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A letter report for UNC
Nuclear Industries, Inc.

Update of Columbia River Flow and Temperature Data Measured at Priest Rapids Dam and Vernita Bridge

G. Whelan
C. A. Newbill

September 1983

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

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UPDATE OF COLUMBIA RIVER
FLOW AND TEMPERATURE DATA MEASURED
AT PRIEST RAPIDS DAM
AND VERNITA BRIDGE

G. Whelan
C. A. Newbill

September 1983

Prepared for
UNC Nuclear Industries, Inc.
Richland, Washington 99352

MASTER

Pacific Northwest Laboratory
Richland, Washington 99352

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EXECUTIVE SUMMARY

Columbia River temperatures and flow rates are collected daily at Priest Rapids Dam and Vernita Bridge. These data are necessary for assessing trends or changes in river conditions downstream of Priest Rapids Dam. In order to analyze these data, Pacific Northwest Laboratory developed a computerized data base using existing U.S. Geological Survey flow and temperature records at Priest Rapids Dam and Vernita Bridge.

Daily-averaged temperature and daily flow information on the Columbia River just downstream of Priest Rapids Dam and upstream of river mile 380 were collected and stored in a data base. A newly developed computer model, COLSTAT (Columbia River Statistical Update), used the data base to statistically analyze temperature and flow conditions by computing the frequency of occurrence and duration of selected temperatures and flow rates for the Columbia River. Information regarding the data base is presented, as well as, a description of the COLSTAT model.

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SYMBOLS

g_m	index
G	frequency of occurrence of temperatures greater than T_0 and discharges less than Q_0
h_m	index when discharges/temperatures exceed the k -th discharge/temperature
H_k	relative cumulative frequency for the k -th discharge/temperature
i	index on record length for discharges/temperatures
j	index on the month of year
k	index on discharge/temperature
ℓ	index on day of month
m	index on discharge/temperature
n	length of record for discharges/temperatures
Q_m	m -th discharge
Q_0	user-specified discharge
$S_{j,\ell}$	standard deviation for month j and day ℓ
T_m	m -th temperature
T_0	user-specified temperature
$U_{i,j,\ell}$	daily-averaged temperature/discharge for year i , month j and day ℓ
$\overline{U}_{j,\ell}$	mean daily-averaged temperature/discharge for month j and day ℓ

1.0 INTRODUCTION

Daily Columbia River temperature and flow data have been collected by the U.S. Geological Survey (USGS) at Priest Rapids Dam^(a) and Vernita Bridge during the past 18 to 24 years, respectively. The average daily river flow records at Priest Rapids Dam extend back to 1 October 1959 and the average daily temperatures extend back to 1 January 1965. These river flow and temperature records are important in determining the water quality trends and changes in the Hanford Reach of the Columbia River.

In order to analyze river flow and temperature conditions, a numerical model (i.e., COLSTAT) was developed which statistically collates existing water flow and temperature data recorded at Priest Rapids Dam and Vernita Bridge. Vernita Bridge is approximately 9.0 river miles downstream of Priest Rapids Dam. For a given discharge and water temperature, the model provides frequency of occurrence and event time durations. The model also provides a statistical summary of all recorded data.

This report is divided into two additional chapters. Chapter 2 presents a brief environmental description of the Columbia River and a history of the temperature and discharge measurements at Priest Rapids Dam and Vernita Bridge. Chapter 3 presents a description of the statistical model COLSTAT (Columbia River Statistical Update Model). Also included in Chapter 3 are the theoretical developments on which the code is based, input requirements, output results, and sample problems. In addition, four appendices are included. Appendix A presents a statistical summary of Columbia River flow rates and temperatures from 1 October 1959 to 14 June 1983. Appendices B and C present results from two sample problems, while Appendix D provides a complete FORTRAN listing of the computer code COLSTAT.

(a) Actual location is approximately 2.5 or 2.6 mi downstream of Priest Rapids Dam.

2.0 COLUMBIA RIVER FLOW AND TEMPERATURE HISTORY

2.1 INTRODUCTION

The Columbia River is the third largest river in the United States. It originates in Canada, flows through eastern Washington, and forms the border between western Oregon and Washington as it flows to the Pacific Ocean. The length of the Columbia River from the Canadian border to the Pacific Ocean is approximately 745 river miles. Eleven dams exist along the Columbia River in the United States. Of the eleven dams, Priest Rapids Dam is located at river mile 397.1. Figure 1 presents the main stem of the Columbia River with the location of the 11 dams, while Figure 2 presents the reach of the river bordering the U.S. Department of Energy's Hanford Site between Priest Rapids and McNary Dams. The only free flowing (i.e., no backwater effects) portion of the river is upstream of Ringold Flat and downstream of Priest Rapids Dam.

Before the McNary and Priest Rapids Dams were completed, temperature and discharge measurements were collected near Richland, Washington. After the dams became operational, recording stations were moved to locations just downstream of Priest Rapids Dam. Since 1959, several locations were used to record flow and temperature data. The locations of the discharge and temperature recording stations and the dates the stations were in operation are presented in Tables 1 and 2. Figure 2 indicates the approximate locations of the recording stations outlined in Tables 1 and 2.

2.2 DISCHARGE HISTORY (1959 - 1983)

Flow conditions on the Columbia River have been studied for the past 100 years. The largest reported discharge at Pasco, Washington just downstream of the Hanford Site is $22,654 \text{ m}^3/\text{sec}$ ($800,000 \text{ ft}^3/\text{sec}$) in 1894. The lowest discharge recorded is $566 \text{ m}^3/\text{sec}$ ($20,000 \text{ ft}^3/\text{sec}$) in 1931.

Discharge information, based on USGS records, at Priest Rapids Dam begins in 1959 and continues to the present. Since the construction of the dams on the Columbia River, flows have been closely regulated. Because the flow from Priest Rapids Dam is regulated, characteristics pertaining to the Columbia

FIGURE 1. Main Stem of the Columbia River

FIGURE 2. Columbia River Near the Hanford Reservation

TABLE 1. Discharge Recording Stations, 1959 - Present^(a)

October 1959 - September 1963

- Latitude 46° 37' 45"
- Longitude 119° 52' 00"
- Located in SE 1/4 NW 1/4 sec 7, T.13 N., R.24 E.,
4.0 km (2.5 mi) downstream from Priest Rapids Dam, and 22.5 km
(14.0 mi) south of Beverly, Washington.

October 1964 - June 1974

- Latitude 46° 37' 44"
- Longitude 119° 51' 49"
- Located in SE 1/4 NW 1/4 sec. 7, T.13 N., R.24 E.,
Grant County, Hydrologic Unit 17020016, 4.2 km (2.6 mi) downstream
of Priest Rapids Dam, 23.7 km (14.7 mi) south of Beverly,
Washington, and at River Mile 394.5.

July 1974 - September 1980

- Latitude 46° 38' 34"
- Longitude 119° 43' 54"
- Located in NW 1/4 SE 1/4 sec. 6, T.13 N., R.25 E.,
Grant County, Hydrologic Unit 17020016, at State Highway 24 Vernita
Bridge crossing, 14.5 km (9.0 mi) downstream from Priest Rapids
Dam, and at River Mile 388.1

December 1979 - Present

- Latitude 46° 37' 44"
- Longitude 119° 51' 49"
- Located in SE 1/4 NW 1/4 sec. 7, T.13 N., R.24 E.,
Grant County, Hydrologic Unit 17020016, 4.2 km (2.6 mi) downstream
of Priest Rapids Dam, 23.7 km (14.7 mi) south of Beverly,
Washington, and at River Mile 394.5.

(a) Locations obtained from Water Resources Data, Washington, U.S. Geological
Survey Water-Data Reports

TABLE 2. Temperature Recording Stations, 1965 - Present^(a)

January 1965 - June 1974

- Latitude 46° 37' 44"
- Longitude 119° 51' 49"
- Located in SE 1/4 NW 1/4 sec. 7, T.13 N., R.24 E.,
Grant County, Hydrologic Unit 17020016, 4.2 km (2.6 mi) downstream
of Priest Rapids Dam, 23.7 km (14.7 mi) south of Beverly,
Washington, and at River Mile 394.5.

July 1974 - September 1980

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Grant County, Hydrologic Unit 17020016, 4.2 km (2.6 mi) downstream
of Priest Rapids Dam, 23.7 km (14.7 mi) south of Beverly,
Washington, and at River Mile 394.5.

(a) Locations obtained from Water Resources Data, Washington, U.S.
Geological Survey Water-Data Reports

River just downstream of Priest Rapids Dam can be quantified. The Columbia River near river mile 380 is relatively shallow and straight. River widths are approximately $450 \text{ m} \pm 50 \text{ m}$ ($1476 \text{ ft} \pm 164 \text{ ft}$) with surface current velocities ranging up to 3.4 m/sec (11.15 ft/sec). The average depth of water for a discharge of $1557 \text{ m}^3/\text{sec}$ ($55,000 \text{ ft}^3/\text{sec}$) is approximately 5 m (16.4 ft). The minimum flow at Priest Rapids Dam is administratively set at $1019 \text{ m}^3/\text{sec}$ ($36,000 \text{ ft}^3/\text{sec}$). The lowest daily flow from October 1959 to June 1983 was $1048 \text{ m}^3/\text{sec}$ ($37,000 \text{ ft}^3/\text{sec}$) on 23 January 1971 and 11 November 1973, while the maximum daily flow for the same time period was $14,527 \text{ m}^3/\text{sec}$ ($513,000 \text{ ft}^3/\text{sec}$) on 11 June 1961. High flows during spring runoff usually range from $7079 \text{ m}^3/\text{sec}$ ($250,000 \text{ ft}^3/\text{sec}$) to $12,743 \text{ m}^3/\text{sec}$ ($450,000 \text{ ft}^3/\text{sec}$). In addition, the annual average flow at river mile 380 is approximately $3398 \text{ m}^3/\text{sec}$ ($120,000 \text{ cfs}$) (WPPSS 1978). Daily flow variations can cause changes in river stage up to 2 m (6.6 ft) (WPPSS 1978).

The river bed consists mainly of large rocks and cobbles with little sand or cohesive material. Flows downstream of Priest Rapids Dam are not necessarily the same as those measured at Priest Rapids Dam. Due to shallow storage zones and river hydraulic dynamics, short term flow fluctuations at Priest Rapids Dam are more extreme than downstream. For example, during one 4-day period in 1978, flow at river mile 380 was measured to be 39% higher than that at the dam (WPPSS 1978).

The daily flow rates just downstream of Priest Rapids Dam for the time period between October 1959 and June 1983 were statistically analyzed and the results of the analysis are presented in Figures 3, 4, and 5 and Appendix A. Figure 3 presents the distribution of daily flows over the period of record. Figure 3 exemplifies the degree at which the dams control the flow rates in the river. As the figure shows, a majority of the flow rates are between $1416 \text{ m}^3/\text{sec}$ ($50,000 \text{ ft}^3/\text{sec}$) and $5664 \text{ m}^3/\text{sec}$ ($200,000 \text{ ft}^3/\text{sec}$). Figure 4 presents the daily composite of flow rates for each day of the year. This information is grouped according to the month the day occurs in. This figure includes curves for the maximum, minimum, and mean daily flows as well as the standard deviations about the means. As the figure shows, the largest discharges occur after the spring snowmelt in June. Figure 5 presents the

relative cumulative frequency distribution (RCFD) of the daily flow rates. The RCFD is represented as the percent of time the daily flow rate is exceeded. This figure shows that the flow rate at which 50% of the discharges are exceeded equals approximately 2876 m³/sec (101,561 ft³/sec). Appendix A presents the tabulated results on which Figures 3, 4, and 5 are based. The results in Appendix A represent the statistically-analyzed daily flows using the computer code COLSTAT. This information is presented in the following forms:

- The RCFD of daily flows between 1000 m³/sec (35,313 ft³/sec) and 15,500 m³/sec (547,357 ft³/sec) for the period of record (i.e., October 1959 - June 1983) using a flow interval of 50 m³/sec (1766 ft³/sec) is tabulated.
- The number of days and percent of time a given flow is exceeded is presented.
- The number of days and percent of time a given flow is within the range encompassed by ± 25 m³/sec (± 883 ft³/sec) is presented.
- The daily composite of maximum, minimum, and mean daily flows for each day of each month during the period of record is tabulated, as well as, the standard deviation about the mean for each day.

The theoretical development on which these computations were based is presented in Section 3.2. It should be noted that Appendix A also includes the tabulated results of the temperature data analysis, which has been statistically analyzed.

2.3 TEMPERATURE HISTORY (1965 - 1982)

Columbia River temperatures vary seasonally. Minimum temperatures are usually recorded in February with maximum temperatures occurring in August. Thermal characteristics of the Columbia River depend to a large extent on flow and storage management of the dams. The free flowing Columbia River at the Hanford Site responds more rapidly than impounded areas to thermal modifications from weather and industrial inputs. Therefore, in the river reach near Hanford summer warming and winter cooling occur more rapidly than at

FIGURE 3. Daily Flow Rates Just Downstream of Priest Rapids Dam on the Columbia River

FIGURE 4. Daily Composite of Daily Flow Rates Just Downstream of Priest Rapids Dam on the Columbia River

FIGURE 5. Relative Cumulative Frequency Distribution for the Daily Flow Rates Just Downstream of Priest Rapids Dam on the Columbia River

other locations along the river. The temperature rise from natural heating at Hanford during late summer and early fall is about 0.50°C (0.90°F) to 0.75°C (1.35°F) between Priest Rapids Dam and Richland.

The lowest daily-averaged temperature recorded just downstream of Priest Rapids Dam from 1 January 1965 through 30 November 1982 was 0.1 °C (32.2°F), while the highest daily-averaged temperature recorded was 20.33°C (68.5°F) on 18 August 1977 and 20-21 August 1977.

The daily-averaged river temperatures just downstream of Priest Rapids Dam for the time period between January 1965 and November 1982 were statistically analyzed and the results of the analysis are presented in Figures 6, 7, and 8 and Appendix A. Figure 6 presents the daily-averaged temperatures temporally distributed over the period of record. Figure 6 presents the variational form of the temperature distribution over the years. The high temperature peaks reflect summer months while the lower temperatures reflect the winter months. Figure 7 presents the daily composite of temperatures for each day of the year. This figure includes curves for maximum, minimum, and mean daily-averaged temperatures, as well as, the standard deviations about the means. Figure 7 exemplifies the sinusoidal form of temperature distribution over a 1-year period. As the figure shows, the maximum temperatures occur in August while the minimum temperatures occur in February. Figure 8 presents the relative cumulative frequency distribution (RCFD) of the daily-averaged temperatures. The RCFD is presented as the percent of time the daily-averaged temperature is exceeded. This figure shows that the temperature at which 50% of the temperatures are exceeded equals approximately 11.2°C (52.1°F). Appendix A presents the tabulated results on which Figures 6, 7, and 8 are based. The results in Appendix A represent the statistically-analyzed daily-averaged temperatures using the computer code COLSTAT. This information is presented in the following forms:

- The RCFD of averaged-daily temperatures between 0°C (32°F) and 22°C (71.6°F) for the period of record (i.e., January 1965 - November 1982) using a temperature interval of 1°C (1.8°F) is tabulated.
- The number of days and percent of time a given temperature is exceeded is presented.
- The number of days and percent of time a given temperature is within the range encompassed by $\pm 0.5^\circ\text{C}$ (0.9°F) is presented.
- The daily composite of maximum, minimum, and mean daily-averaged temperatures for each day of each month during the period of record is tabulated, as well as, the standard deviation about the mean for each day.

FIGURE 6. Daily-Averaged Temperatures Just Downstream of Priest Rapids Dam on the Columbia River

FIGURE 7. Daily Composite of Daily-Averaged Temperatures Just Downstream of Priest Rapids Dam on the Columbia River

FIGURE 8. Relative Cumulative Frequency Distribution for the Daily-Averaged Temperatures Just Downstream of Priest Rapids Dam on the Columbia River

It should be noted that Appendix A also includes the tabulated results of the flow rate data analysis, which has been statistically analyzed. The theoretical development on which these computations were based is presented in Section 3.2.

3.0 COLUMBIA RIVER STATISTICAL UPDATE MODEL

3.1 INTRODUCTION

This chapter summarizes the Columbia River Statistical Update (COLSTAT) model. The COLSTAT code statistically analyzes flow rates and temperatures from recording stations located just downstream of Priest Rapids Dam. The code computes the a) relative cumulative frequency distribution based on the number of times a given discharge/temperature is exceeded, b) percent of time a given discharge/temperature is within a user designated range, and c) daily composite of minimum, maximum, and mean daily-averaged temperatures or discharges for each day of each month during a user-designated period of record, as well as the respective standard deviations about the means, and d) frequency of occurrence of temperatures exceeding and discharges less than a user-specified set of values.

Six sections comprise this chapter of which the first is the introduction. The second section presents the basic theoretical formulations on which the results of the model are based. The basic computations performed are for the mean, standard deviation, and relative cumulative frequency distribution. The third section presents a brief description of the COLSTAT code. The fourth section discusses input requirements to the code and the manner in which the user inputs the data. The fifth section describes the output results, while the final section presents two sample problems with problem descriptions, input information, and output results.

3.2 THEORETICAL DEVELOPMENT

The COLSTAT code was developed to statistically analyze Columbia River flow rates and temperatures over a given period of record. Four basic computations are performed in this statistical package: mean of the daily-averaged temperatures or flow rates, standard deviation, relative cumulative frequency distribution, and frequency of occurrence of temperatures exceeding and discharges less than a user-specified temperature-discharge set of values.

3.2.1 Mean Daily-Averaged Temperatures/Flows

The mean daily-averaged temperatures/flows represent the mean of the daily-averaged temperatures/flows over a period of record for each day of each month. Mathematically, it is defined as follows:

$$\bar{U}_{j,\ell} = \frac{1}{n} \sum_{i=1}^n U_{i,j,\ell}$$

where:

$$1 \leq i \leq n$$

$$\ell = 1, 2, 3, \dots, 31$$

$$j = 1, 2, 3, \dots, 12$$

in which $U_{i,j,\ell}$ = daily-averaged temperature/discharge for year i , month j , and day ℓ ; $\bar{U}_{j,\ell}$ = mean daily-averaged temperature/discharge for month j and day ℓ ; n = length of record for discharges/temperatures (e.g., number of years in the record length)^(a); i = index on record length for discharges/temperatures; j = index on the month of year (e.g., 1 represents January, 2 represents February, ..., and 12 represents December); and ℓ = index on day of month (e.g., 1 represents the first day of month j , 2 represents the second day of month j , etc.).

3.2.2 Standard Deviation

The unbiased standard deviation is defined as the positive square root of the expected value of the square of the difference between a random variable (e.g., flow or temperature) and its mean (Lapedes 1978). In other words, the standard deviation represents the degree in which the random variable differs from the mean of the record. Mathematically, the standard deviation is expressed as:

$$s_{j,\ell}^2 = \frac{1}{n-1} \sum_{i=1}^n (U_{i,j,\ell} - \bar{U}_{j,\ell})^2$$

(a) Years in which data are missing are not included in the record length. For February 29, only leap years are included in the record length.

in which $S_{j,\ell}$ = standard deviation for month j and day ℓ and all other parameters are as previously defined.

3.2.3 Relative Cumulative Frequency Distribution

The relative cumulative frequency distribution (RCFD) as defined herein is the sum of the relative frequencies or probabilities that a variable (e.g., discharge/temperature) can be exceeded by a set of values (e.g., discharges/temperatures). For example, the no-flow case (i.e., zero discharge) does not occur during the record length; therefore, the probability that all recorded flows exceed a discharge of zero is 100%. Mathematically, this is defined herein as follows:

$$H_k = \frac{1}{n} \sum_{m=1}^n h_m$$

where:

$$h_m = 0 \quad \text{for} \quad U_m < U_k$$

$$h_m = 1 \quad \text{for} \quad U_m > U_k$$

$$1 < k < n$$

$$1 < m < n$$

in which H_k = relative cumulative frequency for the k -th discharge/temperature (U_k), h_m = index when discharges/temperatures exceed the k -th discharge/temperature, k = index on the discharge/temperature (e.g., 1 refers to largest discharge/temperature, 2 refers to second largest discharge/temperature, ..., and n refers to smallest discharge/temperature on record), m = index on the discharge/temperature (see definition for k), and all other parameters are as previously defined.

The above equation can also be expressed in the following form:

$$H_k = \frac{\left[\begin{array}{l} \text{Number of times a given variable} \\ \text{(e.g., discharge/temperature) is exceeded in} \\ \text{magnitude in the record length} \end{array} \right]}{\left[\begin{array}{l} \text{Total number of variables} \\ \text{in the record length} \end{array} \right]}$$

It should be noted that the RCFD could have been computed based on the percent of time that the discharges/temperatures were within a certain range (e.g., frequency histogram of discharge/temperature ranges).

3.2.4 Frequency of Occurrence of Temperatures Greater Than and Discharges Less Than a User-Specified Temperature-Discharge Set

The frequency of occurrence of daily temperatures greater than and discharges less than a user-specified temperature-discharge set of values represents the probability that the Columbia River temperatures are greater than a user-specified temperature and discharges less than a corresponding user-specified flow rate. For example, the probability that all recorded flows are less than a discharge of zero and all temperatures exceed 20.33°C (68.5°F) (i.e., maximum recorded temperature) is null (i.e., zero probability). Conversely, the probability that all recorded flows are less than 15,000 m³/sec (529,701 ft³/sec), which includes all flows, and all temperatures exceed 0°C (32°F) is 100%. It should be noted that the temperatures and discharges, which are being compared to the set of specified values, correspond to the same day.

Mathematically, this is defined as follows:

$$G = \frac{1}{n} \sum_{m=1}^n g_m$$

where:

$$g_m = \begin{cases} 0 & \text{for } \begin{cases} (T_m < T_0) \text{ and } (Q_m > Q_0) \\ (T_m = T_0) \text{ and } (Q_m > Q_0) \\ (T_m < T_0) \text{ and } (Q_m = Q_0) \end{cases} \\ 1 & \text{for } \begin{cases} (T_m > T_0) \text{ and } (Q_m < Q_0) \\ (T_m = T_0) \text{ and } (Q_m < Q_0) \\ (T_m = T_0) \text{ and } (Q_m = Q_0) \end{cases} \end{cases}$$

$$1 < m < n$$

in which G = frequency of occurrence of temperatures greater than T_0 and discharges less than Q_0 , g_m = index, T_0 and Q_0 = user-specified temperature and

discharge set, T_m and Q_m = temperature and corresponding discharge associated with the same day, and all other parameters are as previously defined.

3.3 COLSTAT MODEL

The Columbia River Statistical Update (COLSTAT) model computes the maximum, minimum, mean, standard deviation, and RCFD for river flow rates and temperatures, as well as frequency of occurrence of temperatures greater than and discharges less than user-specified values. The COLSTAT model is based on the daily-averaged river temperatures and daily river flow rates. The daily-averaged values (i.e., temperatures) represent the mean for each day over the length of the day. The maximum, minimum, mean, standard deviation, and RCFD temperatures/discharges are computed from the daily-averaged temperatures or daily flow rates and are computed for each day of each month over the period of record. The period of record for river discharges is 1 October 1959 through 14 June 1983, while for river temperatures the period of record is 1 January 1965 through 30 November 1982. The daily-averaged river temperatures and flow daily rates were compiled from information supplied by the USGS at locations just downstream of Priest Rapids Dam. The exact locations of the recording stations are presented in Tables 1 and 2. The measurement error as defined by the USGS in temperature data is $\pm 0.25^\circ\text{C}$ ($\pm 0.45^\circ\text{F}$) and in flow rate data is 5% of the measured flow rate.

The COLSTAT Model was developed to meet certain criteria:

- FORTTRAN Computer Language - The model is written in ASCII (American Standard Code for Information Interchange) FORTRAN and should run on most computing systems with little modification.
- Interactive mode - The model allows for continuous dialogue between the user and the system by way of the CRT (Cathode-Ray Tube) screen. The interactive mode is employed as opposed to the batch (i.e., job control language and data entered to the computing system with keypunched cards) mode.

