1 180 000

DEBIT TOTAL, 12 600 000 dam³

RICHELIEU (RIVIERE) EN AMONT DU BARRAGE FRYERS - STATION NO. 020J012

NIVEAUX D'EAU QUOTIDIENS EN METRES - 1981

JOUR	JAN	FEV	MAR	AVR	MAI	JUN	JUL	AOU	SEP	OCT	NOV	DEC	JOUR
1	1.493E	1.462E	2.064E	1.638E	1.714	1.466E	1.298E	1.128E	1.338E	1.518E	1.928E	1.788E	1
2	1.594E	1.422E	2.064E	1.778E	1.665	1.527E	1.288E	1.108E	1.348E	1.498E	1.868E	1.848E	2
3	1.423E	1.452E	2.054E	1.847E	1.686	1.584E	1.338E	1.088E	1.268E	1.528E	1.878E	1.868E	3
4	1.462E	1.522E	2.024E	1.878E	1.657	1.524E	1.308E	1.128E	1.278E	1.538E	1.888E	1.828E	4
5	1.432E	1.512E	2.014E	1.748	1.688	1.494E	1.288E	1.138E	1.248E	1.548E	1.908E	1.668E	5
6	1.513E	1.543E	1.994E	1.802	1.629	1.524E	1.288E	1.098E	1.218E	1.578E	1.888E	1.538E	6
7	1.522E	1.503E	1.964E	1.813	1.639	1.454E	1.278E	1.108E	1.238E	1.608E	1.848E	1.638E	7
8	1.603E	1.523E	1.994E	1.894	1.660	1.524E	1.258E	1.118E	1.328E	1.528E	1.878E	1.608E	8
9	1.482E	1.523E	1.994E	1.765	1.681	1.504E	1.238E	1.128E	1.278E	1.598E	1.828E	1.578E	9
10	1.592E	1.533E	1.964E	1.785	1.642	1.514E	1.248E	1.128E	1.328E	1.588E	1.858E	1.578E	10
11	1.582E	1.563E	1.954E	1.836	1.653	1.606E	1.228E	1.188E	1.278E	1.578E	1.848E	1.638E	11
12	1.532E	1.593E	1.964E	1.797	1.644	1.438E	1.188E	1.130E	1.288E	1.588E	1.828E	1.678E	12
13	1.552E	1.623E	1.934E	1.808	1.655	1.428E	1.198E	1.128E	1.298E	1.598E	1.828E	1.648E	13
14	1.522E	1.603E	1.914E	2.129	1.636	1.498E	1.178E	1.122E	1.308E	1.588E	1.798E	1.638E	14
15	1.512E	1.623E	1.905E	1.720	1.685	1.478E	1.151E	1.140E	1.288E	1.628E	1.778E	1.578E	15
16	1.562E	1.663E	1.835E	1.811	1.667	1.448E	1.155E	1.173E	1.258E	1.598E	1.753E	1.568E	16
17	1.502E	1.623E	1.865E	1.792	1.648	1.378E	1.196E	1.232E	1.246E	1.578E	1.745E	1.588E	17
18	1.542E	1.683E	1.845E	1.723	1.619	1.328E	1.088E	1.289E	1.220E	1.588E	1.762E	1.578E	18
19	1.412E	1.713E	1.785E	1.743	1.610	1.348E	1.158E	1.318E	1.229E	1.868E	1.788E	1.588E	19
20	1.432E	1.703E	1.805E	1.704	1.661	1.348E	1.208E	1.328E	1.268E	1.648E	1.798E	1.548E	20
21	1.562E	1.803E	1.745E	1.695	1.662	1.378E	1.178E	1.328E	1.268E	1.558E	1.828E	1.578E	21
22	1.482E	1.833E	1.805E	1.726	1.603	1.308E	1.168E	1.328E	1.238E	1.548E	1.838E	1.538E	22
23	1.472E	1.853E	1.795E	1.717	1.564	1.348E	1.128E	1.338E	1.128E	1.528E	1.808E	1.508E	23
24	1.462E	1.874E	1.765E	1.728	1.615	1.338E	1.118E	1.308E	1.298E	1.588E	1.798E	1.538E	24
25	1.502E	1.984E	1.746E	1.739	1.645	1.408E	1.188E	1.278E	1.428E	1.638E	1.778E	1.548E	25
26	1.432E	2.014E	1.757E	1.740	1.626	1.328E	1.238E	1.328E	1.498E	1.618E	1.788E	1.508E	26
27	1.442E	2.034E	1.718E	1.751	1.577	1.328E	1.098E	1.318E	1.558E	1.708E	1.928E	1.528E	27
28	1.372E	2.054E	1.759E	1.731	1.558	1.308E	1.118E	1.288E	1.498E	1.718E	1.758E	1.518E	28
29	1.353E		1.743E	1.712	1.519	1.338E	1.078E	1.288E	1.428E	1.768E	1.788E	1.498E	29
30	1.432E		1.726E	1.753	1.509	1.328E	1.095E	1.338E	1.488E	1.838E	1.814E	1.518E	30
31	1.422E		1.731E		1.449		1.103E	1.338E		1.928E		1.528E	31
MOY	1.490	1.673	1.878	1.777	1.628	1.427	1.196	1.216	1.313	1.620	1.827	1.606	MOY
MAX	1.603	2.054	2.064	2.129	1.714	1.606	1.338	1.338	1.558	1.928	1.928	1.868	MAX
MIN	1.353	1.422	1.718	1.638	1.449	1.308	1.078	1.088	1.128	1.498	1.745	1.498	MIN

SOMMAIRE POUR L'ANNEE 1981

NIVEAUX EN METRES

MOYEN, 1.553
MAXIMUM QUOTIDIEN, 2.129 LE 14 AVR
MINIMUM QUOTIDIEN, 1.078E LE 29 JUL

TYPE DE JAUGE - MANUELLE
EMPLACEMENT - LAT 45 23 41
LONG 73 15 22

E - ESTIMATIVE

DEBIT NATUREL

PLAN DE REFERENCE: ARBITRAIRE
AJOUTER 25.000 m POUR OBTENIR LES COTES SERVICE GEODESIQUE DU CANADA (AJUST. LOCAL 1969)

6.4 Supplying Data to Users - Format Descriptions

Daily discharge data can be supplied to the users either on magnetic tape or cards in station number order within Region unless they are sorted. A period-of-record summary and revision listing as shown in the example below is also provided. When data are requested on magnetic tape, the tapes are written in EBCDIC, 9-track at a density of 1600 bpi but can be supplied in EBCDIC at a density of 800 bpi, 6250 bpi or BCD (even parity on 7-track) at a density of 800 bpi. They do not contain system labels. The first record on tape is the first "Data" record (card image). The last "Data" record (card image) is followed by an 80-character "End-of-Data" record containing 9's in all 80 columns except column 4-5 which are Z's and by "Padding" records in the last block (if necessary) containing 9's in all columns except column 4-5 which are Z's. The last tape block is followed by an end-of-file mark. Unless otherwise specified the data will be supplied as card images on tape with a blocking factor of 40 (3200-characters per block). When data are requested on cards, they will be sent to the user as punched by the computer, i.e. they will not be interpreted or marked in any way unless requested. Normally, up to a maximum of 2000 cards can be provided but the sequence of the cards cannot be guaranteed.

6.4.1 Daily Discharges on Tape (or Cards) - COPFLO

This retrieval program produces three punched cards or card images on tape per month for daily discharges in the following 79-041 format as follows:

Column(s)	Length	Description
1	1	code for type of data and units: Q - discharges in cubic metres per second
3-8	7	station number, e.g. 08AA023
9-11	3	year, e.g. "968" for 1968
12-13	2	month, e.g. "b7" for July
14	1	code for time interval: 1 - daily figures from day 1 to day 10 2 - daily figures from day 11 to day 20 3 - daily figures from day 21 to day 31
15-80	66	ten or eleven 6-digit data fields; refer to notes 1 and 2.

Note 1 Description of Data Fields:

Each data field has six positions. The first five positions contain daily discharge data right justified with a decimal point if necessary; the sixth position contains a symbol: A - Manual Gauge, B - Ice Conditions, E - Estimated, R - Revised since January 1980, S - Revised (and Manual Gauge), T - Revised (and Ice Conditions), W - Revised (and Estimated), or a blank for no sybmol; refer to Section 1.1 for a more detailed explanation of "Revisions". A negative value is entered with a minus sign just to the left of the number, e.g. -12.3 or -0.001. The first data field is in columns 15-20. The successive fields are for consecutive days depending on the interval (column 14) used. Whenever data are missing, the value "-9999" is entered in positions 1-5 and position 6 contains a blank.

Note 2 Daily Figures:

Daily discharges for each month on file are punched on three cards. The first card (1 in column 14) contains data for 10 days from day 1 to day 10; columns 75-78 are not used; the number of days in the month, e.g. "30" for November, is punched in columns 79-80. The second card (2 in column 14) contains 10 days from day 11 to day 20; columns 75-80 are not used. The third card (3 in column 14) contains 11 days from day 21 to 31; the figure "-1111" is punched in the appropriate field for days that do not apply to the month, e.g. 30 and 31 for February 1968, and position 6 contains a blank.

