

Title:

Water Survey of Canada
- LEVELS file (Imperial Units)

Originator:

Water Survey of Canada
Inland Waters Directorate
Fisheries & Environment Canada
Ottawa

G00-00573

John McDonald
Machine Readable Archives
Public Archives Canada
Ottawa

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Background

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. Water level data to 1968 were keypunched by contract using copies of original computation forms or the data publications as source documents; some of the data were entered using the OCR (Optical character REcognition) method. 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 of the automated preparation of camera-ready manuscripts for the eight annual Surface Water Data publications. The historical LEVELS file is then updated to include these annual data along with any corrections, revisions or additions for earlier years.

Although the historical LEVELS file has been in existence since 1968, final design of computer programs was not completed until 1975 at which time all historical corrections, including adjustments to refer the daily water level data to current datum, were processed and printouts of daily water levels for the entire LEVELS file were sent to the Regional Offices for final verification.

The LEVELS file now contains some 12,000 station-years of daily water levels in December 1977 on three reels of tape (some 35 million characters of data are stored at 1600 bpi); data are stored by Region, and station number order within each region. To facilitate the retrieval and publication of monthly and annual mean water levels, a

TOTALS file is created from the LEVELS file and contains the monthly totals in foot-days for all stations on one reel of tape. The TOTALS, PFAKS and HYDEX files are then used for the automated preparation of camera-ready manuscripts for the eight Historical Water Levels Summary publications which are published every three years.

Initially, the historical LEVELS tape file for all of Canada (excluding Quebec) was contained on seven 800 bpi tapes (i.e. one tape for each district) and contained a "Station-Header" record for each station contained on the file. Since the information contained on the "Station-Header" records is now on the HYDEX file and with the facility for high speed tapes introduced on the CYBER 74, "Station-Header" records were removed from the LEVELS file and the historical file is now contained on three 9-track, 1600 bpi tapes, with a blocking factor of 15 records, i.e. 4500 characters per block. With the inclusion of 1975 data, the historical LEVELS file contained approximately 116,000 station-months of data with an annual growth of approximately 5%.

Archival Methodology

In the Fall of 1979, the Water Survey of Canada launched a metric conversion program to convert all of the water survey data from imperial to metric units. The Public Archives was contacted respecting the microfilming of the paper documentation and printouts associated with both the metric and imperial versions of the data.

The Machine Readable Archives Division was advised by representatives of the Water Survey that the imperial units version should be preserved because the data could still be of value to those researchers

wishing to analyze the data in imperial units. The United States, for instance, would prefer to work with data stored in imperial rather than metric units.

Consequently arrangements were made with staff of the Water Survey of Canada to copy the five files of data describing the Survey. No conversion was made and the data are stored as they are described in the 'Operations Manual'. As a result all record types are included complete with the header and trailer records. Only the label of the tape has been changed (i.e. DSI) to conform with MPA standards. The data were successfully copied at the EMR Computer Service Bureau. A dump of the first and last blocks of data was obtained and the data were again copied to a second archival quality tape for off-site storage.

Please refer to the enclosed publication; LEVELS File Operations Manual for a detailed description of the record types and the format of the data as they are stored on the tapes.

Water Survey of Canada - Archive File

G0000572	-	FLOW file
G0000573	-	LEVELS file
G0000574	-	HYDEX file
G0000575	-	PEAKS file
G0000576	-	SEDEX (SEDIMENTS) file.

LEVELS file - G0000573

Vancouver	- 1 tape
Calgaryd, Winnipeg	- 1 tape
Guelph, Montreal, Halifax, Regina	- 1 tape



Fisheries
and Environment
Canada

Pêches
et Environnement
Canada

LEVELS File Operations Manual

First Edition

INLAND WATERS DIVISION
NATURAL RESOURCES BRANCH
OTTAWA, CANADA K1P 6X6



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*INLAND WATERS DIRECTORATE,
WATER RESOURCES BRANCH,
OTTAWA, CANADA, 1979.*

LEVELS File Operations Manual

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1. INTRODUCTION

This manual was prepared by Mr. J.L. P. McIlhinney, Computer Programmer, and Mr. M. Krol, Systems Analyst, and approved by Mr. W.J. Ozga, Head, Data Control Section, Applied Hydrology Division. It contains a detailed description of the LEVELS magnetic tape file of historical daily water levels and also detailed instructions and an explanation of the computer programs for the storage and retrieval of these data on the CDC CYBER 74 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. Water level data to 1968 were keypunched by contract using copies of original computation forms or the data publications as source documents; some of the data were entered using the OCR (Optical character Recognition) method. 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 LEVELS file is then updated to include these annual data along with any corrections, revisions or additions for earlier years.

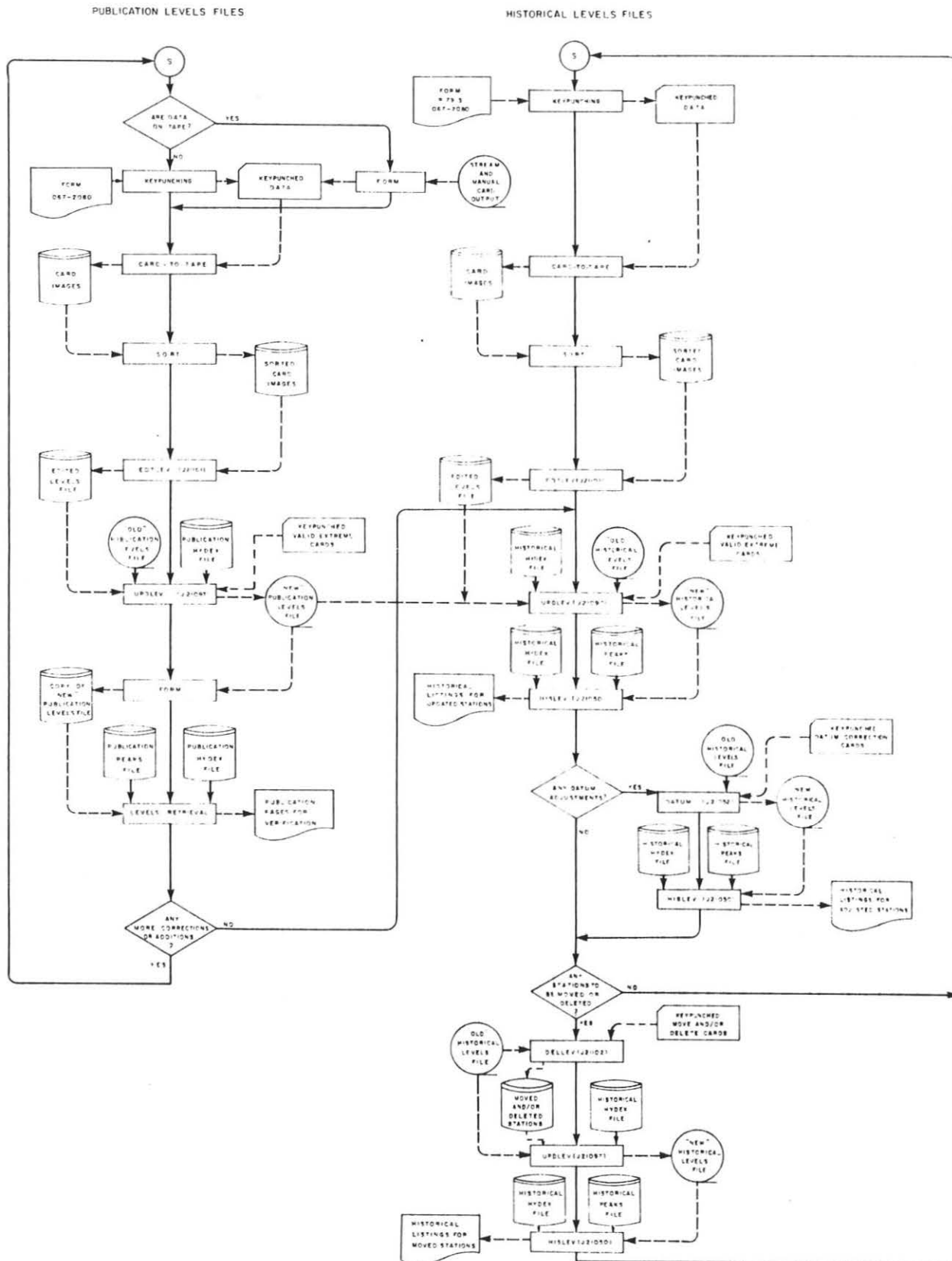
Although the historical LEVELS file has been in existence since 1968, final design of computer programs was not completed until 1975 at which time all historical corrections, including adjustments to refer the daily water level data to current datum, were processed and printouts of daily water levels for the entire LEVELS file were sent to the Regional Offices for final verification.

The LEVELS file now contains some 12,000 station-years of daily water levels to December 1977 on three reels of tape (some 35 million characters of data are stored at 1600 bpi); data are stored by Region, and station number order within each region. To facilitate the retrieval and publication of monthly and annual mean water levels, a TOTALS file is created from the LEVELS file and contains the monthly totals in foot-days for all stations on one reel of tape. The TOTALS, PEAKS and HYDEX files are then used for the automated preparation of camera-ready manuscripts for the eight Historical Water Levels Summary publications which are published every three years.

Historical daily, monthly and annual water level data can be supplied to users on punched cards or magnetic tape for computer processing. This manual also contains instructions for plotting annual daily water level hydrographs using the CYBER 74 computer and CALCOMP plotter at EMR.

This is the first edition of a "LEVELS File Operations Manual" and is subject to revision as new or improved procedures are developed.

2. LEVELS FILE SYSTEM FLOWCHART



3. KEYPUNCHING INSTRUCTIONS

3.1 Daily Water Levels in Card Format 71-102

Both current data and historical corrections are keypunched from either form R79 or 067-2080 (or equivalent) in the following format:

<u>Column(s)</u>	<u>Description</u>
1	code for type of data and unit: 4 - water levels in hundredths of feet 5 - water levels in tenths of feet
2	Region code: 2 - Vancouver 4 - Winnipeg 6 - Montreal 8 - Regina 3 - Calgary 5 - Guelph 7 - Halifax
3-9	stationnumber, e.g. 05AB003
10-12	last three digits of the year, e.g. "969" for 1969
13-15	first three letters of the month, e.g. "JAN" for January
16-17	day corresponding to the first data field, e.g. "08" for January 8
18-20	blank
21-80	numeric and/or alphabetic "free form" data fields; the only permissible alphabetic characters are the letters A, D, E, N or X.

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

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

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

The data field must be complete on each card; that is, the last field on any card should not overflow into the next card. 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 completely repunch the last field into the next card.

Punch the character "D" if the word "Dry" is given in the data field on the source document. Repeat the figure and/or symbol appearing above ditto marks, between "arrows" or within a bracketed period which indicates that this is the value to be used for all the days covered by the bracket.

Symbols in the data field of the source documents are shown to the right of the numeric value either as the letters A or E. Three additional symbols may appear by themselves; N to delete a symbol only, X to delete both the water level and the symbol, and D to indicate a "Dry" reading. All other letters are to be ignored.

3.1.1 Drum Card for the Packed Format 71-102

<u>Column(s)</u>	<u>Punches</u>	
1	0	(zero)
2-4	12	(+ sign)
5-6	12-1	(letter A)
7-12	12	(+ sign)
13-15	12-1	(letter A)
16-17	blank	
18	11	(- sign)
19-20	12	(+ sign)
21-80	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 be keypunched manually.

3.2 Valid Extreme Codes in Card Format 74-103

Valid extreme codes for incomplete years are keypunched from form IW-2080 in the following format:

<u>Column(s)</u>	<u>Description</u>
1	type of record (4 or 5 for water levels)
2	Region code, 2 to 8
3-9	station number, e.g. 03AC007
10	blank
11-14	year
15	blank
16	valid extreme code for an incomplete year 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	blank.

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

<u>Column(s)</u>	<u>Punches</u>
1	0 (zero)
2	12 (+ sign)
3-4	blank
5-6	1
7-9	blank
10	11 (- sign)
11-14	blank
15	11 (- sign)
16	1
17	11 (- sign)
18-80	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 75-900) containing historical daily water levels in feet 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 71-102 from the STREAM or the MANUAL computer programs in the Region 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.

Initially, the historical LEVELS tape file for all of Canada (excluding Quebec) was contained on seven 800 bpi tapes (i.e. one tape for each district) and contained a "Station-Header" record for each station contained on the file. Since the information contained on the "Station-Header" records is now on the HYDEX file and with the facility for high speed tapes introduced on the CYBER 74, "Station-Header" records were removed from the LEVELS file and the historical file is now contained on three 9-track, 1600 bpi tapes, with a blocking factor of 15 records, i.e. 4500 characters per block. With the inclusion of 1975 data, the historical LEVELS file contained approximately 116,000 station-months of data with an annual growth of approximately 5%.

The letter "b" in all record descriptions represent 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 are contained in this file 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 tape..

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"000HD00000bb"
13-16	4	"bbb1"
17-24	8	blank
25-32	8	"FILEbEMR"
33-44	12	file number, e.g. "-WSC-1701-01"
45-52	8	"bb SERIAL"
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. "UPDLEV"
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. "JANb31b1967" for January 31, 1967
80-81	2	blank
82-99	18	range of station numbers, e.g. "01AE003bTOB01MN124"
100-288	189	blank
289-294	6	date on which the tape was written, in the form: 10000 x (year-1900) + 100 x (month) + (day) e.g. "710131" for January 31, 1971
295-300	6	record sequence number, "bbbbbb1".

4.1.2 Data Record (Tape Format 75-901)

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

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1	1	Region code: 2 - Vancouver 3 - Calgary 4 - Winnipeg 5 - Guelph 6 - Montreal 7 - Halifax 8 - Regina
2-8	7	station number, e.g. "01AB003"
9-11	3	year, e.g. "(65" for 1965
12-13	2	month, e.g. "b7" for July
14-15	2	type of data, coded as follows: "b7" for water levels in hundredths of feet "b8" for water levels in tenths of feet
16	1	status code
17	1	month code, coded as follows: 1, 2, 3 or 4 for incomplete months of 28, 29, 30 or 31 days respectively 5, 6, 7, or 8 for complete months of 28, 29, 30 or 31 days respectively

18	1	valid extreme code desired within an incomplete year; only the symbol L,H,B and blank are allowed as follows: blank - the HYDEX file will contain 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	datum code
22-24	3	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 foot-days
285-286	2	day on which the minimum daily water level first occurred for this month
287-288	2	day on which the maximum daily water level first occurred for this month
289-294	6	date on which this record was last updated
295-300	6	sequence number of this record

The daily figures and symbol codes stored in positions 25-272 are as follows:

characters 1-7: daily water level in feet, right justified with leading
 blanks, in Fortran F-type format (to be read as F7.0). The
 decimal point is stored as a character in position 5 or 6
 depending on the type.

character 8: symbol codes as follows:

 1 for no data
 A for Manual Gauge
 E for Estimated
 D for Dry

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.

The DATE in positions 289-294 on which the record was last updated is as follows:
 year-month-day, e.g. "720205" for February 5, 1972.

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

There is only one per reel and it follows the last "Data" record (75-501).

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"999ZZ9999999"
13-288	276	blank
289-294	6	date on which the tape was written, in the form: 10000 (year-1900) + 100 (month) + (day), e.g. "720125" for January 25, 1972
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).

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
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: 10000 (year-1900) + 100 (month) + (day), e.g. "720131" for January 31, 1972
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).

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
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. All daily water levels enter the system on cards or card images on tape and are processed through at least four steps: CARD-to-TAPE, SORT (card images), EDIT and UPDATE. After these four steps the data will be on a master LEVELS tape or an annual LEVELS tape or a correction tape. If data are entered with errors such as under the wrong station number or year or both or without the correct daily symbol, then these errors can easily be corrected in three steps by using the MOVE-and-DELETE, SORT (main file records) and UPDATE. All the valid extreme codes are entered on cards for the UPDATE program where they are checked and entered onto the LEVELS file.