- User oriented - The model is developed to prompt answers from the user by providing easily understood questions on the CRT screen. In addition to the questions, example answers are also provided.
- Units - Output results are either in English units, metric units, or a combination of the two. The English units employed for temperature and discharge are degrees Fahrenheit ($^{\circ}\text{F}$) and cubic feet per second (ft^3/sec), respectively, while metric units used for temperature and discharge are degrees Celsius ($^{\circ}\text{C}$) and cubic meters per second (m^3/sec).
- Time Span - The model allows for the user to specify the time span over which the statistical summary is generated. The period of record for the flow rates (i.e., 1 October 1959 through 14 June 1983) represents the largest time span available at this time. The user may specify any time span within the period of record. For more information and examples, refer to Sections 3.4 and 3.6, respectively.
- Results - Four sets of information are provided as results by the model. The first set is the distribution of the daily-averaged river temperatures over the time span specified by the user. The second set is the distribution of the daily flow rates over the time span specified by the user. The third set is the daily composite of maximum, minimum, mean, and standard deviation of the daily-averaged temperatures and daily flows for each day of each month over the time span specified by the user. The fourth set presents the frequency of occurrence of temperatures greater than and discharges less than a user-specified temperature-discharge set of values. For more information and examples, refer to Sections 3.4 and 3.6, respectively.

3.4 INPUT REQUIREMENTS

This section describes the input requirements of the COLSTAT code. The code is constructed to require a minimal amount of user-generated information. The code requires seven types of information:

- beginning date of analysis
- ending date of analysis
- temperature units
- flow units
- minimum, maximum, and incremental temperatures
- minimum, maximum, and incremental flow rates
- user-specified temperature-discharge set.

Each of the seven requirements will be discussed and examples will be provided.

3.4.1 Beginning and Ending Dates of Analysis

As previously mentioned, the periods of record for river flow rates and temperatures are 1 October 1959 through 14 June 1983 and 1 January 1965 through 30 November 1982, respectively. However, the user need not analyze the data over the entire range of recorded values. The user can analyze only a subset of the data. If this is the case, the user need only enter the beginning and ending dates of the subset to be analyze. Only one beginning and ending date is necessary as the code uses them for both analyses (i.e., for temperatures and flow rates). If the user wants to insure that both temperature and flow rate records are analyzed in their entirety, 1 October 1959 should be used as the beginning date of the analysis and 14 June 1983 as the ending date. The computer program prompts the user for the beginning and ending dates in the following manner:

DATES FOR WHICH DATA IS AVAILABLE

TEMP: 1/ 1/65 TO 11/30/82

FLOW: 10/ 1/59 TO 6/14/83

ENTER BEGINNING AND ENDING DATES FOR DATA ANALYSIS

ENTER DATES IN THIS FORMAT: 8,1,72 FOR AUGUST 1,1972

ENTER BEGINNING DATE:

ENTER ENDING DATE:

The above box after each colon represents the location where the user must supply an answer. Dates are entered by the user in a numbered format. For example, August 1, 1972 is typed in as "8,1,72"; December 31, 1982 is typed in as "12,31,82"; etc.

3.4.2 Temperature and Flow Units

The user has the option of having the analysis presented in English units, metric units, or both (e.g., flow rates presented in English units and temperatures presented in metric units). Flow rate units employed by the code are cubic feet per second (ft³/sec) or cubic meters per second (m³/sec), while temperature units are degrees Fahrenheit (°F) or degrees Celsius (°C). The computer program prompts the user for temperature units in the following manner:

SELECT TEMPERATURE UNITS:

1 = CELSIUS

2 = FAHRENHEIT

and later on for discharge units

SELECT FLOW UNITS:

1 = CUBIC METERS / SECOND

2 = CUBIC FEET / SECOND

The information input by the user in the location of the boxes is either a "1" or a "2".

3.4.3 Maximum, Minimum, and Incremental Flow Rates and Temperatures

The temperature or discharge range, over which the RCDF (or the number of times a discharge/temperature is exceeded in magnitude) and the interval distribution (i.e., number of times a discharge or temperature falls within a user defined range) are computed, are identified by the maximum and minimum values define herein. For example, (e.g., in English units), if the RCDF and

interval range are to be computed over the entire discharge range (i.e., 37,000 ft³/sec to 513,000 ft³/sec) for the period of record, the minimum discharge may be defined as any value less than or equal to 37,000 ft³/sec, while the maximum discharge may be defined as any value greater than or equal to 513,000 ft³/sec. If a statistical analysis is desired by the user over a smaller range, then discharge values for the minimum and maximum flow rate are defined greater than 37,000 ft³/sec and less than 513,000 ft³/sec, respectively. This example also applies to the temperature input where the maximum and minimum temperatures recorded for the period of record are 20.3°C (58.5°F) and 0.1°C (32.3°F).

The RCFD and interval distribution are computed at values between the maximum and minimum values. The increments at which these computations are made are designated by the user. For example (e.g., in English units), if the user wants a statistical summary of discharges between 513,000 ft³/sec and 37,000 ft³/sec at 1000 ft³/sec increments, then the computer program would analyze the data at 37,000 ft³/sec, 38,000 ft³/sec, ..., 513,000 ft³/sec. The increment chosen in this case is 1000 ft³/sec. It should be noted that the program is set up to automatically default to the following values:

Flow Rate: MINIMUM = 1000 m³/sec or 36,000 ft³/sec
MAXIMUM = 15,500 m³/sec or 550,000 ft³/sec
INCREMENT = 50 m³/sec or 2000 ft³/sec
Temperature: MINIMUM = 0°C or 32°F
MAXIMUM = 22°C or 72°F
INCREMENT = 1°C or 2°F

The computer program prompts the user for the minimum, maximum, and incremental temperature information in the following manner (e.g., in metric units)

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS
MIN, MAX, INCREMENT: 0, 22, 1 DEGREES CELSIUS

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

If "0" is input at the location of the box, no further information is required; if a "1" is used, the computer program prompts the user further in the following manner:

ENTER RANGE DESIRED (MIN,MAX,INCREMENT)

The answer is input at the location of the box. The format used is very similar to the one employed in Section 3.4.1. For example (e.g., in metric units), if the user wants a statistical summary of temperatures between 0°C and 10°C in 2°C increments, the user types "0,10,2".

The program also prompts the user in a very similar manner for the discharge information in the following way (e.g., in metric units):

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS

MIN, MAX, INCREMENT: 1000, 15500, 50 CUBIC METERS / SECOND

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

If "0" is input at the location of the box, no further information is required, if a "1" is used, the computer program prompts the user further in the following manner:

ENTER RANGE DESIRED (MIN,MAX,INCREMENT)

An answer is input at the location of the box in a format very similar to the one used in the previous temperature example. For example (e.g., in metric

units), if the user wants a statistical summary of discharges between 1000 m³/sec and 10,000 m³/sec in 100 m³/sec increments, the user types "1000,10000,100".

3.4.4 User-Specified Temperature-Discharge Set

The user-specified river temperature-discharge set of values is used in computing the frequency of occurrence (i.e., probability) of temperatures exceeding and discharges less than said values. The temperature and discharge units are the same as those specified in Section 3.4.2. The computer program prompts the user for the river temperature to be exceeded in the following manner:

FREQUENCY OF OCCURRENCE FOR PAIRS OF
TEMPERATURE AND FLOW VALUES

THE FOLLOWING ANALYSIS WILL COUNT THE NUMBER OF TIMES A GIVEN
TEMPERATURE IS EXCEEDED WHILE AT THE SAME TIME
THE RIVER FLOW IS BELOW A GIVEN VALUE.

THE USER WILL SUPPLY THE TEMPERATURE AND FLOW VALUES
AGAINST WHICH THE DATA WILL BE COMPARED.

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED
ENTER -99 TO EXIT PROGRAM

and later for the maximum flow rate desired:

PLEASE ENTER MAXIMUM FLOW RATE DESIRED FOR THAT TEMP
ENTER -99 TO EXIT PROGRAM

The above boxes represent locations where the user must supply an answer. For example (e.g., in metric units), if the user wants to know what percent of time

the river temperatures were above 10°C and the flow rates were below 5000 m³/sec, the user would type a "10" in the first box and a "5000" in the second box. Upon completion of the calculations, the program again prompts the user to specify another temperature-discharge set of values. If the user elects to by-pass further analysis, the user types "-99".

3.5 OUTPUT RESULTS

This section briefly describes the output from a computer run. The output results are grouped into four tables.

The first table of output presents an analysis of the distribution of daily-averaged temperatures over the user-selected time span. An example (e.g., English units) of the output is presented in Table 3. Column 1 presents the temperatures with the minimum, maximum, and incremental temperatures equaling 32°F, 72°F and 2°F, respectively (refer to Section 3.4.3). Column 2 presents the number of times the corresponding temperature has been exceeded in magnitude over the user designated time span, while Column 3 presents the percent of time the temperature has been exceeded (i.e., relative cumulative frequency distribution). Column 4 presents the user-designated interval range (e.g., 2°F in this case) over which the corresponding temperature is assigned (e.g., very similar to a histogram); Column 5 identifies the number of days the river temperature is within the range defined in Column 4; and Column 6 presents the percent of the time the temperature is within the range.

The second table of output presents the distribution of daily-averaged discharges over the same user selected time span. An example (e.g., in English units) of this output is presented in Table 4. This table is exactly the same as Table 3, except daily discharges are used in the analysis as opposed to temperatures.

The third table of output presents the daily composite of maximum, minimum, and mean temperatures and discharges for each day of each month over the user selected time span, as well as the standard deviation for each day. An example (e.g., in English units) of this output for the month of January is presented in Table 5. Column 1 presents the day of the month. Columns 2, 3, 4, and 5 present the daily-averaged maximum, minimum, and mean temperatures for

TABLE 3. Distribution of Daily-Averaged Temperatures

TEMP (DEG F)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
32.0	6349	100.000	31.0 - 32.9	16	0.252
34.0	6296	99.165	33.0 - 34.9	73	1.150
36.0	6157	96.976	35.0 - 36.9	229	3.607
38.0	5808	91.479	37.0 - 38.9	476	7.497
40.0	5208	82.029	39.0 - 40.9	567	8.931
42.0	4778	75.256	41.0 - 42.9	407	6.410
44.0	4403	69.350	43.0 - 44.9	359	5.654
46.0	4091	64.435	45.0 - 46.9	306	4.820
48.0	3775	59.458	47.0 - 48.9	288	4.536
50.0	3477	54.765	49.0 - 50.9	322	5.072
52.0	3152	49.646	51.0 - 52.9	288	4.536
54.0	2828	44.542	53.0 - 54.9	312	4.914
56.0	2524	39.754	55.0 - 56.9	364	5.733
58.0	2152	33.895	57.0 - 58.9	352	5.544
60.0	1810	28.508	59.0 - 60.9	393	6.190
62.0	1420	22.366	61.0 - 62.9	439	6.914
64.0	888	13.986	63.0 - 64.9	660	10.395
66.0	239	3.764	65.0 - 66.9	420	6.615
68.0	8	0.126	67.0 - 68.9	78	1.229
70.0	0	0.000	69.0 - 70.9	0	0.000
72.0	0	0.000	71.0 - 72.9	0	0.000

TABLE 4. Distribution of Daily Flow Rates

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
36000	8653	100.000	35000 - 36999	0	0.000
38000	8638	99.827	37000 - 38999	26	0.300
40000	8604	99.434	39000 - 40999	32	0.370
42000	8572	99.064	41000 - 42999	38	0.439
44000	8530	98.579	43000 - 44999	40	0.462
46000	8487	98.082	45000 - 46999	37	0.428
48000	8444	97.585	47000 - 48999	53	0.613
50000	8386	96.914	49000 - 50999	59	0.682
52000	8325	96.209	51000 - 52999	68	0.786
54000	8249	95.331	53000 - 54999	83	0.959
56000	8143	94.106	55000 - 56999	103	1.190
58000	8042	92.939	57000 - 58999	115	1.329
60000	7925	91.587	59000 - 60999	116	1.341
62000	7801	90.154	61000 - 62999	121	1.398
64000	7676	88.709	63000 - 64999	134	1.549
66000	7521	86.918	65000 - 66999	153	1.768
68000	7380	85.288	67000 - 68999	146	1.687
70000	7228	83.532	69000 - 70999	144	1.664
72000	7084	81.868	71000 - 72999	177	2.046
74000	6883	79.545	73000 - 74999	175	2.022
76000	6723	77.696	75000 - 76999	173	1.999
78000	6527	75.430	77000 - 78999	205	2.369
80000	6332	73.177	79000 - 80999	188	2.173
82000	6138	70.935	81000 - 82999	192	2.219
84000	5946	68.716	83000 - 84999	199	2.300
86000	5739	66.324	85000 - 86999	194	2.242
88000	5535	63.966	87000 - 88999	202	2.334
90000	5332	61.620	89000 - 90999	203	2.346
92000	5123	59.205	91000 - 92999	190	2.196
94000	4959	57.310	93000 - 94999	165	1.907
96000	4796	55.426	95000 - 96999	169	1.953
98000	4612	53.299	97000 - 98999	173	1.999
100000	4434	51.242	99000 - 100999	165	1.907
102000	4276	49.416	101000 - 102999	149	1.722
104000	4111	47.510	103000 - 104999	163	1.884
106000	3968	45.857	105000 - 106999	141	1.629
108000	3813	44.066	107000 - 108999	159	1.838
110000	3654	42.228	109000 - 110999	161	1.861
112000	3500	40.448	111000 - 112999	149	1.722
114000	3362	38.854	113000 - 114999	140	1.618
116000	3246	37.513	115000 - 116999	119	1.375
118000	3131	36.184	117000 - 118999	111	1.283
120000	3022	34.924	119000 - 120999	110	1.271
122000	2920	33.746	121000 - 122999	99	1.144
124000	2812	32.497	123000 - 124999	107	1.237
126000	2704	31.249	125000 - 126999	109	1.260
128000	2620	30.279	127000 - 128999	85	0.982
130000	2541	29.366	129000 - 130999	79	0.913
132000	2457	28.395	131000 - 132999	84	0.971

TABLE 5. Daily Composite of Maximum, Minimum, and Mean Daily-Averaged Temperatures and Flow Rates for Each Day of Each Month Along with the Respective Standard Deviations

DATE	TEMPERATURE (DEG F)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
1/ 1	44.4	37.2	41.47	1.87	163000	37300	79320	32992
1/ 2	44.4	37.4	41.13	1.88	159000	42500	95262	29062
1/ 3	44.1	37.9	40.90	1.79	153000	53300	98591	27064
1/ 4	44.1	37.6	40.67	1.94	156000	43600	100637	28246
1/ 5	44.1	37.0	40.41	2.01	154000	45700	98866	27554
1/ 6	44.1	35.8	40.16	2.10	144500	42500	97808	26260
1/ 7	43.9	34.7	39.97	2.17	158100	43100	95891	30516
1/ 8	43.5	34.3	39.88	2.14	154000	40700	95412	34014
1/ 9	43.2	34.7	39.88	1.95	154000	38300	90820	30194
1/10	43.2	35.1	39.71	1.81	155000	51400	92575	27413
1/11	43.2	35.2	39.58	1.72	150000	41400	94837	30991
1/12	43.0	34.9	39.35	1.75	162000	45000	92087	26395
1/13	42.8	35.6	39.33	1.67	163000	49300	93616	28787
1/14	42.8	35.2	39.35	1.75	162000	42400	89333	29063
1/15	43.2	36.3	39.44	1.57	161000	54300	90454	26086
1/16	42.8	33.8	39.02	2.03	157000	40400	91608	29173
1/17	42.6	33.8	38.94	1.96	162000	55000	92779	26648
1/18	42.4	33.8	38.93	1.94	152000	51100	92375	25090
1/19	42.6	33.8	38.95	1.99	161000	44100	94900	26773
1/20	42.6	33.8	38.97	2.03	170000	57500	98404	28175
1/21	42.4	33.8	38.90	2.07	162000	47700	99654	32028
1/22	42.4	33.8	38.78	2.07	182000	48200	97958	32749
1/23	42.3	33.8	38.61	2.09	208000	37000	97104	37418
1/24	41.9	33.8	38.54	2.10	202000	38000	96291	35589
1/25	41.7	33.6	38.31	2.11	197000	45700	100558	34145
1/26	41.5	33.6	38.06	2.12	195000	41400	102254	34039
1/27	41.5	33.3	37.85	2.20	198000	59300	101829	35312
1/28	41.7	32.7	37.64	2.36	203000	52300	102108	36770
1/29	42.1	32.5	37.64	2.65	182000	39000	99920	38465
1/30	41.7	32.7	37.50	2.65	183000	38000	100137	37348
1/31	41.9	32.4	37.18	2.63	168000	38500	101350	35899

the corresponding day over the user-designated time span, as well as the standard deviation about the mean for that day. Basically, all temperature information, which is collected on that day regardless of the year, is analyzed to form the basis of the information presented in Columns 2, 3, 4, and 5. Columns 6, 7, 8, and 9 are very similar to Columns 2, 3, 4, and 5, respectively but with flow rates as opposed to temperatures.

The fourth table of output presents frequency of occurrence of temperatures greater than and discharges less than five user-specified temperature-discharge sets of values. An example (e.g., English units) of the output is presented in Table 6. Columns 1 and 2 present the user-specified temperature and flow rate with which all temperatures and corresponding (i.e., same day) discharges within the period of record are compared to. The third column presents the number of times the above criteria is met, while Column 4 presents the percent of time over the length of record the above criteria is met.

3.6 SAMPLE PROBLEMS

This section presents two sample problems to help the user understand the COLSTAT code. User input is presented in this section, while the output results are presented in Appendices.

3.6.1 Sample Problem 1

A user would like to statistically analyze Columbia River data just downstream of Priest Rapids Dam for the time period of 1 October 1959 through 31 December 1970. The user wants temperature in units of degrees Fahrenheit and discharge in units of cubic meters per second. Also the user wants to use the default range supplied by the program for temperature and a discharge range of 1000 m³/sec to 5000 m³/sec in 100 m³/sec increments. In addition, the user would like to know the percent of time the river temperatures are greater than 65°C and discharges less than 2800 m³/sec.

The input data for this problem is presented in Table 7, while the output results are presented in Appendix B.

TABLE 6. Frequency of Occurrence of Temperatures Greater Than and Discharges Less Than Five User-Specified Temperature-Discharge Data Sets

PERCENT OF TIME TEMPERATURE EXCEEDS A GIVEN MINIMUM
WHILE FLOW RATE IS BELOW A GIVEN MAXIMUM

MINIMUM TEMPERATURE		MAXIMUM FLOW	NO. OF TIMES CRITERIA MET	PERCENT OF TIME
-----		-----	-----	-----
45.0	DEG F	1000000 CFS	1943	29.7
50.0	DEG F	2000000 CFS	2854	43.6
55.0	DEG F	3000000 CFS	2600	39.7
60.0	DEG F	4000000 CFS	1810	27.7
65.0	DEG F	5000000 CFS	498	7.6

TABLE 7. Sample Problem 1 Input(a)

DATES FOR WHICH DATA IS AVAILABLE

TEMP: 1/1/65 TO 11/30/82

FLOW: 10/1/59 TO 6/14/83

ENTER BEGINNING AND ENDING DATES FOR DATA ANALYSIS
ENTER DATES IN THIS FORMAT: 8,1,72 FOR AUGUST 1, 1972

ENTER BEGINNING DATE: 10,1,59

ENTER ENDING DATE: 12,31,70

SELECT TEMPERATURE UNITS:

1 = CELSIUS

2 = FAHRENHEIT

2

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS
MIN, MAX, INCREMENT: 32, 72, 2 DEGREES FAHRENHEIT

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

0

SELECT FLOW UNITS:

1 = CUBIC METERS / SECOND

2 = CUBIC FEET / SECOND

1

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS
MIN, MAX, INCREMENT: 1000, 15500, 50 CUBIC METERS / SECOND

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

1

ENTER RANGE DESIRED

1000,5000,100

FREQUENCY OF OCCURRENCE FOR PAIRS OF
TEMPERATURE AND FLOW VALUES

THE FOLLOWING ANALYSIS WILL COUNT THE NUMBER OF TIMES
A GIVEN TEMPERATURE IS EXCEEDED WHILE AT THE SAME TIME
THE RIVER FLOW IS BELOW A GIVEN VALUE.

THE USER WILL SUPPLY THE TEMPERATURE AND FLOW VALUES
AGAINST WHICH THE DATA WILL BE COMPARED.

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED

ENTER -99 TO EXIT PROGRAM

65

PLEASE ENTER MAXIMUM FLOW RATE DESIRED FOR THAT TEMP

ENTER -99 TO EXIT PROGRAM

2800

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED

ENTER -99 TO EXIT PROGRAM

-99

(a) Numbers in blocks are user supplied.

3.6.2 Sample Problem 2

A user would like to statistically analyze Columbia River data just downstream of Priest Rapids Dam for the time period of 1 January 1971 through 24 June 1983. The user wants temperature units in degrees Celsius and discharge in units of cubic feet per second. Also the user wants a temperature range of 2°C to 20°C in 2°C increments and the default range supplied by the program for the discharge. In addition, the user would like to know the percent of time the a) river temperatures are greater than 18°C and discharges less than 100,000 ft³/sec and b) river temperatures are greater than 17°C and discharges less than 90,000 ft³/sec.

The input data for this problem is presented in Table 8, while the output results are presented in Appendix C.

TABLE 8. Sample Problem 2 Input(a)

DATES FOR WHICH DATA IS AVAILABLE
TEMP: 1/1/65 TO 11/30/82
FLOW: 10/1/59 TO 6/14/83

ENTER BEGINING AND ENDING DATES FOR DATA ANALYSIS
ENTER DATES IN THIS FORMAT: 8, 1, 72 FOR AUGUST 1, 1972

ENTER BEGINING DATE:

ENTER ENDING DATE:

SELECT TEMPERATURE UNITS:

1 = CELSIUS

2 = FAHRENHEIT

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS
MIN, MAX, INCREMENT: 0, 22, 1 DEGREES CELSIUS

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

ENTER RANGE DESIRED

SELECT FLOW UNITS:

1 = CUBIC METERS / SECOND

2 = CUBIC FEET / SECOND

THE DEFAULT RANGE FOR THE CUMULATIVE DISTRIBUTION IS
MIN, MAX, INCREMENT: 36000, 550000, 2000 CUBIC FEET / SECOND

DO YOU WISH TO CHANGE THE RANGE OF THE CUMULATIVE DISTRIBUTION?

0 = USE DEFAULT RANGE, 1 = CHANGE

FREQUENCY OF OCCURRENCE FOR PAIRS OF
TEMPERATURE AND FLOW VALUES

THE FOLLOWING ANALYSIS WILL COUNT THE NUMBER OF TIMES
A GIVEN TEMPERATURE IS EXCEEDED WHILE AT THE SAME TIME
THE RIVER FLOW IS BELOW A GIVEN VALUE.

THE USER WILL SUPPLY THE TEMPERATURE AND FLOW VALUES
AGAINST WHICH THE DATA WILL BE COMPARED.

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED
ENTER -99 TO EXIT PROGRAM

PLEASE ENTER MAXIMUM FLOW RATE DESIRED FOR THAT TEMP
ENTER -99 TO EXIT PROGRAM

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED
ENTER -99 TO EXIT PROGRAM

PLEASE ENTER MAXIMUM FLOW RATE DESIRED FOR THAT TEMP
ENTER -99 TO EXIT PROGRAM

PLEASE ENTER THE RIVER TEMPERATURE TO BE EXCEEDED
ENTER -99 TO EXIT PROGRAM

(a) Numbers in blocks are user supplied.