The program also produces an output listing which contains a period-of-record summary for each station retrieved followed by an end of job statistics which shows the total number of complete and incomplete station-months and station-years, the total number of stations, the number of records read from the input file and the total number of records written onto cards or tape. Following the end of job statistics is a list of stations revised since Jan. 1, 1980 if applicable.

6.4.1.1 Control Card Set-up for COPFLO

```
K2010,CM70000,T100,P2,GE1,NT1.                                  See Note 1
ACCOUNT,XXXXX.  FLOW-RETRIEVAL IN 79-041 FORMAT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL(TAPE1,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX)
REQUEST(TAPE21,PE,S,SV,EB, RING,VSN=ERXXXX) See Note 1
ATTACH(LIB,FLOW,ID=METLIB,MR=1)
LIBRARY(LIB)
COPFLO.
7/8/9                                                           multi-punch in col. 1
DATE JUN 30 1983                                                standard "Date" card
67110 T 40                                                      See Note 1&2
67108 JAN 01 1980                                               See Note 3
A01WSC-2201-29 9999                                             See Note 4
67109 01AA001-08ZZ999 1800-1980 02                              See Note 5
99999                                                           See Note 6
6/7/8/9                                                         multi-punch in col. 1
```

Note 1: If the data are to be supplied on cards, the tape parameter option on the Job Card will be adjusted accordingly, the "Request" card for TAPE21 will be removed and the type of output as selected on the "67110" card should be replaced with a "C" as explained in Note 2.

Note 2: The "67110" card contains the type of output for this run. There can only be one "67110" card per run. The format of this card is as follows:

Column(s)	Description
1-5	"67110"
6	blank
7	type of output requested: "T" for tape output "C" for card output "L" for only a period-of-record summary
8	blank
9-10	blocking factor for data written on tape only i.e. only used if "T" option is used in column 7.
11-80	blank

Note 3: The following will outline the format of the date revision card:

Column(s)	Description
1-5	format number always "67108"
6	blank
7-17	date from which program will search for revised data, e.g. JANb01b1980 Any data revised on or after this date will be indicated in the period-of-record summary and the list of revisions
18	blank
19	optional R code to indicate a revision run if this code is present only data revised since the date supplied in columns 7-17 will be output as data
20	blank
21-24	optional year, e.g. 1980 One year can only be supplied during a revision run. When a year is specified all data for that year plus revisions will be supplied as output. This is particularly useful after the master file has been updated with the annual data. At this time many previous users request the annual data plus any revisions made to historical data since they were last supplied
25-80	blank.

Note 4: An input "File Identification" card is required for each input FLOW tape. This card begins with the letter "A", the tape unit number and then the Water Survey of Canada internal file number.

Note 5: The stations requested are read from the "Station-Range" card(s), i.e. "67109" card(s). There may be more than one of these cards in a single run but they must be in ascending order. The card format is as follows:

Column(s)	Description
10-5	"67109"
6	blank
7-21	first and last station to be selected, i.e. 01AA001-99ZZ999 if all data are to be retrieved; columns 7 to 13 contain the first station and 15 to 21 contain the last
22	blank
23-31	year range for which data are to be retrieved
32	blank
33-34	the Region from which data are to be retrieved; if data are to be retrieved from an input file containing more than one Region, then a "67109" card must be supplied for each Region for which data are required; this number is right justified
35-80	blank.

Note 6: A "99999" card follows the last "67109" card, i.e. "Station-Range" card, to mark the end of the job. The omission of this card will cause an abnormal termination.

6.4.1.2 Sample Output (COPFLO Program)

```
WATER SURVEY OF CANADA
JUN  4 1983  PAGE    1
GUELPH, ONT.                         SUMMARY OF DAILY DISCHARGE RECORDS FOR STATION NO. 02CC004

       1            1            1            1            1            1            1            1            1
       9            9            9            9            9            9            9            9            9
       0            1            2            3            4            5            6            7            8
       01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789

 JAN   ----- -----  ----- -----  -CCCC CRRRR  RCCCC CCRRR  RRRRR RRRRR  R---- -----  ----- -----  ----- -----  --*** ***** JAN
 FEB   ----- -----  ----- -----  -CCCC CRRRR  RCCCC CCRRR  RRRRR RRRRR  R---- -----  ----- -----  ----- -----  --*** ***** FEB
 MAR   ----- -----  ----- -----  -CCCC CRRRR  RCRCC CCRRR  RRRRR RRRRR  R---- -----  ----- -----  ----- -----  --*** ***** MAR
 APR   ----- -----  ----- -----  -CCRC CRRRR  RRRRC RRRRR  RRRRR CCRRR  R---- -----  ----- -----  ----- -----  --*** ***** APR
 MAY   ----- -----  ----- -----  -CCCC RCCCR  RCCCC CCCCC  CCCCC CCCCC  C---- -----  ----- -----  ----- -----  --*** ***** MAY
 JUN   ----- -----  ----- -----  -CCCC RCCCR  RCCCC CCCCC  CCCCC CCCCC  C---- -----  ----- -----  ----- -----  --*** ***** JUN
 JUL   ----- -----  ----- -----  -CCCC RCCCR  RCCCC CCCCC  CCCCC CCCCC  C---- -----  ----- -----  ----- -----  --*** ***** JUL
 AUG   ----- -----  ----- -----  -CCCC RCCCR  RCCCC CCCCC  CCCCC CCCCC  C---- -----  ----- -----  ----- -----  --*** ***** AUG
 SEP   ----- -----  ----- -----  -CCCC CCCCR  CCCCC CCCCC  CCCCC CCCCC  C---- -----  ----- -----  ----- -----  --*** ***** SEP
 OCT   ----- -----  ----- -----  CCCCC CCCCR  CCCCC CCCCC  CCCCC CCCCC  ----- -----  ----- -----  ----- -----  --*** ***** OCT
 NOV   ----- -----  ----- -----  CCRCC CRRRR  CCCCC RRRRC  RCCRC CCCCR  ----- -----  ----- -----  ----- -----  --*** ***** NOV
 DEC   ----- -----  ----- -----  CCCCC RRRRR  CRCCC CRRRR  RRRRR RRRRR  ----- -----  ----- -----  ----- -----  --*** ***** DEC

 YEAR  -- -- -----  ----- -----  PCRRC RRRRR  RRRRC RRRRR  RRRRR RRRRR  Z---- -----  ----- -----  ----- -----  --*** ***** YEAR

                   COMPLETE  PARTIAL  TOTAL                SUMMARY OF TAPE OUTPUT                         KEY TO TABLE
 STATION-MONTHS      360        0      360                                                       MISSING                  -
 STATION-YEARS        29        2       31        TAPE OUTPUT FORMAT 79-041 FROM 1800 TO 1999   PARTIAL                  P
                                                                                                 COMPLETE                 C
MONTHS BEFORE 1900 (INCLUDED ABOVE)     0         OUTPUT RECORD COUNT FROM      1  TO    1080   PARTIAL WITH REVISION    Z
                                                                                                 COMPLETE WITH REVISION   R

                                      SUMMARY OF DAILY DISCHARGE RECORDS FOR STATION NO. 02CC005

       1            1            1            1            1            1            1            1            1
       9            9            9            9            9            9            9            9            9
       0            1            2            3            4            5            6            7            8
       01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789  01234 56789

 JAN   ----- -----  ----- -----  ----- -----  ----- -----  ---RR RRRRR  RRRRR CCCCC  RRRRR RCCCC  CCCCC CCCCC  CC*** ***** JAN
 FEB   ----- -----  ----- -----  ----- -----  ----- -----  ---RR RRRRR  RRRRR CCCCC  RRRRR RCCCC  CCCCC CCCCC  CC*** ***** FEB
 MAR   ----- -----  ----- -----  ----- -----  ----- -----  ---RR RRRRR  RRRRR CCCCC  RRRRR RCCCC  CCCCC CCCCC  CC*** ***** MAR
 APR   ----- -----  ----- -----  ----- -----  ----- -----  ---RR CCRCR  CCRCR CCCCC  RRRCR RCCCC  CCCCC CCCCC  CC*** ***** APR
 MAY   ----- -----  ----- -----  ----- -----  ----- -----  ---CC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** MAY
 JUN   ----- -----  ----- -----  ----- -----  ----- -----  --PCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** JUN
 JUL   ----- -----  ----- -----  ----- -----  ----- -----  --CCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** JUL
 AUG   ----- -----  ----- -----  ----- -----  ----- -----  --CCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** AUG
 SEP   ----- -----  ----- -----  ----- -----  ----- -----  --CCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** SEP
 OCT   ----- -----  ----- -----  ----- -----  ----- -----  --CCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** OCT
 NOV   ----- -----  ----- -----  ----- -----  ----- -----  --CRC RCCCR  CCCCC CCCCR  CCCCC CCCCC  CCCCC CCCCC  CC*** ***** NOV
 DEC   ----- -----  ----- -----  ----- -----  ----- -----  --RRR RRRRR  RRRRC CCCCR  RRRRR CCCCC  CCCCC CCCCC  CC*** ***** DEC

 YEAR  ----- -----  ----- -----  ----- -----  ----- -----  --ZRR RRRRR  RRRRR CCCCR  RRRRR RCCCC  CCCCC CCCCC  --*** ***** YEAR

                   COMPLETE  PARTIAL  TOTAL                SUMMARY OF TAPE OUTPUT                         KEY TO TABLE
 STATION-MONTHS      450        1      451                                                       MISSING                  -
 STATION-YEARS        37        1       38        TAPE OUTPUT FORMAT 79-041 FROM 1800 TO 1999   PARTIAL                  P
                                                                                                 COMPLETE                 C
MONTHS BEFORE 1900 (INCLUDED ABOVE)     0         OUTPUT RECORD COUNT FROM   1081  TO    2433   PARTIAL WITH REVISION    Z
                                                                                                 COMPLETE WITH REVISION   R
```

```
WATER SURVEY OF CANADA
JUN  4 1983  PAGE    2
OTTAWA, ONT.                          END OF JOB STATISTICS FOR TAPE OUTPUT

                    810      COMPLETE MONTHS
                      1      INCOMPLETE MONTHS
                     66      COMPLETE YEARS
                      3      INCOMPLETE YEARS
                      2      PAGES
                      2      STATIONS
                  13600      RECORDS READ
                      0      RE-READS ON TAPE UNIT     1
                             LAST STATION READ    02CC006
                   2433      OUTPUT RECORDS WRITTEN ON TAPE
```

```
WATER SURVEY OF CANADA
JUN  4 1983  PAGE    1
OTTAWA, ONT.                           SUMMARY OF REVISIONS SINCE JAN 01 1980

REGION  STATION NO.  YEAR  DATE REVISED

  5      02CC004     1922  MAR 11 1981
  5      02CC004     1923  AUG 27 1980
  5      02CC004     1925  AUG 27 1980
  5      02CC004     1926  AUG 27 1980
  5      02CC004     1927  AUG 27 1980
  5      02CC004     1928  AUG 27 1980
  5      02CC004     1929  AUG 27 1980
  5      02CC004     1930  AUG 27 1980
  5      02CC004     1931  AUG 27 1980
  5      02CC004     1932  AUG 27 1980
  5      02CC004     1933  AUG 27 1980
  5      02CC004     1935  AUG 27 1980
  5      02CC004     1936  AUG 27 1980
  5      02CC004     1937  AUG 27 1980
  5      02CC004     1938  AUG 27 1980
  5      02CC004     1939  AUG 27 1980
  5      02CC004     1940  AUG 27 1980
  5      02CC004     1941  AUG 27 1980
  5      02CC004     1942  AUG 27 1980
                      .
                      .
                      .
```