5.1 CARD-to-TAPE Program CARD - J21075

This program reads records containing water level data and writes a magnetic tape containing card images blocked 10. The input records are either punched cards or card images on magnetic tape, blocked 1. This program also converts the alphabetic month to numeric form so that it can be used as part of the sorting field. If the month is not valid the record is written to the output tape but the month assigned is "00". This output tape or disk file is then sorted.

5.2 SORT Utility (card images)

The input tape or disk file of card images blocked 10 is sorted on a 13-character field containing the Region number, station number, year and month onto an output tape or disk file of card images blocked 10 which is ready for input into for the LEVELS file.

5.3 EDIT Program EDTLEV-J21101

This program reads the output tape or disk file written by the SORT program and creates a tape or disk file in main file format of 300-character records, blocked 15. The program also reads the HYDEX file to obtain the current datum code which will be inserted on each output record. The Region code, station number, year, month and day and the data fields are all checked in the following manner. First, the Region code must be a numeric digit from 2 to 8, inclusive. The station number must contain 2 digits, followed by 2 alphabetic characters, followed by 3 digits. The year must fall in the range from 1800 to the current year.

Since the month was checked by the CARD-to-TAPE program which inserts '00' for an invalid month, this program checks only for '00'. The day is edited for numeric digits in columns 16 and 17 which together should be between 1 and the number of days in the month. Any errors found in these above-mentioned fields will cause the entire card or card image to be rejected. If daily water level 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 water level value must not be longer than 7 digits, including the decimal point and minus sign, if present. If a field has more than 7 digits, the entire value is dropped. The decimal point must always be present in the data

field and must agree with the type of record indicator in col. 1 of each card. Negative values must have a "-" sign in front of the first valid digit.

There must be no imbedded blanks. Each daily water level 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.

If symbols are entered, only the following letters may be used: 'A' for manual gauge, 'D' for dry, 'E' for estimated, 'N' to signify that an existing symbol is to be deleted, or 'X' to signify that an existing daily value and its associated symbol are to be deleted. More than one symbol may be entered for any one day but only the last one encountered will be written onto the output tape (disk) file. Further, if a water level is revised but the symbol is valid, then both the water level value and the symbol must be submitted as a correction. Therefore, a symbol may be added or revised without altering the water level, but a revision to a water level must include the symbol, if applicable.

Symbols entered by themselves (i.e. without a daily water level 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 or E are translated to 2 or 4 resp.; symbol codes of N or X are translated to 8 or 9 resp. So that the Update program will detect these special codes, the status code of any record containing symbol codes of 2,3,4,8 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 water level data read, is written onto the output tape. On the output tape, 8 positions are reserved for each daily value. The first 7 positions contain the daily water level including the decimal point and/or minus sign if present.

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

1 indicates no data for that day
blank for no footnote
A for manual gauge
E for estimated
D for dry

The first day on which the minimum and maximum daily water levels 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, the program writes an "End-of-Data" record, a "Tape Trailer" record and "Padding" records as required.

A control page is printed first for each Region and then for the whole job showing the number of stations, station-years, station-months, non-water level cards, records on the input file (from the trailer), records read (counted) and

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

5.4 UPDATE Program

UPDLEV-J21097

This program updates an old master file according to the corrections 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 principal updating control card indicates which of the two input tapes takes precedence, whether or not this is a combining of correction tapes and whether all, a range or just one Region is to be updated. The output tape file card indicates the range of stations to be included on the output tape. Besides updating the daily water levels this program also inserts, changes or deletes the valid extreme codes as keypunched in card format 74-103. Examples:

1. The annual tape containing data for several Regions for just one year is updated with corrections and additions from the edited tape. All Regions and stations on tape are updated. The old master is called tape "A" and the edit tape of corrections, tape "B", is to take precedence. The output tape, "J", is the new master. The control cards would appear as follows:

DATE MAR 20 1972
A0B1

A05WSC-1201-06 1234
B04WSC-1101-07 5678
J06WSC-1201-07 9999 01AA001-99ZZ999
4405AJ016 1973 B

standard "Date" card
"Priority" control card with tape
"B" given priority
old master of the annual tape
edit tape of corrections
new master of the annual tape
"Valid Extreme Code" card(s)
(74-103)

9999ZZ999

"End of Valid Extreme Code" card

2. The historical main file is updated with the annual tape which is now free of errors. The old master is tape "A" and the annual tape is tape "B". Tape "A" contains all stations for several districts, therefore you want the output tape "5" to contain all stations for those several districts. The control cards would appear as follows:

DATE MAR 20 1972
A0B1 5-8

A05WSC-1703-26 9999
B04WSC-1777-27 9999
J06WSC-1703-27 9999
9999ZZ999

Standard "date" card
Region 5, 6, 7 and 8 will be
updated with tape "B" given
priority
old historical master
annual tape
new historical master
"End of Valid Extreme Code" card

3. The historical main file is updated with the annual tape which is now free of errors. The old master is tape "A" and the annual tape is tape "B". The output tape, "J", is to contain only a specific range of stations for one Region. The control cards would appear as follows:

DATE MAR 20 1972
A0B1 4

A05WSC-1702-26 1234
B04WSC-1201-07 5678
J06WSC-1702-27 9999 01AA001-05NG999
4405JA016 1967 B

9999ZZ999

standard "Date" card
only Region 4, Winnipeg, with
tape "B" given priority
old historical master
annual tape
new historical master
"Valid Extreme Code" card(s)
(74-103)
"End of Valid Extreme Code" card

4. Two tape files each containing corrections and/or additions are to be combined. The correction tape created first would be called tape "A" and similarly the correction tape created later would be called tape "B". This tape "B" would also include any corrections to data now on tape "A". In other words, it might contain corrections to corrections and care should be taken that data to be deleted from a correction is not deleted from the master file on a subsequent updating run. For example a correction submitted for January 10, 1971 is on tape "A". When the listings were checked, it was found that the correction should have been for June 10, 1971. A correction is then submitted to delete the data from tape "A" by means of a correction sheet which is included on Tape "B". When the output tape as obtained by combining the two correction tapes is used as input to an updating run of the master file, January 10, 1971 will be deleted from the master file. To correct such an error, the original data for January 10, 1971 should be resubmitted rather than deleting the data for this date. The control cards would appear as follows:

DATE MAR 20 1972
A0B0C

A05WSC-1201-08 1234
B04WSC-1101-09 5678
J06WSC-1201-09 9999 01AA001-99ZZ999
4405CF026 1970 L

9999ZZ999

standard "Date" card
C for correction run. Dates on
each record determine priority
old correction tape
latest correction tape
new correction tape
"Valid Extreme Code" card(s)
(74-103)
"end of Valid Extreme Code" card

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 data field found with a "9" code will be deleted and a symbol only with no corresponding value on the main file will be dropped, unless the code "C" indicating this is a corrections run only and these records are to be retained. The program recomputes the month code, the monthly total and the minimum and the 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 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 minimum, maximum and month code are re-calculated.

All data records transferred to the output file are of status 1, i.e. they do not contain symbol codes of 2, 3, 4, 8, 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 2, 3, 4, 8, or 9 are performed. If in one given data record of status 2 for which a corresponding record exists, corresponding daily fields are not found for fields whose symbol codes are 2, 3, 4, 8, or 9, then only the concerned daily fields are dropped (i.e. symbol fields of 2, 3, 4, 8 or 9 are replaced by a blank or a 1 code) and the data record is transferred to the output file, provided of course that some valid daily fields still exist on that record.

In order to ensure that all water levels stored on the main file remain adjusted to current datum, the Update program checks the datum code of each output record with the datum code on the HYDEX file. If the datum codes do not match, a warning message is printed unless the several unrelated datums code on HYDEX has an X indicating that the relationship between both datums is not known.

5.5 MOVE-and-DELETE Program

DELLEV-J21102

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 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 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 the symbol code is altered. Several symbol changes, move 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 in 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 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 unaltered symbol codes, the second record using the old station number has a status code of "2" with 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 Sort Utility (main file records)

This SORT is only required when daily data are moved to a new station number and are deleted under the old station number. The output tape or disk file in main file format from the MOVE-and-DELETE program is sorted on a 13-character field containing the Region code, station number, year and month. The output tape from this sort is then used as input to the UPDATE program together with the old master to create a new master file.

5.7 DATUM Program DATUM-J21052

Initially, all water level figures will be adjusted to the current datum as shown on the HYDEX file and the current datum code inserted on every record. In order to maintain the LEVELS file to show water levels to the current datum, both the water level figures and the current datum code must be adjusted each time the current datum changes on the HYDEX file.

Consequently, the DATUM program was written to apply datum corrections to the water level data stored on a LEVELS file. The program also allows the user to change the datum code stored on each record.

The program simply adds a constant value from each water level figure for the range of dates specified on a "Datum Adjustment" card. If a datum code is specified on this card, the program will replace the datum code on every record that falls between the specified dates; otherwise the datum codes remain unchanged. Hence, the program can be used to change only the datum codes by adding zero to each daily figure or only to make datum corrections to the water level figures by leaving out the current datum code.

5.8 FORM utility

The FORM utility is used to convert the data entering the system as card images on tape to a format suitable to be read by the CARD-to-TAPE program. Although this process is not always needed, the user is encouraged to use this utility on all tapes received from other installations since it can handle tape of almost any block size. When maintaining a publication LEVELS file, the FORM utility is again used to translate the output master file to a format suitable for mass storage.

5.9 LEVELS-MAXMIN-CK Program

This program compares differences between maximum and minimum of a month or consecutive months and lists this information if the difference is greater than the value specified, e.g. greater than 30 feet. It is used to help pick out some keypunching errors and data which were submitted using the wrong datum.

5.10 RETDAT Program

This program compares the date at the end of each record of data on the master file with the date you supply. If they are the same or the data record date is greater, then the Region, station number, year and date are listed for that record.

It is used to help us determine which station-years need new listings, in order to bring the listings up-to-date for both Ottawa and the Regions.

6. RETRIEVAL PROGRAMS

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

6.1 Provisional Listing Program DAYLEV-J21016

This program prepares a listing of the provisional daily water levels as shown in the example below so that the data stored on the LEVELS file may be verified. Both the EDIT and the UPDATE programs create a tape (or disk) file in main file format. Thus this program can read the historical or annual tape files as well as a corrections tape file. Data can be printed selectively by Region and station number, by Region and station range or by date. Retrieving by date implies that all the changes made after a given date are to be printed with one station-year per page.

PAGE 1
LEVELS
(1777-24) NOV 29 1978
VANCOUVER, B.C.

STATION NO. 08NM088
YEAR 1977

(PROVISIONAL) WATER LEVEL IN FEET FOR 1977													
DAY	JAN	FEB	MAR	APP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	8.23	7.93	7.67	8.27	8.26	8.27	7.98	8.17	8.19	8.32	8.31	8.36 E	1
2	8.24	7.91	7.66	8.36	8.31	8.28	7.99	8.16	8.19	8.32	8.32	8.38 E	2
3	8.26	7.88	7.65	8.41	8.41	8.29	7.99	8.17	8.17	8.31	8.31	8.40 E	3
4	8.24	7.85	7.64	8.46	8.47	8.32	8.01	8.17	8.16	8.32	8.29	8.42 E	4
5	8.23	7.83	7.61	8.45	8.49	8.35	8.04	8.16	8.18	8.31	8.28	8.41 E	5
6	8.20	7.80	7.61	8.42	8.50	8.39	8.05	8.16	8.17	8.30	8.25	8.45 E	6
7	8.20	7.77	7.60	8.39	8.47	8.41	8.07	8.16	8.16	8.31	8.26	8.44 E	7
8	8.19	7.75	7.62	8.37	8.43	8.42	8.08	8.16	8.15	8.32	8.25	8.43 E	8
9	8.17	7.73	7.62	8.36	8.40	8.39	8.10	8.15	8.17	8.31	8.23	8.42 E	9
10	8.16	7.73	7.61	8.35	8.36	8.39	8.10	8.14	8.17	8.31	8.21	8.41 E	10
11	8.13	7.73	7.57	8.33	8.33	8.35	8.12	8.13	8.16	8.32	8.23	8.40 E	11
12	8.15	7.73	7.57	8.30	8.29	8.30	8.13	8.12	8.16	8.31	8.21	8.40 E	12
13	8.15	7.74	7.56	8.28	8.25	8.28	8.14	8.12	8.17	8.34	8.20	8.39 E	13
14	8.14	7.73	7.55	8.25	8.21	8.28	8.14	8.11	8.18	8.31	8.18	8.38 E	14
15	8.14	7.73	7.56	8.21	8.16	8.28	8.15	8.09	8.19	8.32	8.18	8.37 A	15
16	8.12	7.73	7.56	8.21	8.11	8.27	8.16	8.08	8.18	8.34	8.19	8.36	16
17	8.12	7.73	7.54	8.17	8.06	8.26	8.15	8.07	8.17	8.31	8.20	8.35	17
18	8.15	7.74	7.53	8.15	8.05	8.26	8.15	8.07	8.19	8.35	8.20	8.32	18
19	8.16	7.73	7.53	8.14	8.04	8.25	8.15	8.09	8.21	8.34	8.21	8.29	19
20	8.16	7.73	7.51	8.11	8.04	8.23	8.13	8.10	8.25	8.35	8.20	8.27	20
21	8.16	7.73	7.51	8.11	8.05	8.20	8.14	8.11	8.26	8.35	8.19 A	8.25	21
22	8.15	7.72	7.50	8.11	8.06	8.18	8.15	8.12	8.26	8.31	8.21 E	8.23	22
23	8.16	7.72	7.50	8.11	8.07	8.15	8.15	8.11	8.28	8.34	8.23 E	8.22	23
24	8.15	7.70	7.48	8.10	8.11	8.12	8.15	8.14	8.29	8.31	8.24 E	8.18	24
25	8.13	7.68	7.48	8.10	8.13	8.10	8.13	8.14	8.32	8.32	8.26 E	8.15	25
26	8.10	7.68	7.46	8.12	8.17	8.06	8.11	8.18	8.32	8.34	8.28 E	8.13	26
27	8.08	7.67	7.46	8.14	8.20	8.02	8.14	8.18	8.32	8.34	8.30 E	8.11	27
28	8.05	7.67	7.44	8.17	8.22	7.99	8.18	8.17	8.30	8.31	8.31 E	8.07	28
29	8.02		7.45	8.20	8.23	7.98	8.16	8.20	8.31	8.32	8.31 E	8.09	29
30	7.98		7.45	8.23	8.24	7.97	8.15	8.20	8.32	8.31	8.35 E	8.08	30
31	7.95		7.97		8.25		8.16	8.20		8.32		8.06	31
TOTAL	252.47	217.07	234.67	247.40	255.37	247.04	251.47	252.31	246.55	258.19	247.41	257.24	TOTAL
MEAN	8.14	7.75	7.57	8.25	8.24	8.23	8.11	8.14	8.22	8.31	8.25	8.10	MEAN
MAX.	8.26	7.93	7.97	8.46	8.50	8.42	8.18	8.20	8.32	8.36	8.35	8.45	MAX.
MIN.	7.95	7.67	7.44	8.10	8.04	7.97	7.98	8.07	8.15	8.30	8.18	8.06	MIN.
DATUM	010	010	010	010	010	010	010	010	010	010	010	010	DATUM

6.2 Historical Listing Program HISLEV-J21050

There are two versions of this program, a French and an English version. The program reads the LEVELS, PEAKS and HYDEX files and produces listings of the daily water levels 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 heading on each page contains the station name and number, the year, Region name and the current date. If the year stored on the LEVELS file is complete, a summary is printed at the bottom of each page containing the mean, maximum and minimum daily water level in feet for the year. If the year is incomplete but the LEVELS file contains an L, H or B then the minimum daily water level, maximum daily water level or both, respectively, will be printed at the bottom of the page.

If the PEAKS file contains a maximum instantaneous water level for the year being retrieved, then it will be printed out along with its time and date of first occurrence. The name of the current datum as read from the LEVELS file is also printed at the bottom of the page.