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APPENDIX A

STATISTICAL ANALYSIS

COLUMBIA RIVER FLOW RATES AND TEMPERATURES

1 OCTOBER 1959 TO 14 JUNE 1983

DISTRIBUTION OF AVERAGE DAILY TEMPERATURES FOR 1/ 1/65 TO 11/30/82

TEMP (DEG C)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
0.0	6349	100.000	-0.5 - 0.4	13	0.205
1.0	6312	99.417	0.5 - 1.4	57	0.898
2.0	6195	97.574	1.5 - 2.4	171	2.693
3.0	5937	93.511	2.5 - 3.4	347	5.465
4.0	5428	85.494	3.5 - 4.4	553	8.710
5.0	4952	77.997	4.5 - 5.4	397	6.253
6.0	4609	72.594	5.5 - 6.4	336	5.292
7.0	4281	67.428	6.5 - 7.4	306	4.820
8.0	3990	62.845	7.5 - 8.4	287	4.520
9.0	3724	58.655	8.5 - 9.4	254	4.001
10.0	3477	54.765	9.5 - 10.4	293	4.615
11.0	3173	49.976	10.5 - 11.4	261	4.111
12.0	2900	45.676	11.5 - 12.4	297	4.678
13.0	2621	41.282	12.5 - 13.4	288	4.536
14.0	2261	35.612	13.5 - 14.4	337	5.308
15.0	1957	30.824	14.5 - 15.4	310	4.883
16.0	1644	25.894	15.5 - 16.4	351	5.528
17.0	1251	19.704	16.5 - 17.4	448	7.056
18.0	715	11.262	17.5 - 18.4	589	9.277
19.0	175	2.756	18.5 - 19.4	376	5.922
20.0	8	0.126	19.5 - 20.4	78	1.229
21.0	0	0.000	20.5 - 21.4	0	0.000
22.0	0	0.000	21.5 - 22.4	0	0.000

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
1000	8653	100.000	975 - 1024	0	0.000
1050	8651	99.977	1025 - 1074	8	0.092
1100	8628	99.711	1075 - 1124	32	0.370
1150	8599	99.376	1125 - 1174	30	0.347
1200	8567	99.006	1175 - 1224	39	0.451
1250	8528	98.555	1225 - 1274	35	0.404
1300	8495	98.174	1275 - 1324	24	0.277
1350	8462	97.793	1325 - 1374	51	0.589
1400	8404	97.122	1375 - 1424	52	0.601
1450	8350	96.498	1425 - 1474	57	0.659
1500	8300	95.920	1475 - 1524	61	0.705
1550	8224	95.042	1525 - 1574	84	0.971
1600	8125	93.898	1575 - 1624	99	1.144
1650	8035	92.858	1625 - 1674	103	1.190
1700	7925	91.587	1675 - 1724	95	1.098
1750	7832	90.512	1725 - 1774	113	1.306
1800	7713	89.137	1775 - 1824	115	1.329
1850	7591	87.727	1825 - 1874	148	1.710
1900	7453	86.132	1875 - 1924	102	1.179
1950	7333	84.745	1925 - 1974	139	1.606
2000	7195	83.150	1975 - 2024	127	1.468
2050	7060	81.590	2025 - 2074	165	1.907
2100	6877	79.475	2075 - 2124	168	1.942
2150	6757	78.089	2125 - 2174	136	1.572
2200	6589	76.147	2175 - 2224	180	2.080
2250	6397	73.928	2225 - 2274	180	2.080
2300	6222	71.906	2275 - 2324	181	2.092
2350	6075	70.207	2325 - 2374	140	1.618
2400	5888	68.046	2375 - 2424	199	2.300
2450	5709	65.977	2425 - 2474	174	2.011
2500	5526	63.862	2475 - 2524	177	2.046
2550	5332	61.620	2525 - 2574	162	1.872
2600	5179	59.852	2575 - 2624	178	2.057
2650	5021	58.026	2625 - 2674	154	1.780
2700	4857	56.131	2675 - 2724	158	1.826
2750	4709	54.420	2725 - 2774	125	1.445
2800	4584	52.976	2775 - 2824	168	1.942
2850	4420	51.081	2825 - 2874	146	1.687
2900	4274	49.393	2875 - 2924	157	1.814
2950	4111	47.510	2925 - 2974	148	1.710
3000	4035	46.631	2975 - 3024	80	0.925
3050	3876	44.794	3025 - 3074	156	1.803
3100	3730	43.106	3075 - 3124	156	1.803
3150	3578	41.350	3125 - 3174	153	1.768
3200	3436	39.709	3175 - 3224	71	0.821
3250	3354	38.761	3225 - 3274	118	1.364
3300	3238	37.421	3275 - 3324	132	1.525
3350	3129	36.161	3325 - 3374	104	1.202
3400	3022	34.924	3375 - 3424	60	0.693

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
3450	2971	34.335	3425 - 3474	99	1.144
3500	2861	33.064	3475 - 3524	106	1.225
3550	2759	31.885	3525 - 3574	107	1.237
3600	2660	30.741	3575 - 3624	81	0.936
3650	2613	30.198	3625 - 3674	44	0.508
3700	2535	29.296	3675 - 3724	85	0.982
3750	2454	28.360	3725 - 3774	79	0.913
3800	2373	27.424	3775 - 3824	61	0.705
3850	2349	27.147	3825 - 3874	36	0.416
3900	2275	26.291	3875 - 3924	70	0.809
3950	2217	25.621	3925 - 3974	59	0.682
4000	2165	25.020	3975 - 4024	46	0.532
4050	2112	24.408	4025 - 4074	32	0.370
4100	2080	24.038	4075 - 4124	49	0.566
4150	2034	23.506	4125 - 4174	47	0.543
4200	1989	22.906	4175 - 4224	39	0.451
4250	1951	22.547	4225 - 4274	26	0.300
4300	1928	22.281	4275 - 4324	35	0.404
4350	1883	21.761	4325 - 4374	55	0.636
4400	1839	21.253	4375 - 4424	38	0.439
4450	1795	20.744	4425 - 4474	41	0.474
4500	1770	20.455	4475 - 4524	38	0.439
4550	1718	19.854	4525 - 4574	41	0.474
4600	1678	19.392	4575 - 4624	46	0.532
4650	1631	18.849	4625 - 4674	38	0.439
4700	1612	18.629	4675 - 4724	21	0.243
4750	1578	18.236	4725 - 4774	35	0.404
4800	1548	17.890	4775 - 4824	29	0.335
4850	1511	17.462	4825 - 4874	46	0.532
4900	1471	17.000	4875 - 4924	20	0.231
4950	1443	16.676	4925 - 4974	39	0.451
5000	1409	16.283	4975 - 5024	28	0.324
5050	1386	16.018	5025 - 5074	24	0.277
5100	1353	15.636	5075 - 5124	25	0.289
5150	1335	15.428	5125 - 5174	31	0.358
5200	1295	14.966	5175 - 5224	44	0.508
5250	1262	14.585	5225 - 5274	23	0.266
5300	1234	14.261	5275 - 5324	35	0.404
5350	1206	13.937	5325 - 5374	22	0.254
5400	1181	13.648	5375 - 5424	26	0.300
5450	1153	13.325	5425 - 5474	27	0.312
5500	1127	13.024	5475 - 5524	24	0.277
5550	1109	12.816	5525 - 5574	13	0.150
5600	1096	12.666	5575 - 5624	16	0.185
5650	1070	12.366	5625 - 5674	30	0.347
5700	1046	12.088	5675 - 5724	25	0.289
5750	1019	11.776	5725 - 5774	19	0.220
5800	994	11.487	5775 - 5824	26	0.300
5850	975	11.268	5825 - 5874	25	0.289
5900	951	10.990	5875 - 5924	20	0.231

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
5950	928	10.725	5925 - 5974	15	0.173
6000	916	10.586	5975 - 6024	19	0.220
6050	901	10.413	6025 - 6074	23	0.266
6100	874	10.101	6075 - 6124	19	0.220
6150	858	9.916	6125 - 6174	20	0.231
6200	840	9.708	6175 - 6224	14	0.162
6250	822	9.500	6225 - 6274	25	0.289
6300	796	9.199	6275 - 6324	21	0.243
6350	782	9.037	6325 - 6374	16	0.185
6400	757	8.748	6375 - 6424	15	0.173
6450	746	8.621	6425 - 6474	24	0.277
6500	718	8.298	6475 - 6524	20	0.231
6550	706	8.159	6525 - 6574	12	0.139
6600	689	7.963	6575 - 6624	10	0.116
6650	681	7.870	6625 - 6674	19	0.220
6700	662	7.651	6675 - 6724	14	0.162
6750	646	7.466	6725 - 6774	15	0.173
6800	627	7.246	6775 - 6824	24	0.277
6850	617	7.130	6825 - 6874	11	0.127
6900	596	6.888	6875 - 6924	19	0.220
6950	581	6.714	6925 - 6974	15	0.173
7000	567	6.553	6975 - 7024	12	0.139
7050	560	6.472	7025 - 7074	8	0.092
7100	543	6.275	7075 - 7124	14	0.162
7150	527	6.090	7125 - 7174	20	0.231
7200	511	5.905	7175 - 7224	13	0.150
7250	498	5.755	7225 - 7274	7	0.081
7300	489	5.651	7275 - 7324	15	0.173
7350	478	5.524	7325 - 7374	12	0.139
7400	468	5.409	7375 - 7424	11	0.127
7450	455	5.258	7425 - 7474	6	0.069
7500	450	5.201	7475 - 7524	8	0.092
7550	439	5.073	7525 - 7574	14	0.162
7600	425	4.912	7575 - 7624	9	0.104
7650	417	4.819	7625 - 7674	8	0.092
7700	415	4.796	7675 - 7724	3	0.035
7750	409	4.727	7725 - 7774	6	0.069
7800	402	4.646	7775 - 7824	7	0.081
7850	395	4.565	7825 - 7874	15	0.173
7900	384	4.438	7875 - 7924	2	0.023
7950	379	4.380	7925 - 7974	9	0.104
8000	370	4.276	7975 - 8024	7	0.081
8050	357	4.126	8025 - 8074	15	0.173
8100	350	4.045	8075 - 8124	3	0.035
8150	341	3.941	8125 - 8174	10	0.116
8200	334	3.860	8175 - 8224	10	0.116
8250	323	3.733	8225 - 8274	17	0.196
8300	308	3.559	8275 - 8324	4	0.046
8350	303	3.502	8325 - 8374	13	0.150
8400	290	3.351	8375 - 8424	10	0.116

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
8450	271	3.132	8425 - 8474	18	0.208
8500	258	2.982	8475 - 8524	14	0.162
8550	252	2.912	8525 - 8574	7	0.081
8600	239	2.762	8575 - 8624	10	0.116
8650	227	2.623	8625 - 8674	11	0.127
8700	218	2.519	8675 - 8724	12	0.139
8750	211	2.438	8725 - 8774	5	0.058
8800	203	2.346	8775 - 8824	11	0.127
8850	194	2.242	8825 - 8874	2	0.023
8900	193	2.230	8875 - 8924	4	0.046
8950	189	2.184	8925 - 8974	1	0.012
9000	186	2.150	8975 - 9024	5	0.058
9050	182	2.103	9025 - 9074	3	0.035
9100	179	2.069	9075 - 9124	5	0.058
9150	173	1.999	9125 - 9174	5	0.058
9200	171	1.976	9175 - 9224	0	0.000
9250	169	1.953	9225 - 9274	5	0.058
9300	165	1.907	9275 - 9324	1	0.012
9350	162	1.872	9325 - 9374	5	0.058
9400	160	1.849	9375 - 9424	1	0.012
9450	156	1.803	9425 - 9474	3	0.035
9500	151	1.745	9475 - 9524	10	0.116
9550	143	1.653	9525 - 9574	3	0.035
9600	140	1.618	9575 - 9624	3	0.035
9650	139	1.606	9625 - 9674	3	0.035
9700	135	1.560	9675 - 9724	4	0.046
9750	129	1.491	9725 - 9774	5	0.058
9800	126	1.456	9775 - 9824	2	0.023
9850	126	1.456	9825 - 9874	2	0.023
9900	121	1.398	9875 - 9924	6	0.069
9950	118	1.364	9925 - 9974	0	0.000
10000	117	1.352	9975 - 10024	1	0.012
10050	117	1.352	10025 - 10074	0	0.000
10100	114	1.317	10075 - 10124	3	0.035
10150	114	1.317	10125 - 10174	0	0.000
10200	112	1.294	10175 - 10224	3	0.035
10250	111	1.283	10225 - 10274	0	0.000
10300	111	1.283	10275 - 10324	0	0.000
10350	111	1.283	10325 - 10374	1	0.012
10400	109	1.260	10375 - 10424	1	0.012
10450	109	1.260	10425 - 10474	0	0.000
10500	109	1.260	10475 - 10524	0	0.000
10550	108	1.248	10525 - 10574	2	0.023
10600	106	1.225	10575 - 10624	1	0.012
10650	105	1.213	10625 - 10674	1	0.012
10700	105	1.213	10675 - 10724	2	0.023
10750	103	1.190	10725 - 10774	2	0.023
10800	101	1.167	10775 - 10824	2	0.023
10850	99	1.144	10825 - 10874	0	0.000
10900	99	1.144	10875 - 10924	1	0.012

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
10950	97	1.121	10925 - 10974	2	0.023
11000	96	1.109	10975 - 11024	0	0.000
11050	95	1.098	11025 - 11074	2	0.023
11100	94	1.086	11075 - 11124	0	0.000
11150	93	1.075	11125 - 11174	2	0.023
11200	90	1.040	11175 - 11224	3	0.035
11250	89	1.029	11225 - 11274	1	0.012
11300	88	1.017	11275 - 11324	0	0.000
11350	88	1.017	11325 - 11374	1	0.012
11400	86	0.994	11375 - 11424	2	0.023
11450	80	0.925	11425 - 11474	6	0.069
11500	77	0.890	11475 - 11524	2	0.023
11550	77	0.890	11525 - 11574	2	0.023
11600	75	0.867	11575 - 11624	1	0.012
11650	73	0.844	11625 - 11674	1	0.012
11700	73	0.844	11675 - 11724	2	0.023
11750	71	0.821	11725 - 11774	0	0.000
11800	70	0.809	11775 - 11824	2	0.023
11850	69	0.797	11825 - 11874	1	0.012
11900	67	0.774	11875 - 11924	2	0.023
11950	66	0.763	11925 - 11974	0	0.000
12000	65	0.751	11975 - 12024	2	0.023
12050	60	0.693	12025 - 12074	4	0.046
12100	58	0.670	12075 - 12124	2	0.023
12150	56	0.647	12125 - 12174	2	0.023
12200	54	0.624	12175 - 12224	3	0.035
12250	51	0.589	12225 - 12274	2	0.023
12300	49	0.566	12275 - 12324	3	0.035
12350	43	0.497	12325 - 12374	6	0.069
12400	42	0.485	12375 - 12424	1	0.012
12450	40	0.462	12425 - 12474	2	0.023
12500	38	0.439	12475 - 12524	2	0.023
12550	37	0.428	12525 - 12574	0	0.000
12600	37	0.428	12575 - 12624	2	0.023
12650	34	0.393	12625 - 12674	1	0.012
12700	34	0.393	12675 - 12724	1	0.012
12750	33	0.381	12725 - 12774	1	0.012
12800	31	0.358	12775 - 12824	1	0.012
12850	29	0.335	12825 - 12874	4	0.046
12900	27	0.312	12875 - 12924	0	0.000
12950	26	0.300	12925 - 12974	3	0.035
13000	24	0.277	12975 - 13024	0	0.000
13050	22	0.254	13025 - 13074	3	0.035
13100	19	0.220	13075 - 13124	3	0.035
13150	18	0.208	13125 - 13174	0	0.000
13200	16	0.185	13175 - 13224	3	0.035
13250	15	0.173	13225 - 13274	1	0.012
13300	14	0.162	13275 - 13324	1	0.012
13350	12	0.139	13325 - 13374	1	0.012
13400	11	0.127	13375 - 13424	1	0.012

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 6/14/83

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
13450	11	0.127	13425 - 13474	0	0.000
13500	11	0.127	13475 - 13524	0	0.000
13550	11	0.127	13525 - 13574	1	0.012
13600	10	0.116	13575 - 13624	0	0.000
13650	9	0.104	13625 - 13674	1	0.012
13700	9	0.104	13675 - 13724	0	0.000
13750	9	0.104	13725 - 13774	0	0.000
13800	9	0.104	13775 - 13824	0	0.000
13850	9	0.104	13825 - 13874	0	0.000
13900	8	0.092	13875 - 13924	1	0.012
13950	8	0.092	13925 - 13974	1	0.012
14000	7	0.081	13975 - 14024	0	0.000
14050	6	0.069	14025 - 14074	1	0.012
14100	6	0.069	14075 - 14124	0	0.000
14150	5	0.058	14125 - 14174	1	0.012
14200	5	0.058	14175 - 14224	2	0.023
14250	3	0.035	14225 - 14274	0	0.000
14300	3	0.035	14275 - 14324	0	0.000
14350	2	0.023	14325 - 14374	1	0.012
14400	2	0.023	14375 - 14424	0	0.000
14450	2	0.023	14425 - 14474	1	0.012
14500	1	0.012	14475 - 14524	0	0.000
14550	0	0.000	14525 - 14574	1	0.012
14600	0	0.000	14575 - 14624	0	0.000
14650	0	0.000	14625 - 14674	0	0.000
14700	0	0.000	14675 - 14724	0	0.000
14750	0	0.000	14725 - 14774	0	0.000
14800	0	0.000	14775 - 14824	0	0.000
14850	0	0.000	14825 - 14874	0	0.000
14900	0	0.000	14875 - 14924	0	0.000
14950	0	0.000	14925 - 14974	0	0.000
15000	0	0.000	14975 - 15024	0	0.000
15050	0	0.000	15025 - 15074	0	0.000
15100	0	0.000	15075 - 15124	0	0.000
15150	0	0.000	15125 - 15174	0	0.000
15200	0	0.000	15175 - 15224	0	0.000
15250	0	0.000	15225 - 15274	0	0.000
15300	0	0.000	15275 - 15324	0	0.000
15350	0	0.000	15325 - 15374	0	0.000
15400	0	0.000	15375 - 15424	0	0.000
15450	0	0.000	15425 - 15474	0	0.000
15500	0	0.000	15475 - 15524	0	0.000

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF JANUARY

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
1/ 1	6.9	2.9	5.26	1.04	4615	1056	2246	934
1/ 2	6.9	3.0	5.07	1.05	4502	1203	2697	822
1/ 3	6.7	3.3	4.95	1.00	4332	1509	2791	766
1/ 4	6.7	3.1	4.82	1.08	4417	1234	2849	799
1/ 5	6.7	2.8	4.67	1.11	4360	1294	2799	780
1/ 6	6.7	2.1	4.54	1.16	4091	1203	2769	743
1/ 7	6.6	1.5	4.43	1.21	4477	1220	2715	864
1/ 8	6.4	1.3	4.38	1.19	4360	1152	2701	963
1/ 9	6.2	1.5	4.38	1.08	4360	1084	2571	855
1/10	6.2	1.7	4.28	1.00	4389	1455	2621	776
1/11	6.2	1.8	4.21	0.96	4247	1172	2685	877
1/12	6.1	1.6	4.08	0.97	4587	1274	2607	747
1/13	6.0	2.0	4.07	0.93	4615	1396	2651	815
1/14	6.0	1.8	4.08	0.97	4587	1200	2529	822
1/15	6.2	2.4	4.14	0.87	4559	1537	2561	738
1/16	6.0	1.0	3.90	1.13	4445	1144	2594	826
1/17	5.9	1.0	3.86	1.09	4587	1557	2627	754
1/18	5.8	1.0	3.85	1.08	4304	1447	2615	710
1/19	5.9	1.0	3.86	1.10	4559	1248	2687	758
1/20	5.9	1.0	3.87	1.13	4813	1628	2786	797
1/21	5.8	1.0	3.83	1.15	4587	1350	2821	906
1/22	5.8	1.0	3.77	1.15	5153	1364	2773	927
1/23	5.7	1.0	3.67	1.16	5890	1047	2749	1059
1/24	5.5	1.0	3.63	1.17	5720	1076	2726	1007
1/25	5.4	0.9	3.51	1.17	5578	1294	2847	966
1/26	5.3	0.9	3.37	1.18	5521	1172	2895	963
1/27	5.3	0.7	3.25	1.22	5606	1679	2883	999
1/28	5.4	0.4	3.13	1.31	5748	1481	2891	1041
1/29	5.6	0.3	3.13	1.47	5153	1104	2829	1089
1/30	5.4	0.4	3.06	1.47	5182	1076	2835	1057
1/31	5.5	0.2	2.88	1.46	4757	1090	2869	1016

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF FEBRUARY

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
2/ 1	5.4	0.1	2.94	1.49	5012	1410	2830	863
2/ 2	5.4	0.5	3.07	1.31	5408	1356	2944	924
2/ 3	5.6	0.6	3.05	1.30	5465	1475	2901	969
2/ 4	5.8	0.8	2.99	1.28	4842	1302	2981	899
2/ 5	5.7	1.1	2.94	1.25	4842	1313	3001	914
2/ 6	5.5	1.1	2.89	1.20	4901	1328	2997	1047
2/ 7	5.6	0.2	2.78	1.33	4615	1211	2914	883
2/ 8	5.5	0.2	2.74	1.31	4785	1090	2890	883
2/ 9	5.5	0.3	2.68	1.26	4757	1815	2978	820
2/10	5.5	0.4	2.73	1.24	4729	2101	2961	764
2/11	5.5	0.4	2.76	1.22	4672	1679	2891	855
2/12	5.6	0.5	2.83	1.21	4474	1500	2870	875
2/13	5.4	0.8	2.88	1.11	4191	1636	2914	748
2/14	5.3	1.1	2.96	1.07	3992	1568	2931	720
2/15	5.2	1.0	3.01	1.08	4077	1268	2822	624
2/16	5.2	1.0	3.05	1.05	3454	1891	2732	521
2/17	5.2	1.1	3.08	1.06	4162	1701	2757	602
2/18	5.0	1.1	3.09	1.03	4587	1172	2846	834
2/19	5.0	1.1	3.14	1.05	4389	1752	2823	789
2/20	4.8	1.1	3.20	1.06	4474	1192	2767	811
2/21	4.8	1.1	3.19	1.07	4021	1585	2861	685
2/22	4.8	1.1	3.13	1.03	4275	1653	2860	724
2/23	4.8	1.1	3.18	1.00	5527	1390	2952	877
2/24	4.8	1.1	3.21	0.99	5054	1090	2967	903
2/25	5.1	1.1	3.24	1.05	5309	1127	2894	1004
2/26	5.1	1.3	3.29	1.04	5250	1390	2939	1018
2/27	5.0	1.4	3.34	1.03	5558	1432	2913	1048
2/28	5.2	1.5	3.42	0.98	5456	1667	2935	920
2/29	4.2	2.5	3.35	0.70	3964	1526	2502	1101

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF MARCH

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
3/ 1	5.3	1.6	3.39	0.91	5904	1464	2993	1107
3/ 2	5.0	1.7	3.39	0.85	5728	1214	2979	1103
3/ 3	5.0	1.7	3.41	0.87	6258	1294	3131	1204
3/ 4	5.1	1.7	3.42	0.89	6122	1523	3041	1148
3/ 5	5.1	1.8	3.51	0.89	6139	1500	2943	1130
3/ 6	5.2	1.9	3.59	0.90	5751	1548	3035	1090
3/ 7	5.2	2.2	3.62	0.86	5298	1449	3042	977
3/ 8	5.3	2.3	3.69	0.86	5674	1243	2957	1119
3/ 9	5.4	2.4	3.81	0.84	5558	1653	3063	1052
3/10	5.5	2.5	3.84	0.83	5159	1599	3006	956
3/11	5.6	2.5	3.90	0.84	5884	1294	2874	1099
3/12	5.6	2.7	3.94	0.79	5884	1356	2977	1174
3/13	5.7	2.7	4.00	0.85	6275	1050	2998	1218
3/14	5.9	2.6	4.02	0.81	6490	1676	3044	1086
3/15	5.9	2.8	4.08	0.75	6467	1557	2969	1241
3/16	6.0	2.9	4.22	0.76	6490	1503	2981	1222
3/17	5.8	3.1	4.24	0.67	6470	1415	3059	1214
3/18	5.9	3.2	4.31	0.66	6394	1452	3009	1229
3/19	6.0	3.2	4.36	0.69	6187	1582	2915	1244
3/20	6.1	3.3	4.44	0.67	6385	1625	2977	1237
3/21	6.2	3.3	4.55	0.70	6193	1648	3010	1276
3/22	6.3	3.3	4.65	0.72	6173	1534	3143	1395
3/23	6.2	3.3	4.71	0.67	6731	1682	3208	1365
3/24	6.2	3.4	4.76	0.69	6408	1574	3103	1304
3/25	6.1	3.6	4.83	0.67	6736	1483	3176	1352
3/26	6.3	3.5	4.91	0.75	6266	1673	3178	1285
3/27	6.3	3.5	4.98	0.76	6357	1512	3220	1278
3/28	6.5	3.6	5.12	0.80	6368	1370	3063	1292
3/29	6.8	3.7	5.18	0.81	6309	1277	2942	1124
3/30	6.5	4.0	5.26	0.66	6456	1418	3206	1218
3/31	6.4	4.0	5.33	0.66	6085	1622	3378	1150