6.4.1.3 Quality Control Checks

The user should ensure that the following conditions are met to ensure successful completion of the run:

(a) the "Tape Header" label on page 1 of the listing is the same as that specified on the input "File Identification" card. If these are not the same, the program will print out the appropriate error message on page 1 and the job will terminate.

(b) the format number of the "Job Type" card is "67110". If the format number is incorrect, the program will print "INCORRECT FORMAT NUMBER" after the printout of the card. The same applies for the "Station-Range" card if the format number is other than "67109" and the "Date-Revision" card if the format number is other than "67108".

(c) the "Station-Range" cards printed on the following pages should be the same as those desired. If data are not available (i.e. not on the input file) for the range specified, the message "STATION NOT ON TAPE" will be printed out following the printout of the "Station-Range" card.

(d) the last station read as specified on the end of job statistics is that of the next station on the input file.

(e) the number of output records is specified on the end of job statistics. This should be three times the number of station-months requested.

(f) on the tape summary the type and status of the input tape should both be "3" and the number of I/O faults and error code should both be zero.

(g) the last page is on an "END OF JOB" page. If this message is not present the job has terminated abnormally and the dayfile should be checked.

6.4.2 Annual Maximum and Minimum Daily Water Levels or Discharges - ANNEXT

This program produces data on punched cards or card images on tape in 79-113 format. Each card or card-image may contain the yearly maximum and minimum daily values for 2 years for a station.

This program also produces an output listing which contains a period-of-record summary for each station retrieved followed by an end of job statistics which shows the total number of station-years, the total number of stations, the total number of years before 1900 and the total number of records written on to cards or tape. Following the end of job statistics is a list of stations revised since Jan. 1, 1980 if applicable.

6.4.2.1 Control Card Set-up

```
K1234,CM70000,P2,T400,GE1.
ACCOUNT,XXXXX.  ANNUAL EXTREMES 79-113 FORMAT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH,X,FLOW,ID=OBJECT,MR=1.
IGET,LGO=ANNEXT/X.
LABEL,FLOW,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.        See Note 1
ATTACH,HYDEX,HYDEX,ID=DATA,MR=1.
LGO.
7/8/9                                                         multi-punch in col. 1
1 01AA001 01AC012 1910 1970 04 C                              See Note 2
1 02AB003 04AA001 1950 1960 04 C                              See Note 2
6/7/8/9                                                       multi-punch in col. 1
```

Note 1: A LABEL card for FLOW input must always be present. If the output is to be an unlabelled 9-track, 1600 bpi tape then the tape request parameter on the JOB card should be modified, the output request cards should have a T in column 32 and a REQUEST card should be entered as follows:

```
REQUEST,TAPE21,S,SV,PE,EB,RING,VSN=ERXXXX.
```

If the data are to be supplied on cards then only one tape is required for the FLOW input. The output request cards should have a C in column 32.

Note 2: The request card for the ANNEXT Program has the following format:

Column(s)	Description
1	code for type of data being processed "4" - water levels "1" - discharges
2	blank
3-17	station range, e.g. 01AA001-99ZZ999
18	blank
19-27	year range, e.g. 1800-1980
28	blank
29-30	region code, e.g. 03 Calgary
31	blank
32	type of output requested: "C" - card output "T" - tape output "L" - period-of-record summary listing only
33-80	blank.

6.4.2.2 Sample Output (ANNEXT Program)

WATER SURVEY OF CANADA
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GUELPH, ONT.

ANNUAL MAXIMUM AND MINIMUM DAILY DISCHARGES

STATION NUMBER	1900 01234	56789	1910 01234	56789	1920 01234	56789	1930 01234	56789	1940 01234	56789	1950 01234	56789	1960 01234	56789	1970 01234	56789	1980 01234	RECORD COUNT
02BF001	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--BBB	BBBBB	BBBBB	BB---	8
02BF002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--BBB	BBBBB	BBBBB	BB---	16
02CA002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-BBBB	BBBBB	BB---	32
02CB001	-----	-----	-----	-----	-----	-----	-----	-----	-----	-RRRR	RX---	-RRRR	RRRRB	BBBBB	BBBBB	BBBBB	BB---	48
02CB002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	BBBBB	BBBBB	BBBBB	BBL--	-----	-----	-----	57
02CB003	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	RB---	58
02CC002	-----	-----	-----	BBBBH	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	61
02CC003	-----	-----	-----	----B	B----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	62
02CC004	-----	-----	-----	-----	BBRRB	RRRRR	RRRRB	RRRRR	RRRRR	RRRRR	X----	-----	-----	-----	-----	-----	-----	78
02CC005	-----	-----	-----	-----	-----	-----	-----	-----	--XRR	RRRRR	RRRRR	BBBBR	RRRRR	RBBBB	BBBBB	BBBBB	BB---	98
02CC006	-----	-----	-----	-----	-----	-----	-----	-----	-----	--BBB	B----	-----	-----	-----	-----	-----	-----	100
02CC007	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	BBBBB	BBBBB	BBBBB	BBBBB	BBBBB	BBBBB	BB---	116
02CC008	-----	-----	-----	-----	-----	-----	-----	-----	RRRRR	RRRRR	R----	-----	-RRRR	RBBBB	BBBBB	BBBBB	BB---	132
02CC009	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	BBBBB	BBBBB	BBBBB	BBBBB	BB---	143

KEY TO TABLE

MISSING	-
VALID MAX AND MIN	B
VALID MAX ONLY	H
VALID MIN ONLY	L
VALID MAX AND MIN WITH REVISION	R
VALID MAX WITH REVISION	X
VALID MIN WITH REVISION	Z

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FEB 17 1983 PAGE 9
OTTAWA, ONT.

END OF JOB STATISTICS

	VANCOUVER	CALGARY	WINNIPEG	GUELPH	LONGUEUIL	DARTMOUTH	REGINA	YELLOWKNIFE	TOTAL
FLOW STATIONS	0	0	0	118	0	0	0	0	118
FLOW STATION-YEARS	0	0	0	377	0	0	0	0	377
FLOW STATION-YEARS BEFORE 1900 (INCLUDED ABOVE)	0	0	0	98	0	0	0	0	98

RECORDS WRITTEN ON TAPE 000143

WATER SURVEY OF CANADA
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OTTAWA, ONT.