If the station contains several unrelated datums then the message "WATER LEVELS FOR PERIOD-OF-RECORD ARE REFERRED TO SEVERAL UNRELATED DATUMS" is printed at the bottom of an English page or "LES NIVEAUX D'EAU POUR TOUTE LA PÉRIODE D'OBSERVATION SE RAPPORTENT À PLUSIEURS PLANS DE RÉFÉRENCE DIFFÉRENTS" is printed at the bottom of a French page.

WATER SURVEY OF CANADA NOV. 29 1978 PAGE 1 VANCOUVER, B.C.				SKAHA LAKE AT OKANAGAN FALLS DAILY WATER LEVEL IN FEET FOR 1977										STATION NO. 08NM084	
DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY		
1	8.23	7.93	7.67	8.27	8.26	8.27	7.98	8.17	8.19	8.32	8.31	8.36 E	1		
2	8.24	7.91	7.66	8.36	8.31	8.28	7.99	8.16	8.19	8.32	8.32	8.36 E	2		
3	8.26	7.88	7.65	8.41	8.41	8.29	7.99	8.17	8.17	8.33	8.31	8.40 E	3		
4	8.24	7.85	7.64	8.46	8.47	8.32	8.01	8.17	8.16	8.32	8.29	8.42 E	4		
5	8.23	7.83	7.61	8.45	8.49	8.35	8.04	8.16	8.18	8.31	8.28	8.43 E	5		
6	8.20	7.80	7.61	8.42	8.50	8.39	8.05	8.16	8.17	8.30	8.25	8.45 E	6		
7	8.20	7.77	7.60	8.39	8.47	8.41	8.07	8.16	8.16	8.31	8.26	8.44 E	7		
8	8.19	7.75	7.62	8.37	8.43	8.42	8.08	8.16	8.15	8.32	8.25	8.43 E	8		
9	8.17	7.73	7.62	8.36	8.40	8.39	8.10	8.15	8.17	8.33	8.23	8.42 E	9		
10	8.16	7.73	7.61	8.35	8.36	8.39	8.10	8.14	8.17	8.33	8.23	8.41 E	10		
11	8.13	7.73	7.57	8.33	8.33	8.35	8.12	8.13	8.16	8.32	8.23	8.40 E	11		
12	8.15	7.73	7.57	8.30	8.29	8.30	8.13	8.12	8.16	8.31	8.21	8.40 E	12		
13	8.15	7.74	7.56	8.28	8.25	8.28	8.14	8.12	8.17	8.34	8.20	8.39 E	13		
14	8.14	7.73	7.55	8.25	8.21	8.28	8.14	8.11	8.18	8.33	8.18	8.38 E	14		
15	8.14	7.73	7.56	8.21	8.16	8.28	8.15	8.09	8.19	8.32	8.18	8.37 A	15		
16	8.12	7.73	7.56	8.21	8.11	8.27	8.16	8.08	8.18	8.34	8.19	8.36	16		
17	8.12	7.73	7.54	8.17	8.06	8.26	8.15	8.07	8.17	8.33	8.20	8.35	17		
18	8.15	7.74	7.53	8.15	8.05	8.26	8.15	8.07	8.19	8.35	8.20	8.32	18		
19	8.16	7.73	7.53	8.14	8.04	8.25	8.15	8.09	8.21	8.36	8.21	8.29	19		
20	8.16	7.73	7.51	8.13	8.04	8.23	8.13	8.10	8.25	8.35	8.20	8.27	20		
21	8.16	7.73	7.51	8.11	8.05	8.20	8.14	8.11	8.26	8.35	8.19 A	8.25	21		
22	8.15	7.72	7.50	8.11	8.06	8.18	8.15	8.12	8.26	8.33	8.21 E	8.23	22		
23	8.16	7.72	7.50	8.11	8.07	8.15	8.15	8.11	8.28	8.34	8.23 E	8.22	23		
24	8.15	7.70	7.48	8.10	8.11	8.12	8.15	8.14	8.29	8.33	8.24 E	8.18	24		
25	8.13	7.68	7.48	8.10	8.13	8.10	8.13	8.14	8.32	8.32	8.26 E	8.15	25		
26	8.10	7.68	7.46	8.12	8.17	8.06	8.13	8.18	8.32	8.34	8.28 E	8.13	26		
27	8.08	7.67	7.46	8.14	8.20	8.02	8.14	8.18	8.32	8.34	8.30 E	8.11	27		
28	8.05	7.67	7.44	8.17	8.22	7.99	8.18	8.17	8.30	8.33	8.31 E	8.07	28		
29	8.02	7.65	7.45	8.20	8.23	7.98	8.16	8.20	8.31	8.32	8.33 E	8.09	29		
30	7.98	7.65	7.45	8.23	8.24	7.97	8.15	8.20	8.32	8.33	8.35 E	8.08	30		
31	7.95	7.67	7.47	8.25	8.25		8.16	8.20		8.32		8.06	31		
MEAN	8.14	7.75	7.57	8.25	8.24	8.23	8.11	8.14	8.22	8.33	8.25	8.30	MEAN		
MAX	8.26	7.93	7.97	8.46	8.50	8.42	8.18	8.20	8.36	8.36	8.35	8.45	MAX		
MIN	7.95	7.67	7.44	8.10	8.04	7.97	7.98	8.07	8.15	8.30	8.18	8.06	MIN		

SUMMARY FOR THE YEAR 1977

MEAN WATER LEVEL, 8.13 FT
 MAXIMUM DAILY WATER LEVEL, 8.50 FT ON MAY 6
 MINIMUM DAILY WATER LEVEL, 7.44 FT ON MAR 28
 MAXIMUM INSTANTANEOUS WATER LEVEL,
 8.51 FT AT 0901 PST ON MAY 6

A-MANUAL GAUGE
 E-ESTIMATED

WATER LEVELS ARE REFERRED TO ASSUMED DATUM
 APPLY 1100.42 FT ADJUSTMENT TO CONVERT TO GEODETIC SURVEY OF CANADA DATUM (LOCAL 1959 ADJ.)

JOUR	JAN	FEV	MAR	AVR	MAI	JUN	JUL	AOU	SEP	OCT	NOV	DEC	TOT
1	681.10	679.85	679.16	681.86	681.73	681.03	680.80	680.33	680.63	682.48	681.46	681.81	1
2	681.07	679.74	679.18	682.01	681.69	680.97	680.77	680.28	680.61	682.75	681.44	681.88	2
3	681.05	679.67	679.16	682.13	681.65	680.92	680.74	680.22	680.63	682.81	681.44	681.84	3
4	681.01	679.64	679.14	682.13	681.64 E	680.89	680.75	680.16	680.65	682.79	681.44	681.84	4
5	680.95	679.61	679.20	682.13	681.64 E	680.88	680.68	680.12	680.67	682.69	681.60	681.77	5
6	680.89	679.60	679.21	682.13	681.57 E	680.85	680.66	680.12	680.67	682.59	681.61	681.80	6
7	680.84	679.58	679.20	682.08	681.47	680.88	680.63	680.11	680.65	682.38	681.67	681.84	7
8	680.79	679.56	679.19	682.00	681.45	680.89	680.64	680.12	680.66	682.21 E	681.54	681.93	8
9	680.74	679.52	679.21	681.90	681.41	680.84	680.59	680.04	680.72	682.09 E	681.51	681.92	9
10	680.70	679.50	679.23	681.76	681.38	680.77	680.58	680.00	680.70	682.08	681.51	681.88	10
11	680.71	679.46	679.27	681.66	681.42	680.76	680.58	679.99	680.63	682.02	681.62	681.82	11
12	680.66 E	679.42	679.37	681.56	681.41	680.82	680.61	679.96	680.63	682.08	681.63	681.75	12
13	680.61 E	679.40 E	679.56	681.54	681.37	680.76	680.61	679.94	680.67	682.05	681.72	681.74	13
14	680.56	679.38 E	679.91	681.63	681.34	680.72	680.60	679.94	680.79	682.01	681.74	681.80	14
15	680.51	679.36	680.39	681.68	681.33	680.67	680.60	679.92	680.96	682.08	681.75	681.84	15
16	680.47	679.35	680.83	681.69	681.32	680.64	680.58	679.88	681.06	682.14	681.75	681.88	16
17	680.43 E	679.34	681.22	681.67	681.29	680.62	680.58	679.97	681.11	682.26	681.81	681.84	17
18	680.39 E	679.32	681.40	681.62	681.23	680.58	680.59	680.14	681.17	682.44	682.00	681.80	18
19	680.36 E	679.30	681.48	681.56	681.20	680.67	680.62	680.21	681.15	682.41	682.11	681.74	19
20	680.28	679.27	681.49	681.48	681.16	680.70	680.60	680.26	681.13	682.30	682.21	681.66	20
21	680.23	679.27	681.47	681.42	681.16	680.66	680.58	680.32	681.31	682.25	682.31	681.59	21
22	680.18	679.25	681.41	681.38	681.19	680.67	680.50	680.41	681.53	682.09 E	682.21	681.56	22
23	680.12	679.21	681.38	681.39	681.17	680.67	680.49	680.42	681.64	681.95 E	682.10	681.56	23
24	680.06	679.18	681.32	681.44	681.18	680.67	680.50	680.42	681.71	681.82 E	682.01	681.54	24
25	680.00	679.19	681.22	681.55	681.17	680.71	680.48	680.49	681.78	681.70 E	681.89	681.56	25
26	679.99	679.19	681.12	681.66	681.10	680.73	680.43	680.54	681.85	681.58	681.86	681.60	26
27	679.96	679.15	681.01	681.75	681.08	680.78	680.40	680.58	682.15	681.46	681.98	681.61	27
28	679.90	679.17	680.94	681.80	681.06	680.77	680.39	680.62	682.30	681.45	681.94	681.60	28
29	679.88		681.02	681.80	681.07	680.82	680.39	680.64	682.43	681.47	681.91	681.61	29
30	679.87		681.20	681.75	681.08	680.83	680.37	680.60	682.44	681.51	681.87	681.59	30
31	679.87		681.54		681.05		680.35	680.63		681.50		681.58	31
MOY	680.46	679.41	680.34	681.74	681.32	680.77	680.57	680.24	681.17	682.11	681.80	681.74	MOY
MAX	681.10	679.85	681.54	682.13	681.73	681.03	680.80	680.64	682.44	682.81	682.31	681.93	MAX
MIN	679.87	679.15	679.14	681.38	681.05	680.58	680.35	679.88	680.61	681.45	681.44	681.55	MIN

SOMMAIRE POUR L'ANNEE 1977

NIVEAU D'EAU MOYEN, 680.98 PI
NIVEAU MAXIMUM QUOTIDIEN, 682.81 PI LE 3 OCT
NIVEAU MINIMUM QUOTIDIEN, 679.14 PI LE 4 MAR
NIVEAU MAXIMUM INSTANTANE, 682.86 PI LE 4 OCT A 1415 HNE

E ESTIMATIVE

PLAN DE REFERENCE: SERVICE GEODESIQUE DU CANADA (ANCIEN DATUM)
AJOUTER .13 PI POUR OBTENIR LES COTES GEODESIQUES

6.3 Publication Listing Program LEVELS-RETRIEVAL

There are two versions of this program, a French and an English version. The program reads the Publication LEVELS, HYDEX and PEAKS files and produces listings of the daily water levels with one calendar year per page as shown in the examples below. The listing produced is identical to the final annual publication pages except that a date block is present in the upper left hand corner of each page. 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 daily water levels, the summary, the maximum instantaneous water level and the current datum name at the bottom of the page are printed in the same fashion as those in the Historical Listing program. In addition, descriptive information from the HYDEX file which includes: the type of gauge, location, drainage area, data contributed by, international, regulated or natural flow and revised data.

SKAHA LAKE AT OKANAGAN FALLS

STATION NO. 08NH084

DAILY WATER LEVEL IN FEET FOR 1977

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	8.23	7.93	7.67	8.27	8.26	8.27	7.98	8.17	8.19	8.32	8.31	8.36E	1
2	8.24	7.91	7.66	8.16	8.31	8.28	7.99	8.16	8.19	8.32	8.32	8.38E	2
3	8.26	7.88	7.65	8.41	8.41	8.29	7.99	8.17	8.17	8.33	8.31	8.40E	3
4	8.24	7.85	7.64	8.46	8.47	8.32	8.01	8.17	8.16	8.32	8.29	8.42E	4
5	8.23	7.81	7.61	8.45	8.49	8.35	8.04	8.16	8.18	8.31	8.28	8.43E	5
6	8.20	7.80	7.61	8.42	8.50	8.39	8.05	8.16	8.17	8.30	8.25	8.45E	6
7	8.20	7.77	7.60	8.19	8.47	8.41	8.07	8.16	8.16	8.31	8.26	8.44E	7
8	8.19	7.75	7.62	8.17	8.43	8.42	8.08	8.16	8.15	8.32	8.25	8.43E	8
9	8.17	7.73	7.62	8.16	8.40	8.39	8.10	8.15	8.17	8.33	8.23	8.42E	9
10	8.16	7.73	7.61	8.35	8.36	8.39	8.10	8.14	8.17	8.33	8.23	8.41E	10
11	8.13	7.73	7.57	8.11	8.13	8.35	8.12	8.13	8.16	8.32	8.23	8.40E	11
12	8.15	7.73	7.57	8.10	8.29	8.30	8.13	8.12	8.16	8.31	8.21	8.40E	12
13	8.15	7.74	7.56	8.28	8.25	8.28	8.12	8.17	8.16	8.34	8.20	8.39E	13
14	8.14	7.73	7.55	8.25	8.21	8.28	8.14	8.11	8.18	8.33	8.18	8.38E	14
15	8.14	7.73	7.56	8.21	8.16	8.28	8.15	8.09	8.19	8.32	8.18	8.37A	15
16	8.12	7.73	7.56	8.21	8.11	8.27	8.16	8.08	8.18	8.34	8.19	8.36	16
17	8.12	7.73	7.54	8.17	8.06	8.26	8.15	8.07	8.17	8.33	8.20	8.35	17
18	8.15	7.74	7.53	8.15	8.05	8.26	8.15	8.07	8.19	8.35	8.20	8.32	18
19	8.16	7.73	7.53	8.14	8.04	8.25	8.15	8.09	8.21	8.36	8.21	8.29	19
20	8.16	7.73	7.51	8.13	8.04	8.23	8.13	8.10	8.25	8.35	8.20	8.27	20
21	8.16	7.73	7.51	8.11	8.05	8.20	8.14	8.11	8.26	8.35	8.19A	8.25	21
22	8.15	7.72	7.50	8.11	8.06	8.18	8.15	8.12	8.26	8.33	8.21E	8.23	22
23	8.16	7.72	7.50	8.11	8.07	8.15	8.15	8.11	8.28	8.34	8.23E	8.22	23
24	8.15	7.70	7.48	8.10	8.11	8.12	8.15	8.14	8.29	8.33	8.24E	8.18	24
25	8.13	7.68	7.48	8.10	8.13	8.10	8.13	8.14	8.32	8.32	8.26E	8.15	25
26	8.10	7.68	7.46	8.12	8.17	8.06	8.13	8.18	8.32	8.34	8.28E	8.13	26
27	8.08	7.67	7.46	8.14	8.20	8.02	8.14	8.18	8.32	8.34	8.30E	8.11	27
28	8.05	7.67	7.44	8.17	8.22	7.99	8.18	8.17	8.30	8.33	8.31E	8.07	28
29	8.02		7.45	8.20	8.23	7.98	8.16	8.20	8.30	8.32	8.33E	8.09	29
30	7.98		7.65	8.23	8.24	7.97	8.15	8.20	8.32	8.33	8.35E	8.08	30
31	7.95		7.97		8.25		8.16	8.20	8.32	8.32		8.06	31
MEAN	8.14	7.75	7.57	8.25	8.20	8.23	8.11	8.14	8.22	8.33	8.25	8.30	MEAN
MAX	8.26	7.91	7.97	8.46	8.50	8.42	8.18	8.20	8.32	8.36	8.35	8.45	MAX
MIN	7.95	7.67	7.44	8.10	8.04	7.97	7.98	8.07	8.15	8.30	8.18	8.06	MIN

SUMMARY FOR THE YEAR 1977

MEAN WATER LEVEL, 8.13 FT
MAXIMUM DAILY WATER LEVEL, 8.50 FT ON MAY 6
MINIMUM DAILY WATER LEVEL, 7.44 FT ON MAR 28
MAXIMUM INSTANTANEOUS WATER LEVEL, 8.51 FT AT 0901 PST ON MAY 6

TYPE OF GAUGE - RECORDING
LOCATION - LAT 49 21 12 N
LONG 119 34 48 W

A-MANUAL GAUGE
E-ESTIMATED
REGULATED

WATER LEVELS ARE REFERRED TO ASSUMED DATUM.
APPLY 1100.42 FT ADJUSTMENT TO CONVERT TO GEODETIC SURVEY OF CANADA DATUM (LOCAL 1959 ADJ.)