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF APRIL

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
4/ 1	6.4	4.0	5.44	0.69	5751	1146	3171	1212
4/ 2	6.5	4.1	5.49	0.68	5295	1345	3124	1094
4/ 3	6.8	4.0	5.60	0.71	5436	1070	3056	1180
4/ 4	6.5	4.1	5.71	0.64	5346	1127	3023	1110
4/ 5	6.7	4.6	5.92	0.57	5417	1110	3166	1166
4/ 6	6.9	4.6	5.99	0.57	5493	1758	3281	1112
4/ 7	7.2	4.6	6.08	0.61	5776	1659	3172	1089
4/ 8	7.5	4.7	6.22	0.63	6201	1806	3234	1126
4/ 9	7.7	4.9	6.36	0.64	5720	1557	3257	1104
4/10	8.0	5.2	6.54	0.63	5635	1132	3128	1190
4/11	7.7	5.3	6.60	0.61	5352	1362	3126	1244
4/12	7.7	5.4	6.64	0.60	5606	1172	3313	1215
4/13	7.7	5.5	6.68	0.58	5731	1548	3458	1232
4/14	7.8	5.6	6.82	0.59	5841	1775	3379	1362
4/15	8.1	5.7	6.96	0.65	5663	1784	3487	1309
4/16	8.4	5.7	7.02	0.73	5691	1427	3459	1249
4/17	8.6	5.7	7.11	0.76	5436	1254	3361	1287
4/18	8.3	5.8	7.14	0.71	5380	1631	3462	1146
4/19	8.3	6.0	7.17	0.69	5861	1288	3529	1176
4/20	8.4	6.2	7.29	0.67	5465	1543	3442	984
4/21	8.6	6.5	7.43	0.65	5436	1851	3342	1047
4/22	8.7	6.5	7.58	0.70	5635	1665	3367	1087
4/23	8.8	7.0	7.79	0.68	5833	1625	3385	1083
4/24	9.1	7.1	7.97	0.73	5720	1444	3398	1126
4/25	9.3	7.0	8.09	0.72	5946	1546	3329	1207
4/26	9.5	7.2	8.26	0.71	5720	1220	3207	1282
4/27	9.6	7.3	8.33	0.66	6003	1435	3334	1237
4/28	9.7	7.2	8.51	0.72	5691	1282	3343	1254
4/29	9.9	7.2	8.61	0.77	5776	1585	3420	1154
4/30	10.1	7.4	8.81	0.77	5946	1180	3423	1166

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83

FOR MONTH OF MAY

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
5/ 1	10.3	7.5	8.97	0.80	6031	1472	3552	1140
5/ 2	10.4	7.7	9.16	0.77	6881	1619	3797	1285
5/ 3	10.5	7.7	9.29	0.77	6059	1840	3867	1276
5/ 4	10.7	7.8	9.39	0.83	7107	1996	3944	1379
5/ 5	10.9	7.8	9.48	0.84	6909	1801	4017	1367
5/ 6	10.6	7.9	9.62	0.74	7051	1679	3978	1446
5/ 7	10.7	8.2	9.69	0.64	7136	1387	4008	1460
5/ 8	10.9	8.5	9.83	0.62	7645	1189	4205	1613
5/ 9	10.8	9.0	9.97	0.52	7702	1990	4375	1488
5/10	10.8	9.1	10.02	0.51	7645	1849	4393	1463
5/11	11.2	9.2	10.09	0.57	7645	1679	4438	1485
5/12	11.3	9.4	10.21	0.57	7928	1812	4377	1517
5/13	11.7	9.5	10.35	0.54	7957	1755	4543	1638
5/14	12.1	9.6	10.41	0.56	8013	1571	4579	1592
5/15	12.6	9.6	10.52	0.64	8466	1472	4642	1690
5/16	13.0	9.6	10.68	0.76	8750	2211	4753	1708
5/17	13.3	9.9	10.75	0.75	8438	2435	4838	1764
5/18	13.6	10.1	10.86	0.81	8353	2406	4967	1777
5/19	13.8	10.3	10.98	0.85	8155	1755	5001	1762
5/20	13.8	10.3	11.07	0.82	8183	1868	5064	1762
5/21	13.9	10.4	11.30	0.82	8070	1897	5187	1735
5/22	14.0	10.3	11.44	0.84	8551	1699	5305	1784
5/23	14.1	10.4	11.58	0.82	8410	2525	5480	1606
5/24	13.9	10.2	11.60	0.84	8551	2661	5653	1572
5/25	13.7	10.1	11.71	0.77	9005	2406	5660	1601
5/26	13.7	10.5	11.75	0.74	9882	1330	5742	1842
5/27	13.8	10.7	11.78	0.71	9911	1330	5808	1913
5/28	14.0	10.9	11.84	0.68	10194	1132	5846	2123
5/29	14.4	11.1	11.97	0.73	10647	1274	5980	2127
5/30	14.6	11.1	12.02	0.77	10958	2038	6270	2130
5/31	14.5	11.1	12.11	0.73	11185	2208	6343	2081

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF JUNE

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
6/ 1	14.4	11.0	12.20	0.80	11440	3029	6415	2080
6/ 2	14.3	11.0	12.36	0.82	12006	2350	6517	2318
6/ 3	14.4	11.0	12.45	0.92	12488	1670	6458	2623
6/ 4	14.6	11.3	12.58	0.97	12827	1642	6554	2685
6/ 5	14.9	11.5	12.76	1.01	13054	1189	6590	2793
6/ 6	15.0	11.5	12.84	0.97	13564	2265	6720	2754
6/ 7	15.0	11.6	12.99	0.94	13960	2265	6804	2822
6/ 8	14.9	11.8	13.10	0.88	14130	2010	6898	3004
6/ 9	14.8	12.1	13.14	0.77	14215	2095	6855	3106
6/10	14.9	12.2	13.21	0.75	14470	1500	6947	3302
6/11	15.1	12.2	13.28	0.81	14526	1472	7193	3243
6/12	15.2	12.2	13.38	0.91	14328	1444	7076	3225
6/13	15.2	12.3	13.48	0.91	14215	2491	7089	3133
6/14	15.1	12.5	13.59	0.87	14045	2350	7071	3223
6/15	15.0	12.6	13.72	0.83	13875	2265	7180	3324
6/16	15.0	12.8	13.81	0.78	13196	1529	7281	3327
6/17	15.4	13.1	13.95	0.77	13196	1245	7242	3473
6/18	15.7	13.0	14.10	0.83	13309	1868	7332	3346
6/19	16.1	13.0	14.29	0.92	13394	1953	7218	3260
6/20	16.1	12.9	14.37	1.01	13252	2265	7159	3207
6/21	16.0	12.8	14.45	1.04	12969	2520	7225	3153
6/22	16.2	12.5	14.51	1.09	12827	2406	7243	3178
6/23	16.4	12.4	14.57	1.12	12346	1727	7156	3214
6/24	16.7	12.1	14.60	1.21	12374	1982	7090	3250
6/25	16.7	12.3	14.67	1.20	12969	1897	7194	3104
6/26	16.8	12.8	14.72	1.20	13649	1755	7045	3213
6/27	17.1	13.2	14.81	1.20	13337	2378	6965	3107
6/28	16.9	13.3	14.83	1.10	13026	2180	6768	3001
6/29	16.8	13.4	14.90	1.04	13082	2038	6675	3005
6/30	16.6	13.6	14.96	1.03	12289	1755	6510	3007

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83

FOR MONTH OF JULY

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
7/ 1	16.6	13.4	15.09	0.99	12034	1982	6432	2976
7/ 2	16.8	13.2	15.17	1.06	11865	1161	6472	2845
7/ 3	16.9	13.3	15.33	1.06	12034	1359	6339	2766
7/ 4	17.1	13.3	15.44	1.07	10760	1104	5959	2793
7/ 5	17.3	13.6	15.59	1.04	10704	1812	6099	2517
7/ 6	17.4	13.8	15.64	0.99	11043	2293	6054	2304
7/ 7	17.3	13.8	15.72	0.97	10534	2322	6162	2270
7/ 8	17.3	14.0	15.81	0.97	10081	1953	6022	2342
7/ 9	17.6	13.9	15.96	1.05	10194	1217	6001	2228
7/10	17.8	13.9	15.97	1.08	9712	1104	5831	2158
7/11	18.2	14.0	16.03	1.15	9514	1812	5686	2054
7/12	18.3	14.2	16.06	1.11	9429	1868	5519	2040
7/13	18.1	14.5	16.10	1.03	9599	2350	5377	2077
7/14	18.2	14.8	16.25	1.03	9514	1982	5457	1995
7/15	18.4	14.8	16.37	1.02	9486	1670	5322	2059
7/16	18.7	15.0	16.47	1.01	9344	2180	5373	1726
7/17	18.7	15.4	16.57	0.95	8920	1500	5296	1747
7/18	18.8	15.5	16.70	0.92	8778	2690	5283	1752
7/19	19.2	15.4	16.85	0.97	8693	2406	5132	1654
7/20	18.9	15.3	16.92	1.00	8891	2038	5029	1662
7/21	18.4	15.5	17.02	0.89	8353	2576	5016	1448
7/22	18.2	15.5	17.06	0.81	7815	2208	4787	1429
7/23	18.3	15.6	17.16	0.84	7277	2038	4793	1299
7/24	18.3	15.7	17.31	0.86	6796	2067	4721	1209
7/25	18.6	15.6	17.41	0.91	6739	2237	4481	1269
7/26	18.9	15.8	17.64	0.86	6456	1868	4339	1324
7/27	18.8	16.1	17.72	0.85	6767	1755	4204	1356
7/28	18.8	16.3	17.89	0.79	6003	1868	4118	1161
7/29	18.9	16.6	17.91	0.73	5578	1784	4015	1127
7/30	19.1	16.8	17.90	0.71	5827	2265	4092	943
7/31	19.3	16.9	17.99	0.73	5369	1642	4085	888

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83

FOR MONTH OF AUGUST

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
8/ 1	19.4	16.6	18.07	0.74	5663	2378	4022	966
8/ 2	19.5	16.7	18.12	0.68	5720	2222	3887	1046
8/ 3	19.6	16.8	18.16	0.65	6456	1925	3910	1182
8/ 4	19.7	16.9	18.22	0.68	6371	2322	3922	1164
8/ 5	19.5	17.0	18.18	0.66	6399	1585	3931	1174
8/ 6	19.4	17.1	18.22	0.64	6173	1755	3801	1083
8/ 7	19.4	17.0	18.25	0.66	6059	1585	3790	965
8/ 8	19.4	16.8	18.28	0.70	5776	2605	3784	859
8/ 9	19.6	17.2	18.37	0.63	5097	2548	3659	871
8/10	19.6	17.4	18.48	0.62	5465	1883	3506	994
8/11	19.5	17.2	18.56	0.66	5946	2463	3652	929
8/12	19.6	17.3	18.63	0.66	5635	1614	3549	932
8/13	19.8	17.4	18.65	0.66	5153	2237	3477	785
8/14	19.8	17.3	18.63	0.63	5015	1642	3422	766
8/15	19.9	17.1	18.66	0.70	4672	1840	3360	638
8/16	20.1	16.8	18.66	0.83	4530	1189	3178	824
8/17	20.1	16.8	18.52	0.82	4389	1500	3086	763
8/18	20.3	16.7	18.48	0.82	6314	2038	3199	885
8/19	20.1	16.8	18.44	0.81	6201	1161	3109	1001
8/20	20.3	17.0	18.47	0.85	5748	1868	3024	812
8/21	20.3	17.1	18.53	0.84	4955	1387	2960	762
8/22	20.0	17.4	18.59	0.76	5295	1557	3031	703
8/23	20.1	16.9	18.56	0.82	4870	2081	2932	640
8/24	20.2	16.8	18.54	0.81	4757	1217	2775	745
8/25	20.0	16.8	18.57	0.81	4332	1274	2776	705
8/26	20.0	16.8	18.54	0.81	4559	1302	2851	638
8/27	19.9	16.7	18.54	0.85	4360	1557	2813	594
8/28	19.8	16.8	18.49	0.86	6144	1333	3005	930
8/29	19.9	16.8	18.47	0.95	5550	1582	2891	820
8/30	20.0	16.7	18.43	0.93	5068	1866	2897	667
8/31	19.9	16.8	18.41	0.86	5068	1789	2782	713

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF SEPTEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
9/ 1	20.0	17.1	18.44	0.82	4672	1701	2575	700
9/ 2	19.6	17.1	18.37	0.77	4304	1076	2422	716
9/ 3	19.8	17.2	18.31	0.84	4332	1076	2383	679
9/ 4	19.8	17.0	18.29	0.76	4191	1121	2361	654
9/ 5	19.6	16.9	18.33	0.67	4134	1214	2282	654
9/ 6	19.6	17.2	18.33	0.60	3879	1172	2299	678
9/ 7	19.6	17.5	18.33	0.55	5210	1104	2434	997
9/ 8	19.5	17.4	18.31	0.57	5493	1809	2650	842
9/ 9	19.4	17.5	18.33	0.53	5323	1727	2548	819
9/10	19.1	17.2	18.26	0.46	4842	1336	2495	853
9/11	19.3	17.1	18.24	0.53	4474	1319	2428	727
9/12	19.4	16.8	18.19	0.66	3369	1251	2297	535
9/13	19.5	16.5	18.08	0.76	3737	1387	2340	642
9/14	19.5	16.5	18.06	0.78	3511	1240	2344	545
9/15	19.5	16.5	17.94	0.79	3568	1500	2305	526
9/16	19.4	16.7	17.92	0.79	3228	1379	2326	500
9/17	19.2	16.7	17.86	0.78	3256	1478	2309	447
9/18	19.1	16.6	17.78	0.78	3341	1217	2256	558
9/19	19.4	16.3	17.74	0.76	3313	1220	2164	548
9/20	19.6	16.1	17.67	0.79	3313	1078	2156	572
9/21	19.5	16.0	17.58	0.79	3341	1285	2233	568
9/22	19.3	15.6	17.52	0.81	3369	1582	2207	447
9/23	19.3	15.6	17.44	0.86	3143	1444	2135	444
9/24	19.5	15.8	17.43	0.86	3313	1381	2211	394
9/25	19.6	16.1	17.42	0.82	3369	1523	2231	484
9/26	19.5	16.2	17.37	0.79	3483	1175	2155	512
9/27	19.1	16.2	17.28	0.73	3228	1146	2165	545
9/28	19.0	16.2	17.22	0.76	3171	1197	2185	487
9/29	18.8	16.1	17.18	0.69	3086	1390	2172	489
9/30	18.8	16.1	17.14	0.69	3171	1384	2225	513

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF OCTOBER

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
10/ 1	18.8	16.2	17.07	0.66	3769	1104	2289	655
10/ 2	18.6	15.9	16.93	0.70	3652	1203	2258	727
10/ 3	18.6	15.6	16.88	0.80	3652	1118	2233	649
10/ 4	18.6	15.3	16.72	0.82	3822	1132	2259	667
10/ 5	18.6	15.2	16.64	0.83	3248	1226	2176	592
10/ 6	18.5	15.2	16.49	0.84	3171	1175	2082	555
10/ 7	18.5	15.1	16.39	0.86	3100	1245	2210	508
10/ 8	18.3	14.9	16.29	0.87	3143	1379	2220	478
10/ 9	18.1	15.0	16.21	0.84	3228	1359	2251	571
10/10	17.8	14.8	16.04	0.81	3086	1415	2222	453
10/11	17.8	14.7	15.96	0.82	3058	1339	2271	436
10/12	17.6	14.5	15.75	0.82	3228	1328	2158	560
10/13	17.8	14.2	15.64	0.90	3426	1441	2200	524
10/14	17.6	14.2	15.52	0.84	3228	1330	2282	543
10/15	17.6	14.0	15.37	0.84	3080	1132	2275	509
10/16	17.5	13.8	15.29	0.85	3092	1076	2216	573
10/17	17.1	13.8	15.20	0.82	3174	1107	2239	466
10/18	17.0	13.6	15.10	0.88	3293	1509	2310	508
10/19	16.8	13.5	15.00	0.90	3313	1132	2282	627
10/20	16.7	13.2	14.88	0.91	3304	1206	2204	562
10/21	16.7	13.4	14.75	0.83	3457	1189	2207	575
10/22	16.7	13.1	14.59	0.87	3432	1350	2273	585
10/23	16.6	13.3	14.56	0.82	3610	1141	2136	629
10/24	16.5	13.4	14.47	0.80	3661	1347	2271	555
10/25	16.5	13.4	14.39	0.80	3596	1571	2272	518
10/26	16.2	13.4	14.19	0.74	3720	1543	2247	468
10/27	16.1	13.3	14.11	0.77	3684	1325	2316	570
10/28	16.0	13.1	14.01	0.76	3735	1240	2344	573
10/29	15.7	13.0	13.88	0.70	3896	1124	2301	629
10/30	15.5	12.9	13.75	0.67	3876	1084	2409	695
10/31	15.4	12.7	13.65	0.70	3675	1192	2270	622

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83

FOR MONTH OF NOVEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
11/ 1	15.3	12.5	13.53	0.73	3559	1197	2189	577
11/ 2	15.2	12.3	13.41	0.75	3534	1118	2307	623
11/ 3	15.1	12.3	13.34	0.75	3440	1197	2275	549
11/ 4	15.0	12.1	13.19	0.80	3358	1387	2345	484
11/ 5	15.0	11.7	13.06	0.87	3389	1370	2381	547
11/ 6	14.8	11.5	12.92	0.86	3262	1101	2362	570
11/ 7	14.7	11.4	12.77	0.84	3284	1364	2276	513
11/ 8	14.7	11.1	12.64	0.90	3307	1183	2338	562
11/ 9	14.5	10.9	12.48	0.92	3284	1248	2259	546
11/10	14.3	10.8	12.28	0.92	3483	1104	2249	631
11/11	14.2	10.7	12.13	0.94	3398	1047	2306	651
11/12	14.1	10.5	12.04	0.92	3100	1427	2313	591
11/13	13.9	10.3	11.89	0.91	3454	1240	2305	622
11/14	13.8	10.1	11.75	0.93	3426	1095	2227	523
11/15	13.8	9.8	11.54	0.99	3851	1330	2369	622
11/16	13.7	9.6	11.41	1.01	4275	1254	2367	687
11/17	13.7	9.4	11.31	1.06	3737	1155	2288	594
11/18	13.6	9.2	11.09	1.08	3596	1132	2370	646
11/19	13.5	8.6	10.90	1.12	3794	1387	2299	651
11/20	13.4	8.2	10.75	1.17	3369	1285	2339	621
11/21	13.4	8.4	10.64	1.18	3794	1161	2388	685
11/22	13.3	8.6	10.48	1.19	3199	1166	2358	577
11/23	13.2	8.5	10.28	1.20	3171	1455	2357	532
11/24	13.2	8.6	10.15	1.16	3624	1217	2293	714
11/25	13.1	8.5	9.99	1.16	3364	1413	2317	597
11/26	12.7	8.4	9.82	1.08	3754	1611	2380	594
11/27	12.5	8.1	9.69	1.07	3961	1302	2402	687
11/28	12.5	8.0	9.56	1.09	3879	1350	2361	655
11/29	12.4	7.9	9.46	1.08	3791	1585	2517	534
11/30	12.4	7.7	9.31	1.09	3746	1529	2545	519

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 6/14/83
FOR MONTH OF DECEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
12/ 1	12.2	7.3	9.24	1.14	3718	1444	2545	662
12/ 2	11.9	7.2	9.15	1.09	3692	1189	2429	628
12/ 3	11.4	7.1	9.01	1.03	3681	1161	2418	684
12/ 4	11.0	6.8	8.88	1.02	3681	1115	2473	688
12/ 5	10.7	6.7	8.71	0.96	3497	1359	2450	637
12/ 6	10.1	6.8	8.52	0.86	3539	1580	2477	538
12/ 7	9.5	7.0	8.38	0.76	3766	1597	2524	543
12/ 8	9.3	6.8	8.23	0.79	4445	1495	2590	784
12/ 9	9.2	6.6	8.08	0.85	4106	1585	2507	633
12/10	9.1	6.3	7.97	0.83	3794	1594	2631	608
12/11	9.1	6.3	7.84	0.82	4247	1274	2586	776
12/12	9.2	6.1	7.80	0.86	4275	1483	2566	772
12/13	9.3	5.9	7.69	0.90	4813	1084	2581	782
12/14	9.3	5.7	7.60	0.92	3568	1404	2416	508
12/15	9.2	6.1	7.62	0.79	4247	1260	2464	721
12/16	9.1	6.3	7.53	0.76	3483	1557	2536	519
12/17	8.8	6.2	7.42	0.77	3709	1611	2500	602
12/18	8.6	6.2	7.33	0.78	3964	1260	2583	681
12/19	8.5	6.1	7.24	0.78	3568	1455	2568	639
12/20	8.3	6.0	7.16	0.79	3369	1387	2486	640
12/21	8.2	5.6	6.97	0.90	3228	1220	2416	521
12/22	8.3	5.4	6.85	0.92	3483	1438	2574	568
12/23	8.2	5.5	6.74	0.89	3568	1299	2497	610
12/24	8.1	5.4	6.69	0.87	3143	1067	2083	655
12/25	8.0	5.4	6.60	0.87	2718	1056	1729	536
12/26	7.9	5.1	6.46	0.90	3483	1271	2188	683
12/27	7.9	5.1	6.34	0.93	3992	1158	2586	703
12/28	7.9	4.4	6.22	0.95	4275	1336	2685	713
12/29	7.8	3.2	6.00	1.07	4870	1226	2767	854
12/30	7.7	2.5	5.87	1.16	5182	1268	2747	918
12/31	7.6	2.7	5.75	1.12	4700	1061	2573	869

APPENDIX B

SAMPLE PROBLEM 1 OUTPUT RESULTS

DISTRIBUTION OF AVERAGE DAILY TEMPERATURES FOR 1/ 1/65 TO 12/31/70

TEMP (DEG F)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
32.0	2190	100.000	31.0 - 32.9	6	0.274
34.0	2178	99.452	33.0 - 34.9	15	0.685
36.0	2150	98.174	35.0 - 36.9	35	1.598
38.0	2081	95.023	37.0 - 38.9	121	5.525
40.0	1881	85.890	39.0 - 40.9	238	10.868
42.0	1676	76.530	41.0 - 42.9	187	8.539
44.0	1531	69.909	43.0 - 44.9	131	5.982
46.0	1410	64.384	45.0 - 46.9	128	5.845
48.0	1286	58.721	47.0 - 48.9	86	3.927
50.0	1195	54.566	49.0 - 50.9	105	4.795
52.0	1084	49.498	51.0 - 52.9	101	4.612
54.0	951	43.425	53.0 - 54.9	128	5.845
56.0	829	37.854	55.0 - 56.9	146	6.667
58.0	683	31.187	57.0 - 58.9	117	5.342
60.0	588	26.849	59.0 - 60.9	132	6.027
62.0	449	20.502	61.0 - 62.9	170	7.763
64.0	233	10.639	63.0 - 64.9	232	10.594
66.0	51	2.329	65.0 - 66.9	98	4.475
68.0	2	0.091	67.0 - 68.9	14	0.639
70.0	0	0.000	69.0 - 70.9	0	0.000
72.0	0	0.000	71.0 - 72.9	0	0.000

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 10/ 1/59 TO 12/31/70

FLOW (CMS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
1000	4110	100.000	950 - 1049	0	0.000
1100	4092	99.562	1050 - 1149	41	0.998
1200	4047	98.467	1150 - 1249	48	1.168
1300	3994	97.178	1250 - 1349	45	1.095
1400	3937	95.791	1350 - 1449	74	1.800
1500	3863	93.990	1450 - 1549	89	2.165
1600	3745	91.119	1550 - 1649	131	3.187
1700	3607	87.762	1650 - 1749	147	3.577
1800	3459	84.161	1750 - 1849	167	4.063
1900	3278	79.757	1850 - 1949	181	4.404
2000	3093	75.255	1950 - 2049	173	4.209
2100	2905	70.681	2050 - 2149	195	4.745
2200	2718	66.131	2150 - 2249	211	5.134
2300	2514	61.168	2250 - 2349	191	4.647
2400	2317	56.375	2350 - 2449	199	4.842
2500	2134	51.922	2450 - 2549	182	4.428
2600	1946	47.348	2550 - 2649	160	3.893
2700	1825	44.404	2650 - 2749	119	2.895
2800	1702	41.411	2750 - 2849	102	2.482
2900	1596	38.832	2850 - 2949	118	2.871
3000	1506	36.642	2950 - 3049	91	2.214
3100	1399	34.039	3050 - 3149	96	2.336
3200	1314	31.971	3150 - 3249	59	1.436
3300	1254	30.511	3250 - 3349	67	1.630
3400	1198	29.148	3350 - 3449	42	1.022
3500	1156	28.127	3450 - 3549	51	1.241
3600	1102	26.813	3550 - 3649	44	1.071
3700	1060	25.791	3650 - 3749	42	1.022
3800	1018	24.769	3750 - 3849	34	0.827
3900	992	24.136	3850 - 3949	29	0.706
4000	965	23.479	3950 - 4049	29	0.706
4100	945	22.993	4050 - 4149	20	0.487
4200	924	22.482	4150 - 4249	18	0.438
4300	912	22.190	4250 - 4349	13	0.316
4400	889	21.630	4350 - 4449	26	0.633
4500	872	21.217	4450 - 4549	18	0.438
4600	846	20.584	4550 - 4649	21	0.511
4700	832	20.243	4650 - 4749	12	0.292
4800	818	19.903	4750 - 4849	20	0.487
4900	797	19.392	4850 - 4949	19	0.462
5000	775	18.856	4950 - 5049	17	0.414