SUMMARY OF REVISIONS SINCE JAN 01 1980

REGION	STATION NO	YEAR	DATE REVISED
5	02BF005	1980	JUN 23 1982
5	02BF008	1980	JUN 23 1982
5	02CB001	1946	JUN 23 1982
5	02CB001	1947	MAR 26 1982
5	02CB001	1948	MAR 26 1982
5	02CB001	1949	MAR 26 1982
5	02CB001	1950	MAR 26 1982
5	02CB001	1951	MAR 26 1982
5	02CB001	1956	MAR 26 1982
5	02CB001	1957	MAR 26 1982
5	02CB001	1958	MAR 26 1982
5	02CB001	1959	MAR 26 1982
5	02CB001	1960	MAR 26 1982
5	02CB001	1961	MAR 26 1982
5	02CB001	1962	MAR 26 1982
5	02CB001	1963	MAR 26 1982
5	02CB003	1980	JUN 23 1982
5	02CC004	1922	MAR 11 1981
5	02CC004	1923	AUG 27 1980
5	02CC004	1925	AUG 27 1980
5	02CC004	1926	AUG 27 1980
5	02CC004	1927	AUG 27 1980
5	02CC004	1936	AUG 27 1980
5	02CC004	1937	AUG 27 1980
5	02CC004	1938	AUG 27 1980
5	02CC004	1939	AUG 27 1980
5	02CC004	1940	AUG 27 1980
5	02CC004	1941	AUG 27 1980
5	02CC004	1942	AUG 27 1980
5	02CC004	1943	AUG 27 1980
5	02CC004	1944	AUG 27 1980
5	02CC004	1945	AUG 27 1980
5	02CC004	1946	AUG 27 1980
5	02CC004	1947	AUG 27 1980
5	02CC004	1948	AUG 27 1980
5	02CC004	1949	AUG 27 1980
5	02CC004	1950	AUG 27 1980
5	02CC005	1942	AUG 27 1980
5	02CC005	1943	AUG 27 1980
5	02CC005	1944	AUG 27 1980
5	02CC005	1945	AUG 27 1980
5	02CC005	1946	AUG 27 1980
5	02CC008	1965	MAR 26 1982

************ ITOMEB5 //// END OF LIST ////
************ ITOMER5 //// END OF LIST ////

The following error messages are printed if required:

(a) If no FLOW tape or LEVELS tape is available, then the message "NO FLOW OR LEVELS TAPE FOUND" is printed and job terminates.

(b) If no station-year range card was entered, then the message "NO STATION RANGE CARD ENTERED" is printed and job terminates.

(c) If the first station-year range card read in is not requesting the same type of output that is available from the input file, then the message "WRONG FILE ENTERED NO DATA REQUESTED" is printed and a new request card is read. This message would appear if a range card with 4 in column one which requests LEVELS data, was entered with a FLOW tape.

(d) If it is determined by the program that the maximum and minimum daily values are not valid for the year of station data, then the message "MAX. AND MIN. NOT VALID FOR STATION 01AA001" is printed. The program follows the same action as the EXTREMES RETRIEVAL program using FLOW and HYDEX files which is described on page 6 of the annual "PUBLICATION PROCEDURES FOR THE HISTORICAL STREAMFLOW SUMMARY".

(e) If the monthly minimum and maximum value or symbols cannot be manipulated properly, i.e. a decimal point in wrong place or invalid symbol field such as 9 (deleted symbol on correction tape only) or 1 (no data) the following messages is printed: "FLOW OR LEVEL MONTHLY DATA WRONG FOR STATION 01AA001 YEAR 1XXX". This error occurs when processing monthly data and searching for the minimum and maximum. When this error is found, the job terminates since it appears to be working with a correction tape or the monthly maximum day or minimum day was chosen when there was no data available.

(f) The message "CARD INCORRECT" followed by the card image is printed when the card fields are not filled properly, e.g. 4 01AA001 99ZZ999 6940 1950 04 T (in the example the year is not correct).

6.4.2.3 Quality Control Checks

To ensure that there was successful completion of the run the following checks should be made:

(a) Each card entered should be printed on the first page of the job.

(b) The end of job statistics should be checked for the total number of stations, station-years, years before 1900 and records written on tape.

(c) A list of revised stations should appear if revised stations are indicated in the period-of-record summary.

(d) That the last line before the period-of-record summary is "NORMAL JOB TERMINATION".

6.5 Annual Discharge Hydrograph Program - RETFLO

Annual hydrographs may be produced for any station-year(s) that appears on the master or annual FLOW file in either metric or imperial units. The hydrographs are plotted on white paper by a Calcomp 1051 plotter using a linear or 3-cycle semi-logarithmic hydrograph scale. The resulting 11 by 17 inch plots do not contain the grid but may be used as an overlay onto a standard 067-2002 hydrograph form for logarithmic plots or a standard 067-2001 for linear plots, if it is desirable to determine values from the plot. Should the range of the data exceed 3 cycles on the logarithmic plot the lowest portion of the bottom cycle is made linear to handle discharges as low as zero m^3/s.

Linear plots will give the same grid scale for all years requested on the "Station-Request" card. The grid scale is chosen by the user by keypunching the base value and increments per inch on the "Station Request" card.

Logarithmic plots can be chosen with the same grid scale for all years requested or the best grid possible for each individual year for all years requested. The grid scale is calculated by the computer from a predefined algorithm based on maximum and minimum values.

This program requires 140 000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved, their position on the FLOW tape(s) and which options you choose on the "Station-year" request card. Thus the average time used on running the job is 2 seconds for every station-year written onto the "PLOTER" disk file.

These "PLOTER" disk files are normally only retained for 24 hours after completion of the plotting so any requests for replotting should be made immediately. Each annual hydrograph takes about 2 minutes to be plotted.

6.5.1 Control Card Set-up

```
K1234,CM140000,P2,T100,GE1.
ACCOUNT,XXXXX. FLOW-ANNUAL HYDROGRAPHS
MOUNT,VSN=EMR107,SN=AHD.
LABEL,TAPE20,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.
ATTACH,CPLOT,ID=FLOW,CY=1,MR=1,SN=AHD.                  See Note 1
BEGIN,CCR,,CAL1051,PAPER=11,TYPE=2,P1=NIB,
PROC=CPLOT,NAME=$name/STOP-7$,XSIZE=1200,PRI=DAY.
7/8/9                                                   mutli-punch in col. 1
DATE JUN 30 1983
A20WSC-4201-80                                          Input "File Identification"
68019 04    05PC019-05QA010 1969-1972 JAN 1             See Note 2
68019 04    05QE008-05RA001 1972-1973 JAN 1  150.00  50.00
99999                                                   See Note 3
6/7/8/9                                                 multi-punch in col. 1
```

Note 1: Because our object module is in our library, a procedure file had to be created with the following control statements:

```
.PROC,CPLOT.
SETNAME,AHD.
ATTACH,A,FLOW,ID=METLIB,MR=1.
LIBRARY(A,PLTLIB)
ATTACH,TAPE7,HYDEX,ID=DATA,MR=1.
FILE,TAPE7,RT=F,BT=C,FL=300,CM=YES.
LDSET(PRESET=ZERO,FILES=TAPE7,LIB=CALCMPL/TEKDISK)
RETFLO.
REVERT.
```

Note 2: The format of the "Station-Year" request card(s) is as follows:

Column(s)	Description
1-5	control card number, e.g. "68019"
6	blank
7-8	Region, e.g. "04" for Winnipeg
9	blank
10-11	Province, e.g. "07" for Ontario (default is all provinces)
12	blank
13-19	station number "from", e.g. "01AA001"
20	blank
21-27	station number "to", e.g. "99ZZ999"
28	blank
29-32	year "from", e.g. "1900"
33	blank
34-37	year "to", e.g. "1977"
38	blank
39-41	beginning month for plot, e.g. "OCT" for a water-year plot (if blank, default is "JAN" for a calendar-year plot)
42	blank
43	code for scaling type: 1 - same scale plots (default) 2 - selective scale plots (scale selected for each year
44	blank
45-51	base value - right justified (see Note 4)
52-54	blank
55-61	increment value - right justified (see Note 4)
62-64	blank
65-69	size factor - right justified (changes plot size in both the X and Y direction)
70	blank
71	code for numeric type of data on output: "I" for imperial units blank for metric units
72-80	blank.

Note 3: This card is used to signal the end of the "Station-Year" request cards. Columns 1-5 must contain nines, if this card is not present the job will abort and the hydrographs may not be plotted.

Note 4: Both base and increment value (non-zero) must be entered or left blank, otherwise an error is given. If a value is entered in both then a linear plot is produced and if left blank a logarithmic plot is produced.

6.5.1 Quality Control Checks

To ensure that this program has executed properly and reliable hydrographs have been drawn the following points should be noted:

(a) Check the dayfile for fatal system messages such as a time limit.

(b) Check the listing from the retrieval program to be sure the correct stations and year ranges have been retrieved and that the message "NO DATA" does not appear.

(c) Look at the end of the listing for the plot statistics. The presence of this message ensures that the plot has been stored on disk successfully.

(d) Scan the discharge hydrographs for pen drag or paper slippage. Also look in the upper right hand corner of each hydrograph for a plus sign, "+", which should fall directly over the corner of the grid. If there has been paper slippage in any direction this plus sign will not be plotted over the grid corner and this hydrograph can be replotted immediately without rerunning the job provided the "Plotter" file has not been scratched. The plotter block number to be replotted is the plot number for this station-year. This plot number is obtained from the retrieval listing.

6.6 Continuous Hydrographs Program - CONPLOTF

This program was written for the Regions as a visual check for keypunching errors. The program plots continuous annual hydrographs for each station-year range given on the "Station Request" card.

The regular and default size of each year plotted is 11 x 17 inches but this can be reduced down to 11 x 1.7 inches (90% redution) if desired.

The program requires 140 000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved their position on the FLOW tape(s) and the number of station-years actually plotted. Thus most jobs plotting 30 station-years or less can be plotted in 200 octal seconds (128 decimal seconds).