MEMPHREMAGOG (LAC) A MAGOG
NIVEAUX D'EAU QUOTIDIENS EN PIEDS - 1977

STATION NO. 020E012

JOUR	JAN	FEB	MAR	AVR	MAI	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JOUR
1	681.10	679.85	679.16	681.86	681.73	681.03	680.80	680.33	680.63	682.48	681.46	681.86	1
2	681.07	679.74	679.18	682.01	681.69	680.97	680.77	680.28	680.61	682.75	681.44	681.88	2
3	681.05	679.67	679.16	682.13	681.65	680.92	680.74	680.22	680.63	682.81	681.44	681.86	3
4	681.01	679.64	679.14	682.13	681.64E	680.88	680.75	680.16	680.65	682.79	681.48	681.83	4
5	680.95	679.61	679.20	682.13	681.64E	680.88	680.68	680.12	680.67	682.69	681.60	681.77	5
6	680.89	679.60	679.21	682.13	681.57E	680.85	680.66	680.12	680.67	682.59	681.63	681.80	6
7	680.84	679.58	679.20	682.08	681.47	680.88	680.63	680.13	680.65	682.38	681.60	681.88	7
8	680.79	679.56	679.19	682.00	681.45	680.89	680.64	680.12	680.66	682.23E	681.56	681.93	8
9	680.74	679.52	679.21	681.90	681.41	680.84	680.59	680.04	680.72	682.09E	681.51	681.92	9
10	680.70	679.50	679.23	681.76	681.38	680.77	680.58	680.00	680.70	682.08	681.53	681.88	10
11	680.71	679.46	679.27	681.66	681.42	680.76	680.58	679.99	680.63	682.02	681.62	681.82	11
12	680.66E	679.42	679.37	681.56	681.43	680.82	680.61	679.96	680.63	682.08	681.69	681.75	12
13	680.61E	679.40E	679.56	681.54	681.37	680.76	680.61	679.94	680.67	682.05	681.72	681.74	13
14	680.56	679.38E	679.91	681.63	681.34	680.72	680.60	679.94	680.79	682.01	681.76	681.80	14
15	680.51	679.36	680.39	681.68	681.33	680.67	680.60	679.92	680.96	682.08	681.75	681.86	15
16	680.47	679.35	680.83	681.69	681.32	680.64	680.58	679.88	681.06	682.14	681.75	681.88	16
17	680.43E	679.34	681.22	681.67	681.29	680.62	680.58	679.97	681.11	682.26	681.81	681.84	17
18	680.39E	679.32	681.40	681.62	681.23	680.58	680.59	680.14	681.17	682.44	682.00	681.80	18
19	680.36E	679.30	681.48	681.56	681.20	680.67	680.62	680.21	681.15	682.41	682.13	681.74	19
20	680.28	679.27	681.49	681.48	681.16	680.70	680.60	680.26	681.13	682.30	682.23	681.66	20
21	680.23	679.27	681.47	681.42	681.16	680.66	680.58	680.32	681.31	682.25	682.33	681.59	21
22	680.18	679.25	681.41	681.38	681.19	680.67	680.50	680.41	681.53	682.09E	682.23	681.56	22
23	680.12	679.21	681.38	681.39	681.17	680.67	680.49	680.42	681.64	681.95E	682.10	681.56	23
24	680.06	679.18	681.32	681.44	681.18	680.67	680.50	680.42	681.71	681.82E	682.03	681.55	24
25	680.00	679.19	681.22	681.55	681.17	680.71	680.48	680.49	681.78	681.70E	681.89	681.56	25
26	679.99	679.19	681.12	681.66	681.10	680.73	680.43	680.54	681.85	681.58	681.86	681.60	26
27	679.96	679.15	681.01	681.75	681.08	680.78	680.40	680.58	682.15	681.46	681.98	681.61	27
28	679.90	679.17	680.94	681.80	681.06	680.77	680.39	680.62	682.30	681.45	681.94	681.60	28
29	679.88		681.02	681.80	681.07	680.82	680.39	680.64	682.43	681.47	681.91	681.61	29
30	679.87		681.20	681.75	681.08	680.83	680.37	680.60	682.44	681.51	681.87	681.59	30
31	679.87		681.54		681.05		680.35	680.63		681.50		681.58	31
MOY	680.46	679.41	680.34	681.74	681.32	680.77	680.57	680.24	681.17	682.11	681.80	681.74	MOY
MAX	681.10	679.85	681.54	682.13	681.73	681.03	680.80	680.64	682.44	682.81	682.33	681.93	MAX
MIN	679.87	679.15	679.14	681.38	681.05	680.58	680.35	679.88	680.61	681.45	681.44	681.55	MIN

SOMMAIRE POUR L'ANNEE 1977

NIVEAU D'EAU MOYEN, 680.98 PI
NIVEAU MAXIMUM QUOTIDIEN, 682.81 PI LE 3 OCT
NIVEAU MINIMUM QUOTIDIEN, 679.14 PI LE 4 MAR
NIVEAU MAXIMUM INSTANTANÉ, 682.86 PI LE 4 OCT A 1435 HNE

TYPE DE JAUGE - ENREGISTREUSE
EMPLACEMENT - LAT 45 16 01
LONG 72 09 38

E-ESTIMATIVE
REGULARISE

PLAN DE REFERENCE: SERVICE GEODESIQUE DU CANADA (ANCIEN DATUM)
AJOUTER 0.13 PI POUR OBTENIR LES COTES GEODESIQUES

6.4 Supplying Data to Users - Format Descriptions

Daily water level data can be supplied to the users either on cards or magnetic tape. A period of record summary listing as shown in the example below is also provided. When data are requested on magnetic tape, the tapes are written in EBCDIC (odd parity on 9-track) at a density of 1600 bpi but can be supplied in EBCDIC at a density of 800 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 unblocked card images on tape. A blocking factor of 40 (3200-character blocks) is suggested. 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.

WATER SURVEY OF CANADA
NOV 29 1978 PAGE 1
VANCOUVER, B.C.

SUMMARY OF DAILY WATER LEVEL RECORDS FOR STATION NO. 08MG012

	1 8 9	1 9 0	1 9 1	1 9 2	1 9 3	1 9 4	1 9 5	1 9 6	1 9 7	1 9 8	1 9 9
	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789
JAN	-----	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CPCCC	CPCCC PCCCP	PCPPC CCC -	JAN
FEB	-----	-----	-----	-----	-----	CCCCC CCCCC	CCCCC CPCCC	CCCCC CCCCC	CPCCC CCCCC	CPCCC CCC -	FEB
MAR	-----	-----	-----	-----	-----	CCCCC CCCCC	CCCCC CPCCC	CCCCC PCCCC	CPCCC CCCCC	CCCCC CCC -	MAR
APR	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC PCCCC	CPCCC CCCCC	CCCCC CCC -	APR
MAY	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CPCCC	CPCCC CCCCC	CCCCC CCC -	MAY
JUN	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CPCCC	CPCCC CCCCC	CCCCC CCC -	JUN
JUL	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CPCCC CCCCC	CCCCC CCC -	JUL
AUG	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CPCCC	CPCCC CCCCC	CCCCC CCC -	AUG
SEP	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CPCCC CCCCC	CCCCC CCC -	SEP
OCT	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CPCCC CCCCC	CCCCC CCC -	OCT
NOV	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CPCCC CCCCC	CCCCC CCC -	NOV
DEC	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CCCCC CCCCC	CPCCC CCCCC	PPPPC PCC -	DEC
YEAR	-----	-----	-----	-----	-----	PC CCCCC	CCCCC CCCCC	CCCCP PFFFF	PCPCP PCCPP	PPPPC PCC -	YEAR
STATION-MONTHS	COMPLETE		PARTIAL		TOTAL		KEY TO TABLE				
STATION-YEARS	504		11		515		MISSING -				
	27		18		45		PARTIAL P				
NUMBER OF MONTHS BEFORE 1890					0		COMPLETE P				

KEY TO TABLE
MISSING -
PARTIAL P
COMPLETE C

SUMMARY OF DAILY WATER LEVEL RECORDS FOR STATION NO. 08MG014

	1 8 9	1 9 0	1 9 1	1 9 2	1 9 3	1 9 4	1 9 5	1 9 6	1 9 7	
	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	01234 56789	
JAN	-----	-----	-----	-----	-----	-----	-----	-----	-----	
FEB	-----	-----	-----	-----	-----	-----	-----	-----	-----	
MAR	-----	-----	-----	-----	-----	-----	-----	-----	-----	
APR	-----	-----	-----	-----	-----	-----	-----	-----	-----	
MAY	-----	-----	-----	-----	-----	-----	-----	-----	-----	
JUN	-----	-----	-----	-----	-----	-----	-----	-----	-----	
JUL	-----	-----	-----	-----	-----	-----	-----	-----	-----	
AUG	-----	-----	-----	-----	-----	-----	-----	-----	-----	
SEP	-----	-----	-----	-----	-----	-----	-----	-----	-----	
OCT	-----	-----	-----	-----	-----	-----	-----	-----	-----	
NOV	-----	-----	-----	-----	-----	-----	-----	-----	-----	
DEC	-----	-----	-----	-----	-----	-----	-----	-----	-----	
YEAR	-----	-----	-----	-----	-----	-----	-----	-----	-----	
STATION-MONTHS	COMPLETE		PARTIAL		TOTAL		KEY TO TABLE			
STATION-YEARS	449		10		459		MISSING -			
	28		12		40		PARTIAL P			
NUMBER OF MONTHS BEFORE 1890					0		COMPLETE			

KEY TO TABLE
MISSING -
PARTIAL P
COMPLETE C

6.4.1 Daily Water Levels on Cards (or Tape) - COPLEV - J21051

This retrieval program always produces the period of record summary with two stations per page for the stations requested and has the option of punching 3 cards or card images on tape per month of only the daily water levels in the following format, called 67-002:

<u>Column(s)</u>	<u>Description</u>
1	code for type of data and units: 4 - water levels in hundredths of feet 5 - water levels in tenths of feet
2-8	station number, e.g. 08AA023
9-11	year, e.g. "968" for 1968
12-13	month, e.g. "b7" for July
14	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	ten or eleven 6-digit data fields.

Each data field has 6 positions. Water levels are punched right justified with no decimal point shown, therefore the values shown are in hundredths of feet or tenths of feet depending on whether the type of data is a 4 or 5 respectively. A negative value is entered with a minus sign just to the left of the number, e.g. -12.3 or -0.01. The value "-99999" is entered for missing daily water levels and "-11111" is used for days which are not applicable, such as November 31. The date shown on the card applies to the first data field in columns 15-20. The successive fields are for consecutive days. The first card (1 in column 14) contains 10 days from day 1 to day 10 with the datum code in columns 76-78 and the number of days in the month, e.g. 30 for November, punched in columns 79-80. The second card (2 in column 14) contains 10 days from day 11 to day 20 with columns 75-80 blank. The third card (3 in column 14) contains 11 days from day 21 to day 31.

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

This retrieval program produces either punched cards or card images on tape in the following format called 76-113:

<u>Column(s)</u>	<u>Description</u>
1	code for type of data: 1 - FLOW data in cfs 4 - LEVELS data in feet
2	blank
3-17	first and last station to be selected, e.g. 01AA001-99ZZ999 if all stations are to be retrieved; columns 3-9 contain the first station and columns 11-17 contain the last station
18	blank
19-27	first and last years to be selected, e.g. 1800-1986 if all years are to be retrieved columns 19-22 contain the first year columns 24-27 contain the last year
28	blank
29-30	Region to be selected; it is possible to have an input tape with

more than one Region and to retrieve stations from more than one Region using several cards as long as the ascending station number order within the Region is maintained

31 blank

32 code for output type:
 C - output on cards
 T - output on tape

33-80 blank.

6.5 Annual Water Level Hydrograph Program

Annual hydrographs may be produced for any station-year(s) that appears on the master or annual LEVELS file. The hydrographs are plotted on white paper by a Calcomp drum plotter using a linear hydrograph scale. The resulting 11 by 17 inch plots do not contain the grid but may be used as an overlay onto a standard 067-2001 hydrograph form if it is desirable to determine values from the plot.

These 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.

6.6 Continuous Hydrographs for Regions

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

The size of the annual plots are determined by the scaling factor: normal or default size is 11 X 17 inch plots.

6.7 Comparison Hydrograph Program HYPLEV

This program was written for the Data Review Unit to provide a visual check when comparing the daily water levels at stations on the same body of water. The program plots linear annual hydrographs for one to five stations on a single graph. For each station being plotted the water level data may have a conversion factor added to bring all stations to the same datum.

7. INSTRUCTIONS FOR COMPUTER RUNS FOR FILE MAINTENANCE

Data can be stored on the master LEVELS file in four steps which can be run either as individual jobs or as one complete job submission. Each individual job is described in detail giving the program description, the computer control card setup, and the quality control checks. After this, the complete job submission describes the computer control card setup and the references to the quality control checks in each job step.

7.1 Individual Job Submissions

If a large amount of data is to be processed as quickly as possible it is advantageous to submit each job consecutively 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 will not be processed until the evening shift. Each of the 4 steps involved are described below.

7.1.1 Step 1 - CARD-to-TAPE Program (CARD-J21075)

7.1.1.1 Description

The purpose of this program is to read 80-character records containing daily water level data 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 program. 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 when run singly or on disk when run together with the SORT. The last block of the output file is padded to fill the block, and padding appears as "9999ZZ9999" and seventy blanks for each record.

7.1.1.2 Control Card Set-up

K2000,CM50000,P2,T100,NT1,MT1.

See Note 1

ACCOUNT,XXXXX. CARD-TO-TAPE

See Note 2

MOUNT,VSN=EMR107,SN=AHD.

SETNAME,AHD.

REQUEST(TAPE1,HY,S,SV) MOUNT TAPE NO. XXXX WITHOUT A RING

See Note 3

LABEL(TAPE2,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX)

See Note 4

ATTACH(LIB,FLOW,ID=LIBRARY,MR=1)

LIBRARY(LIB)

CARD.

7/8/9

multipunch in column one

DATE MAR 08 1978

See Note 5

WSC-1000-58 9999

See Note 6

DATA CARDS ARE INCLUDED HERE IF REQUIRED

6/7/8/9

multipunch in column one

Note 1: "Job" card. The "Job" card must specify the maximum amount of central memory, CM, the maximum time in octal seconds, T, the priority, P and the number of tape drives required, MT and NT. The MT parameter is only required when tape input and/or output are used.

Note 2: "Account" card. Each job to be processed must also have an "Account" card containing a valid account number to which the cost of this job will be billed. Thus in this fashion each user pays for only the services he requires. The programmers name and address can begin anywhere after column 15 and these will appear in the monthly bills. Alternatively, the name of the program could be punched here. When comments extend past column 40, spaces should be provided so complete words end before column 40 and remaining comments start after column 41. This is done to enhance the readability of the dayfile.

Note 3: "Request" card. This card is required only if there is an unlabelled input tape. "XXXX" is the visual reel number to be mounted.