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF JANUARY

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
1/ 1	44.1	37.2	41.21	2.72	2279	1056	1640	421
1/ 2	43.9	37.4	41.12	2.46	3398	1203	2196	725
1/ 3	43.5	37.9	41.12	2.06	3511	1509	2255	582
1/ 4	43.7	37.6	40.97	2.24	3029	1234	2253	589
1/ 5	43.2	37.0	40.61	2.19	3794	1294	2257	664
1/ 6	42.8	37.0	40.55	2.04	3426	1203	2263	610
1/ 7	42.8	37.0	40.46	1.99	3284	1220	2108	631
1/ 8	43.2	37.6	40.55	1.90	3398	1152	2034	639
1/ 9	42.8	38.3	40.70	1.59	2916	1084	2127	607
1/10	43.2	39.0	40.64	1.45	2616	1455	2021	441
1/11	43.2	39.0	40.58	1.48	2647	1172	1916	512
1/12	43.0	38.5	40.19	1.70	2916	1274	2156	575
1/13	42.8	38.3	40.22	1.72	2636	1396	2123	456
1/14	42.8	38.3	40.52	1.52	2661	1200	1971	455
1/15	43.2	38.1	40.40	1.75	3341	1537	2168	563
1/16	42.8	37.8	40.13	1.75	3228	1144	2212	655
1/17	42.6	37.4	39.86	1.83	2746	1585	2199	391
1/18	42.4	37.0	39.92	1.83	2726	1447	2122	435
1/19	42.6	37.0	40.04	1.90	2746	1248	2242	455
1/20	42.6	36.9	40.16	1.99	3341	1628	2288	469
1/21	42.4	36.5	40.22	2.10	3709	1350	2261	645
1/22	42.4	35.8	39.86	2.30	3568	1364	2300	631
1/23	42.3	35.2	39.68	2.43	3114	1407	2220	514
1/24	41.9	34.9	39.50	2.48	3341	1407	2158	525
1/25	41.7	34.2	39.17	2.63	2973	1294	2236	520
1/26	41.5	34.0	38.96	2.60	2687	1172	2272	419
1/27	41.5	33.3	38.75	2.83	4106	1679	2229	664
1/28	41.7	32.7	38.51	3.06	4360	1481	2244	768
1/29	42.1	32.5	38.57	3.29	3596	1104	2070	750
1/30	41.7	32.7	38.54	3.14	3228	1076	2154	620
1/31	41.9	32.5	38.42	3.17	3624	1090	2214	707

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70

FOR MONTH OF FEBRUARY

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
2/ 1	41.7	32.5	38.39	3.12	3511	1410	2210	640
2/ 2	41.7	32.9	38.39	2.93	3398	1356	2281	487
2/ 3	42.1	33.1	38.48	2.94	4134	1475	2306	680
2/ 4	42.4	33.4	38.63	2.93	3709	1302	2319	632
2/ 5	42.3	34.0	38.60	2.73	3907	1313	2444	759
2/ 6	41.9	34.2	38.54	2.57	3596	1328	2333	566
2/ 7	42.1	34.0	38.54	2.68	3284	1211	2416	514
2/ 8	41.9	34.2	38.60	2.66	3568	1090	2358	590
2/ 9	41.9	34.2	38.33	2.65	3058	1815	2453	372
2/10	41.9	34.2	38.24	2.64	3171	2101	2539	326
2/11	41.9	34.5	38.42	2.54	3313	1679	2462	500
2/12	42.1	35.1	38.45	2.44	3511	1829	2563	585
2/13	41.7	35.1	38.39	2.28	3794	1636	2610	561
2/14	41.5	34.9	38.42	2.37	3794	1568	2560	621
2/15	41.4	35.1	38.33	2.36	2973	1268	2432	465
2/16	41.4	35.6	38.33	2.18	3454	1970	2506	420
2/17	41.4	35.4	38.36	2.17	3454	1701	2438	501
2/18	41.0	35.4	38.48	1.98	3964	1172	2354	778
2/19	41.0	35.8	38.66	2.00	3822	1752	2360	616
2/20	40.6	35.4	38.66	2.04	3539	1192	2257	588
2/21	40.6	35.1	38.51	2.07	3568	1585	2338	534
2/22	40.6	35.1	38.39	2.02	3284	1653	2309	506
2/23	40.6	35.1	38.42	1.96	2888	1390	2326	443
2/24	40.6	35.1	38.45	1.98	3568	1090	2401	611
2/25	41.2	34.9	38.54	2.17	3511	1127	2286	725
2/26	41.2	35.1	38.63	2.07	3596	1390	2347	644
2/27	40.8	35.1	38.69	1.98	3313	1432	2303	542
2/28	40.8	35.6	38.72	1.77	3171	1667	2387	483
2/29	39.6	39.6	39.56	0.00				

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF MARCH

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
3/ 1	40.8	36.0	38.57	1.65	2973	1540	2280	463
3/ 2	40.6	36.1	38.63	1.58	2777	1214	2189	544
3/ 3	40.6	36.0	38.78	1.67	3341	1294	2302	574
3/ 4	40.8	36.3	38.81	1.61	3511	1523	2283	563
3/ 5	40.6	36.7	38.96	1.47	3483	1500	2230	598
3/ 6	40.8	36.7	39.11	1.47	3341	1548	2349	573
3/ 7	40.6	36.7	39.05	1.42	3822	1449	2501	728
3/ 8	40.6	36.9	39.20	1.39	3766	1243	2351	678
3/ 9	40.6	37.0	39.35	1.25	3766	1653	2552	616
3/10	40.5	36.9	39.32	1.26	3766	1599	2460	660
3/11	40.8	37.0	39.35	1.24	3936	1294	2354	829
3/12	41.0	37.0	39.35	1.31	3794	1356	2319	756
3/13	41.4	36.9	39.59	1.52	4502	1050	2370	923
3/14	40.5	36.7	39.44	1.42	3737	1676	2309	625
3/15	40.5	37.2	39.62	1.26	3199	1557	2244	542
3/16	40.6	37.2	39.77	1.30	2945	1503	2274	530
3/17	40.6	37.6	39.65	1.10	3284	1415	2325	558
3/18	41.0	37.8	39.74	1.15	4134	1452	2355	764
3/19	41.0	37.8	39.80	1.21	3086	1582	2221	492
3/20	41.0	38.1	39.95	1.06	3143	1625	2311	538
3/21	41.4	38.3	40.16	1.11	3568	1648	2315	622
3/22	41.7	38.8	40.40	1.07	3681	1602	2306	657
3/23	41.4	39.7	40.61	0.68	2990	1682	2360	491
3/24	41.7	39.2	40.55	0.96	3426	1574	2379	593
3/25	41.9	39.2	40.76	0.98	3709	1483	2409	594
3/26	42.1	39.2	40.97	1.11	3284	1673	2389	603
3/27	42.1	39.0	41.00	1.11	3398	1512	2444	674
3/28	43.2	39.6	41.45	1.21	3284	1370	2254	556
3/29	43.0	39.6	41.60	1.19	2837	1277	2292	554
3/30	42.6	40.1	41.60	0.88	3341	1418	2547	528
3/31	42.6	40.5	41.78	0.79	4021	1622	2736	709

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF APRIL

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
4/ 1	43.0	40.8	42.17	0.78	3907	1146	2478	905
4/ 2	43.7	40.8	42.35	0.96	3964	1345	2440	934
4/ 3	44.2	41.2	42.53	1.02	4332	1070	2436	1002
4/ 4	43.7	41.4	42.71	0.85	3964	1127	2445	945
4/ 5	44.1	41.5	42.92	0.94	4389	1110	2649	1030
4/ 6	44.4	41.5	43.13	0.99	4785	1758	2717	1017
4/ 7	45.0	41.5	43.28	1.13	5012	1659	2719	1105
4/ 8	45.5	42.1	43.52	1.20	5323	1806	2899	1132
4/ 9	45.9	42.3	43.97	1.21	5153	1772	2922	1144
4/10	46.4	42.4	44.33	1.29	5233	1478	2930	1252
4/11	45.9	43.2	44.51	0.96	5323	1362	2870	1294
4/12	45.9	43.5	44.45	0.85	5431	1172	3009	1285
4/13	45.3	43.5	44.33	0.71	5595	2214	3084	1189
4/14	46.0	43.7	44.69	0.85	5680	1775	3017	1305
4/15	46.6	43.9	45.02	0.97	5640	1826	3157	1222
4/16	47.1	44.4	45.20	1.13	5453	1427	3126	1399
4/17	47.5	44.2	45.26	1.27	5436	1254	3120	1407
4/18	46.6	44.2	45.14	0.95	5380	1631	3296	1200
4/19	46.4	43.9	44.96	1.01	5861	1288	3543	1263
4/20	46.4	44.1	45.05	1.00	5465	2412	3438	1037
4/21	46.6	43.9	45.20	1.06	5436	1851	3320	1129
4/22	47.1	43.7	45.41	1.25	5635	2002	3550	1203
4/23	47.5	44.6	45.80	1.12	5833	2055	3420	1194
4/24	47.8	44.8	46.04	1.11	5720	1767	3425	1219
4/25	47.7	45.1	46.22	0.88	5946	1546	3400	1340
4/26	47.1	45.3	46.28	0.62	5720	1220	3362	1412
4/27	47.5	45.5	46.43	0.78	6003	1435	3523	1326
4/28	48.2	45.5	46.79	0.93	5691	1282	3266	1276
4/29	48.7	45.7	46.88	1.11	5776	2058	3351	1178
4/30	49.3	46.2	47.30	1.20	5946	1180	3295	1371

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF MAY

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
5/ 1	49.1	46.0	47.48	1.19	5946	1868	3283	1199
5/ 2	49.1	46.6	47.72	1.12	6881	1619	3623	1602
5/ 3	49.8	46.6	48.08	1.37	5946	1840	3522	1384
5/ 4	50.5	46.6	48.38	1.55	6399	1996	3635	1432
5/ 5	50.4	46.2	48.65	1.61	6513	1801	3669	1442
5/ 6	50.5	46.6	49.10	1.44	6371	1679	3640	1484
5/ 7	50.4	47.1	49.25	1.19	5918	1387	3573	1456
5/ 8	50.9	47.8	49.61	1.05	6286	2115	3863	1546
5/ 9	50.7	48.6	49.79	0.85	6314	1990	4061	1501
5/10	51.1	48.7	49.94	0.83	6569	1849	4273	1523
5/11	52.2	48.6	50.15	1.16	6513	1679	4208	1618
5/12	52.3	48.9	50.42	1.10	6541	1900	4213	1654
5/13	52.0	49.5	50.57	0.93	6824	1863	4531	1837
5/14	51.6	49.5	50.69	0.73	6909	1571	4602	1843
5/15	51.8	49.3	50.75	0.88	6994	2293	4705	1727
5/16	53.4	49.3	51.23	1.39	6966	2211	4775	1720
5/17	52.5	49.8	51.29	0.96	7334	2973	4819	1679
5/18	52.9	50.2	51.53	1.03	7362	2406	4957	1773
5/19	53.2	50.5	51.77	1.18	7447	2449	5107	1752
5/20	53.1	50.5	51.95	1.01	7419	2480	5286	1669
5/21	54.0	50.7	52.37	1.15	7532	2775	5638	1533
5/22	54.5	51.1	52.55	1.21	7730	2602	5739	1624
5/23	54.9	51.1	52.70	1.27	7872	2525	5829	1536
5/24	55.2	51.3	52.82	1.36	8268	4530	6294	1058
5/25	55.0	51.6	52.97	1.24	9005	4842	6554	1092
5/26	54.7	51.6	53.09	1.15	9882	5068	6611	1278
5/27	54.5	51.4	53.12	1.10	9911	4983	6758	1291
5/28	54.0	51.6	53.21	0.86	10194	5408	7008	1313
5/29	54.0	52.0	53.48	0.79	10647	4389	7004	1584
5/30	54.0	52.0	53.45	0.80	10958	5833	7308	1495
5/31	54.1	52.3	53.48	0.69	11185	5691	7434	1581

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70

FOR MONTH OF JUNE

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
6/ 1	54.7	52.0	53.63	1.12	11440	5153	7528	1708
6/ 2	55.4	53.1	54.32	0.96	12006	5776	7802	1787
6/ 3	55.8	52.3	54.47	1.39	12488	5182	7993	1991
6/ 4	56.7	52.5	54.83	1.61	12827	4077	8180	2299
6/ 5	57.0	52.7	55.31	1.67	13054	4077	8233	2410
6/ 6	57.6	52.9	55.46	1.69	13564	5439	8435	2386
6/ 7	57.7	53.4	55.85	1.66	13960	5221	8555	2510
6/ 8	57.6	53.8	56.03	1.47	14130	4666	8802	2581
6/ 9	57.4	53.8	55.82	1.35	14215	4780	8792	2647
6/10	57.2	54.0	55.73	1.23	14470	4989	9043	2633
6/11	57.2	54.0	55.70	1.24	14526	5408	9311	2556
6/12	58.1	54.0	55.88	1.57	14328	4864	9147	2687
6/13	58.5	54.1	55.94	1.62	14215	5156	9196	2579
6/14	58.6	54.5	56.03	1.57	14045	5298	9240	2583
6/15	59.0	54.7	56.18	1.66	13875	5105	9171	2736
6/16	59.0	55.0	56.36	1.49	13196	5176	9210	2581
6/17	59.0	55.6	56.60	1.39	13196	5244	9251	2678
6/18	59.4	55.6	56.90	1.49	13309	5977	9283	2463
6/19	59.5	55.4	57.26	1.70	13394	5043	9027	2678
6/20	60.3	55.2	57.50	2.13	13252	4813	8882	2755
6/21	60.8	55.0	57.65	2.28	12969	5032	8997	2572
6/22	61.2	54.5	57.68	2.51	12827	4949	8935	2588
6/23	61.5	54.3	57.86	2.60	12346	5133	8835	2459
6/24	62.1	53.8	57.86	2.88	12374	4964	8677	2496
6/25	62.1	54.1	58.10	2.64	12969	4944	8706	2575
6/26	62.2	55.0	58.28	2.39	13649	4808	8602	2691
6/27	62.8	55.8	58.55	2.35	13337	3652	8401	2728
6/28	61.9	56.1	58.46	1.95	13026	3701	8168	2598
6/29	61.0	56.1	58.40	1.71	13082	3814	8025	2535
6/30	61.2	56.5	58.49	1.70	12289	3885	7925	2383

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70

FOR MONTH OF JULY

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
7/ 1	61.3	56.1	58.70	1.89	12034	3769	7843	2231
7/ 2	61.5	55.8	58.91	2.13	11865	3879	7804	2077
7/ 3	62.1	55.9	59.42	2.19	12034	4040	7705	2023
7/ 4	62.8	55.9	59.66	2.28	10760	3024	7407	1938
7/ 5	63.1	56.5	60.02	2.21	10704	3964	7493	1676
7/ 6	63.3	57.0	60.20	2.08	11043	3893	7351	1795
7/ 7	63.1	57.7	60.50	1.83	10534	4224	7401	1698
7/ 8	63.1	58.5	60.62	1.74	10081	4097	7332	1720
7/ 9	63.7	58.8	60.86	1.90	10194	4222	7392	1706
7/10	64.0	59.0	61.04	2.02	9712	3766	7197	1710
7/11	64.8	59.0	61.19	2.27	9514	3378	7018	1811
7/12	64.9	59.0	61.13	2.30	9429	3429	6906	1721
7/13	64.6	59.0	61.07	2.02	9599	3341	6612	1930
7/14	64.8	59.4	61.25	1.96	9514	3774	6722	1614
7/15	65.1	59.2	61.40	2.08	9486	3596	6552	1650
7/16	65.7	59.5	61.55	2.21	9344	3669	6401	1544
7/17	65.7	59.9	61.61	2.13	8920	3075	6284	1619
7/18	65.8	60.3	61.91	2.03	8778	2755	6120	1625
7/19	66.6	60.6	62.24	2.23	8693	2565	5829	1594
7/20	66.0	60.4	62.09	2.16	8891	3624	5810	1438
7/21	65.1	60.6	61.97	1.82	8353	3820	5681	1255
7/22	63.9	60.6	61.91	1.41	7815	2973	5406	1319
7/23	64.4	60.6	62.18	1.61	7277	3398	5335	1232
7/24	64.9	60.8	62.63	1.71	6796	3375	5201	1094
7/25	65.3	61.0	62.81	1.75	6739	2508	4988	1237
7/26	66.0	62.1	63.64	1.64	6456	2642	4765	1247
7/27	65.8	61.7	63.53	1.59	6767	2752	4606	1269
7/28	65.8	62.1	63.86	1.39	6003	2653	4440	1106
7/29	65.3	62.4	63.89	1.03	5210	3398	4312	649
7/30	64.9	62.4	63.98	0.89	5210	3652	4221	585
7/31	64.9	62.4	64.10	0.91	4983	3313	4237	592

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF AUGUST

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
8/ 1	65.1	62.8	64.25	0.83	5663	2752	4079	929
8/ 2	65.1	63.1	64.34	0.72	5720	2222	3997	1050
8/ 3	65.3	63.7	64.40	0.57	5153	2245	3927	929
8/ 4	65.7	63.9	64.52	0.73	5153	2916	3888	848
8/ 5	65.3	63.5	64.28	0.62	4757	3055	3935	578
8/ 6	65.5	63.7	64.40	0.63	4530	2814	3691	569
8/ 7	65.7	63.5	64.55	0.89	4547	3001	3700	478
8/ 8	66.2	63.7	64.55	1.00	4275	2831	3607	511
8/ 9	66.0	63.3	64.76	0.95	4162	2548	3503	658
8/10	66.2	63.3	64.88	1.03	4191	2220	3352	615
8/11	66.9	63.0	65.00	1.39	4247	2579	3378	554
8/12	67.1	63.1	65.09	1.46	4134	2945	3467	399
8/13	66.9	63.5	65.15	1.31	3879	2625	3269	386
8/14	66.6	63.9	65.30	1.10	3879	2749	3282	368
8/15	66.7	63.5	65.42	1.35	3964	2642	3265	386
8/16	67.1	63.3	65.57	1.57	3992	2013	3103	657
8/17	66.6	63.1	65.09	1.35	4332	1854	3081	645
8/18	66.0	63.1	64.94	1.11	3879	2262	3107	463
8/19	66.4	63.0	64.94	1.30	3879	2511	3117	365
8/20	66.7	63.0	65.00	1.47	3228	1945	2879	382
8/21	66.7	63.0	65.12	1.44	3568	1594	2938	556
8/22	67.6	63.3	65.36	1.52	3199	2273	2945	291
8/23	68.2	62.4	65.36	1.96	3568	2081	2841	436
8/24	68.4	62.2	65.27	1.99	3709	1217	2766	646
8/25	68.0	62.2	65.15	1.88	3454	2463	2850	388
8/26	67.1	62.2	64.76	1.74	3454	2489	2780	316
8/27	67.8	62.1	64.73	2.05	3539	2135	2752	399
8/28	67.5	62.2	64.43	2.02	4021	1333	2842	699
8/29	67.8	62.2	64.19	2.17	4021	1582	2810	737
8/30	67.5	62.1	64.13	2.02	3511	1866	2681	581
8/31	67.8	62.2	64.49	2.05	3256	1789	2571	504

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70

FOR MONTH OF SEPTEMBER

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
9/ 1	68.0	62.8	64.82	1.90	2945	1701	2354	324
9/ 2	67.1	62.8	64.61	1.65	2823	1407	2204	443
9/ 3	66.7	63.0	64.25	1.68	2973	1665	2283	427
9/ 4	65.5	62.6	63.98	1.24	3143	1121	2181	643
9/ 5	65.5	62.4	64.04	1.11	2760	1214	2106	456
9/ 6	65.3	63.0	64.16	0.96	2591	1172	1977	426
9/ 7	65.1	63.5	64.34	0.66	3029	1104	2023	653
9/ 8	65.3	63.3	64.37	0.82	2973	1809	2283	371
9/ 9	65.5	63.7	64.55	0.84	2945	1795	2314	308
9/10	65.5	63.9	64.64	0.69	2945	1336	2119	399
9/11	65.7	63.7	64.61	0.82	2916	1319	2168	417
9/12	65.7	63.3	64.37	0.92	2709	1251	2117	389
9/13	64.8	62.8	63.95	0.84	2888	1529	2149	437
9/14	64.4	62.4	63.86	0.73	2616	1976	2255	208
9/15	63.9	62.6	63.50	0.47	2523	1500	2124	337
9/16	64.2	62.8	63.44	0.62	2554	1379	2073	378
9/17	64.8	62.4	63.38	0.86	2545	1478	2045	297
9/18	64.0	61.9	63.23	0.92	2888	1605	2121	428
9/19	63.9	61.3	62.99	0.93	2888	1220	2085	588
9/20	63.9	61.0	62.93	1.06	3256	1078	2040	587
9/21	64.8	60.8	62.99	1.32	3341	1285	2108	549
9/22	64.6	60.1	62.93	1.58	2704	1582	2096	322
9/23	64.6	60.1	62.69	1.64	2888	1498	2045	352
9/24	64.6	60.4	62.63	1.54	2483	1381	2060	310
9/25	64.6	61.0	62.69	1.33	3001	1571	2160	493
9/26	64.6	61.2	62.72	1.20	2735	1175	1987	466
9/27	64.9	61.2	62.75	1.26	2557	1146	2017	439
9/28	65.1	61.2	62.84	1.36	2585	1500	2112	290
9/29	64.9	61.5	62.93	1.21	2973	1390	2131	524
9/30	64.2	61.5	62.84	0.95	2760	1384	2214	436

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF OCTOBER

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
10/ 1	62.8	61.2	62.36	0.63	3769	1104	2136	764
10/ 2	62.8	60.6	61.94	0.80	3618	1203	2135	707
10/ 3	63.1	60.4	61.85	1.05	3449	1118	2111	606
10/ 4	63.1	60.4	61.73	1.01	3381	1132	2080	580
10/ 5	62.4	60.3	61.52	0.92	3233	1226	2073	604
10/ 6	61.9	59.7	61.13	0.79	3126	1175	2086	546
10/ 7	61.9	59.2	61.01	1.02	3100	1543	2223	479
10/ 8	62.1	58.8	60.77	1.23	2984	1379	2076	501
10/ 9	62.1	59.0	60.74	1.19	2922	1390	2128	479
10/10	61.7	58.6	60.41	1.28	2882	1656	2090	362
10/11	61.7	58.5	60.26	1.31	2857	1339	2102	401
10/12	61.0	58.1	59.66	1.22	2877	1353	2003	542
10/13	60.8	57.6	59.33	1.47	2956	1441	2189	547
10/14	60.6	57.6	59.18	1.42	2990	1676	2197	463
10/15	60.1	57.2	58.79	1.20	3080	1132	2127	591
10/16	60.1	56.8	58.49	1.21	3092	1076	2152	584
10/17	60.4	56.8	58.34	1.35	3174	1107	2100	514
10/18	59.9	56.5	58.01	1.29	3293	1509	2142	499
10/19	59.2	56.3	57.74	1.16	3273	1132	2089	622
10/20	59.0	55.8	57.56	1.23	3304	1206	2067	603
10/21	59.0	56.1	57.62	1.01	3457	1432	2052	540
10/22	58.5	55.6	57.26	1.09	3432	1350	2049	564
10/23	57.9	55.9	57.32	0.88	3610	1141	1975	700
10/24	57.7	56.1	57.14	0.64	3661	1347	2187	629
10/25	57.2	56.5	56.93	0.36	3596	1687	2188	488
10/26	57.2	56.3	56.72	0.41	3720	1543	2193	602
10/27	57.0	55.9	56.54	0.48	3684	1325	2218	601
10/28	57.2	55.6	56.42	0.62	3735	1240	2252	594
10/29	57.2	55.4	56.27	0.71	3896	1124	2150	689
10/30	57.2	55.2	56.24	0.87	3876	1084	2152	673
10/31	57.2	54.9	56.06	0.98	3675	1192	2042	594