6.6.1 Control Card Set-up

```
K1234,CM140000,P2,T200,GE1.
ACCOUNT,XXXXX.  FLOW Continuous Hydrographs
MOUNT,VSN,EMR107,SN=AHD.
ATTACH,CPLOT,ID=FLOW,CY=5,MR=1,SN=AHD.                    See Note 3
LABEL,TAPE1,R,L=HISTFLOW,F=X,X=SV,D=GE,N=EB,VSN=ERXXXX.
BEGIN,CCR,,CAL0151,PAPER=11,TYPE=2,P1=NIB,PROC=CPLOT,
NAME=$name/STOP-7$,XSIZE=1200,PRI=DAY.
7/8/9                                                     multi-punch in col. 1
DATE JUNE 30 1983                                         standard "Date" card
67109 05EG009 05EG011 1890-1977 08 .20                    See Note 1
999                                                       See Note 2
6/7/8/9                                                   multi-punch in col. 1
```

Note 1: "Station Request" card

Column(s)	Description
1-5	"67109"
6	blank
7-13	beginning station to be plotted, e.g. "05EG009"
14	blank
15-21	ending station to be plotted, e.g. "05EG011"
22	blank
23-26	beginning station to be plotted, e.g. "1890"
27	blank
28-31	ending year to be plotted, e.g. "1977"
32	blank
33-34	Region, e.g. "08" for Regina
35	blank
36-38	scale reduction factor, e.g. ".20" is 80% reduction or one fifth normal size
39-80	blank

Note 2: "End of Plot" card

Column(s)	Description
1-3	"999" as the name implies this signals the end of the "Station Request' cards
7-80	blank.

6.6.2 Quality Control Checks

There are several things that should be checked on the output listing:

(a) Check the end of the listing for the statement *END OF JOB* and the plot statistics. These indicate that the plot has been stored on the disk successfully.

(b) Check each input station number to ensure that the correct station year was retrieved.

(c) At the end of each station an L is placed at the top right hand corner of the graph to form a plus, "+", sign if the plot is exact.

(d) Should a particular section be below the level of accuracy required, the plot may be replotted, usually without charge, by quoting the plot file number shown on the listing.

Also with the program are the following error messages:

"Date" Card Missing	If the word "DATE" does not appear in columns 1-4 on the first card read, the job will abort.
Parity Error	If 16 consecutive parity errors occur at the same point on the LEVELS tape, the job will stop immediately.
Processed Beyond End of File	If a station requested does not appear on the tape or the station number request cards are not in sequence, then the program will search until the end of file is encountered.

Note 3: Because the program to be executed is in our own library, a procedure file had to be created with the following control statements:

```
.PROC,CPLOT.
SETNAME,AHD.
ATTACH,A,FLOW,ID=METLIB,MR=1.
ATTACH,TAPE31,HYDEX,ID=DATA,MR=1.
LIBRARY(A,PLTLIB)
LDSET(PRESET=ZERO,LIB=CALCMPL/TEKDISK)
CONPLOTF.
REVERT.
```

6.7 Comparison Hydrograph Program - HYPLOT

This program was written for the Data Management Unit to provide a visual check when comparing the daily discharges at one station with those of other stations within the same drainage basin. The program plots one to five semi-logarithmic annual hydrographs on a single graph in either metric or imperial units. These hydrographs may be from single stations or may be the result of summing two to five stations together. Also, the discharges may be divided by their drainage area to produce plots in units of m^3/s per square kilometre. The graphs are plotted in semi-logarithmic scale that can be

used as an overlay on a standard 067-2002 hydrograph form. The normal size of the graph is 11 by 17 inches per year but can be reduced up to 90% in length if requested.

Requests for summed hydrographs normally appear on the 067-2087M. This gives the period-of-record to be considered, the stations involved, the summing configuration and up to 60 characters of identification for each trace on the plot. Most of these requests originate within the section but some come in from the Regional Offices.

The graphs can be drawn in one year sections or up to the total period. However, by default they are plotted in five-year sections for convenience in handling and minimum error in plotting. Each station or summed station is plotted in ink with a unique colour for identification purposes.

If the range of the data is greater than three logarithmic cycles then the lower portion of the bottom cycle is automatically given a linear scale. When stations are summed care should be taken because any station with partial data will not produce a sum on those days where data are missing.

This program requires 140 000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved, their position on the FLOW tape(s) and the number of station-years actually plotted. Thus most jobs plotting 30 station-years or less can be completed in 200 octal seconds (128 decimal seconds). This is represented by T200 on the "Job" card.

6.7.1 Control Card Set-up

The first example produces individual hydrograph plots but makes use of the two options: a variable number of years and a second FLOW input tape. The second example produces summed hydrograph plots but uses the default options of a 5-year block and only one FLOW input tape.

a) Example 1

```
K2013,CM140000,P2,T300,GE2.                                  See Note 1
ACCOUNT,XXXXX.  FLOW-HYPLOT
MOUNT,VSN=EMR107,SN=AHD.
ATTACH,CPLOT,ID=FLOW,CY=2,MR=1,SN=AHD.                       See Note 4
LABEL,TAPE1,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.      See Note 2
LABEL,TAPE2,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERYYYY.      See Note 3
BEGIN,CCR,,CAL1051,PAPER=11,TYPE=2,XSIZE=1200,P1=NIB,
PROC=CPLOT,PRI=DAY,NAME=$name/STOP-7$.
7/8/9                                                        multi-punch in col. 1
DATE JUN 30 1983
1 1972-1978 7                                                See Note 5
1 05EF001 8                                                  See Note 6
7                                                            See Note 7
2 05ED002 3
3 05EE004 3
8                                                            See Note 8
 1       NORTH SASKATCHEWAN RIVER NEAR DEER CREEK            See Note 9
   2     ATIMOSIVE CREEK NEAR ELK POINT
     3   VERMILLION RIVER NEAR HAZELDINE
999                                                          See Note 10
6/7/8/9                                                      multi-punch in col. 1
```

b) Example 2

```
K2014,CM140000,P2,T250,GE1.
ACCOUNT,XXXXX. FLOW-HYPLOT
MOUNT,VSN=EMR107,SN=AHD.
ATTACH,CPLOT,ID=FLOW,CY=2,MR=1,SN=AHD.        See Note 4
LABEL,TAPE1,R,L=HISTFLOW,F=S,X=SV,D=GE,N=EB,VSN=ERXXXX.        See Note 2
BEGIN,CCR,,CAL1051,PAPER=11,TYPE=2,XSIZE=1200,P1=NIB,
PROC=CPLOT,NAME=$name/STOP-7$.
7/8/9                                                          mutli-punch in col. 1
DATE JUN 30 1983
1 1961-1969                                                    See Note 5
1 05AD002 2                                                    See Note 6
2 05AD005 3
3 04AD013 3
4 05AD021 3
5 05AD027 3
9                                                              See Note 8
         5 WATERTON-BELLY DIVERSION                            See Note 11
     3+4   U.I.D. PLUS WATERTON-BELLY DIVERSION
   2-3-4+5 MTN VIEW LESS U.I.D. LESS ST MARY DIV. PLUS WATERTON DIV.
 1         STAND OFF
999
6/7/8/9                                                        multi-punch in col. 1
```

Note 1: Ordinarily, GE1 is sufficient but with a second or third FLOW input tape GE2 or GE3 is required.

Note 2: The first input FLOW tape is always TAPE1. ERXXXX is the visual serial number.

Note 3: The second and third input tapes, if required, are always TAPE2 and TAPE3.

Note 4: Because our load module is in our own library, a procedure file had to be created with the following control statements:

```
.PROC,CPLOT.
SETNAME,AHD.
ATTACH,A,FLOW,ID=METLIB,MR=1.
LIBRARY(A,PLTLIB)
LDSET(PRESET=ZERO,LIB=CALCMPL/TEKDISK)
HYPLOT.
REVERT.
```

Note 5: "Period" card

Column(s)	Description
1	code for type of record, e.g. "1" for discharges
2	blank
3-11	year range for which the plots are desired
12	blank
13-14	number of years per section (right justified); if left blank a default of 5 years is assumed
15	blank
16-18	scale reduction value (between 0.1 and 10.; default = 1.0 normal size - reduces the plot in the X direction only)
19	blank

20	code for numeric type on output: "I" for imperial units blank for metric units
21-80	blank.

Note 6: "Station Number Request" card

Column(s)	Description
1	identification sequence number from 1 to 5
2	blank
3-9	station number requested
10	blank
11	Region number
12	blank
13-18	drainage area in square kilometres if units of m^3/s per square kilometre are required; otherwise, blank
19-80	blank.

These cards must be in station number order and up to a maximum of 5 are allowed. This same identification sequence number is also used on plot identification cards as mentioned in Notes 9 and 11.

Note 7: "Tape Change" card

Column(s)	Description
1	contains a 7
2-80	blank.

If the data are contained on 2 or 3 tapes, then one or two "Tape Change" cards are inserted within the "Station Number Request" cards at the point the second or third tape is to be read.

Note 8: "Plot Type" card

Column(s)	Description
1	contains an 8 to indicate that individual plots are to follow, or a 9 to indicate that summed plots are to follow
2-80	blank.