Note 4: "Label" card for the output tape. T=XXX is the retention period parameter in days and is up to three numeric characters. Normally this is set to 999 for infinite retention. But if a tape is only required for a "short" time then T=30 may be used.

Note 5: Standard "Date" card. When input is card images on tape, column 21 must be any non-zero numeric character, usually 1.

Note 6: "Output File Identification" card.
"WSC-1000-" is the file identification.

"58" 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).

7.1.1.3 Quality Control Checks

From page one of the program listing compare the following:

- (a) The date printed to the "Date" card.
- (b) The listing header file EMR-WSC-1000-58 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 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, subtract 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	125

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.

7.1.2 Step 2 - SORT Utility

7.1.2.1 Description

The card images are sorted on a 13-character field which contains a 1-character Region code, a 7-character station number, a 3-character year and a 2-character month. After sorting, the card images are arranged in Region number order, within Region in station number order, within station in year and month order. The core required is 40,000 octal words of central memory and the time to sort one thousand card images is five seconds. The input is from the CARD-to-TAPE program (J21075). The sorted output can now be used by either of the two EDIT programs. 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.

7.1.2.2 Control Card Set-up

K2001,CM60000,P2,T100,NT2.	
ACCOUNT,XXXXX. SORT	See Note 1
LABEL(TAPE2,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX)	See Note 2
LABEL(TAPE3,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX)	See Note 3
FILE(TAPE2,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)	
FILE(TAPE3,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)	
SORTMRG.	
7/8/9	multipunch in column one
SORT	See Note 4
FILE,INPUT=TAPE2(C),OUTPUT=TAPE3(R).	See Note 5
FIELD,IDENT(2,15,DISPLAY)	See Note 6
KEY,IDENT(A,DISPLAY)	See Note 7
EQUATE,DISPLAY(,0)	See Note 8
END	See Note 9
6/7/8/9	multipunch in column one

Note 1: "Account" card. See the "Account" card in Note 1 of the CARD-to-TAPE.

- Note 2: "Label" card for the input tape from Step 1, CARD-to-TAPE. ERXXXX is the visual reel number taken from the dayfile of the CARD-to-TAPE program.
- Note 3: "Label" card for the output tape. T=XXX is the retention cycle parameter and can be up to three numeric characters.
- Note 4: "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 5: "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 6: "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 no 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 Optional 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 7: "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 directive; therefore, they may not be used in other positions.

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

order Specifies 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 assumes 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 8: "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 9: "End" control card. This card terminates the control cards to the sort/merge and must appear as the last sort/merge control card.

7.1.2.3 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 in 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.

7.1.3 Step 3 - EDIT Program (EDTLEV-J21101)

7.1.3.1 Description

The sorted card images are edited, invalid data are rejected and an edit tape in master file format with 300-character records blocked 15 is created. For a complete definition of all validity checking carried out in this EDIT program, refer to the "Description of Errors" section, which follows. The core required is 45,000 octal words of central memory and the time to process one thousand card images is fifty seconds. The input is a sorted card image file created in the sort step. The output file, in master file format, can be written to tape or disk and also printed on the output print file (see "Date" card Note 3). The tape or disk file created can also be printed by using the provisional listing program DAYLEV (J21049).

7.1.3.2 Control Card Set-up

```
K2002,CM70000,P2,T200,NT2.
ACCOUNT,XXXXX. LEVELS EDIT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL(TAPE3,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX) See Note 1
LABEL(TAPE4,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX) See Note 2
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
ATTACH(TAPE9,HYDEX,ID=DATA,MR=1)
FILE(TAPE7,FO=SQ,RT=F,BT=C,FL=300,CM=YES)
LDSET(FILES=TAPE7)
EDTLEV.
7/8/9 multipunch in column one
DATE MAR 12 1977 See Note 3
A03WSC-1000-08 9999 See Note 4
J04WSC-1101-08 9999 See Note 5
6/7/8/9 multipunch in column one
```

Note 1: "Label" card: This input is from the SORT program. ERXXXX is the visual reel number taken from the dayfile of the SORT program.

Note 2: "Label" card for the output file, T=XXX is the retention period and is from one to three numeric characters.

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.

7.1.3.3 Quality Control Checks

The dayfile should be checked for fatal system errors.

The program listing contains a tape I/O request, Region listings and summaries, a Job summary, and a standard tape summary.

The Tape I/O request lists 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 Tape summary page follows the Job summary and contains the error codes. For example, the job is terminated if there are more than sixteen sequential parity errors either on the input or output tape.

The number of "Records on File" for the input tape will always be three less than the number of "Records Processed". This is because the "Header" record, the "End-of-Data" record, and the "Trailer" record are not counted.

The "I/O Faults" indicates the total number of parity errors encountered during I/O operations for the specified tape.

The "Type", "Status", and "Error" codes can be interpreted by referring to section 9.1 Tape Summary Codes.

The Region listings and summaries are checked for any error messages. A sample Region listing as shown below indicates a range of errors that may occur at some time while running this program.

EDTLEV
(1000-

WATER SURVEY OF CANADA

NOV 29 1978

PAGE

STATION NUMBER	RECORD COUNT	NO. OF MONTHS	NO. OF YEARS	ERROR DIAGNOSTICS									
DISTRICT NO. 2 VANCOUVER, B.C.													
				TYPE ERROR	5207EE008974	110	10.20+20.20+						
				FIELD ERROR	4207EE008974	201	1.00+2.00+3.00+4.00 5.00+						
				FIELD ERROR	4207EE008974	210	1.0+2.0+3.0+4.0+5.0+						
				FIELD ERROR	4207EE008974	215	6.0						
				IDENT ERROR	4207EE008674	301							
				IDENT ERROR	4207EE008974	342							
				DUPLICATION ERROR	4207EE008974	410	6.50+						
07EE008	4	3	1	1 DUPLICATION ERRORS 2 IDENTIFICATION ERRORS 6 FIELD ERRORS 7 ERROR CARDS									
				INVALID PLUS SIGN	4207EE009974	501	1.00+2.00+3.00+4.00+5.00						
07EE009	4	0	2	0 DUPLICATION ERRORS 0 IDENTIFICATION ERRORS 0 FIELD ERRORS 2 ERROR CARDS									
07FC005	6	2	3	NO ERRORS									
SUMMARY FOR THE DISTRICT													
3 STATIONS													
3 STATION-YEARS													
5 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 for that station.

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.

7.1.3.3.1 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 8), 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 an invalid day. Note that the month code is set to zero if it was found erroneous by the CARD-to-TAPE program.

7.1.3.3.2 Type Errors

Although the EDIT program allows daily water level data to be entered in either tenths or hundredths of feet, data types cannot be mixed within one station-month of data since the output records can only contain data of one type. If this situation arises, the type code for the card with the lowest data takes precedence and all subsequent cards for that station month that contain a different type of data code are rejected. The error message "TYPE ERROR" along with the contents of the data fields are printed for each card.

7.1.3.3.3 Field Errors

Field errors can occur from either an illegal daily water level value, such as 1A2, or an invalid symbol, such as Q. The only valid symbols are A, E, N, and X. The daily water level value must appear first if one is present and be followed by the symbol. Each daily water level value cannot exceed 7 digits including the decimal point and minus sign. If the type of data code indicates water levels in tenths, all daily value is hundreds are rejected to field errors, and vice versa.

7.1.3.3.4 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:

5202RB014072FEB15	17.0+18.0+19.0+20.0A+21.0A+22.0E+23.0E+IJE+
5202RB014972FEB15	17.0+18.0+19.0+20.0A+21.0B+22.0E+23.0E+25.0+26.0+27.0+28.0+ 29.0+30.0+31.0+

An error was made while punching the daily data for the eighth day on the first card. A second card was punched but the first one was not removed so that the same seven valid days appeared on both cards. Thus the EDIT program will detect seven duplications and one field error. When the first card was read the data for the seven valid days, February 15 to February 21, would be stored correctly but there would be nothing stored for February 22 because of the field error. The data from the second card for February 15 to February 21 would then be stored over that from the first card and all the remaining data on this card would be stored for February 22 to February 29.

7.1.3.3.5 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.

7.1.3.3.6 Other Errors

If the EDIT program cannot find the station number on the HYDEX file, a warning message to that effect is printed before the station is processed. In such a case, the datum code on each output record for that station is left blank.

7.1.4 Step 4 - UPDATE Program (UPDFLO-J21062)

7.1.4.1 Description

The edited file, either tape or disk, is used to add, amend, or delete data from either the historical LEVELS file, the annual LEVELS file or a previously created edit file. All files are in master file format, 300-character records, blocked 15. The core required is 60,000 octal words of central memory, and the time to process one thousand records is approximately fifteen seconds. The total number of input records is the determining factor in timing. The "Priority" control card indicates which input file shall have precedence, whether one district (historical LEVELS) several districts (historical LEVELS) or all district (annual LEVELS), or whether a previously created file is to be edited (annual + historical corrections).

7.1.4.2 Control Card Set-up

K2003,CM70000,P2,T500,NT3.

ACCOUNT,XXXXX. LEVELS UPDATE

MOUNT,VSN=EMR107,SN=AHD.

SETNAME,AHD.

LABEL(TAPE4,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.

See Note 1

LABEL(TAPE5,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.

See Note 2

LABEL(TAPE6,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.

See Note 3

ATTACH(LIB1,FLOW,ID=LIBRARY,MR=1)

ATTACH(LIB2,LEVELS,ID=LIBRARY,MR=1)

LIBRARY(LIB1,LIB2)

ATTACH(TAPE7,HYDEX,ID=DATA,MR=1)

FILE(TAPE7,FO=SQ,RT=F,BT=C,FL=300,CM=YES)

LDSET(FILES=TAPE7)

UPDLEV.

7/8/9

multipunch in column one

6/7/8/9

multipunch in column one

Note 1: "Label" card for the input file containing corrections.
"XXXX" is the visual reel number.

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.

DATE APR 11 1977

A0B0 C

See Note 4

A05WSC-1701-07 XXXX

See Note 5

B04WSC-1101-08 XXXX

See Note 6

J06WSC-1701-08 9999 01AA001-99ZZ999

See Note 7

4502BF010 1973 L

9999ZZ999

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.

EXAMPLE 1 CORRECTING AN EDITED TAPE

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-1701-07" tape label of edit 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-1701-08" tape label of corrected output file.
"9999" reference digits; any four.
"01AA001-99ZZ999" station range to be corrected.

EXAMPLE 2 UPDATING THE ANNUAL FILE

DATE APR 11 1973	standard "Date" card
A0B1	See Note 8
A05WSC-1777-27 XXXX	See Note 9
B04WSC-1101-08 XXXX	See Note 10
J06WSC-1777-27 9999 01AA001-99ZZ999	See Note 11
4502BF010 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 Identification" card.

"A05" file named "TAPE5".
"WSC-1777-27" tape label of old annual LEVELS file.
"XXXX" visual reel number (Note 2).

Note 10: "Input File Identification" card.

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

Note 11: "Output File Identification" card.

"J06" file named "TAPE6".
"WSC-1777-27" tape label of new annual LEVELS 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 Key punching Instructions. If for example a valid extreme code of B is to be changed to H it is only necessary to key punch 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.

EXAMPLE 3 UPDATING THE HISTORICAL FILE CONTAINING ONE DISTRICT

DATE APR 11 9173	standard "Date" card
A0B1 3	See Note 13
A05WSC-1701-27 XXXX	See Note 14
B04WSC-1201-08 XXXX	See Note 15
J06WSC-1701-27 9999 01AA001-99ZZ999	See Note 16
4306JA017 1942 B	
9999ZZ999	

Note 13: "Priority" control card.

"A0B1" corrections tape has priority. "B1" indicates priority tape.
"3" specific Region to be updated.
2 - Vancouver 4 - Winnipeg
3 - Calgary 5 - Guelph, etc.

Note 14: "Input File Identification" card.

"A05" file named "TAPE5".
"WSC-1701-27" tape label of old historical LEVELS file.
"XXXX" visual reel number (Note 2).

Note 15: "Input File Identification" card.

"B04" file named "TAPE4".
"WSC-1201-08" tape label of annual LEVELS file used to update historical LEVELS file and create yearly publications.
"XXXX" visual reel number (Note 1).

Note 16: "Output File Identification" card.

"J06" file named "TAPE6", output.
"WSC-" tape label (Water Survey of Canada).
"1701-" "17" numeric LEVELS file identifier
"01" number of the reel for master LEVELS tapes
"27" file generation number - if you add 50 to this number you get the last year stored on that tape.
"9999" reference digits.
"01AA001-99ZZ999" station range.

EXAMPLE 4 UPDATING THE HISTORICAL FILE CONTAINING SEVERAL DISTRICTS

DATE APR 11 1973	standard "Date" card
A0B1 3 4	See Note 17
A05WSC-1702-27 XXXX	See Note 18
B04WSC-1201-08 XXXX	See Note 19
J06WSC-1702-27 9999 01AA001-99ZZ999	See Note 20
4306JA017 1942 B	
9999ZZ999	

Note 17: "priority" control card.

"A0B1" corrections tape has priority. "B1" indicates
priority tape.
"3 4" specific Region range to be updated.
2 - Vancouver 4 - Winnipeg
3 - Calgary 5 - Guelph, etc.

Note 18: "Input File Identification" card.

"A05" file named "TAPE5".
"WSC-1702-27" tape label of old historical LEVELS file.
"XXXX" visual reel number (Note 2).

Note 19: "Input File Identification" card.

"B04" file named "TAPE4".
"WSC-1201-08" tape label of annual LEVELS file used to update
historical LEVELS file and create yearly publications.
"XXXX" visual reel number (Note 1).

Note 20: "Output File Identification" card.

"J06" file named "TAPE6", output.
"WSC- tape label (Water Survey of Canada).
"1702- "17" numeric LEVELS file identifier
"02" number of the reel for master LEVELS tapes
"27" file generation number - if you add 50 to this number
you get the last year stored on that tape.
"9999" reference digits.
"01AA001-99ZZ999" station range

7.1.4.3 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 10.1 Tape Summary Codes of this publication.

If processing has continued, the program will print one line per station showing which years are missing, partial, or complete and the cumulative number of records for that station. A line is also printed for each station showing the valid extremes for the incomplete years. A sample listing is shown below.

UPDLEV (1701-27)(- 0)		WATER SURVEY OF CANADA										NOV 29 1978		PAGE	
SUMMARY OF WATER LEVEL RECORDS															
OUTPUT TAPE RECORD COUNT	1 9 1 01234 56789	1 9 2 01234 56789	1 9 3 01234 56789	1 9 4 01234 56789	1 9 5 01234 56789	1 9 6 01234 56789	1 9 7 01234 56789	1 9 8 01234 56789	1 9 9 01234 56789	1 9 0 01234 56789	1 9 1 01234 56789	1 9 2 01234 56789	1 9 3 01234 56789	STATION NO.	DIST.
53	-----	-----	-----	-P-PP-PPPP	PPPP-	-----	-----	-----	-----	-----	-----	-----	-----	*****	08MH018 VANC.
563	-----	-----	-----	---PPP HHH	CCPPP CPPP- BBBB BH	-----	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MF017 VANC.
684	-----	-----	-----	-----	-----	---PP	PPPPP HH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08ME019 VANC.
1458	-----	---PPP CCCPC HHB B	CCCCP CPPCP H BB B	CCPPP CCPPC BBB BH	PPCCC CCCPP LB BB	PPPCP PPPPP HHB B BHHB	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MF005 VANC.
1499	-----	-----	-----	P P-PPP PPPPP	PPPP-	-----	-----	-----	-----	-----	-----	-----	-----	*****	08MF017 VANC.
1727	-----	-----	-----	-----	-----	-----	P H	PPPPP HHH	PPCCC B	CCPPP PPCP- BBB BH H	-----	-----	-----	*****	08MF015 VANC.
1733	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	*****	08MF052 VANC.
1911	-----	-----	-----	---PC PPPPP H HHHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	P- H	-----	-----	-----	-----	-----	*****	08MF064 VANC.
2448	-----	-----	-----	---PC H B	CCCCC B	CCCCC B	CCCCC B	CCCCP PPPPP B BHHB	PCPCP PCCPP H B H HH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MG012 VANC.
2927	-----	-----	-----	---PC H	CCCCC B	CCCCC B	CCCCC B	CCCCP CCCC B	CCCCP CCCC B	CCCCP CCCC B	CCCCP CCCC B	CCCCP CCCC B	CCCCP CCCC B	*****	08MG014 VANC.
3002	-----	-----	-----	-----	-----	-----	-----	-----	-----	PPCP PCP- HH H H	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MG020 VANC.
3057	-----	-----	-----	-----	-----	-----	-----	-----	-----	PP PC BB BB	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MG022 VANC.
3406	-----	-----	-----	PPPPP HH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MH029 VANC.
3417	-----	-----	-----	-----	P L	-----	-----	-----	-----	-----	-----	-----	-----	*****	08MH011 VANC.
3521	-----	-----	-----	-----	-----	-----	-----	PPPPP PCCPP B	P- H	-----	-----	-----	-----	*****	08MH046 VANC.
3828	-----	-----	-----	-----	-----	---PPC CCCPC	CCCCC B	CCCCC B	CCCCC B	CCCCC B	CCCCC B	CCCCC B	CCCCC B	*****	08MH047 VANC.
3842	-----	-----	-----	-----	-----	-----	-----	-----	-----	---PC	PPPPP HHH	PPPPP HHH	PPPPP HHH	*****	08MH068 VANC.