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF NOVEMBER

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
11/ 1	57.2	54.5	55.88	1.05	3559	1197	1948	577
11/ 2	57.0	54.1	55.64	1.15	3534	1118	2058	595
11/ 3	56.7	54.1	55.52	1.06	3440	1197	2141	565
11/ 4	56.5	54.1	55.22	1.15	3358	1721	2287	544
11/ 5	56.3	53.8	55.04	1.16	3389	1370	2197	592
11/ 6	55.8	53.6	54.74	0.97	3262	1101	2125	616
11/ 7	55.6	53.4	54.50	0.90	3284	1364	2121	588
11/ 8	55.2	53.4	54.29	0.81	3307	1183	2017	530
11/ 9	55.2	53.1	54.08	0.96	3194	1248	1989	512
11/10	55.2	52.7	53.75	0.98	3123	1254	2009	536
11/11	55.0	52.5	53.48	0.99	3029	1325	2006	533
11/12	54.9	52.3	53.51	0.85	3029	1427	2066	529
11/13	54.3	52.3	53.36	0.65	2743	1240	2002	491
11/14	53.8	52.0	53.21	0.67	3114	1095	1990	496
11/15	53.4	51.3	52.82	0.82	2562	1614	2025	306
11/16	53.4	50.9	52.58	0.88	2477	1254	1965	304
11/17	53.4	50.5	52.28	0.97	2973	1155	2029	483
11/18	53.4	50.4	52.01	1.01	2678	1421	2030	454
11/19	53.2	50.5	51.77	0.88	2945	1387	1909	428
11/20	52.9	50.4	51.53	0.90	3086	1285	2029	498
11/21	52.3	49.5	51.11	1.10	2916	1161	2028	539
11/22	51.8	48.7	50.72	1.14	2625	1166	2054	420
11/23	51.6	48.0	50.39	1.33	2831	1455	2061	447
11/24	51.3	48.2	50.18	1.24	3137	1223	2066	612
11/25	51.1	48.0	49.76	1.18	3364	1413	2211	613
11/26	50.5	47.7	49.46	1.06	3754	1611	2284	637
11/27	50.7	47.1	49.25	1.24	3961	1574	2274	743
11/28	50.5	46.6	48.95	1.35	3879	1350	2185	791
11/29	50.9	46.4	48.86	1.52	3791	1585	2321	606
11/30	50.7	45.9	48.47	1.59	3746	1529	2296	592

TEMPERATURE AND FLOW ANALYSIS FOR 10/ 1/59 TO 12/31/70
FOR MONTH OF DECEMBER

DATE	TEMPERATURE (DEG F)				FLOW (CMS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
12/ 1	50.5	45.1	48.23	1.78	3718	1633	2375	700
12/ 2	50.4	45.0	47.99	1.77	3692	1483	2343	663
12/ 3	50.2	44.8	47.93	1.82	3681	1161	2213	701
12/ 4	50.0	44.2	47.66	1.93	3681	1115	2218	674
12/ 5	49.5	44.1	47.30	1.80	3497	1359	2236	616
12/ 6	49.3	44.2	47.09	1.66	3358	1580	2199	520
12/ 7	48.4	44.6	46.97	1.34	3188	1597	2182	450
12/ 8	48.2	44.4	46.76	1.37	3171	1495	2067	525
12/ 9	48.4	44.2	46.52	1.40	3284	1585	2198	436
12/10	47.8	44.2	46.46	1.23	2828	1594	2193	343
12/11	47.8	43.9	46.22	1.38	2726	1274	2100	498
12/12	47.8	43.7	46.10	1.50	3029	1483	2047	494
12/13	47.5	43.3	45.83	1.58	3114	1084	2113	616
12/14	47.3	43.2	45.65	1.59	2735	1404	2100	388
12/15	46.9	43.0	45.47	1.54	3029	1260	2073	543
12/16	46.8	43.3	45.26	1.35	3256	1557	2303	475
12/17	46.6	43.2	45.02	1.40	2973	1611	2261	441
12/18	46.8	43.2	44.81	1.54	3454	1260	2339	654
12/19	46.6	43.0	44.60	1.45	3568	1455	2303	712
12/20	46.6	43.0	44.54	1.53	3001	1387	2170	626
12/21	46.2	42.1	44.21	1.77	3086	1220	2181	505
12/22	46.0	42.1	43.97	1.73	3426	1438	2323	640
12/23	45.9	41.9	43.76	1.62	3154	1299	2292	615
12/24	46.0	41.7	43.82	1.62	3143	1067	1857	602
12/25	46.0	41.7	43.52	1.71	2423	1056	1542	531
12/26	45.1	41.2	43.22	1.69	3086	1271	1974	613
12/27	45.0	41.2	42.92	1.61	3114	1158	2192	655
12/28	45.0	39.9	42.65	1.84	3228	1336	2255	602
12/29	44.8	37.8	42.05	2.42	3369	1226	2298	668
12/30	44.4	36.5	41.90	2.80	3511	1268	2220	575
12/31	44.1	36.9	41.75	2.55	3114	1061	2025	532

B.15

PERCENT OF TIME TEMPERATURE EXCEEDS A GIVEN MINIMUM
WHILE FLOW RATE IS BELOW A GIVEN MAXIMUM

MINIMUM TEMPERATURE	MAXIMUM FLOW	NO. OF TIMES CRITERIA MET	PERCENT OF TIME
65.0 DEG F	2800 CMS	45	2.1

APPENDIX C

SAMPLE PROBLEM 2 OUTPUT RESULTS

DISTRIBUTION OF AVERAGE DAILY TEMPERATURES FOR 1/ 1/71 TO 11/30/82

TEMP (DEG C)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
2.0	4041	97.163	1.0 - 2.9	293	7.045
4.0	3459	83.169	3.0 - 4.9	638	15.340
6.0	3010	72.373	5.0 - 6.9	392	9.425
8.0	2620	62.996	7.0 - 8.9	354	8.512
10.0	2282	54.869	9.0 - 10.9	366	8.800
12.0	1915	46.045	11.0 - 12.9	328	7.887
14.0	1533	36.860	13.0 - 14.9	429	10.315
16.0	1119	26.906	15.0 - 16.9	446	10.724
18.0	539	12.960	17.0 - 18.9	727	17.480
20.0	6	0.144	19.0 - 20.9	171	4.112

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
36000	4543	100.000	35000 - 36999	0	0.000
38000	4536	99.846	37000 - 38999	7	0.154
40000	4530	99.714	39000 - 40999	6	0.132
42000	4521	99.516	41000 - 42999	10	0.220
44000	4507	99.208	43000 - 44999	13	0.286
46000	4494	98.921	45000 - 46999	14	0.308
48000	4480	98.613	47000 - 48999	14	0.308
50000	4461	98.195	49000 - 50999	19	0.418
52000	4438	97.689	51000 - 52999	23	0.506
54000	4415	97.182	53000 - 54999	27	0.594
56000	4381	96.434	55000 - 56999	30	0.660
58000	4353	95.818	57000 - 58999	31	0.682
60000	4318	95.047	59000 - 60999	33	0.726
62000	4281	94.233	61000 - 62999	40	0.880
64000	4241	93.352	63000 - 64999	37	0.814
66000	4198	92.406	65000 - 66999	49	1.079
68000	4148	91.305	67000 - 68999	45	0.991
70000	4105	90.359	69000 - 70999	45	0.991
72000	4048	89.104	71000 - 72999	61	1.343
74000	3973	87.453	73000 - 74999	73	1.607
76000	3915	86.177	75000 - 76999	62	1.365
78000	3836	84.438	77000 - 78999	78	1.717
80000	3750	82.545	79000 - 80999	86	1.893
82000	3671	80.806	81000 - 82999	82	1.805
84000	3585	78.913	83000 - 84999	90	1.981
86000	3497	76.976	85000 - 86999	82	1.805
88000	3394	74.708	87000 - 88999	103	2.267
90000	3296	72.551	89000 - 90999	99	2.179
92000	3191	70.240	91000 - 92999	100	2.201
94000	3097	68.171	93000 - 94999	98	2.157
96000	2996	65.948	95000 - 96999	100	2.201
98000	2895	63.724	97000 - 98999	106	2.333
100000	2773	61.039	99000 - 100999	118	2.597
102000	2679	58.970	101000 - 102999	91	2.003
104000	2574	56.659	103000 - 104999	103	2.267
106000	2491	54.832	105000 - 106999	81	1.783
108000	2389	52.586	107000 - 108999	103	2.267
110000	2280	50.187	109000 - 110999	110	2.421
112000	2169	47.744	111000 - 112999	109	2.399
114000	2070	45.565	113000 - 114999	103	2.267
116000	1990	43.804	115000 - 116999	79	1.739
118000	1907	41.977	117000 - 118999	81	1.783
120000	1824	40.150	119000 - 120999	85	1.871
122000	1750	38.521	121000 - 122999	69	1.519
124000	1670	36.760	123000 - 124999	82	1.805
126000	1590	34.999	125000 - 126999	80	1.761
128000	1531	33.700	127000 - 128999	60	1.321
130000	1477	32.512	129000 - 130999	51	1.123
132000	1411	31.059	131000 - 132999	68	1.497

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
134000	1355	29.826	133000 - 134999	55	1.211
136000	1311	28.858	135000 - 136999	48	1.057
138000	1262	27.779	137000 - 138999	46	1.013
140000	1214	26.722	139000 - 140999	45	0.991
142000	1179	25.952	141000 - 142999	36	0.792
144000	1141	25.116	143000 - 144999	44	0.969
146000	1102	24.257	145000 - 146999	33	0.726
148000	1066	23.465	147000 - 148999	37	0.814
150000	1036	22.804	149000 - 150999	31	0.682
152000	1006	22.144	151000 - 152999	32	0.704
154000	965	21.241	153000 - 154999	39	0.858
156000	940	20.691	155000 - 156999	29	0.638
158000	904	19.899	157000 - 158999	34	0.748
160000	861	18.952	159000 - 160999	38	0.836
162000	833	18.336	161000 - 162999	28	0.616
164000	796	17.521	163000 - 164999	41	0.902
166000	769	16.927	165000 - 166999	27	0.594
168000	738	16.245	167000 - 168999	27	0.594
170000	721	15.871	169000 - 170999	19	0.418
172000	684	15.056	171000 - 172999	37	0.814
174000	662	14.572	173000 - 174999	24	0.528
176000	637	14.022	175000 - 176999	24	0.528
178000	618	13.603	177000 - 178999	17	0.374
180000	590	12.987	179000 - 180999	30	0.660
182000	572	12.591	181000 - 182999	18	0.396
184000	545	11.996	183000 - 184999	28	0.616
186000	525	11.556	185000 - 186999	19	0.418
188000	501	11.028	187000 - 188999	29	0.638
190000	477	10.500	189000 - 190999	21	0.462
192000	459	10.103	191000 - 192999	15	0.330
194000	442	9.729	193000 - 194999	17	0.374
196000	419	9.223	195000 - 196999	22	0.484
198000	405	8.915	197000 - 198999	12	0.264
200000	392	8.629	199000 - 200999	19	0.418
202000	375	8.254	201000 - 202999	15	0.330
204000	350	7.704	203000 - 204999	23	0.506
206000	342	7.528	205000 - 206999	11	0.242
208000	322	7.088	207000 - 208999	18	0.396
210000	312	6.868	209000 - 210999	9	0.198
212000	300	6.604	211000 - 212999	10	0.220
214000	284	6.251	213000 - 214999	19	0.418
216000	268	5.899	215000 - 216999	16	0.352
218000	254	5.591	217000 - 218999	15	0.330
220000	244	5.371	219000 - 220999	9	0.198
222000	229	5.041	221000 - 222999	15	0.330
224000	223	4.909	223000 - 224999	6	0.132
226000	213	4.689	225000 - 226999	9	0.198
228000	204	4.490	227000 - 228999	10	0.220
230000	195	4.292	229000 - 230999	6	0.132
232000	191	4.204	231000 - 232999	5	0.110

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
234000	187	4.116	233000 - 234999	5	0.110
236000	177	3.896	235000 - 236999	9	0.198
238000	172	3.786	237000 - 238999	4	0.088
240000	170	3.742	239000 - 240999	3	0.066
242000	168	3.698	241000 - 242999	3	0.066
244000	162	3.566	243000 - 244999	4	0.088
246000	158	3.478	245000 - 246999	4	0.088
248000	158	3.478	247000 - 248999	0	0.000
250000	156	3.434	249000 - 250999	4	0.088
252000	152	3.346	251000 - 252999	4	0.088
254000	148	3.258	253000 - 254999	4	0.088
256000	141	3.104	255000 - 256999	5	0.110
258000	137	3.016	257000 - 258999	5	0.110
260000	134	2.950	259000 - 260999	2	0.044
262000	134	2.950	261000 - 262999	0	0.000
264000	131	2.884	263000 - 264999	4	0.088
266000	129	2.840	265000 - 266999	2	0.044
268000	128	2.818	267000 - 268999	0	0.000
270000	123	2.707	269000 - 270999	5	0.110
272000	120	2.641	271000 - 272999	3	0.066
274000	119	2.619	273000 - 274999	1	0.022
276000	119	2.619	275000 - 276999	0	0.000
278000	118	2.597	277000 - 278999	1	0.022
280000	115	2.531	279000 - 280999	3	0.066
282000	109	2.399	281000 - 282999	6	0.132
284000	106	2.333	283000 - 284999	3	0.066
286000	102	2.245	285000 - 286999	4	0.088
288000	99	2.179	287000 - 288999	3	0.066
290000	95	2.091	289000 - 290999	4	0.088
292000	92	2.025	291000 - 292999	3	0.066
294000	90	1.981	293000 - 294999	2	0.044
296000	85	1.871	295000 - 296999	5	0.110
298000	76	1.673	297000 - 298999	9	0.198
300000	72	1.585	299000 - 300999	4	0.088
302000	67	1.475	301000 - 302999	5	0.110
304000	66	1.453	303000 - 304999	1	0.022
306000	62	1.365	305000 - 306999	4	0.088
308000	60	1.321	307000 - 308999	2	0.044
310000	58	1.277	309000 - 310999	2	0.044
312000	55	1.211	311000 - 312999	3	0.066
314000	55	1.211	313000 - 314999	0	0.000
316000	54	1.189	315000 - 316999	1	0.022
318000	54	1.189	317000 - 318999	0	0.000
320000	53	1.167	319000 - 320999	1	0.022
322000	51	1.123	321000 - 322999	2	0.044
324000	51	1.123	323000 - 324999	0	0.000
326000	50	1.101	325000 - 326999	1	0.022
328000	48	1.057	327000 - 328999	2	0.044
330000	47	1.035	329000 - 330999	1	0.022
332000	46	1.013	331000 - 332999	1	0.022

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
334000	45	0.991	333000 - 334999	1	0.022
336000	45	0.991	335000 - 336999	0	0.000
338000	44	0.969	337000 - 338999	1	0.022
340000	43	0.947	339000 - 340999	1	0.022
342000	39	0.858	341000 - 342999	4	0.088
344000	34	0.748	343000 - 344999	5	0.110
346000	32	0.704	345000 - 346999	2	0.044
348000	31	0.682	347000 - 348999	1	0.022
350000	28	0.616	349000 - 350999	3	0.066
352000	28	0.616	351000 - 352999	0	0.000
354000	27	0.594	353000 - 354999	1	0.022
356000	26	0.572	355000 - 356999	1	0.022
358000	26	0.572	357000 - 358999	0	0.000
360000	26	0.572	359000 - 360999	0	0.000
362000	25	0.550	361000 - 362999	1	0.022
364000	25	0.550	363000 - 364999	0	0.000
366000	25	0.550	365000 - 366999	0	0.000
368000	24	0.528	367000 - 368999	1	0.022
370000	24	0.528	369000 - 370999	0	0.000
372000	24	0.528	371000 - 372999	0	0.000
374000	24	0.528	373000 - 374999	0	0.000
376000	24	0.528	375000 - 376999	0	0.000
378000	23	0.506	377000 - 378999	1	0.022
380000	23	0.506	379000 - 380999	0	0.000
382000	22	0.484	381000 - 382999	1	0.022
384000	22	0.484	383000 - 384999	0	0.000
386000	21	0.462	385000 - 386999	1	0.022
388000	21	0.462	387000 - 388999	0	0.000
390000	21	0.462	389000 - 390999	0	0.000
392000	20	0.440	391000 - 392999	1	0.022
394000	19	0.418	393000 - 394999	1	0.022
396000	18	0.396	395000 - 396999	1	0.022
398000	17	0.374	397000 - 398999	1	0.022
400000	17	0.374	399000 - 400999	0	0.000
402000	16	0.352	401000 - 402999	1	0.022
404000	14	0.308	403000 - 404999	2	0.044
406000	12	0.264	405000 - 406999	2	0.044
408000	10	0.220	407000 - 408999	2	0.044
410000	9	0.198	409000 - 410999	1	0.022
412000	8	0.176	411000 - 412999	1	0.022
414000	7	0.154	413000 - 414999	1	0.022
416000	7	0.154	415000 - 416999	0	0.000
418000	6	0.132	417000 - 418999	1	0.022
420000	5	0.110	419000 - 420999	1	0.022
422000	4	0.088	421000 - 422999	1	0.022
424000	3	0.066	423000 - 424999	1	0.022
426000	2	0.044	425000 - 426999	1	0.022
428000	1	0.022	427000 - 428999	1	0.022
430000	0	0.000	429000 - 430999	1	0.022
432000	0	0.000	431000 - 432999	0	0.000

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
434000	0	0.000	433000 - 434999	0	0.000
436000	0	0.000	435000 - 436999	0	0.000
438000	0	0.000	437000 - 438999	0	0.000
440000	0	0.000	439000 - 440999	0	0.000
442000	0	0.000	441000 - 442999	0	0.000
444000	0	0.000	443000 - 444999	0	0.000
446000	0	0.000	445000 - 446999	0	0.000
448000	0	0.000	447000 - 448999	0	0.000
450000	0	0.000	449000 - 450999	0	0.000
452000	0	0.000	451000 - 452999	0	0.000
454000	0	0.000	453000 - 454999	0	0.000
456000	0	0.000	455000 - 456999	0	0.000
458000	0	0.000	457000 - 458999	0	0.000
460000	0	0.000	459000 - 460999	0	0.000
462000	0	0.000	461000 - 462999	0	0.000
464000	0	0.000	463000 - 464999	0	0.000
466000	0	0.000	465000 - 466999	0	0.000
468000	0	0.000	467000 - 468999	0	0.000
470000	0	0.000	469000 - 470999	0	0.000
472000	0	0.000	471000 - 472999	0	0.000
474000	0	0.000	473000 - 474999	0	0.000
476000	0	0.000	475000 - 476999	0	0.000
478000	0	0.000	477000 - 478999	0	0.000
480000	0	0.000	479000 - 480999	0	0.000
482000	0	0.000	481000 - 482999	0	0.000
484000	0	0.000	483000 - 484999	0	0.000
486000	0	0.000	485000 - 486999	0	0.000
488000	0	0.000	487000 - 488999	0	0.000
490000	0	0.000	489000 - 490999	0	0.000
492000	0	0.000	491000 - 492999	0	0.000
494000	0	0.000	493000 - 494999	0	0.000
496000	0	0.000	495000 - 496999	0	0.000
498000	0	0.000	497000 - 498999	0	0.000
500000	0	0.000	499000 - 500999	0	0.000
502000	0	0.000	501000 - 502999	0	0.000
504000	0	0.000	503000 - 504999	0	0.000
506000	0	0.000	505000 - 506999	0	0.000
508000	0	0.000	507000 - 508999	0	0.000
510000	0	0.000	509000 - 510999	0	0.000
512000	0	0.000	511000 - 512999	0	0.000
514000	0	0.000	513000 - 514999	0	0.000
516000	0	0.000	515000 - 516999	0	0.000
518000	0	0.000	517000 - 518999	0	0.000
520000	0	0.000	519000 - 520999	0	0.000
522000	0	0.000	521000 - 522999	0	0.000
524000	0	0.000	523000 - 524999	0	0.000
526000	0	0.000	525000 - 526999	0	0.000
528000	0	0.000	527000 - 528999	0	0.000
530000	0	0.000	529000 - 530999	0	0.000
532000	0	0.000	531000 - 532999	0	0.000

DISTRIBUTION OF AVERAGE DAILY FLOW FOR 1/ 1/71 TO 6/14/83

FLOW (CFS)	NO. OF TIMES EXCEEDED	PER CENT OF TIME	RANGE	DAYS WITHIN	PER CENT OF TIME
534000	0	0.000	533000 - 534999	0	0.000
536000	0	0.000	535000 - 536999	0	0.000
538000	0	0.000	537000 - 538999	0	0.000
540000	0	0.000	539000 - 540999	0	0.000
542000	0	0.000	541000 - 542999	0	0.000
544000	0	0.000	543000 - 544999	0	0.000
546000	0	0.000	545000 - 546999	0	0.000
548000	0	0.000	547000 - 548999	0	0.000
550000	0	0.000	549000 - 550999	0	0.000

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF JANUARY

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
1/ 1	6.9	4.3	5.34	0.76	163000	54000	97415	33582
1/ 2	6.9	4.0	5.07	0.90	159000	79000	110246	23262
1/ 3	6.7	3.5	4.88	0.96	153000	60000	114615	21091
1/ 4	6.7	3.1	4.73	1.02	156000	85000	118469	20419
1/ 5	6.7	3.0	4.61	1.11	154000	83000	115069	19384
1/ 6	6.7	2.1	4.42	1.22	144500	72000	112930	19833
1/ 7	6.6	1.5	4.28	1.29	158100	67400	114038	24333
1/ 8	6.4	1.3	4.17	1.26	154000	65000	115346	29208
1/ 9	6.2	1.5	4.13	1.14	154000	59400	104084	30799
1/10	6.0	1.7	4.00	1.02	155000	63000	110500	21879
1/11	5.8	1.8	3.91	0.92	150000	94000	117830	17847
1/12	5.7	1.6	3.83	0.93	162000	76000	105576	23679
1/13	5.6	2.0	3.80	0.83	163000	70000	109392	27990
1/14	5.4	1.8	3.73	0.87	162000	54000	106023	27287
1/15	5.2	2.4	3.85	0.70	161000	63000	102207	25458
1/16	5.0	1.0	3.59	1.11	157000	56000	103007	29617
1/17	4.8	1.0	3.60	1.07	162000	55000	105569	28549
1/18	4.7	1.0	3.57	1.04	152000	69000	107107	22276
1/19	4.7	1.0	3.56	1.04	161000	68000	108200	27208
1/20	4.6	1.0	3.54	1.02	170000	75000	113284	27736
1/21	4.6	1.0	3.47	0.99	162000	59000	116415	29476
1/22	4.7	1.0	3.47	1.01	182000	66000	112115	34173
1/23	4.8	1.0	3.38	0.98	208000	37000	112915	42632
1/24	4.8	1.0	3.37	1.00	202000	38000	113276	38195
1/25	4.5	0.9	3.27	0.98	197000	56000	118830	34116
1/26	4.5	0.9	3.12	0.99	195000	61000	120084	34890
1/27	4.3	0.8	3.00	0.99	198000	66000	121361	32085
1/28	4.3	0.7	2.89	1.08	203000	71000	121438	33081
1/29	5.1	0.5	2.88	1.27	182000	59000	122600	32167
1/30	5.0	0.4	2.77	1.30	183000	43000	120484	35976
1/31	4.3	0.2	2.50	1.19	168000	45000	120946	32282