Note 9: "Plot Identification" card:

Column(s)	Description
1	"+", "-" or blank
2	"1" or blank
3	"+", "-" or blank
4	"2" or blank
5	"+", "-" or blank
6	"3" or blank
7	"+", "-" or blank
8	"4" or blank
9	"+", "-" or blank
10	"5" or blank
11-70	identification for the particular plot
71-80	blank.

For Individual Plots:

Columns 1, 3, 5, 7 and 9 must all be blank and only one of the columns from 2, 4, 6, 8 or 10 may be filled with the appropriate identification sequence number. These cards may be in any order but up to a maximum of 5 cards are allowed.

For Summed Plots:

Any combination of the columns 1-10 may be filled to create a summed plot. Plus signs (+) are assumed unless minus signs (-) are present denoting negative addition. These cards may be in any order but up to a maximum of 5 cards are allowed.

Note 10: "End of Plot" card.

Column(s)	Description
1-3	"999" (as the name implies, this signals the end of the job)
4-80	blank.

6.6.1 Quality Control Checks

There are several things that should be checked on the output listing:

(a) Check the end of the listing for the statement *END OF JOB* and the plot statistics. These indicate that the plot has been stored on disk successuflly.

(b) Check each input station number to ensure that the correct station-year was retrieved.

(c) Check below each station to determine if there are any years with no data. This is especially important if summed plots are requested as no plot is created for days on which one member of a sum has missing data.

(d) Note if an arithmetic scale was required on the bottom cycle of a logarithmic plot.

(e) At the end of each section an L is placed at the top right hand corner of the graph to form a plus, "+", sign if the plot is exact.

(f) Should a particular section be below the level of accuracy required, the plot may be replotted, usually without charge, by quoting the plot number from the plot statistics on the listing.

Also within the program are the following error messages:

"Date" Card Missing	- If the word "DATE" does not appear in columns 1 to 4 on the first card read, the job will abort.
Parity Error	- If 16 consecutive parity errors occur at the same point on the FLOW tape, the job will stop immediately.
Processed Beyond End of File	- If a station requested does not appear on the tape or the station number request cards are not in sequence, then the program will search until the end of file is encountered.

7. TOTALS FILE

At present the FLOW file, which contains daily discharges, consists of 8 tapes and data are added to it every year. Requests are often received for monthly and annual mean discharges which are computed from daily discharges. Depending on the request, this may involve processing one or more tapes.

Also, every five years "Historical Streamflow Summary" publications by province are produced. These publications contain monthly and annual mean discharges and annual extremes.

In order to facilitate the retrieval of monthly and annual means it was decided to create a file of monthly totals. This file contains flow totals for every complete month retrieved from the FLOW file. The file name is TOTALS and it contains monthly totals for all of Canada on one reel of tape.

7.1 TOTALS File Specifications

The TOTALS tape file consists of 180-character records containing one year of data. The block size is 1800 characters and thus the blocking factor is 10. The tape is 9-track and is written in EBCDIC at a density of 6250 bpi. This tape is in ascending sequential order by Region, station number and year.

7.1.1 Record Descriptions

The letter "b" in all record descriptions represents a blank. All records except the "Padding" records (79-610) are numbered sequentially in positions 175-180 starting at 1 for the "Tape Header" record (79-605). The six record formats contained in this file are described below.

7.1.1.1 Tape Header Record (Format 79-605)

There is only one and it is always the first record on the tape.

Position(s)	Length	Description
1-12	12	"000HD00000bb"
13-16	4	"bbb1"
17-24	8	blank
25-32	8	"FILEbEMR"
33-44	12	file number, e.g. "-WSC-9201-b1"
45-52	8	"bbSERIAL"
53-54	2	blank
55-58	4	always "9999"
59-60	2	blank
61-66	6	"TOTALS"
67-68	2	blank
69-79	11	date on which the tape was written, in the form: (first 3 letters of the month) - (day) - (year), e.g. "JANb31b1967" for January 31, 1967
80-168	89	blank
169-174	6	date on which tape was written, in the form: 169-170 Year (last two digits) 171-172 Month (numeric) 173-174 Day
175-180	6	record sequence number, "bbbbb1".

7.1.1.2 Station Header Record (Format 79-606)

There is only one per station and it is always the first record for each station.

Position(s)	Length	Description
1	1	Region code: 2 - Vancouver 3 - Calgary 4 - Winnipeg 5 - Guelph 6 - Longueuil 7 - Dartmouth 8 - Regina 9 - Yellowknife
2-8	7	station number
9-11	3	"101"
12	1	blank
13-19	7	drainage area
20-30	11	blank
31-100	70	station name
101-166	66	blank
167-168	2	province code: 01 - Yukon Territory 02 - Northwest Territories 03 - British Columbia 04 - Alberta 05 - Saskatchewan 06 - Manitoba 07 - Ontario 08 - Quebec 09 - New Brunswick 10 - Nova Scotia 11 - Prince Edward Island 12 - Newfoundland
169-174	6	date on which this record was last updated, in the form: 169-170 Year (last two digits) 171-172 Month (numeric) 173-174 Day
175-180	6	record sequence number.

7.1.1.3 Data Record (Format 79-607)

This tape format is designed to store one year of monthly totals per record for each year in which there is at least one month of complete data.

Position(s)	Length	Description
1	1	Region code
2-8	7	station number
9-11	3	year, e.g. "971" for 1971
12	1	revision code: "R" if at least one month within the year has been revised; otherwise blank
13-156	144	twelve 12-digit fields for the monthly totals, decimal indicators and revision code
157-166	10	blank
167-168	2	province code
169-174	6	date on which this record was last updated in the form: 169-170 Year (last two digits) 171-172 Month (numeric) 173-174 Day
175-180	6	record sequence number.

The monthly totals and codes in positions 13-156 are as follows:

character 1 — blank.

character 2-10 — monthly total in m^3/s-days, right justified with leading zeros. The decimal point, if present, is stored as a character.

character 11 — decimal indicator as follows:
1 for no data, i.e. blank
2 for a figure with no decimal
3 for a figure with one decimal place
4 for a figure with two decimal places
5 for a figure with three decimal places
If digits 3, 4 or 5 are used then the decimal point is acctually present in the field.

character 12 — revision code: "R" if value has been revised since Jan 1, 1980; otherwise blank

7.1.1.4 End-of-Data Record (Format 79-608)

There is only one and it follows the last "Data" record.

Position(s)	Length	Description
1-12	12	"999ZZ9999999"
13-168	156	blank
169-174	6	date on which the tape was written
175-180	6	record sequence number.

7.1.1.5 Tape Trailer Record (Format 79-609)

There is only one and it follows the "End-of-Date" record.

Position(s)	Length	Description
1-12	12	"000TR0000000"
13-168	156	blank
169-174	6	date on which the tape was written
175-180	6	record sequence number.

7.1.1.6 Padding Record (Format 79-610)

These records follow the "Tape Trailer" record and are used if it is necessary to pad the last tape block to 1800 characters (10 records).

Position(s)	Length	Description
1-12	12	"999ZZ9999999"
13-168	156	blank
169-180	12	"999999999999".

7.2 File Maintenance Program - TOTFLO

The TOTALS file is maintained by using the HYDEX and FLOW files. The FLOW file is used to create the "Data" records, while the HYDEX file is used to create the "Station Header" records. The TOTALS and FLOW files are in Region and station number order whereas the HYDEX file is in station number order. Thus, the first step involved is to sort the HYDEX file into Region and station number order and the second step is a file creation program called TOTFLO. This program must be run once for each FLOW tape involved.

7.2.1 Description

The input HYDEX tape or disk file is sorted on an 8-character field containing the Region and station number and written on an output tape or disk file which is ready for input into the program, TOTFLO. The core required to sort the HYDEX file is approximately 40 000 octal words of central memory and the time is about 6 seconds.

Generally the TOTALS file is created upon completion of the FLOW file updating, i.e. at least twice a year. The TOTFLO program retrieves information from both the HYDEX file and FLOW file to create a new TOTALS file. Also, if a previous TOTALS file was created from a different FLOW tape, then monthly totals will be copied from that file onto the new TOTALS file. Each successive run of the TOTFLO program will add to the TOTALS file until the one file contains all the totals.

Only the totals for each month having complete data are copied onto the TOTALS file. This is indicated by digits 5, 6, 7 or 8 in position 17 of the FLOW file "Data" record. If there are no data for a given month or it is incomplete as indicated by codes 1, 2, 3 or 4 in position 17 of the "Data" record of the FLOW file, then the field for that month on the TOTALS file is filled with blanks and the decimal point indicator contains the digit 1. If none of the months contain complete information for a given year then the record is not written on the TOTALS file.

The total for the month is located in positions 273 to 284 of the FLOW file. The decimal point is in position 281. Before copying the total onto the TOTALS file positions 284, 283 and 282 are tested for zeros. If position 284 does not contain a zero, then positions 276 to 284 are copied onto the TOTALS file and the digit 5 is inserted as the decimal point indicator. If position 284 contains a zero but position 283 does not, then positions 275 to 283 are copied onto the TOTALS file and the digit 4 is inserted as the decimal point indicator. If positions 283 and 284 contain zeros but position 282 does not, then positions 275-282 are copied onto the TOTALS file and the digit 3 is inserted as the decimal point indicator. If positions 282, 283 and 284 contain zeros then positions 273-280 are copied onto the TOTALS file and the digit 2 is inserted as the decimal point indicator. The totals on the TOTALS file are right justified with leading zeros.