Five types of warning messages can appear within this summary. These messages are as follows:

1. FOR mmm yyyy OF xxxxxx THE UNITS HAVE CHANGED FROM HUNDREDTHS TO TENTHS

where mmm is the month, yyyy is the year and xxxxxx is the station number. This message indicates that a record with water levels in hundredths (type 7) has been updated with a record with water levels in tenths (type 8). In such a case, all data fields for the old record (type 7) are dropped and only the data fields for the new record (type 8) are outputted. The same situation arises when going from tenths to hundredths.

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

where xxxxxxxx is the station number, yyyy is the year and mm is the month. This indicates that a record containing symbol codes of 2,3,4,8 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.

3. DISTRICT n STATION NUMBER xxxxxxxx YEAR yyyy CODE OF z HAS NOT BEEN UPDATED

where n is the Region number, xxxxxxxx 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 file.

4. THE FOLLOWING STATION IS NOT ON HYDEX

This message indicates that the following station could not be found on the HYDEX file.

5. WARNING ** NNNNNN STATION-MONTHS FOR ABOVE STATION ARE NOT REFERRED TO CURRENT
DATUM

where NNNNNN is a right justified number with leading zeroes suppressed. This indicates that there are water level records for a particular station which contain datum codes different then the current datum stored on the HYDEX file.

At the end of processing the completion codes for each file are printed in tabular form. The table also lists the number of records on the file, number of records processed and whether or not any parity errors were encountered. The completion codes are interpreted in Section 10.1 of this publication.

7.2 Complete Job Submission

7.2.1 Description

Control decks can be prepared to produce either an edited file of corrections, steps 1 to 3, or to also update a file, 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 DAYLEV 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 DAYLEV program control cards required to print either the entire file or only the corrections.

7.2.2 Control Card Set-up to Produce an Edit File

```
K2004,CM70000,P2,T1000,NT2.
ACCOUNT,XXXXX. LEVELS CTT-SORT-EDIT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
CARD.
FILE(TAPE2,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)
FILE(TAPE3,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)
SORTMRG.
LABEL(TAPE4,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX) See Note 3 for EDIT program
ATTACH(TAPE7,HYDEX,ID=DATA,MR=1)
FILE(TAPE7,FO=SQ,RT=F,BT=C,FL=300,CM=YES)
LDSET(FILES=TAPE7)
EDTLEV.
7/8/9 multipunch in column one
DATE APR 17 1977 standard "Date" card
WSC-1000-58 9999 See CARD-to-TAPE notes
.
.
DATA CARDS OF CORRECTIONS ARE INCLUDED HERE
.
.
7/8/9 multipunch in column one
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 multipunch in column one
DATE APR 17 1977 standard "Date" card
A03WSC-1000-08 9999 See EDIT program notes
J04WSC-1101-08 9999 See EDIT program notes
6/7/8/9 multipunch in column one
```

7.2.3 Control Card Set-up to Update a File

K2004,CM70000,P2,T1000,NT2.
ACCOUNT,XXXXX. LEVELS CTT-SORT-EDIT-UPDATE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
CARD.
FILE(TAPE2,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)
FILE(TAPE3,RT=F,BT=K,FO=SQ,FL=80,RB=10,MRL=80,MBL=800)
SORTMRG.
ATTACH(TAPE7,HYDEX,ID=DATA,MR=1)
FILE(TAPE7,FO=SQ,RT=F,BT=C,FL=300,CM=YES)
LDSET(FILE=TAPE7)
EDTLEV.
LABEL(TAPE5,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX) See Note 3 for UPDATE program
LABEL(TAPE6,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.) See Note 4 for UPDATE program
LDSET(FILE=TAPE7)
UPDLEV.
7/8/9 multipunch in column one
DATE APR 17 1977 standard "Date" card
WSC-1000-58 9999 See CARD-to-TAPE notes

DATA CARDS OF CORRECTIONS ARE INCLUDED HERE

7/8/9 multipunch in column one
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 multipunch in column one
DATE APR 17 1977 standard "Date" card
A03WSC-1000-08 9999 See EDIT program notes
J04WSC-1101-08 9999 See EDIT program notes
7/8/9 multipunch in column one
DATE APR 17 1977 standard "Date" card
A0B0 See UPDATE program notes
A05WSC-1101-08 XXXX See UPDATE program notes
B04WSC-1101-08 9999 See UPDATE program notes
J06WSC-1101-08 8888 01AA001-99ZZ999 See UPDATE program notes
9999ZZ999
6/7/8/9 multipunch in column one

7.2.4 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 (1-9) must be punched in column 21 of the first "Date" card. The NT

parameter of the "Job" card must be increased by one or the MT parameter must be specified.

The sorted output may be required to be passed to the FLOW EDIT therefore will require a "Label" card inserted before the "SORTMRG" card.

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 submitter.

The NT and MT parameters of the "Job" card is the total number of drives required for tape input, saved outputs and possibly the intermediate output of the SORT.

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

7.2.5 Quality Control Checks

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

7.3 MOVE-and-DELETE Program (DELLEV-J20939)

7.3.1 Description

The purpose of this program is to read a main file and copy onto an output tape either all or part of the data records contained on the input tape, with the following options:

- the data records can be copied exactly as found on the input file.
- the data records can be copied under a new station number.
- the data records can be copied under a new Region number.
- the data records can be copied with modifications to the data.
- the data records can be copied with some insertions or deletions made to the symbol field.
- the data records can be copied with a delete code in all or part of the symbol fields so that the output file can be updated with the input file to delete the specified data.

7.3.2 Control Card Set-up

```

K2005,CM70000,P2,T100,NT2.
ACCOUNT,XXXXX. LEVELS MOVE-AND-DELETE
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
LABEL,TAPE3,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.      input tape
LABEL,TAPE4,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.            output tape
DELLEV.
7/8/9                      multipunch in column 1
DATE MAR 08 1977           standard "Date" card
A03WSC-1201-07 XXXX        "Input File Identification" card
J04WSC-4901-15 9999        "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                    multipunch in column 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. 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 generated 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,D,E,N,X or a 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 file for the station specified in columns 8-16.

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.
- A or E - the records specified in columns 8-40 will be copied to the output file with a code for the symbol A 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.

7.3.2.1 Examples for the "Move or Delete" card

1. 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.

2. 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.

3. Copying records for a given station with some modifications to the symbol fields:

67106 2 08LB001 JAN 01 1960 MAR 18 1960 A

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 "A" inserted in the symbol field for those days between January 1, 1960 and March 18, 1960.

4. 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.

5. 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.

6. 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.

7. Deleting part of a record for a given station:

67106 2 08LB001 JAN 01 1960 JAN 15 1960

The program will generate delete codes, figure and symbol codes of 9, for those days between 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.

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

<u>Column(s)</u>	<u>Description</u>
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
52-80	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.

7.3.2.2 Examples for the "Move and Delete" card

1. 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.

2. 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.

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.

7.3.3 Quality Control Checks

1. 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.
2. 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.

3. If only the "Move or Delete" card (67106) is used, the output file can be used immediately as input into the LEVELS 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 LEVELS 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).
4. 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 LEVELS UPDATE program that the file has been sorted and that the "Tape Trailer" record follows immediately after the "Tape Header" record.
5. The sort is done on the first thirteen characters of each record (Region number, station number, year and month).
6. 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:

7.3.4.1 Deck Set-up for only a Main File SORT

```

K2006,CM70000,P2,T100,NT2.
ACCOUNT,XXXX. LEVELS MAIN FILE SORT
LABEL,TAPE4,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.
LABEL,TAPE5,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.
FILE(TAPE4,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460,CM=YES)
FILE(TAPE5,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460,CM=YES)
SORTMRG.
7/8/9                                multipunch in column 1
SORT                                See Note 6
FILE,INPUT=TAPE4(C),OUTPUT=TAPE5(C). See Note 7
FIELD,IDENT(1,13,DISPLAY)           See Note 8
KEY,IDENT(A,DISPLAY)                See Note 8
EQUATE,DISPLAY( ,0)                 See Note 9
END                                  "End of SORT" card
6/7/8/9                             multipunch in column 1

```

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

```

K2007,CM70000,P2,T100,NT2.
ACCOUNT,XXXXX. LEVELS MOVE-AND-DELETE WITH SORT
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
LABEL,TAPE3,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.

```

DELLEV.

UNLOAD,TAPE3.

LABEL,TAPE5,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.

FILE(TAPE4,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460,CM=YES)

FILE(TAPE5,RT=F,FO=SQ,BT=K,FL=300,RB=15,MRL=300,MBL=4500,BFS=460,CM=YES)

SORTMRG.

7/8/9

multipunch in column 1

DATE MAR 08 1977

standard "Date" card

A03WSC-1201-07 XXXX

"Input File Identification" card

J04WSC-4901-55 9999

See Note 5

67106 04 02DA003 JAN 01 1965 DEC 31 1965 N

67105 06 01EC001 JAN 1950 MAR 1956 10EC001

99999

7/8/9

multipunch in column 1

SORT

See Note 6

FILE,INPUT=TAPE4(C),OUTPUT=TAPE5(R).

See Note 7

FIELD,IDENT(1,13,DISPLAY)

See Note 8

KEY,IDENT(A,DISPLAY)

See Note 8

EQUATE,DISPLAY(,0)

See Note 9

END

"End of SORT" card

6/7/8/9

multipunch in column 1

Note 5: The output file from the MOVE-and-DELETE program is assigned a generation number greater than 50 (55 in this example) to indicate to the LEVELS UPDATE program that the file has been sorted (i.e. the "Tape Trailer" record follows the "Tape Header" record).

Note 6: The sort is performed on a 13-character field of each 300-character record.

Note 7: 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, 1600 bpi density with a block size of 4500 characters. The "Data" records for both the input file and the output file of the SORT program have a fixed length (300 characters per record).

Note 8: 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 9: 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.

7.4 DATUM Program (DATUM-J21052)

This program is used to make adjustments to the water level figures because of a change of current datum and/or to make changes to the datum codes stored on the LEVELS file. These corrections, if necessary, are usually made after the annual or historical LEVELS file is updated.

The core requirement for this program is approximately 42,000 octal words and the timing is 3 seconds for every 1000 records on the input file plus approximately .5 seconds for every record updated.

7.4.1 Control Card Set-up

```
K2008,CM70000,PO,T1000,NT2.
ACCOUNT,XXXXX. DATUM
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
LABEL,TAPE3,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.   Input LEVELS file
LABEL,TAPE4,W,L=HISTLEV,F=S,X=SV,D=PE,N=EB,T=XXX.         Output LEVELS file
DATUM.
7/8/9                multipunch in column 1
DATE APR 16 1977                standard "Date" card
A03WSC-1701-11 XXXX            Input "File Identification" card
J04WSC-1701-12 9999            Output "File Identification" card
73108 04 05LM005 MAY 01 1966 SEP 30 1966    700.23        See Note 1
73108 04 05PB002 NOV 01 1914 SEP 30 1919    -1.40 035        See Note 1
73108 04 05PD010                    060        See Note 1
99999                                "End of Run" card
6/7/8/9                multipunch in column 1
```

Note 1: The "Datum Adjustment" card contains the Region, the station number and the range of dates which are to be adjusted, along with the adjustment figure and the new datum code. The card format is as follows:

Column(s)	Description
1-5	"73108"
6	blank
7-8	Region number, e.g. "02" for Vancouver
9	blank
10-16	station number
17	blank
18-28	beginning or "from" date from which data on the input file are to be adjusted, in the form "month-day-year", e.g. JAN 01 1950
29	blank
30-40	ending on "to" date up to which data on the input file are to be adjusted, in the form "month-day-year", e.g. DEC 31 1960
41	blank
42-51	adjustment factor to be applied to each water level figure; this field may be left blank if only the datum code is to be changed
52	blank
53-55	the new datum code to be inserted on each data record; this field may be left blank if the datum code is not to be changed
56-80	blank.

Columns 1-5 must always contain the digits "73108". Columns 7-16 identify the data on the input file and must always be present. The "from" and "to" dates 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 7-16.

7.5 LEVELS-MAXMIN-CK Program

This program is used to help keep all levels data correct and under the right datum. The core requirement for this program is approximately 34,000 octal words and the timing is 2 seconds for every 1,000 records on the input file.

7.5.1 Control Card Set-up

```
K1234,CM 40000,P2,T200,NT1.
ACCOUNT,XXXXX.  L-MAX-MIN-CK
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,LEVELS,R,F=S,X=SV,D=PE,N=EB,L=HISTLEV,VSN=ERXXXX.
ATTACH,LGO,LEVMAXMIN,ID=CK,CY=2,MR=1.      Main program
ATTACH,SR,LEVMAXMIN,ID=CK,CY=3,MR=1.      Subroutine
LOAD,SR,LGO.
EXECUTE.
7/8/9                      multipunch in column 1
030.00                      See note 1
6/7/8/9                    multipunch in column 1
```

Note 1: This input value tells the program to print out all exceeding maximum-minimum differences in each month or between adjacent months.

7.6 RETDAT Program

This program is used to help us keep our set and the Regions' set of listings complete and up-to-date. It gives you a listing of all station-years updated after a certain date which is specified as input into the program. The core required for this program is approximately 35,000 octal words and the time is 2 seconds for every 1,000 records on the input file.

7.6.1 Control Card Set-up

```
K1234,CM40000,P2,T200,NT1.
ACCOUNT,XXXXX.
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,TAPE3,R,F=S,X=SV,D=PE,N=EB,L=HISTLEV,VSN=ERXXXX.
ATTACH,LGO,MISCELLANEOUS,ID=PROGRAMS,CY=2,MR=1.
LGO.
7/8/9                      multipunch in column 1
760101                      See note 1
6/7/8/9                    multipunch in column 1
```

Note 1: 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:

<u>Column(s)</u>	<u>Description</u>
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 day
7-80	blank.

8. INSTRUCTIONS FOR COMPUTER RUNS FOR RETRIEVAL OF DATA

8.1 Provisional Listing Program (DAYLEV-J21049)

8.1.1 Description

This program produces a provisional listing of the daily water level 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 LEVELS 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, the card reader, line printer and one tape or disk file are required. The core requirement for this program is approximately 42,000 octal words and the timing is approximately 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 foot-days is computed. For complete months, the monthly mean in feet and the maximum and minimum daily water levels are also computed. If daily data are missing but a symbol is present on the LEVELS file, then only the symbol will be printed. The symbols A,D,E,N and X are the only valid symbols.

As the program reads through the input LEVELS 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 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 LEVELS tape, the number of I/O faults, and an error code if the job was terminated abnormally. This summary is normally created after the LEVELS input tape has been processed but if for example more than 16 consecutive parity errors occurred on the LEVELS tape then this tape summary is produced at the time the error condition is detected.

8.1.2 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,NT1.
ACCOUNT,XXXX. LEVELS DAILIES
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,TAPE6,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)
LIBRARY(LIB1,LIB2)
DAYLEV.
```

7/8/9	multipunch in column 1
DATE APR 16 1977	standard "Date" card
A06WSC-1201-21 XXXX	"Input File Identification" card
67108 JAN 01 1977	"Select Date" card - See Note 1
67109 01AA001-07EA001 1900 1969 02	"Station Range" card - See Note 2
67109 06AA001-06ZZ999 1900 1970 03	
99999	"End of Job" card - See Note 3
6/7/8/9	multipunch in column 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, 1977 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:

<u>Column(s)</u>	<u>Description</u>
1-5	"67108"
6	blank
7-17	date on which all changes on or after this date are to be printed, e.g. "JUL bb9b1972" 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
18-80	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:

<u>Column(s)</u>	<u>Description</u>
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.