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF FEBRUARY

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
2/ 1	4.8	0.1	2.63	1.32	177000	79000	118476	23339
2/ 2	4.7	1.1	2.81	1.11	191000	88000	123800	29416
2/ 3	4.3	1.0	2.75	1.05	193000	74900	120253	31900
2/ 4	4.1	1.0	2.61	0.92	171000	92000	125100	24349
2/ 5	4.2	1.1	2.55	0.92	171000	76000	122623	27274
2/ 6	4.1	1.1	2.49	0.88	173100	61000	125692	36848
2/ 7	4.1	0.2	2.36	1.06	163000	43000	117815	32678
2/ 8	4.0	0.2	2.28	0.97	169000	85000	117938	30151
2/ 9	3.9	0.3	2.27	0.94	168000	87000	120869	29746
2/10	3.8	0.4	2.36	0.97	167000	82200	117184	30158
2/11	3.6	0.4	2.35	0.93	165000	74000	114953	33165
2/12	3.9	0.5	2.45	0.97	158000	53000	110569	35712
2/13	3.9	0.8	2.55	0.91	148000	59000	112038	28537
2/14	3.7	1.1	2.65	0.83	141000	72400	114646	23418
2/15	3.8	1.0	2.76	0.90	144000	78700	111330	19651
2/16	4.0	1.0	2.82	0.93	122000	66800	103261	18894
2/17	4.4	1.1	2.86	0.95	147000	76000	106915	19763
2/18	4.4	1.1	2.84	0.93	162000	88000	115253	22891
2/19	4.4	1.1	2.87	0.94	155000	66000	113553	25331
2/20	4.2	1.1	2.95	0.97	158000	60000	112969	25825
2/21	4.4	1.1	2.98	1.00	142000	91800	116700	15779
2/22	4.3	1.1	2.93	0.96	151000	80900	117492	18575
2/23	4.4	1.1	2.98	0.93	195200	80000	122946	28425
2/24	4.5	1.1	3.03	0.93	178500	70700	121684	29808
2/25	4.7	1.1	3.04	0.96	187500	63000	120407	32914
2/26	4.9	1.3	3.10	0.97	185400	80000	121515	36147
2/27	5.0	1.4	3.16	0.99	196300	70000	121138	39201
2/28	5.2	1.5	3.27	0.98	192700	81800	120030	33877
2/29	3.4	2.5	3.07	0.49	140000	72000	115666	37899

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF MARCH

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
3/ 1	5.3	1.6	3.26	0.91	208500	51700	127007	40423
3/ 2	5.0	1.7	3.24	0.84	202300	58600	128823	35859
3/ 3	5.0	1.7	3.23	0.82	221000	90000	135330	40917
3/ 4	5.1	1.7	3.24	0.88	216200	76000	130069	40079
3/ 5	5.1	1.8	3.32	0.91	216800	72000	125261	40122
3/ 6	5.2	1.9	3.42	0.91	203100	78000	127692	38851
3/ 7	5.2	2.2	3.48	0.88	187100	84700	123600	33360
3/ 8	5.3	2.3	3.54	0.90	200400	71700	122561	41746
3/ 9	5.4	2.4	3.67	0.90	196300	69500	123492	41205
3/10	5.5	2.5	3.73	0.90	182200	81000	122492	33225
3/11	5.6	2.5	3.81	0.92	207800	50000	117053	40058
3/12	5.6	2.7	3.87	0.85	207800	55000	124815	42327
3/13	5.7	2.8	3.89	0.87	221600	52000	124623	42766
3/14	5.9	2.8	3.96	0.84	229200	90400	129492	35714
3/15	5.9	2.8	4.01	0.79	228400	65000	126553	47611
3/16	6.0	2.9	4.17	0.80	229200	70000	126430	47176
3/17	5.8	3.1	4.24	0.72	228500	85000	129938	45439
3/18	5.9	3.2	4.32	0.70	225800	70000	125807	45885
3/19	6.0	3.3	4.38	0.73	218500	56000	123715	49341
3/20	6.1	3.3	4.45	0.73	225500	68000	125076	49215
3/21	6.2	3.3	4.56	0.76	218700	66100	127100	49695
3/22	6.3	3.3	4.64	0.80	218000	54200	136030	52212
3/23	6.2	3.3	4.68	0.79	237700	63800	138661	51840
3/24	6.2	3.4	4.77	0.77	226300	67000	131192	50975
3/25	6.1	3.6	4.81	0.74	237900	70000	135084	52595
3/26	6.3	3.5	4.87	0.83	221300	79000	135800	47502
3/27	6.3	3.5	4.97	0.85	224500	77000	136930	46456
3/28	6.5	3.6	5.05	0.87	224900	78000	132353	47819
3/29	6.8	3.7	5.10	0.89	222800	69700	124933	42372
3/30	6.5	4.0	5.22	0.74	228000	67700	132969	48362
3/31	6.4	4.0	5.28	0.76	214900	98800	138507	42064

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF APRIL

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
4/ 1	6.4	4.0	5.33	0.78	203100	90000	132676	40623
4/ 2	6.3	4.1	5.37	0.72	187000	69000	130769	31086
4/ 3	6.5	4.0	5.48	0.76	192000	48000	126476	38361
4/ 4	6.4	4.1	5.58	0.70	188800	60000	124023	36233
4/ 5	6.6	4.6	5.84	0.60	191300	65000	127246	39827
4/ 6	6.6	4.6	5.88	0.57	194000	77000	132730	34787
4/ 7	6.9	4.6	5.97	0.61	204000	61000	125530	33714
4/ 8	7.1	4.7	6.12	0.62	219000	67000	124223	38223
4/ 9	7.1	4.9	6.20	0.58	202000	55000	125015	36314
4/10	7.1	5.2	6.36	0.53	199000	40000	116384	40903
4/11	7.3	5.3	6.42	0.58	189000	54000	118053	42698
4/12	7.4	5.4	6.50	0.62	198000	58700	126076	40207
4/13	7.7	5.5	6.59	0.65	202400	54700	133323	43156
4/14	7.6	5.6	6.70	0.63	206300	68000	130146	48863
4/15	7.8	5.7	6.82	0.68	200000	63000	133038	48117
4/16	8.0	5.7	6.86	0.75	201000	72500	132123	38217
4/17	8.1	5.7	6.98	0.78	184000	48000	125900	42223
4/18	8.3	5.8	7.06	0.79	189300	67200	127223	39869
4/19	8.3	6.0	7.15	0.77	201600	57700	124253	40640
4/20	8.4	6.2	7.31	0.75	169800	54500	121715	34619
4/21	8.6	6.5	7.48	0.70	183000	69500	118684	36013
4/22	8.7	6.8	7.64	0.72	163200	58800	113469	35356
4/23	8.8	7.1	7.85	0.73	176000	57400	118507	36355
4/24	9.1	7.1	8.05	0.79	187200	51000	119246	38597
4/25	9.3	7.0	8.18	0.81	206100	59600	115438	40113
4/26	9.5	7.2	8.42	0.80	188000	51800	108646	42494
4/27	9.6	7.3	8.49	0.72	195300	60300	112084	41889
4/28	9.7	7.2	8.65	0.78	198000	50000	120384	45359
4/29	9.9	7.2	8.78	0.81	203000	56000	122884	41608
4/30	10.1	7.4	8.96	0.79	206000	62000	124700	35550

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF MAY

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
5/ 1	10.3	7.5	9.16	0.82	213000	52000	133492	38225
5/ 2	10.4	7.7	9.37	0.77	207000	72000	139307	34861
5/ 3	10.5	7.7	9.47	0.74	214000	74000	146892	40625
5/ 4	10.7	7.8	9.54	0.81	251000	88000	148507	47074
5/ 5	10.9	7.8	9.60	0.82	244000	73000	152276	45260
5/ 6	10.6	7.9	9.68	0.74	249000	61000	150615	49710
5/ 7	10.7	8.2	9.75	0.66	252000	68000	154561	49968
5/ 8	10.9	8.5	9.86	0.67	270000	42000	158753	59064
5/ 9	10.8	9.0	10.01	0.56	272000	97000	163923	52386
5/10	10.8	9.1	10.05	0.55	270000	85000	158723	51760
5/11	11.0	9.2	10.10	0.55	270000	89000	163615	49362
5/12	11.3	9.4	10.19	0.58	280000	64000	159500	51035
5/13	11.7	9.5	10.37	0.57	281000	62000	160784	53934
5/14	12.1	9.6	10.43	0.65	283000	95000	161007	50306
5/15	12.6	10.1	10.58	0.72	299000	52000	162053	61025
5/16	13.0	10.2	10.67	0.79	309000	93000	167200	62441
5/17	13.3	10.2	10.77	0.87	298000	86000	171438	67142
5/18	13.6	10.2	10.86	0.94	295000	86000	175707	65467
5/19	13.8	10.3	10.98	0.96	288000	62000	173407	64886
5/20	13.8	10.3	11.06	0.95	289000	66000	172200	66495
5/21	13.9	10.4	11.29	0.94	285000	67000	169715	65771
5/22	14.0	10.3	11.45	0.95	302000	60000	174400	66837
5/23	14.1	10.4	11.63	0.91	297000	95000	183130	58810
5/24	13.9	10.2	11.62	0.92	302000	94000	180507	62312
5/25	13.7	10.1	11.73	0.84	287000	85000	170916	55944
5/26	13.7	10.5	11.77	0.81	298000	47000	176815	69429
5/27	13.8	10.7	11.81	0.78	300000	47000	176730	71491
5/28	14.0	11.0	11.87	0.78	305000	40000	171746	78359
5/29	14.4	11.3	11.98	0.85	327000	45000	180600	77441
5/30	14.6	11.3	12.08	0.90	348000	72000	190415	79048
5/31	14.5	11.1	12.20	0.86	344000	78000	191430	72420

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF JUNE

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
6/ 1	14.4	11.0	12.29	0.88	340000	107000	193313	68575
6/ 2	14.3	11.0	12.34	0.98	350000	83000	191769	77719
6/ 3	14.4	11.0	12.43	1.04	344000	59000	182240	85765
6/ 4	14.6	11.3	12.52	1.05	330000	58000	182900	78529
6/ 5	14.9	11.5	12.64	1.09	332000	42000	183676	83182
6/ 6	15.0	11.5	12.73	1.02	337000	80000	186107	77522
6/ 7	15.0	11.6	12.83	0.97	345000	80000	187984	77654
6/ 8	14.9	11.8	12.95	0.93	361000	71000	186723	83717
6/ 9	14.8	12.1	13.09	0.81	378000	74000	184238	88672
6/10	14.9	12.2	13.22	0.82	408000	53000	182700	97936
6/11	15.1	12.3	13.35	0.89	423000	52000	190746	94285
6/12	15.2	12.2	13.45	0.96	404000	51000	187992	91154
6/13	15.2	12.4	13.57	0.95	382000	88000	187415	84788
6/14	15.1	12.5	13.72	0.88	405000	83000	184923	89312
6/15	15.0	12.9	13.87	0.77	421000	80000	189158	98014
6/16	15.0	13.0	13.96	0.75	425000	54000	194683	105640
6/17	15.4	13.1	14.11	0.76	430000	44000	190700	110980
6/18	15.7	13.0	14.25	0.84	427000	66000	195800	109384
6/19	16.1	13.0	14.43	0.92	420000	69000	196391	102795
6/20	16.1	13.2	14.48	0.94	410000	80000	197050	99751
6/21	16.0	13.3	14.55	0.94	401000	89000	197825	98989
6/22	16.1	13.5	14.65	0.94	406000	85000	201033	103754
6/23	16.1	13.4	14.68	0.96	408000	61000	198383	110369
6/24	16.3	13.4	14.73	1.01	417000	70000	199008	115217
6/25	16.3	13.3	14.76	1.09	414000	67000	205075	105100
6/26	16.5	13.3	14.78	1.18	411000	62000	198391	108368
6/27	16.8	13.3	14.85	1.20	404000	84000	199516	103522
6/28	16.9	13.3	14.90	1.16	391000	77000	193708	100667
6/29	16.8	13.5	15.03	1.10	396000	72000	192075	104318
6/30	16.6	13.6	15.10	1.10	398000	62000	184133	106454

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF JULY

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
7/ 1	16.6	13.8	15.24	0.98	393000	70000	181458	108100
7/ 2	16.8	13.8	15.29	1.03	385000	41000	185458	105163
7/ 3	16.9	13.8	15.38	1.03	367000	48000	179666	99953
7/ 4	17.1	13.9	15.48	1.01	341000	39000	163591	100934
7/ 5	17.2	13.9	15.60	0.99	326000	64000	170283	89336
7/ 6	17.1	13.8	15.63	0.95	305000	81000	171833	74630
7/ 7	17.0	13.8	15.66	0.99	296000	82000	177508	76929
7/ 8	17.0	14.0	15.75	1.02	279000	69000	170283	78903
7/ 9	17.1	13.9	15.92	1.09	256000	43000	166875	66745
7/10	17.2	13.9	15.88	1.10	231000	39000	161700	62005
7/11	17.4	14.0	15.94	1.14	227000	64000	157683	50627
7/12	17.5	14.2	16.00	1.07	226000	66000	150016	49250
7/13	17.6	14.5	16.08	1.03	229000	83000	149900	53809
7/14	17.7	14.8	16.25	1.05	257000	70000	151775	56124
7/15	17.8	14.8	16.39	1.01	265000	59000	148150	62233
7/16	17.7	15.0	16.49	0.94	213000	77000	156475	46941
7/17	17.7	15.4	16.63	0.86	217000	53000	155050	48095
7/18	17.9	15.5	16.74	0.85	242000	95000	159450	54648
7/19	18.0	15.4	16.88	0.86	236000	85000	158650	52733
7/20	18.1	15.3	17.03	0.93	240000	72000	152316	55554
7/21	18.1	15.5	17.21	0.80	227000	91000	155633	48848
7/22	18.2	15.5	17.28	0.76	207000	78000	148991	46972
7/23	18.3	15.6	17.36	0.78	199000	72000	151725	42249
7/24	18.3	15.7	17.45	0.82	216000	73000	151158	41678
7/25	18.6	15.6	17.56	0.88	214000	79000	141850	40841
7/26	18.6	15.8	17.66	0.88	208000	66000	139416	46631
7/27	18.8	16.1	17.82	0.86	194000	62000	135483	48728
7/28	18.7	16.3	17.98	0.82	189000	66000	135033	41597
7/29	18.9	16.6	18.00	0.80	197000	63000	132225	49799
7/30	19.1	16.8	17.97	0.81	205800	80000	140341	42319
7/31	19.3	17.0	18.08	0.83	189600	58000	139375	38929

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF AUGUST

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
8/ 1	19.4	16.6	18.14	0.85	196000	84000	140225	36601
8/ 2	19.5	16.7	18.19	0.79	189000	83000	133691	38092
8/ 3	19.6	16.8	18.24	0.76	228000	68000	137541	50089
8/ 4	19.7	16.9	18.30	0.79	225000	82000	139658	50648
8/ 5	19.5	17.0	18.31	0.76	226000	56000	138716	55311
8/ 6	19.4	17.1	18.33	0.73	218000	62000	137775	50327
8/ 7	19.4	17.0	18.33	0.73	214000	56000	136750	45213
8/ 8	19.4	16.8	18.38	0.76	204000	92000	139416	38330
8/ 9	19.6	17.2	18.45	0.69	180000	90000	134250	36666
8/10	19.6	17.5	18.59	0.63	193000	66500	128841	44469
8/11	19.5	17.6	18.67	0.59	210000	87000	137841	40319
8/12	19.6	17.5	18.75	0.58	199000	57000	127966	44411
8/13	19.8	17.4	18.77	0.62	182000	79000	129533	35601
8/14	19.8	17.3	18.70	0.65	177100	58000	125375	35537
8/15	19.9	17.1	18.70	0.70	165000	65000	121733	28756
8/16	20.1	16.8	18.67	0.85	160000	42000	114675	34501
8/17	20.1	16.8	18.58	0.87	155000	53000	109183	31345
8/18	20.3	16.7	18.57	0.92	223000	72000	115975	41120
8/19	20.1	16.8	18.52	0.88	219000	41000	109566	48468
8/20	20.3	17.0	18.54	0.90	203000	66000	111491	37837
8/21	20.3	17.1	18.60	0.89	175000	49000	105266	33119
8/22	20.0	17.4	18.62	0.76	187000	55000	109816	33460
8/23	19.8	17.6	18.57	0.71	172000	74000	106500	28065
8/24	19.6	17.5	18.57	0.68	168000	63000	98316	30180
8/25	19.8	17.5	18.64	0.70	153000	45000	95658	32532
8/26	20.0	17.6	18.71	0.71	161000	46000	102983	29840
8/27	19.8	17.9	18.72	0.64	154000	55000	101333	26313
8/28	19.8	17.9	18.73	0.62	217000	60000	111425	39250
8/29	19.9	18.0	18.77	0.67	196000	61000	104716	32361
8/30	20.0	17.9	18.73	0.71	179000	80000	109308	24854
8/31	19.6	17.8	18.58	0.68	179000	67400	105083	29591

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF SEPTEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
9/ 1	19.7	17.7	18.54	0.71	165000	68000	98083	31411
9/ 2	19.6	17.7	18.49	0.70	152000	38000	92616	30749
9/ 3	19.8	17.6	18.50	0.75	153000	38000	87425	30346
9/ 4	19.8	17.8	18.56	0.67	148000	56000	89216	22863
9/ 5	19.6	17.9	18.59	0.54	146000	49000	86300	27547
9/ 6	19.6	17.9	18.57	0.50	137000	56000	91616	26363
9/ 7	19.6	17.7	18.52	0.55	184000	43000	99283	39906
9/ 8	19.5	17.7	18.48	0.57	194000	68000	105458	35980
9/ 9	19.4	17.5	18.45	0.54	188000	61000	97600	37893
9/10	19.1	17.2	18.33	0.49	171000	60000	100308	36002
9/11	19.3	17.1	18.31	0.58	158000	49000	94175	30993
9/12	19.4	16.8	18.30	0.72	119000	49000	86966	21585
9/13	19.5	16.5	18.25	0.83	132000	49000	88866	26930
9/14	19.5	16.5	18.23	0.87	124000	43800	85700	25967
9/15	19.5	16.5	18.16	0.88	126000	59000	87233	22049
9/16	19.4	16.7	18.14	0.86	114000	64000	90333	17594
9/17	19.2	16.7	18.07	0.83	115000	74000	90142	15234
9/18	19.1	16.7	18.00	0.81	118000	43000	84083	22900
9/19	19.4	16.9	18.00	0.74	117000	48000	78983	18525
9/20	19.6	16.7	17.92	0.78	117000	57000	79933	19842
9/21	19.5	16.6	17.77	0.78	118000	47000	82925	20644
9/22	19.3	16.8	17.68	0.75	119000	57000	81591	18729
9/23	19.3	16.7	17.64	0.79	111000	51000	78325	18193
9/24	19.5	16.7	17.63	0.82	117000	62900	82991	15015
9/25	19.6	16.6	17.60	0.83	119000	53800	81327	17250
9/26	19.5	16.6	17.52	0.83	123000	55600	81575	18421
9/27	19.1	16.5	17.38	0.75	114000	50500	81700	21859
9/28	19.0	16.2	17.26	0.79	112000	42300	79575	22029
9/29	18.8	16.1	17.18	0.73	109000	52900	78033	16778
9/30	18.8	16.1	17.15	0.78	112000	53000	78900	20998

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF OCTOBER

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
10/ 1	18.8	16.2	17.18	0.78	118000	58000	86233	18156
10/ 2	18.6	16.0	17.09	0.78	129000	46000	84125	26706
10/ 3	18.6	15.6	17.04	0.88	129000	59100	83183	24509
10/ 4	18.6	15.3	16.83	0.94	135000	44000	86141	25601
10/ 5	18.6	15.2	16.77	0.96	114700	52000	80508	20789
10/ 6	18.5	15.2	16.65	0.97	112000	49000	73400	20778
10/ 7	18.5	15.2	16.55	0.98	109000	44000	77608	19702
10/ 8	18.3	15.1	16.45	0.94	111000	57000	83533	14997
10/ 9	18.1	15.0	16.34	0.93	114000	48000	83875	22853
10/10	17.8	14.9	16.18	0.86	109000	50000	83166	18002
10/11	17.8	14.9	16.10	0.86	108000	65000	86158	14780
10/12	17.6	14.6	15.95	0.84	114000	46900	81708	19652
10/13	17.8	14.5	15.88	0.88	121000	51000	78116	18515
10/14	17.6	14.5	15.75	0.81	114000	47000	83600	21950
10/15	17.6	14.4	15.64	0.83	99000	50000	85616	13420
10/16	17.5	14.5	15.61	0.79	109000	42000	80525	20496
10/17	17.1	14.7	15.51	0.71	109000	62000	84000	13622
10/18	17.0	14.5	15.45	0.76	116000	57800	87550	16945
10/19	16.8	14.3	15.38	0.79	117000	47300	87458	20993
10/20	16.7	14.2	15.25	0.81	107000	44000	82700	17919
10/21	16.7	13.9	15.03	0.84	108000	42000	83433	20786
10/22	16.7	13.8	14.89	0.87	116000	49000	88166	19014
10/23	16.6	13.6	14.84	0.85	108300	45000	81108	18676
10/24	16.5	13.5	14.75	0.85	104000	55000	83166	17120
10/25	16.5	13.4	14.68	0.86	117000	55500	83183	19575
10/26	16.2	13.4	14.45	0.81	99000	61100	81275	10611
10/27	16.1	13.3	14.37	0.83	114000	56000	85241	19267
10/28	16.0	13.2	14.25	0.83	122000	51000	86033	19829
10/29	15.7	13.0	14.09	0.75	113000	49000	86608	19441
10/30	15.5	12.9	13.91	0.73	119000	47000	94141	22718
10/31	15.4	12.9	13.81	0.74	118000	50000	88233	20690

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83

FOR MONTH OF NOVEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
11/ 1	15.3	12.8	13.67	0.79	113000	56100	85783	17266
11/ 2	15.2	12.5	13.55	0.79	123800	49300	90300	20003
11/ 3	15.1	12.4	13.49	0.81	114500	51000	85091	18440
11/ 4	15.0	12.1	13.35	0.87	107000	49000	84875	15330
11/ 5	15.0	11.7	13.21	0.97	106000	62000	90608	15852
11/ 6	14.8	11.5	13.08	0.98	115000	57000	91841	14857
11/ 7	14.7	11.4	12.92	0.97	103000	60000	85875	13741
11/ 8	14.7	11.1	12.78	1.06	112000	69500	93933	13942
11/ 9	14.5	10.9	12.59	1.08	116000	65000	89308	15925
11/10	14.3	10.8	12.39	1.09	123000	39000	87891	22892
11/11	14.2	10.7	12.24	1.10	120000	37000	92058	22494
11/12	14.1	10.5	12.09	1.11	109500	51000	90416	19894
11/13	13.9	10.3	11.91	1.12	122000	53000	92116	21428
11/14	13.8	10.1	11.74	1.14	121000	61000	87016	15956
11/15	13.8	9.8	11.53	1.21	136000	47000	95800	23887
11/16	13.7	9.6	11.39	1.23	151000	48000	97808	26041
11/17	13.7	9.4	11.33	1.29	132000	53000	89966	21139
11/18	13.6	9.2	11.07	1.30	127000	40000	95733	22766
11/19	13.5	8.6	10.85	1.37	134000	63000	95016	21529
11/20	13.4	8.2	10.69	1.43	119000	46000	93558	20877
11/21	13.4	8.4	10.65	1.43	134000	53000	97066	22544
11/22	13.3	8.6	10.52	1.44	113000	44000	94041	19913
11/23	13.2	8.5	10.32	1.43	112000	63000	93700	15844
11/24	13.2	8.6	10.18	1.38	128000	43000	88966	26887
11/25	13.1	8.5	10.05	1.39	118000	56000	85591	20761
11/26	12.7	8.4	9.88	1.30	122000	63000	87433	19719
11/27	12.5	8.1	9.75	1.26	122000	46000	89383	22333
11/28	12.5	8.0	9.64	1.27	111000	61000	89625	15961
11/29	12.4	7.9	9.51	1.22	114000	74000	95808	13510
11/30	12.4	7.9	9.39	1.22	114000	80700	98700	9811