Informative messages are printed within the program:

```
****    STATION CREATED                 9999999
```

This message is printed each time a station is created.

```
****    STATION UPDATED                 9999999
```

This message is printed each time a station is updated.

In addition the following messages are printed at the end of each update run:

```
NUMBER OF RECORDS READ FROM OLD TOTALS      XXXXX
NUMBER OF STATIONS READ FROM OLD TOTALS     XXXXX
NUMBER OF STATIONS CREATED                  XXXXX
NUMBER OF STATIONS WRITTEN ON NEW TOTALS    XXXXX
NUMBER OF RECORDS WRITTEN ON NEW TOTALS     XXXXX
```

The core required to run the TOTFLO program is approximately 60 000 octal words of central memory and the time is about 3 seconds for every 1000 records.

7.2.2 Control Card Set-up

```
K7536,CM40000,P2,T200,GE3.
ACCOUNT,XXXXX.  FLOW TOTALS
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(HYDISK,HYDEX,ID=DATA,MR=1)                          HYDEX Disk File
FILE(HYDISK,RT=F,BT=C,FL=300,FO=SQ,CM=YES)
FILE(TAPE33,RT=F,BT=C,FL=300,FO=SQ,CM=YES)
SORTMRG.
ATTACH,X,FLOW,ID=OBJECT,MR=1,PW=EMR.
IGET,LGO=TOTFLO/X.
LABEL(TAPE30,R,L=TOTALS,F=S,X=SV,VSN=ERNNNN,D=GE,N=EB)     See Note 1
LABEL(TAPE31,W,L=TOTALS,F=S,X=SV,T=30,D=GE,N=EB)           New TOTALS file
LABEL(TAPE32,R,L=HISTFLOW,D=GE,N=EB,F=S,X=SV,VSN=ERXXXX)   FLOW file
LGO.
7/8/9                                                      multi-punch in col. 1
SORT
FILE,INPUT=HYDISK(C),OUTPUT=TAPE33(R)
FIELD,DIST(8,1,DISPLAY),STANO(1,7,DISPLAY)
KEY,DIST(A,DISPLAY),STANO(A,DISPLAY)
EQUATE,DISPLAY( ,0)
END
7/8/9                                                      multi-punch in col. 1
DATE JUN 30 1983                                           standard "Date card
OLDWSC-9201-01                                             See Note 1
NEWWSC-9201-01                                             New TOTALS file
HYDWSC-1201-01                                             HYDEX File
FLOWSC-2202-29                                             FLOW file
6/7/8/9                                                    multi-punch in col. 1
```

Note 1: If there is no old TOTALS file, as in system start-up, then only the identification code "OLD" is punched in columns 1 to 3 and the rest of the card is left blank. Also, the "Label" card for TAPE30 is omitted.

7.2.3 Quality Control Checks

The dayfile will contain a count of the total records sorted and total records output. These figures will be equal and be approximately 5700 if the SORT has run succesfully. Informative messages are created for each station which is created and a run log is produced at the end of the job. The run log which appears on the second last page should be checked.

The listings should be checked for any of the following error messages:

a) `****  NO DATE CARD.  RUN STOPPED.`
   `****  ERROR IN DATE CARD.  RUN STOPPED.`

The "Date" card is checked first for its presence and then for obvious errors. If any error condition occurs then an appropriate message is printed and the run is stopped.

b) **** LABEL CHECK UNSUCCESSFUL
CARD LABEL IS
TAPE LABEL IS

The tape labels are compared with card labels and if there is a mismatch then a message is printed showing the card label and the tape label. Any tape label error will cause the run to be stopped.

c) **** OLD TOTALS SEQUENCE ERROR 9999999

The sequence number on the old TOTALS file is checked and if an error occurs a message is printed along with the sequence number and the run is stopped.

d) **** FLOW SEQUENCE ERROR

The Region and station number on the FLOW file must be in ascending order otherwise a message will be printed and the program will stop.

e) **** TOTALS NOT ENDED HYDEX ENDED

If the HYDEX file ends before the old TOTALS file is ended, then a message will be printed and old TOTALS will be copied onto new TOTALS.

f) **** MISSING HYDEX 9999999

If a station number is found on the FLOW file but no corresponding station number on the HYDEX file is found then none of the information for that station is entered on the TOTALS file and a missing HYDEX message is printed opposite the station number.

7.3 Retrieval Program MEANS

There are three versions of the MEANS retrieval program; one which produces English printouts; another which produces French printouts; and one which put the monthly and annual mean discharges on either cards or tape. The program reads the TOTALS and the HYDEX files to produce a printout of the monthly and annual mean discharges for the year or the period-of-record in cubic metres per second. The monthly totals are extracted from the TOTALS file and the station name and standard period is obtained from the HYDEX file. The HYDEX file must first be sorted into Region and station number order before the MEANS retrieval program can be executed.

7.3.1 Description

The two versions which produce printouts, produce the monthly and annual means printed on separate pages for each station retrieved. The top of each page contains the station name (uncentered), the station number and the standard data heading block containing the Division name, Regional office location, date and page number. The twelve monthly means are printed across the page with the annual mean at the extreme right. Annual means are obtained only if the year or standard period is complete. Each decade is printed in a block of ten consecutive lines with a blank line signifying one or more years of missing data. The last line to be printed for each station contains the means of the monthly and annual means. For a detailed description of these versions of the program along with its job set-up, the uses is referred to section 4.6 of the manual "Publication Procedures for the Historial Streamflow Summary".

The version which produces cards or card images on tape of the monthly and annual mean discharges produces them in format 79-102. When these data are requested on magnetic tape, the tapes are usually written in EBCDIC on 9-track at a density of 1600 bpi. They do not contain tape labels. The first record on tape is the first "Data" record (card image). The last data record is followed by "Padding"

record(s) to fill up the block. Unless otherwise specified the data will be supplied as blocked card images on tape with a blocking factor of 40. When data are requested on cards, they will be sent to the user as punched by the computer, i.e. they are not interpreted or marked in any way unless requested. A maximum of 2000 cards can be provided; the sequence of the cards cannot be guaranteed.

At the same time as producing cards or card images on tape the program produces a period-of-record summary for those stations retrieved.

The layout for the monthly and annual means in format 79-102 is as follows:

Column(s)	Description
1	code for type of units: Q - mean discharges in cubic metres per second
2-8	station number, e.g. 08AA023
9-11	year, e.g. "968" for 1968
12-13	beginning month for data in columns 15-50, i.e. either "01" for January or "07" for July
14	code for type of data: 4 - monthly and annual figures
15-50	six 6-character data fields (used for monthly figures only)
51-80	refer to Note 1 and 2

Note 1: Description of Data Fields

Each data field has six positions. The first five positions contain monthly mean discharges right justified with a decimal point if necessary; the sixth position may contain the symbol R to indicate that at least one daily value in the month has been revised, added or corrected since January 1, 1980, or it contains a blank for no revision. A negative value is entered with a minus sign just to the left of the number, e.g. -12.3 or -0.001. The successive fields are for consecutive months. The value "-9999" is entered in positions 1-5 whenever a figure is missing in a field that would normally contain a figure and position 6 contains a blank.

Note 2: Monthly and Annual Mean Figures

Data for each year of file are punched on two cards. The first card contains six monthly means in columns 15-50, starting with January as indicated in columns 12-13; columns 51-76 are blank; columns 77-80 contain the beginning and ending months for the year or standard period. The second card contains six monthly means in columns 15-50, starting with July as indicated in columns 12-13; columns 51-74 are blank; columns 75-79 contain the mean for th year or standard period, right justified; column 80 contains the symbol R or is blank.

7.3.2 Control Card Set-up

In the following card deck set-up the HYDEX file has been read from the catalogued disk file and sorted onto a temporary disk file which is in Region and station number order.

```
K6812,CM70000,P2,T100,GE1.
ACCOUNT,XXXXX.      MEANS RETREIVAL
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(HYDISK,HYDEX,ID=DATA,MR=1)                    HYDEX Disk File
FILE(HYDISK,RT=F,BT=C,FL=300,FO=SQ,CM=YES)
FILE(HYDEX,RT=F,BT=C,FL=300,FO=SQ,CM=YES)
SORTMRG.
```

```
ATTACH,X,FLOW,ID=OBJECT,MR=1,PW=EMR.
IGET,LGO=MEANS/X.
LABEL(TOTALS,R,L=TOTALS,F=S,X=SV,VSN=ERNNNN,D=GE,N=EB)
LGO.
7/8/9                                                    multi-punch in col. 1
SORT
FILE,INPUT=HYDISK(C),OUTPUT=HYDEX(R)
FIELD,DIST(1,1,DISPLAY),STANO(2,7,DISPLAY)
KEY,DIST(A,DISPLAY),STANO(A,DISPLAY)
EQUATE,DISPLAY( ,0)
END
7/8/9
DATE JUN 30 1983                                         standard "Date" card
WSC01 D08 01AA00199ZZ999 C                               See Note 1
6/7/8/9                                                  multi-punch in col. 1
```

Note 1: "Station Request" card

Column(s)	Description
1-5	"WSC01"
6	blank
7	D - retrieval by Region
8-9	Region requested: 02 Vancouver 03 Calgary 04 Winnipeg 05 Guelph 06 Longueuil 07 Dartmouth 08 Regina 09 Yellowknife
10	blank
11-17	station "from"
18-24	station "to"
25	blank
26	type of output: "C" for output on cards "T" for output on tape "L" for period-of-record summary only
27-80	blank

7.3.3 Quality Control Checks

The dayfile should be checked for fatal system messages.