8.1.3 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.

8.2 Historical Listing Program - HISLEV-J21050

8.2.1 Description

This program reads the LEVELS, PEAKS and HYDEX files and produces listings of the daily water levels and symbols, one station-year per page, to be kept by the Regional Offices. For each station or consecutive set of stations required, a "Station Range" 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 LEVELS tape, the pages are prepared and printed immediately. Thus only the card reader, line printer and two tape drives are required. The core requirement for this program is approximately 60,000 octal words and the timing is 0.5 seconds per station-year (page).

The station name is read from the HYDEX file. The daily water levels are read from the LEVELS file and printed exactly as found. If the symbol D is encountered, the word DRY is printed as the "water level". The monthly mean water level is shown only for complete months. The printing of the maximum and minimum water level for the year is guided by the same rules used for the printing of daily discharges, i.e. the extremes are always shown for a complete year unless indicated otherwise on the HYDEX file and only shown for incomplete years if a code of B, H or L is present on the LEVELS file. The maximum instantaneous water level is printed if present on the PEAKS file. The current datum code is read from the HYDEX file and its corresponding datum name is printed on the bottom of each page. Also if symbols such as A 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.

This program will not print symbols by themselves and thus this program should only be used with a master LEVELS 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 stations except those in the province of Quebec and a French version for all stations in the province of Quebec.

8.2.2 Card Deck Set-up

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

K2009,CM70000,P2,T100,NT1.	
ACCOUNT,XXXXX. LEVELS-HISTORICAL LISTING	
MOUNT,VSN=EMR107,SN=AHD.	
SETNAME,AHD.	
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)	See Note 3
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)	
LIBRARY(LIB1,LIB2)	See Note 3
ATTACH(TAPE7,HYDEX,ID=DATA,MR=1)	HYDEX file
FILE(TAPE7,FO=SQ,RT=F,BT=C,FL=300,CM=YES)	
ATTACH(TAPE8,PEAKS,ID=DATA,MR=1)	PEAKS file
FILE(TAPE8,FO=SQ,RT=F,BT=C,FL=300,CM=YES)	
LABEL,TAPE6,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.	LEVELS file
LDSET(FILES=TAPE7/TAPE8)	
HISLEV.	See Note 3
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	multipunch in column 1
DATE APR 25 1977	standard "Date" card
67109 05GG008 05GG010 1960 1967 04	See Note 2
67109 05NB016 05NB016 1960 1960 08	
99999	
6/7/8/9	multipunch in column 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 Range" card is the same as the one used for the DAILIES program (See Note 2, Section 8.1.2)

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 ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)
to ATTACH(LGO,QUEBEC,ID=OBJECT,CY=2,MR=1)
change LIBRARY(LIB1,LIB2) to LIBRARY(LIB2)
change HISLEV. to LGO.

8.2.3 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) On the last output page, the program prints out a run log summary showing which range of stations were requested. The program will print out any diagnostic messages on this page.

8.3 Publication Listing Program - LEVELS-RETRIEVAL

8.3.1 Description

Much like the Historical Listing Program, this program reads the LEVELS, HYDEX and PEAKS files and produces listings of the daily water levels and symbols, one station-year per page, for checking by the Regional Office staff prior to the publication of these current data.

The station name is read from the HYDEX file. The daily water levels are read from the LEVELS file and printed exactly as found. If the symbol D is encountered, the word DRY is printed as the "water level". If the year stored on the HYDEX file is complete a summary for the year is prepared which contains the maximum and minimum daily water levels together with their respective dates of first occurrence. Also if symbols such as A 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. Descriptive information is also extracted from HYDEX including the type of gauge, location, drainage area, data contributed by, and international designator. The maximum instantaneous water level if available for this year is read from PEAKS and printed with its time and date of first occurrence.

This program will not print symbols by themselves and thus this program should only be used with a master LEVELS 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 Range" 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 LEVELS tape, the pages are prepared and printed immediately. The core requirement for this program is approximately 45,000 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 all Quebec listings only.

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".

8.4. Supplying Data to Users - Program Descriptions

8.4.1 Daily Water Levels on Cards (or Tape) - COPLEV (J21051)

8.4.1.1 Description

The purpose of this program is to retrieve daily water levels from the LEVELS file in a format suitable for supplying data to users. This program produces a period-of-record summary on the output listing and has the option to produce card output or card images on tape. The program produces 3 cards (or card images) for each month of data in 67-002 format. This card format is described in this manual under the section 6.4 "Supplying Data to Users" and in Technical Bulletin 111 on "Supplying Data to Users".

The program requires approximately 45,000 octal words of central memory and approximately 13 seconds of central processor time per thousand records of card or tape output, plus the searching time. Searching time is approximately 1 second for each thousand records by-passed on the historical master files and approximately 1.5 seconds for each thousand records by-passed on the annual master file. The program makes use of a card reader, a 132-character line printer and up to 4 tape drives depending on the type of output requested.

Along with the card output or the images of these cards on tape, the program always produces a period-of-record summary which indicates for each month requested on the LEVELS file whether it was complete or partial. It also produces at the end of the job a general summary indicating the number of cards (or card images) created, the number of records read on the master file, the number of stations retrieved and the number of complete and incomplete months and years processed.

8.4.1.2 Control Card Set-up for COPLEV (J21051)

K2010,CM60000,T100,P2,NT2.	See Note 1
ACCOUNT,XXXXX. LEVELS-RETRIEVAL IN 67-002 FORMAT	
MOUNT,VSN=EMR107,SN=AHD.	
SETNAME,AHD.	
LABEL(TAPE1,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX)	
REQUEST(TAPE21,PE,EB,S,SV) ERNNNN IS OUTPUT	See Note 1
ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)	
ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)	
LIBRARY(LIB1,LIB2)	
COPLEV.	
7/8/9	multipunch in column 1
DATE MAR 08 1974	standard "Date" card
67110 T 09	See Note 1
A01WSC-3201-41 2199	See Note 2
67109 01AA001-05ZZ999 1900 03	See Note 3
99999	See Note 4
6/7/8/9	multipunch in column 1

Note 1: If the data are to be supplied on magnetic tape, the program should be equipped with at least 2 magnetic tapes, i.e. NT2 parameter on the "Job" card, and a "Request" card for TAPE21 if it is to be unlabelled or a "Label" card if it is to be labelled. The type of output is selected on the "67110" card. If tape output is desired, this card will contain a "T" in column 7 and the blocking factor specified in columns 9-10.

If the data are to be supplied as card images on a "labelled" tape, then the "Request" card is replaced with a "Label" card such as the following:

LABEL(TAPE62,W,L=WSC,X=SV,T=90)

and the "Coplev" card is changed to COPLEV(,,,,,TAPE62) and the "67110" card will have a "C" in column 7.

If the data are to be supplied on cards, or only the period-of-record summary is desired, then the program should only be equipped with one tape for each input tape. Normally, there is only one input tape so the tape parameter is NT1 on the "Job" card, and the "Request" or "Label" card for TAPE21 will be omitted. In this case column 7 on the "67110" card will contain a "C" for card output or an "L" for only the period-of-record summary, and the blocking factor will be omitted.

Note 2: An "Input File Identification" card is required for the input LEVELS tape. This card begins with the letter "A", the tape unit number and then the Water Survey of Canada internal file number.

Note 3: 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:

<u>Column(s)</u>	<u>Description</u>
1-5	"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
23-26	year from which data are to be retrieved, i.e. 1900, if all data are to be retrieved or 1965 if only data from 1965 to date are to be retrieved
27	blank
28-29	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 from which data are required; this number is right justified
30-80	blank.

Note 4: 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.

8.4.1.3 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".

- (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(s)) 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 summary page is that of the next station on the input file.
- (e) the number of output records is specified on the summary page. This should be three times the number of station-months requested.
- (f) on the tape summary the type and status of the input tape(s) should both be "3" and the number of I/O faults and error code should both be zero.
- (g) the last page is an "END OF JOB" page. If this message is not present the job has terminated abnormally and the dayfile should be checked.

8.4.2 Annual Maximum and Minimum Daily Water Levels or Discharges

8.4.2.1 Description

The purpose of this program, ANNEXT, is to retrieve the maximum and minimum daily water levels or discharges from the LEVELS or FLOW file, in a format suitable for supplying data to users.

This program uses the HYDEX and LEVELS or HYDEX and FLOW files to produce either punched cards or card images on tape in format 76-113 which is described in Section 6 of this manual.

Each card or card-image produced may contain the yearly maximum and minimum daily values for 2 years for a station. The output is produced in station number within Region order unless output file is sorted. The program requires 70,000 octal words of central memory, line printer, card reader and possibly the card punch if cards are requested. A tape drive is required for the LEVELS or FLOW file and another tape drive may be required if card images on tape are requested.

One or more "Request" cards must be entered giving type of retrieval, station and year range, Region and type of output.

8.4.3.2 Control Card Set-up

K1234,CM70000,P2,T400,NT2.

See Note 1

ACCOUNT,11662. ANNUAL EXTREMES 76-113 FORMAT

MOUNT,VSN=EMR107,SN=AHD.

SETNAME,AHD.

ATTACH,OLDPL,ANNEXT,ID=SOURCE,CY=1.

LABEL,FLOLEV,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ER1234.

See Note 2

FILE,FLOLEV,RT=F,BT=K,FO=SQ,FL=300,RB=15,MRL=300,MBL=4500,BFS=460,CM=YES.

REQUEST,TAPOUT,PE,S. ERNNNN IS OUTPUT

See Note 1

UPDATE(F)

COBOL(I=COMPILE)

ATTACH,HYDEX,HYDEX,ID=DATA,MR=1.

FILE, HYDEX, FO=SQ, RT=F, BT=C, FL=300, CM=yes.

LDSET, FILES=HYDEX.

LGO.

7/8/9

multipunch in column 1

*IDENT FIX01

7/8/9

multipunch in column 1

4 01AA001 01AC012 1910 1970 04 T

See Note 1

4 02AB003 04AA001 1950 1960 04 T

See Note 2

Note 1: Two 9-track tapes must be requested on the job card for LEVELS input and annual extremes output. If the output is to be unlabelled then the REQUEST card should be entered as follows:

REQUEST, TAPOUT, PE, S. MOUNT ER1234 WITH RING IN for a stranger tape.

If output is to be on a labelled tape then the "REQUEST" card is replaced with a "LABEL" card as follows:

LABEL, TAPOUT, W, L=MINMAX, F=S, X=SV, D=PE, N=EB, T=999.

If the data are to be supplied on cards then only one tape is required for the LEVELS input. Then the job card tape parameter would become NT1 and the "LABEL" or "REQUEST" cards should be removed. For card output the MINMAX request cards would have a C not a T in column 32.

Note 2: The MINMAX request cards give the stations and years to be retrieved from the specified Region and the output form. There may be more than one of these cards but they must be in ascending station number order within Region. A retrieval may contain cards for stations in different Regions provided they are on the same tape.

8.4.3.3 Quality Control Checks

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

(a) that each card entered was printed at the end of the job. (b) that the last line before the day file is "NORMAL JOB TERMINATION".

Error messages are printed if required.

1. If no FLOW tape or LEVELS tape is available or does not contain data, message is: "NO FLOW OR LEVEL TAPE FOUND" and job terminates.
2. If no station-year range card was entered, message is: "NO STATION RANGE CARD ENTERED" and job terminates.
3. If the first station-year range card read in is not requesting the same type of output that is available from the input file, a message is printed as follows: "WRONG FILE ENTERED NO DATA REQUESTED".

This message would appear if a range card with 4 in column one which requests LEVELS data, was entered with a FLOW tape.

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

8.5 Annual Water level Hydrograph Program RETLEV

8.5.1 Description

Annual hydrographs can be produced for any station-years whose daily water levels are on the LEVELS file. The program can retrieve linear plots with various options as explained later.

This program requires 74,000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved, their position on the LEVELS 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 "PLOTTER" tape.

These "PLOTTER" tapes 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. The time to actually draw the hydrograph is about 2.5 minutes.

8.5.2 Control Card Set-up

```
K1234,CM77000,P2,T100,NT1,MT1.
ACCOUNT,XXXXX. L-ANNUAL HYDROGRAPHS
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
LABEL,TAPE20,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.
ATTACH,A,FLOW,ID=LIBRARY,MR=1.
ATTACH,B,PLOTLIB,MR=1,SN=PUBLIC.
ATTACH,C,LEVELS,ID=LIBRARY,MR=1.
LIBRARY(A,C)
```



```

REQUEST,PLOTTER.
LDSET(LIB=B)
RETLEV. "NAME,DROP7,CL2 .2MM BLACK NIB 12 INCH"
UNLOAD,PLOTTER.
EXIT.      PLOT EVEN IF INCOMPLETE
UNLOAD,PLOTTER.
7/8/9                                multipunch in column 1
DATE JAN 01 1978                      standard "Date" card
A21WSC-1702-27                        "Input File Identification"
68019 04 05PC019 1969-1972 JAN 1      See Note 1
68019 04 05QE007 1968-1968 JAN 1
68019 04 05QE008 1972-1973 JAN 2
99999                                  See Note 2
6/7/8/9                                multipunch in column 1

```

Note 1: The format of the "Station-Year" request cards is as follows:

<u>Column(s)</u>	<u>Description</u>
1-5	control card number, e.g. "68019" for station-year range card
6	blank
7-8	Region, e.g. "04" for Winnipeg
9	blank
10-16	station number, e.g. "01AA001"
17	blank
18-21	year "from", e.g. "1900"
22	"-"
23-26	year "to", e.g. "1977"
27	blank
28-30	beginning month for plot, e.g. "OCT" for a water-year plot (if blank, default is "JAN" for a calendar-year plot)
31	blank
32	code for scaling type:
	1 - same scale plots (default)
	2 - selective scale plots (scale selective for each year)
33-80	blank.

Note 2: 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.

8.5.3 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 from the plotting program for the informative message "RETRIEVAL PLOT TAPE COMPLETED". The presence of this message ensures that the end of the intermediate tape has been reached.

- (d) Scan the water level 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" tape has not been scratched (recycled). The plotter block number to be replotted is the plot number for this station-year. This plot number is obtained from the retrieval listing.

8.6 Continuous Hydrographs for Regions

8.6.1 Description

This program produces continuous hydrographs for all station-years requested 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% reduction) if desired.

The program requires 110,000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved, their position on the LEVELS 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).

8.6.2 Control Card Set-up

```
K1234,CM110000,P2,T200,NT2,MT1.
ACCOUNT,XXXXX. L-Continuous Hydrographs
MOUNT,VSN=EMR107,SN=AHD.
SETNAME,AHD.
ATTACH,L1B1,FLOW,ID=LIBRARY,MR=1.
ATTACH,L1B2,PLOTLIB,SN=PUBLIC,MR=1.
LABEL,TAPE1,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.
LABEL,TAPE31,R,L=HYDEX,F=S,X=SV,D=PE,N=EB,VSN=ERXXXX.
ATTACH,LGO,PLOT,ID=HYPLEV,MR=1.
LIBRARY (LIB1, LIB2)
REQUEST,PLOTTER. PLOT ALWAYS
LDSET,PRESET=ZERO.
LGO. "WRB 12 INCH PAPER CL-2 BLACK INK STOP-7"
7/8/9
DATE SEP 01 1978
67109 05EG009 05EG011 1890-1977 08 .20
67109 11AC055 11AC055 1890-1950 08 .20
999
6/7/8/9
```

See Note 1

See Note 2

See Note 3

See Note 4

standard "Date" card

See Note 5

See Note 6

multipunch in column 1

Note 1: NT2 is used to let the system know that two 9-track tape drives are needed one for the LEVELS file and the other for the HYDEX file. MT1 is used to let the system know that a 7-track tape drive is needed for the "PLOTTER" tape.