TEMPERATURE AND FLOW ANALYSIS FOR 1/ 1/71 TO 6/24/83
FOR MONTH OF DECEMBER

DATE	TEMPERATURE (DEG C)				FLOW (CFS)			
	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.	MAXIMUM	MINIMUM	AVERAGE	STD. DEV.
12/ 1	12.2	8.0	9.38	1.26	127000	51000	95908	21297
12/ 2	11.9	8.0	9.31	1.17	118000	42000	88825	21480
12/ 3	11.4	7.8	9.11	1.08	126100	56000	92683	22196
12/ 4	11.0	7.6	8.99	1.03	128000	57000	96325	22213
12/ 5	10.7	7.5	8.83	0.96	122000	49000	94108	21505
12/ 6	10.1	7.2	8.60	0.86	125000	76400	97283	14412
12/ 7	9.5	7.0	8.42	0.81	133000	83700	101258	14115
12/ 8	9.3	6.8	8.25	0.84	157000	77900	109933	22706
12/ 9	9.2	6.6	8.09	0.93	145000	64000	99491	23399
12/10	9.1	6.3	7.93	0.95	134000	77000	108366	17232
12/11	9.1	6.3	7.81	0.89	150000	74000	108508	24911
12/12	9.2	6.1	7.78	0.92	151000	68700	108991	22728
12/13	9.3	5.9	7.70	0.96	170000	74000	107691	22968
12/14	9.3	5.7	7.61	0.98	126000	76000	97490	13856
12/15	9.2	6.8	7.71	0.79	150000	61000	100808	23943
12/16	9.1	6.6	7.64	0.79	123000	57000	97841	16516
12/17	8.8	6.4	7.54	0.78	131000	61000	96700	23403
12/18	8.6	6.4	7.47	0.74	140000	65800	99866	22668
12/19	8.5	6.3	7.40	0.76	126000	75500	100050	15578
12/20	8.3	6.0	7.29	0.77	119000	54300	98950	17594
12/21	8.2	5.6	7.10	0.87	114000	58300	93616	15495
12/22	8.3	5.4	6.98	0.94	123000	82200	99775	12653
12/23	8.2	5.6	6.88	0.90	126000	65600	95475	19573
12/24	8.1	5.6	6.78	0.89	111000	41000	81583	22953
12/25	8.0	5.7	6.73	0.84	96000	38000	67691	17406
12/26	7.9	5.5	6.61	0.90	123000	46000	84816	24964
12/27	7.9	5.3	6.52	0.96	141000	80200	105250	18238
12/28	7.9	5.2	6.42	0.89	151000	85000	110008	19269
12/29	7.8	5.2	6.28	0.81	172000	67000	114333	27321
12/30	7.7	5.0	6.11	0.82	183000	54000	115616	32085
12/31	7.6	4.7	5.97	0.89	166000	53000	110250	28316

PERCENT OF TIME TEMPERATURE EXCEEDS A GIVEN MINIMUM
WHILE FLOW RATE IS BELOW A GIVEN MAXIMUM

MINIMUM TEMPERATURE	MAXIMUM FLOW	NO. OF TIMES CRITERIA MET	PERCENT OF TIME
18.0 DEG C	100000 CFS	297	6.8
17.0 DEG C	90000 CFS	343	7.9

APPENDIX D

COLSTAT COMPUTER LISTING

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C *** COLSTAT.FOR ***
C
C COLUMBIA RIVER STATISTICS
C
C USES 2 INPUT FILES - FLOW.DAT AND TEMP.DAT
C
C READS AVERAGE FLOW AND TEMPERATURE FOR EACH DAY FROM EACH FILE RESPECTIVELY
C CALCULATES MEAN OVER SEVERAL YEARS FOR A GIVEN DAY EACH MONTH
C CALCULATES STANDARD DEVIATION BASED ON SEVERAL YEAR'S MEASUREMENTS FOR
C A GIVEN DAY EACH MONTH
C CALCULATES NUMBER OF DAYS EXCEEDING A GIVEN FLOW OR TEMPERATURE
C AND WHAT PERCENTAGE OF TOTAL DAYS EXCEEDS THAT VALUE.
C
C MONDYS = NUMBER OF DAYS PRECEEDING EACH MONTH
C MONDS = NUMBER OF DAYS IN EACH MONTH
C-----
C
C DIMENSION TAV(31,12),TSTD(31,12),TMN(31,12),TMX(31,12)
C DIMENSION VAV(31,12),VSTD(31,12),VMN(31,12),VMX(31,12)
C DIMENSION VSQ(31,12),NDY(31,12)
C DIMENSION MONDYS(12),MONDS(12),MONTH(3,12)
C DIMENSION VF1(372),VF2(372)
C DIMENSION RLABEL(2,2,2), TITLE(2)
C DIMENSION T(10000),F(10000)
C
C COMMON /M/ MONDYS
C
C DATA RLABEL/('DEG',' C'),'('DEG',' F'),'('CM','S'),'('CF',
+ 'S') '/'
C DATA TITLE/'TEMP','FLOW'/
C DATA MONDYS/0,31,59,90,120,151,181,212,243,273,304,334/
C DATA MONDS/31,29,31,30,31,30,31,31,30,31,30,31/
C DATA MONTH/'JANU','ARY','FEBR','UARY','MARC','H','APRI','L','MAY','JUNE','JULY','AUGU','ST','SEPT','EMBE','R','OCTO','BER','NOVE','MBER','DECE','MBER'/'
C
C NODATA = 0
C ITUNIT = 1
C-----
C OPEN INPUT FILES, READ FIRST LINES TO OBTAIN STARTING DATES
C-----
C
C OPEN(UNIT=1,FILE='TEMP.DAT',STATUS='OLD',READONLY)
C READ(1,*) IM1,ID1,IY1
C READ(1,*) IM2,ID2,IY2
20 FORMAT(17X,F10.0)
30 FORMAT(1X,I5,2X,3I3,F10.0)
50 OPEN(UNIT=2,FILE='FLOW.DAT',STATUS='OLD',READONLY)
C READ(2,*) IM3,ID3,IY3
C READ(2,*) IM4,ID4,IY4
70 WRITE(5,80) IM1,ID1,IY1,IM2,ID2,IY2,IM3,ID3,IY3,IM4,ID4,IY4
80 FORMAT/' DATES FOR WHICH DATA IS AVAILABLE: '//
+ ' TEMP: ',I2,'/',I2,'/',I2,2X'TO'2X,I2,'/',I2,'/',I2/
+ ' FLOW: ',I2,'/',I2,'/',I2,2X'TO'2X,I2,'/',I2,'/',I2//
+ ' ENTER BEGINNING AND ENDING DATES FOR DATA ANALYSIS'//
+ ' ENTER DATES IN THIS FORMAT: 8,1,72 FOR AUGUST 1,1972'//
C-----
C ENTER USER DESIRED RANGE FOR ANALYSIS
C-----
90 WRITE(5,100)

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320  FORMAT(' MIN, MAX, INCREMENT: 32, 72, 2 DEGREES FAHRENHEIT')
      GO TO 400
C
350  WRITE(5,360)
360  FORMAT(/' THE DEFAULT RANGE FOR CUMULATIVE FLOW DISTRIBUTION IS')
      IF(IUNITS.EQ.2) GO TO 380
      RMIN = 1000
      RMAX = 15500
      RINC = 50
      WRITE(5,370)
370  FORMAT(' MIN, MAX, INCREMENT: 1000, 15500, 50 CUBIC METERS /'
+,' SECOND')
      GO TO 400
380  RMIN = 36000
      RMAX = 550000
      RINC = 2000
      WRITE(5,390)
390  FORMAT(' MIN, MAX, INCREMENT: 36000, 550000, 2000 CUBIC FEET',
+,' / SECOND')
400  WRITE(5,410)
410  FORMAT(/' DO YOU WISH TO CHANGE THE RANGE'/
+,' OF THE CUMULATIVE DISTRIBUTION?'/
+,' 0 = USE DEFAULT RANGE, 1 = CHANGE'/)
      READ(5,*) ICD
C
      IF(ICD.NE.1) GO TO 430
      WRITE(5,420)
420  FORMAT(' ENTER RANGE DESIRED (MIN,MAX,INCREMENT)')
      READ(5,*) RMIN, RMAX, RINC
430  NI = (RMAX-RMIN)/RINC + 0.5
      IF(NI.GT.371) NI = 371
      RMAX = RMIN + NI*RINC
      NII = NI + 1
C-----
C      * ANALYSIS LOOP *
C
C READ DATA
C MAKE NECESSARY UNITS CONVERSION
C START THE CALCULATION FOR MEAN AND STANDARD DEVIATION
C COUNT NUMBERS OF VALUES IN EACH INCREMENT OF RINC BETWEEN RMIN & RMAX
C N = NUMBER OF LINES READ FROM INPUT FILE (= 1 AT THIS POINT)
C NV = NUMBER OF VALUES USED IN ANALYSIS (NON -88.)
C-----
500  IF(VAR.NE.-88.) GO TO 510
      READ(ITF,30,END=550) LINE,ID,IM,IY,VAR
      N = N + 1
      IF(N.GT.ND) GO TO 600
      GO TO 500
510  NV = NV + 1
      IDL = ID
      IML = IM
      IYL = IY
      IF(ITF.EQ.1 .AND. IUNITS.EQ.2) VAR = 9./5.*VAR + 32.
      IF(ITF.EQ.2 .AND. IUNITS.EQ.1) VAR = VAR/35.3137
      VMN(ID,IM) = MIN(VMN(ID,IM),VAR)
      VMX(ID,IM) = MAX(VMX(ID,IM),VAR)
      VAV(ID,IM) = VAV(ID,IM) + VAR
      VSQ(ID,IM) = VSQ(ID,IM) + VAR * VAR
      NDY(ID,IM) = NDY(ID,IM) + 1
C
      DINC = (VAR-RMIN)/RINC
      IND = DINC + 1.5
      IF(IND.LT.1) GO TO 520
      IF(IND.GT.NII) GO TO 520
      VF1(IND) = VF1(IND) + 1
520  IND = DINC + 0.99999

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C-----
      IDS = ID1
      IMS = IM1
      IYS = IY1
      IDE = ID2
      IME = IM2
      IYE = IY2
C-----
C COMPARE USER RANGE WITH DATA RANGE
C-----
      IF(IRS.GE.NDS) GO TO 220
      IF(IRE.GT.NDS) GO TO 200
      WRITE(5,190) TITLE(ITF)
190   FORMAT(/' ENTIRE USER RANGE PRECEEDS DATA RANGE FOR ',A4)
      NODATA = NODATA + 1
      GO TO 800
200   WRITE(5,210) TITLE(ITF),IM,ID,IY
210   FORMAT(/' BEGINNING OF USER RANGE PRECEEDS DATA RANGE FOR ',A4/
      +' ANALYSIS WILL BEGIN WITH FIRST DATE OF DATA: 'I2,'/',I2,'/',I2)
      IDS = ID
      IMS = IM
      IYS = IY
      ND = IRE - NDS + 1
      GO TO 260
220   ND = IRS - NDS
      IF(ND.EQ.0) GO TO 250
      IF(ND.EQ.1) GO TO 240
      NDM1 = ND - 1
      DO 230 I=1,NDM1
      READ(ITF,30,END=550)
230   CONTINUE
240   READ(ITF,30,END=550) LINE,ID,IM,IY,VAR
C-----
C NOW SET ND = NUMBER OF DAYS OF DATA TO BE ANALYZED
C-----
250   ND = IRE - IRS + 1
C-----
C SELECT TEMP AND FLOW UNITS
C-----
260   IF(ITF.EQ.1) WRITE(5,270)
      IF(ITF.EQ.2) WRITE(5,280)
270   FORMAT(/' SELECT TEMPERATURE UNITS: '/' 1 = CELSIUS   '/'
      +' 2 = FAHRENHEIT')
280   FORMAT(/' SELECT FLOW UNITS: '/' 1 = CUBIC METERS / SECOND'/'
      +' 2 = CUBIC FEET / SECOND')
      READ(5,*) IUNITS
      IF(ITF.EQ.1) IUNT = IUNITS
      IF(ITF.EQ.2) IUNF = IUNITS
C-----
C ENTER USER RANGE (MIN,MAX,INCREMENT) FOR CUMULATIVE DISTRIBUTION
C-----
      IF(ITF.EQ.2) GO TO 350
      WRITE(5,290)
290   FORMAT(/' THE DEFAULT RANGE FOR CUMULATIVE TEMPERATURE ',
      +' DISTRIBUTION IS')
      IF(IUNITS.EQ.2) GO TO 310
      RMIN = 0
      RMAX = 22
      RINC = 1
      WRITE(5,300)
300   FORMAT(' MIN, MAX, INCREMENT: 0, 22, 1  DEGREES CELSIUS  ')
      GO TO 400
310   RMIN = 32
      RMAX = 72
      RINC = 2
      WRITE(5,320)

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        GO TO 697
695    IV = V
        I1 = V - 0.5*RINC
        I2 = V + 0.5*RINC - 1
        WRITE (6,720) IV, NE, PE, I1, I2, NR, PR
697    NE = NE - VF2(I)
C      WRITE(3,701) V, PE
700    CONTINUE
C701    FORMAT(2F10.1)
710    FORMAT(5X,F8.1,I19,F20.3,9X, F7.1,'-',F5.1,I14,F18.3)
720    FORMAT(5X,I10,I17,F20.3,10X,I6,'-',I6,I12,F18.3)
C      CLOSE (UNIT=3)
C-----
C CALCULATE MEAN, STANDARD DEVIATION FOR EACH DAY OF THE YEAR
C-----
        DO 750 J=1,12
        DO 750 I=1,31
        NDAYS = NDY(I,J)
        IF(NDAYS.LT.2) GO TO 750
        VAV(I,J) = VAV(I,J)/NDAYS
        VAVE = VAV(I,J)
        VSTD(I,J) = SQRT( (VSQ(I,J) - NDAYS*VAVE*VAVE) / (NDAYS-1) )
750    CONTINUE
C-----
C STORE TEMP DATA IF WE'RE IN THE TEMPERATURE LOOP (ITF=1)
C-----
        IF(ITF.NE.1) GO TO 800
C      OPEN(UNIT=3,FILE='T.OUT',STATUS='NEW')
        ITUNIT = IUNITS
        DO 760 J=1,12
        DO 760 I=1,31
        TMN(I,J) = VMN(I,J)
        TMX(I,J) = VMX(I,J)
        TAV(I,J) = VAV(I,J)
        TSTD(I,J) = VSTD(I,J)
        IF(VMN(I,J).EQ.1.E20) GO TO 760
C      WRITE(3,761) VMN(I,J),VMX(I,J),VAV(I,J),VSTD(I,J)
760    CONTINUE
C761    FORMAT(4F10.2)
C      CLOSE (UNIT=3)
C-----
C UPDATE ITF
C IF ITF = 2 LOOP BACK THROUGH FOR THE FLOW
C-----
800    ITF = ITF + 1
        IF(ITF.LT.3) GO TO 1
C-----
C WRITE TEMP AND FLOW RESULTS FOR EACH DAY OF THE YEAR
C-----
C      OPEN(UNIT=3,FILE='P.OUT',STATUS='NEW')
C      DO 801 J=1,12
C      DO 801 I=1,31
C      IF(VMN(I,J).EQ.1.E20) GO TO 801
C      WRITE(3,761) VMN(I,J),VMX(I,J),VAV(I,J),VSTD(I,J)
C801    CONTINUE
C      CLOSE (UNIT=3)
        J = 1
        I1 = 1
        IJ = 0
        IJE = 366
        IF(ND.GT.364) GO TO 805
        IF(IMS.LT.3 .AND. IME.GT.2 .AND. MOD(IYS,4).NE.0) ND = ND + 1
        J = IMS
        I1 = IDS
        IJE = ND
805    WRITE(6,810) IM1,ID1,IY1,IM2,ID2,IY2,(MONTH(I,J),I=1,3)

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      IF(IND.LT.1) GO TO 530
      IF(IND.GT.NII) IND = NII
      VF2(IND) = VF2(IND) + 1
C
530  READ(ITF,30,END=550) LINE,ID,IM,IY,VAR
      N = N + 1
      IF(N.GT.ND) GO TO 600
      GO TO 500
C
550  WRITE(5,560) IML,IDL,IYL
560  FORMAT(/2X' --- END OF DATA ENCOUNTERED ---'/
+ ' LAST DATE OF AVAILABLE DATA IS ',I2,'/',I2,'/',I2/
+ ' WE WILL JUST USE THE DATA AVAILABLE TO US')
      IDE = IDL
      IME = IML
      IYE = IYL
C-----
C WRITE CUMULATIVE DISTRIBUTION
C-----
600  IF(NV.NE.0) GO TO 610
      WRITE(5,605) TITLE(ITF)
605  FORMAT(/' NO ',A4,' DATA IN THAT TIME RANGE')
      NODATA = NODATA + 1
      GO TO 800
610  IF(ITF.EQ.2) GO TO 630
      WRITE(6,620) IMS,IDS,IYS,IME,IDE,IYE
620  FORMAT(1H1/5X' DISTRIBUTION OF AVERAGE DAILY TEMPERATURES FOR '
+ ,I2,'/',I2,'/',I2' TO ' I2,'/',I2,'/',I2//)
      GO TO 650
630  WRITE(6,640) IMS,IDS,IYS,IME,IDE,IYE
640  FORMAT(1H1/5X' DISTRIBUTION OF AVERAGE DAILY FLOW FOR ',
+ I2,'/',I2,'/',I2' TO ' I2,'/',I2,'/',I2//)
650  WRITE(6,660) TITLE(ITF),RLABEL(1,IUNITS,ITF),RLABEL(2,IUNITS,ITF)
660  FORMAT(24X'NO. OF TIMES'9X'PER CENT'47X'PER CENT'/
+ 6X,A4,1X,2A4,7X'EXCEEDED',11X'OF TIME',15X'RANGE',
+ 10X'DAYS WITHIN',7X'OF TIME'/
+ 6X,I2(' '),6X,I2(' '),9X,8(' '),9X,15(' '),5X,
+ 11(' '),7X,8(' '))
C-----
C NE = NUMBER EXCEEDING THE I-TH VALUE
C PE = PORTION EXCEEDING THE I-TH VALUE
C NR = NUMBER OF DAYS WITHIN THE I-TH RANGE
C PR = PORTION OF DAYS WITHIN THE I-TH RANGE
C NV = NUMBER OF VALUES USED IN ANALYSIS
C N = TOTAL NUMBER OF DAYS OF DATA CONSIDERED
C-----
C      IF(ITF.EQ.1) OPEN(UNIT=3,FILE='CDT.OUT',STATUS='NEW')
C      IF(ITF.EQ.2) OPEN(UNIT=3,FILE='CDF.OUT',STATUS='NEW')
      NE = 0
      DO 680 I=1,NII
      NE = NE + VF2(I)
680  CONTINUE
      I = 0
      DO 700 V=RMIN,RMAX,RINC
      I = I + 1
      IF(MOD(I,50).NE.0) GO TO 690
      IF(ITF.EQ.1) WRITE(6,620) IMS,IDS,IYS,IME,IDE,IYE
      IF(ITF.EQ.2) WRITE(6,640) IMS,IDS,IYS,IME,IDE,IYE
      WRITE(6,660) TITLE(ITF),RLABEL(1,IUNITS,ITF),RLABEL(2,IUNITS,ITF)
690  PE = 100. * NE/NV
      NR = VFI(I)
      PR = VFI(I)/NV * 100.
      IF(ITF.NE.1) GO TO 695
      VMR = V - 0.5*RINC
      VPR = V + 0.5*RINC - 0.06
      WRITE(6,710) V, NE, PE, VMR,VPR, NR, PR

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810  FORMAT(1H1,5X,' TEMPERATURE AND FLOW ANALYSIS FOR '
      +I2,'/'I2'/'I2' TO 'I2'/'I2'/'I2'/'6X,' FOR MONTH OF ',
      +3A4/)
      IF(NODATA.LT.2) GO TO 830
      WRITE(6,820)
820  FORMAT(5X,' NO DATA AVAILABLE IN THAT RANGE')
      GO TO 999
830  WRITE(6,840) RLABEL(1,ITUNIT,1),RLABEL(2,ITUNIT,1),
      + RLABEL(1,IUNITS,2),RLABEL(2,IUNITS,2)
840  FORMAT(/26X,'TEMPERATURE ',2A4,31X,'FLOW ',2A4/26X,19('-'),
      +32X,11('-'),//7X'DATE',5X'MAXIMUM',4X'MINIMUM',4X,'AVERAGE'
      +4X'STD. DEV.',7X'MAXIMUM',4X'MINIMUM',4X'AVERAGE',4X,
      + 'STD. DEV.'/7X'----',5X,7('-'),2(4X,7('-')),4X,9('-'),
      + 7X,7('-'),2(4X,7('-')),4X,9('-') )
C
      I2 = MONDS(J)
      IF(ND.LT.365 .AND. J.EQ.IME) I2 = IDE
      DO 930 I=11,I2
      WRITE(6,850) J,I
850  FORMAT(1H5,5X,I2,'/'I2)
      IF(TMN(I,J).NE.1.E20) GO TO 870
      WRITE(6,860)
860  FORMAT(1H+,16X' NO TEMP DATA AVAILABLE')
      GO TO 890
870  WRITE(6,880) TMX(I,J),TMN(I,J),TAV(I,J),TSTD(I,J)
880  FORMAT(1H+,2F11.1,2F11.2)
890  IF(VMN(I,J).NE.1.E20) GO TO 910
      WRITE(6,900)
900  FORMAT(1H+,72X,' NO FLOW DATA AVAILABLE')
      GO TO 925
910  IVMN = VMN(I,J)
      IVMX = VMX(I,J)
      IVAV = VAV(I,J)
      ISTD = VSTD(I,J)
      WRITE(6,920) IVMX,IVMN,IVAV,ISTD
920  FORMAT(1H+,59X,4I11)
925  IJ = IJ + 1
930  CONTINUE
      IF(IJ.GE.IJE) GO TO 940
      J = J + 1
      I1 = 1
      IF(J.GT.12) J = 1
      GO TO 805
C-----
C FREQUENCY OF TEMP EXCEEDING T WHILE FLOW IS BELOW F
C-----
940  WRITE(5,950)
950  FORMAT(/)
      REWIND (1)
      REWIND (2)
C-----
C SAVE USER RANGE DATES
C-----
      IDS = ID1
      IMS = IM1
      IYS = IY1
      IDE = ID2
      IME = IM2
      IYE = IY2
C-----
C BEGIN READING REWOUND DATA FILES TEMP.DAT AND FLOW.DAT
C-----
      READ(1,*) IM1,ID1,IY1
      READ(1,*) IM2,ID2,IY2
      READ(2,*) IM3,ID3,IY3
      READ(2,*) IM4,ID4,IY4

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      IF(IUNT.EQ.2) TV = 1.8 * TV + 32.
      FV = F(I+NSF)
      IF(IUNF.EQ.1) FV = FV/35.3145
      IF(TV.GE.TEMP .AND. FV.LE.FLOW) NG = NG + 1
      IF(TV.EQ.TEMP .AND. FV.EQ.FLOW) NG = NG - 1
1060  CONTINUE
1070  PERCENT = 100. * NG/NPT
      IFLOW = FLOW + 0.5
      WRITE(6,1080) TEMP,IFLOW,NG,PERCENT
1080  FORMAT(2X,F4.1,10X,I7,11X,I5,7X,F7.1)
      IF(IUNT.EQ.1) WRITE(6,1090)
      IF(IUNT.EQ.2) WRITE(6,1100)
1090  FORMAT(1H+,7X,'DEG C')
1100  FORMAT(1H+,7X,'DEG F')
      IF(IUNF.EQ.1) WRITE(6,1110)
      IF(IUNF.EQ.2) WRITE(6,1120)
1110  FORMAT(1H+,23X,'CMS')
1120  FORMAT(1H+,23X,'CFS')
      GO TO 1000
1130  WRITE(5,1140)
1140  FORMAT(/1X,'*** ANALYSIS FINISHED ***'/)
C
999  STOP
      END
C
      SUBROUTINE TLAPSE(ID1,IM1,IY1,IRS)
C
C FIND THE TIME ELAPSED FROM JAN 1,1959 TO IM1 ID1,IY1
C
      COMMON /M/ MONDYS(12)
      IRS = 0
      IDY = IY1 - 59
      IF(IDY.LT.0) IRS = -731
      IF(IDY.EQ.0) GO TO 20
      DO 10 I = 1,IDY
      IRS = IRS + 365
      IF(MOD(58+I,4).EQ.0) IRS = IRS + 1
10   CONTINUE
20   IRS = IRS + ID1 + MONDYS(IM1)
      IF(MOD(IY1,4).EQ.0 .AND. IM1.GT.2) IRS = IRS + 1
      RETURN
      END

```