7.3.4 Sample Output (MEANS program)

WATER SURVEY OF CANADA
FEB 17 1983 PAGE 1
GUELPH, ONT.

MONTHLY AND ANNUAL MEAN DISCHARGES

STATION NUMBER	190 01234	190 56789	191 01234	191 56789	192 01234	192 56789	193 01234	193 56789	194 01234	194 56789	195 01234	195 56789	196 01234	196 56789	197 01234	197 56789	198 01234	RECORD COUNT
02BF001	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--PCC	CCCCC	CCCCC	CC---	30
02BF002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--PCC	CCCCC	CCCCC	CC---	60
02BF003	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-PCCC	CCCP-	-----	76
02BF004	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CC---	80
02BF005	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	ZC---	84
02BF006	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CC---	88
02BF007	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-P---	90
02BF008	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	ZC---	94
02BF009	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-P---	96
02CA001	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CC---	340

PRIOR TO 1900 DATA AVAILABLE FOR YEARS ,1860-C,1861-C,1862-C,1863-C,1864-C,1865-C,1866-C,1867-C,1868-C,1869-C
,1871-C,1872-C,1873-C,1874-C,1875-C,1876-C,1877-C,1878-C,1879-C,1880-C
,1882-C,1883-C,1884-C,1885-C,1886-C,1887-C,1888-C,1889-C,1890-C,1891-C
,1893-C,1894-C,1895-C,1896-C,1897-C,1898-C,1899-C

STATION NUMBER	190 01234	190 56789	191 01234	191 56789	192 01234	192 56789	193 01234	193 56789	194 01234	194 56789	195 01234	195 56789	196 01234	196 56789	197 01234	197 56789	198 01234	RECORD COUNT
02CA002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-PCCC	CCCCC	CC---	362
02CB001	-----	-----	-----	-----	-----	-----	-----	-----	-----	-ZRRR	RZ---	-----	---PC	CCCCC	CCCCC	CCCCC	CC---	412
02CB002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	PCCCC	CCCCC	CCCCC	CCP--	-----	-----	-----	448
02CB003	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	ZC---	452
02CC002	-----	-----	-----	PCCCP	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	462
02CC003	-----	-----	-----	----P	P----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	466
02CC004	-----	-----	-----	-----	PCRRC	RRRRR	RRRRC	RRRRR	RRRRR	RRRRR	Z----	-----	-----	-----	-----	-----	-----	528
02CC005	-----	-----	-----	-----	-----	-----	-----	-----	--ZRR	RRRRR	RRRRR	CCCCR	RRRRR	RCCCC	CCCCC	CCCCC	CC---	608
02CC006	-----	-----	-----	-----	-----	-----	-----	-----	-----	--PCC	P----	-----	-----	-----	-----	-----	-----	616
02CC007	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	PCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CCCCC	CC---	680
02CC008	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-ZRRR	RCCCC	CCCCC	CCCCC	CC---	722
02CC009	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	PCCCC	CCCCC	CCCCC	CCCCC	CC---	766

KEY TO TABLE	
MISSING	-
PARTIAL	P
COMPLETE	C
PARTIAL WITH REVISION	Z
COMPLETE WITH REVISION	R

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END OF JOB STATISTICS

	VANCOUVER	CALGARY	WINNIPEG	GUELPH	LONGUEUIL	DARTMOUTH	REGINA	YELLOWKNIFE	TOTAL
NO. OF STATIONS	0	0	0	22	0	0	0	0	22
NO. OF MONTHS	0	0	0	4429	0	0	0	0	4429
COMPLETE STATION-YEARS	0	0	0	356	0	0	0	0	356
INCOMPLETE STATION-YEARS	0	0	0	27	0	0	0	0	27
STATION-YEARS BEFORE 1900 (INCLUDED ABOVE)	0	0	0	40	0	0	0	0	40

OUTPUT RECORDS WRITTEN ON TAPE 766

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SUMMARY OF REVISIONS SINCE JAN 01 1980

REGION	STATION NO.	YEAR	DATE REVISED	REGION	STATION NO.	YEAR	DATE REVISED
5	02BF005	1980	JUN 23 1982	5	02CC005	1960	AUG 27 1980
5	02BF008	1980	JUN 23 1982	5	02CC005	1961	AUG 27 1980
5	02CB001	1946	JUN 23 1982	5	02CC005	1962	AUG 27 1980
5	02CB001	1947	MAR 26 1982	5	02CC005	1963	AUG 27 1980
5	02CB001	1948	MAR 26 1982	5	02CC005	1964	AUG 27 1980
5	02CB001	1949	MAR 26 1982	5	02CC005	1965	AUG 27 1980
5	02CB001	1950	MAR 26 1982	5	02CC008	1961	MAR 26 1982
5	02CB001	1951	MAR 26 1982	5	02CC008	1962	MAR 26 1982
5	02CB003	1980	JUN 23 1982	5	02CC008	1963	MAR 26 1982
5	02CC004	1922	MAR 11 1981	5	02CC008	1964	MAR 26 1982
5	02CC004	1923	AUG 27 1980	5	02CC008	1965	MAR 26 1982
5	02CC004	1925	AUG 27 1980				
5	02CC004	1926	AUG 27 1980				

⋮

8. VERIFICATION OF DATA

The first step is to ensure that each computer program used has run successfully by observing the Quality Control Checks as outlined in the previous sections. The provisional listing program (DAYFLO) is used to get a "quick" check of the daily discharges which have been added to the FLOW file. This program can read the output tape (disk) from both the EDIT and the UPDATE programs. If only the EDIT output tape (disk) is used, only the corrections themselves will be printed but if the UPDATE output tape (disk) is used, all the available data for the station-year which has changed will be printed.

For the daily discharges (historical or annual) to receive final verification, the Historical or Publication listing is sent to the Regional Offices. Only monthly totals need to be checked for complete months but each daily discharge must be checked for incomplete months. Each symbol must of course be checked in both cases. On this same listing, the valid extremes for incomplete years or standard periods must be checked.

Once the annual data have been verified and the annual publications have been produced the data on the single annual FLOW tape are added to the 8 historical FLOW tapes.

8.1 Tape Summary Codes

"TYPE" of File.

1 = Unused tape unit, i.e. no tape I/O card for this unit.
2 = Input file not necessarily in sequence ("Tape Trailer" record behind "End-of-Data" record), output from the MOVE-and-DELETE program is an example.
3 = Input file in sequence and unsorted ("Tape Trailer" record behind "End-of-Data" record), such as output from UPDATE program.
4 = Input file in sorted sequence ("Tape Trailer" record behind "Tape Header" record), such as sorted MOVE-and-DELETE tape file.
5 = Output file not necessarily in sequence.
6 = Output file in sequence.
7 = Scratch file (output file to be released at the end of the job).

"STATUS" of File.

1 = The file has not yet been opened, or this is an unused tape unit.
2 = The file has been opended but not closed.
3 = The file has been closed.
4 = An error has been detected on this file.

"ERROR" Codes.

1 = Parity error while reading the file.
2 = Premature end-of-file while reading the file.
3 = Count error, i.e. the number of records processed is not equal to the number of records on file.
4 = Input record count does not match the record sequence numbers.
5 = Identification fields are not in sequence in a file that should be in sequence.
6 = File is not "Type" 3 or 4 for input, or 6 for output. The file should be in sequence or should have been sorted.
7 = File is not "Type" 2 for input or "Type" 5 for output.
8 = Wrong file, or reel number, or other format error in "Tape Header" record.
9 = Wrong record length or parity or unreadable "Tape Header" record.
10 = The same file has been opened more than once.
11 = The same file has been closed more than once.
12 = The file has not been opended before being closed.
13 = The file has not been closed.
14 = This tape unit is not available and further processing is requested.
15 = For a multi-reel file, the identification fields are not in sequence from one reel to the next.
16 = Error in "Tape I/O Request" card.
17 = Error in "Data" record, i.e. year beyond current year.
18 = Region code on the "Data" record is blank or other than 2 to 8.

9. TAPE HISTORY

A tape history sheet is kept for both the historical and the annual files, showing each generation of the files. As the fourth generation is verified, all tape reels pertaining to the first generation may be released. These reels are shown on the history sheet as being released. Reel numbers are assigned automatically by the computer for all output tapes and this number is displayed only in the dayfile. File numbers are composed of four digits, a hyphen, then two digits, followed by the reel number. File numbers are assigned as follows:

1st digit - code for Region:

1-more than one Region
2-Vancouver
3-Calgary
4-Winnipeg
5-Guelph
6-Longueuil
7-Dartmouth
8-Regina
9-Yellowknife

2nd digit - program code:

0-CARD-to-TAPE
1-EDIT
2-FLOW master file

3rd and 4th digits - indicates number of reels in this Region, e.g.

01-for the first reel; 02-for the second reel, etc.

The last two digits of the file number are either "01" (for CARD-to-TAPE files) or the last two digits of the year of the latest data on file minus 50, e.g. if the latest year on file is 1980, then the last two digits of the file number would be 30 (80-50).