Note 2: Tape1 is always used to denote the LEVELS file.

Note 3: Tape31 is used to denote the HYDEX file.

Note 4: The message within the quotes (4-8 multipunch) is used to identify the plot and to instruct the plotter operator on the specifications for this plot. This message must not go beyond column 60.

Note 5: "Station Request" card

<u>Column(s)</u>	<u>Description</u>
1-5	"6709"
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 year to be plotted, e.g. "1890"
27	"_"
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 6: "End of PLOT" card

<u>Column(s)</u>	<u>Description</u>
1-3	"999" as the name implies this signals the end of the "Station Request" cards
4-80	blank.

8.6.3 Quality Control Checks

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

- (a) Check the end of the listing for the two statements *END OF JOB* and PLOT TIME = XX MIN. These indicate that the plot has been stored on the "PLOTTER" tape successfully.
- (b) Check each input station number to ensure that the correct station-year was retrieved.
- (c) 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.
- (d) Should a particular section be below the level of accuracy required, that portion may be replotted, usually without charge, by quoting the block number at which that section begins. This block number can be found on the output listing with the section number.

Also within 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 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.

8.7 Comparison Hydrograph Program (HYPLEV)

8.7.1 Description

Comparison hydrographs can be produced for any station whose daily water levels are on the LEVELS file. The program is limited to a maximum of five stations as input and a maximum of five stations on one plot as output. Also there is no limit to the number of years in the period requested but by default a period of five years will be assumed.

This program requires 110,000 octal words of central memory. The timing varies greatly depending upon the number of station-years retrieved, their position on the LEVELS 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. Because the job priority is dropped to zero for times in excess of T400, all larger jobs should be run under T500 to ensure that they do not run out of time. This program uses a card reader, line printer, one to three tape drives for the input LEVELS files on units 1, 2 and 3, one tape drive for the output plot file and up to 10 binary scratch disk files.

This program could produce hydrographs similar to the "Continuous Hydrograph" program mentioned in Section 8.6, however only one station per run could be processed.

8.7.2 Control Card Set-up

K2013,CM110000,P2,T300,NT2,MT1.

ACCOUNT, XXXXX. L-HYPLEV

See Note 1

MOUNT,VSN=EMR107,SN=AHD.

SETNAME,AHD.

ATTACH(LIB1,LEVELS,ID=LIBRARY,MR=1)

ATTACH(LIB2,FLOW,ID=LIBRARY,MR=1)

ATTACH(LIB,PLOTLIB,MR=1,SN=PUBLIC)

LIBRARY(LIB,LIB1)

REQUEST,PLOTTER. PLOT ONLY IF 999 PLOTTED

LABEL,TAPE1,R,L=HISTLEV,F=S,X=SV,VSN=ERXXXX,D=PE,N=EB.

See Note 2

LABEL,TAPE2,R,L=HISTLEV,F=S,X=SV,VSN=ERXXXX,D=PE,N=EB.

See Note 3

LDSET(LIB=LIB2)

HYPLEV."WRB PVM CL-2 MULTICOLOR 12IN PAPER"

See Note 4

UNLOAD,PLOTTER.

EXIT. DO NOT RETURN OR PLOT TAPE

See Note 5

7/8/9

multipunch in column 1

DATE MAR 21 1978

standard "Date" card

4 1965-1971 7 0.1

See Note 6

1 05KH002 8

See Note 7

7

See Note 8

2 05KH003 4
3 05KH004 4
8

1	CUMBERLAND LAKE NEAR CUMBERLAND HOUSE	See Note 9
2	BIRCH RIVER ABOVE BRACKEN DAM NEAR THE PAS	See Note 10
3	BIRCH RIVER BELOW BRACKEN DAM NEAR THE PAS	
999		See Note 11
6/7/8/9	multipunch in column 1	

Note 1: Ordinarily, NT1 is sufficient but with a second or third LEVELS input tape NT2 or NT3 is required. MT1 is needed for the 7-track "PLOTTER" tape

Note 2: The first input LEVELS 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: The message within the quotes (4-8 multipunch) is used to identify the plot and to instruct the plotter operator that a multicolored plot is to follow, 12 inch paper is required and that a class 2 (Good Quality) plot is requested. (Class 3 is only fair but Class 1 is suitable for publication). This message must not go beyond column 60.

Note 5: If the job terminates abnormally the information that has been stored on the "PLOTTER" tape is not to be plotted.

Note 6: "Period" card

<u>Column(s)</u>	<u>Description</u>
1	code for type of record, e.g. "4" for water levels
2	blank
3-11	year range for which the plots are desired
12	blank
13-14	number of years to be combined in a section (right justified); if left blank, a default of 5 years is assumed
15	blank
16-18	scale reduction factor, e.g. "0.1" is a 90% reduction or one tenth normal size
19-80	blank.

Note 7: "Station Number Request" card

<u>Column(s)</u>	<u>Description</u>
1	identification sequence number from 1 to 5
2	blank
3-9	station number requested
10	blank
11	Region number
12-20	blank
21-29	datum conversion factor - add the specified value to the requested data in order to bring all data to the same datum (leave blank if not needed)
30-80	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 10 and 13.

Note 8: "Tape Change" card

<u>Column(s)</u>	<u>Description</u>
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 9: "Plot Type" card

<u>Column(s)</u>	<u>Description</u>
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 10: "Plot Identification" card for individual plots

<u>Column(s)</u>	<u>Description</u>
2	1 or blank
4	2 or blank
6	3 or blank
8	4 or blank
10	5 or blank
11-70	identification for the particular plot
71-80	blank.

Only one of the columns from 2-10 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.

Note 11: "End of Plot" card

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

8.7.3 Quality Control Checks

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

- (a) Check the end of the listing for the two statements *END OF JOB* and PLOT TIME = XX MIN. These indicate that the plot has been stored on the "PLOTTER" tape successfully.
- (b) Check each input station number to ensure that the correct station-year was retrieved.

(c) 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.

(d) Should a particular section be below the level of accuracy required, that portion may be replotted, usually without charge, by quoting the block number at which that section begins. This block number can be found on the output listing with the section number.

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 LEVELS tape, the job will stop immediately.

Processed Beyond End of File

- If a station requested does not appear on the tape or the number request cards are not in sequence, then the program will search until the end of file is encountered.

9. TOTALS FILE

At present the LEVELS file, which contains daily water levels, consists of 3 tapes and data are added to it every year. Requests are often received for monthly and annual mean water levels and are computed from daily water levels. Depending on the request, this may involve processing one or more tapes.

Also every three years "Historical Water Levels Summary" publications by province are produced. These publications contain monthly and annual means 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 water level totals for every complete month retrieved from the LEVELS file. The TOTALS file contains monthly totals for all of Canada on one reel of tape (actually the name TOTLEV is used internally to distinguish it from the TOTALS file for the FLOW data).

9.1 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 (odd parity) at a density of 1800 bpi. This tape is in ascending sequential order by Region, station number and year.

9.1.1 Record Descriptions

The letter "b" in all record descriptions represents a blank. All records except the "Padding" records (70-610) are numbered sequentially in positions 175-180 starting at 1 for the "Tape Header" record (70-605). The six record formats contained in this file are described below.

9.1.1.1 Tape Header Record (Format 70-605)

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

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"00HD000000bb"
13-16	4	"bbb5"
17-24	8	blank
25-32	8	"FILEbEMR"
33-44	12	file number, e.g. "-WSC-0401-b1"
45-52	8	"bbSERIAL"
53-54	2	blank
55-58	4	used to be the reel serial number, e.g. "6136", but is now always "9999"
59-60	2	blank
61-66	6	number of the program that created the tape, e.g. "J21086"
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: 10000x (year-1900) + 100x(month) + (day), e.g. "71031" for January 31, 1971
175-180	6	record sequence number, "bbbbbb1".

9.1.1.2 Station Header Record (Format 70-606)

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

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-7	7	station number
8	1	Region code:
		2 for Vancouver 6 for Montreal
		3 for Calgary 7 for Halifax
		4 for Winnipeg 8 for Regina
		5 for Guelph
9	1	blank
10-12	3	"101"
13-18	6	drainage area
19-30	12	blank
31-100	70	station name
101-166	66	blank
167-168	2	province code:
		01 for Yukon Territory 07 for Ontario
		02 for Northwest Territories 08 for Quebec
		03 for British Columbia 09 for New Brunswick
		04 for Alberta 10 for Nova Scotia
		05 for Saskatchewan 11 for Prince Edward
		Island
		06 for Manitoba 12 for Newfoundland
169-174	6	date on which this record was last updated, e.g. "720131" for January 31, 1972
175-180	6	record sequence number.

9.1.1.3 Data Record (Format 77-007)

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.

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-7	7	station number
8	1	Region code
9	1	blank
10-12	3	year, e.g. "971" for 1971
13-132	120	twelve 11-digit fields for the monthly totals and decimal indicators
133-144	12	blank
145-148	3	datum code
148-166	19	blank
167-168	2	province code

169-174	6	date on which this record was last updated
175-180	6	record sequence number.

The monthly totals and codes in positions 13-132 are as follows:

character 1-9	monthly total in foot-days, right justified with leading zeros. The decimal point is stored as a character.
character 10	decimal indicator as follows:
	1 for no data, i.e. blank
	3 for a figure with one decimal place
	4 for a figure with two decimal places.

9.1.1.4 End-of-Data Record (Format 70-608)

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"99ZZ99999999"
13-168	156	blank
169-174	6	date on which the tape was written
175-180	6	record sequence number.

9.1.1.5 Tape Trailer Record (Format 70-609)

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

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"00TR00000000"
13-168	156	blank
169-174	6	date on which the tape was written
175-180	6	record sequence number.

9.1.1.6 Padding Record (Format 70-610)

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).

<u>Position(s)</u>	<u>Length</u>	<u>Description</u>
1-12	12	"99ZZ99999999"
13-168	156	blank
169-180	12	"999999999999".

9.2 File Maintenance Program (TOTALS-FILE)

The TOTALS file is maintained by using the HYDEX and LEVELS files. The LEVELS file is used to create and update the "Data" records, while the HYDEX file is used to create and update the "Station Header" records. The TOTALS and LEVELS 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 an update program called TOTALS-FILE. This update program must be run once for each LEVELS tape involved.

9.2.1 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 updating program, TOTALS-FILE. The core required to sort the HYDEX file is approximately 40,000 octal words of central memory and the time is about 6 seconds.

Within the next step, the TOTALS-FILE program, information is retrieved from both the LEVELS and the HYDEX files to create a new TOTALS file. Also, if an old TOTALS file is available, monthly totals from it are also copied onto the new TOTALS file. In this fashion, the new TOTALS file is gradually built up until all the totals from the LEVELS files are contained on one tape.

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 LEVELS 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 LEVELS 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 records from the LEVELS file for the updating of the TOTALS file are selected by means of the date on which these records were last updated. Each record on the LEVELS file contains a date in positions 289-294. This data indicates when the record was last updated thus permitting the retrieval of records which were updated or created after a certain date.

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

The following digits are used in the decimal point indicator field:

- 1 - indicates no data in the field, i.e. blank
- 3 - one decimal digit
- 4 - two decimal digits.

If digits 3 or 4 are used then the decimal point is actually present in the field.

Two informative messages are printed within this 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 UPDATED	XXXXX
NUMBER OF STATIONS CREATED	XXXXX
NUMBER OF STATIONS WRITTEN ON NEW TOTALS	XXXXX
NUMBER OF RECORDS WRITTEN ON NEW TOTALS	XXXXX

If the "Station Header" record is updated but a "Data" record is not, then no message is printed.

The core required to update the TOTALS file is approximately 40,000 octal words of central memory and the time is about 3 seconds for every 1,000 records.

9.2.2 Control Card Set-up

In the following card deck set-up the HYDEX file has been read from the catalogued disk file, HYDISK, and sorted onto a temporary disk file called TAPE33 which is in Region and station number order.

K7536,CM40000,P2,T200,NT3.	
ACCOUNT,XXXXX	TOTALS UPDATE
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(LGO,TOTALS,CY=3,ID=OBJECT,MR=1)	
LABEL(TAPE30,R,L=TOTLEV,F=S,X=SV,VSN=ERNNNN,D=PE,N=EB)	Old TOTALS File
LABEL(TAPE31,W,L=TOTLEV,F=S,X=SV,T=30,D=PE,N=EB)	New TOTALS File
LABEL(TAPE32,R,L=HISTLEV,F=S,X=SV,D=PE,N=EB,VSN=ERMMMM)	LEVELS File
LDSET(FILES=TAPE33)	
LGO.	
7/8/9	Multipunch in column 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	Multipunch in column 1
DATE JAN 1 1960	NOV 15 1974
OLDWSC-9201-24 NNNN	Note 1
NEWWSC-9201-25 9999	Old TOTALS File
	New TOTALS File
	Note 2
HYDWSC-1301- 1 9999	HYDEX File
LEVWSC-1701-27 MMMM	LEVELS File
6/7/8/9	Multipunch in column 1

Note 1: "Date" card. According to this card all the monthly totals from the "Data" records on the LEVELS file which have a creation date greater than or equal to January 1, 1960 will be copied onto the TOTALS file. The current date is entered on this card in columns 20-40.

Note 2: 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.

9.2.3 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 successfully. Informative messages are created for each station which is created or updated 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 update listings should be checked for any of the following error messages:

```
****      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.

```
****      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. If the program has been running and subsequent tape mounts for the LEVELS file have a label error a message is printed and this tape is bypassed and processing continues. Any other tape label error will cause the run to be stopped.

```
****      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.

```
****      LEVELS SEQUENCE ERROR
```

The Region and station number on the LEVELS file must be in ascending order otherwise a message will be printed and the program will skip to the next LEVELS tape.

```
****      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.

```
****      MISSING HYDEX      9999999
```

If a station number is found on the LEVELS 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.

10. 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 sections 7 and 8 "Instructions for Computer Runs for File Maintenance" and "Retrieval of Data". The provisional listing program (DAYLEV) is used to get a "quick" check of the daily water levels which have been added to the LEVELS file. This program can read the output tape 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. This listing is useful to detect simple errors such as missing water levels or symbols and is used only within the Data Control Section itself.

For the daily water levels (historical or annual) to receive final verification, the Historical or Publication listing is sent to the Regional Offices. Only monthly means need to be checked for complete months but each daily water level 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 must be checked.

Once the annual data have been verified and the annual publications have been produced the data on the single annual LEVELS tape are added to the 3 historical LEVELS tapes.

10.1 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 a 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 opened 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 opened 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.

11. 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 - always equal to "1"

2nd digit - program code:

0-CARD-to-TAPE

1-EDIT

2-UPDATE (produces master)

3-DELETE

4-DAILIES

6-EDIT (WL)

7-UPDATE (WL)

8-DAILIES (WL)

3rd and 4th digits - indicates number of reels in the LEVELS file, e.g.

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

The last two digits of the file number show the order the raw data were received. Numbers 1 to 49 are used successively as data are received from the Regions and processed. For a file which is to be sorted (CARD-to-TAPE or DELETE) this number is increased by 50, and then when it is sorted the number reverts to its original value, i.e. 5000-51 is the first unsorted card-to-tape reel for Guelph, and 5000-01 is that same reel sorted; 5100-01 is that same data (01) edited, and 5201-01 and 5202-01 are the two new master files updated with the same data (01).