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APPRAISAL OF HYDROLOGICAL FORECASTING METHODS APPLIED ON DATA IN TURKIYE

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ABSTRACT

APPRAISAL OF HYDROLOGICAL FORECASTING METHODS
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The purpose of this study is to examine the hydrological forecasting methods which are commonly used in other countries and apply it on data obtained from regions within Turkiye. These methods were applied on Ceyhan River Basin in this study. 30 years of the river flow data of five stations were taken into consideration in the calculations. Then, the same methods were applied on Seyhan River Basin for accuracy of calculations. The estimation of river discharge from the relevant basin by using runoff data is required for planning of water resources projects. If the existing data is not sufficient, then, regional relationship methods are used.

Data application was made in two different ways, long-term forecasting, and short-term forecasting. The development of the technique involves the processing of hydrological and meteorological observation data according to definite systems and the determination of the relationship between the various factors by means of graphs and formulas.

Finally, the goodness-of-fit was investigated by comparing the calculated variables with the observed ones. Forecast error was estimated and river flow for future years were found for the basins in concern.

Key Words: Hydrological Forecasting Methods, River flow forecasting, Basin, River Flow, Runoff, Prediction

ÖZET

HİDROLOJİK TAHMİN METOTLARININ TÜRKİYEDEKİ VERİLERE UYGULANMASI

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Bu çalışmanın amacı, diğer ülkelerde bulunan en yaygın hidrolojik tahmin metotları kullanılarak Ceyhan Nehri Havzası için Su akımı tahmini yapmaktır. Toplam yağış alanı 8608.8 km^2 olan 5 istasyonun 30 yıllık su akım değerleri üzerinde bir çalışma yapılmış, Sonuçların tam doğru olması için aynı metotlar Seyhan Nehri verilerine de uygulanmıştır. Su yapılarının planlanmasında akımların mevcut verilerinin önemi kadar, gelecek yılların verileride önemlidir. Gelecek yılların verilerini bulmak için gözlenmiş değerlerden gidilmesi şartır. Gözlenmiş değerlerin bulunmadığı veya eksik olduğu bir havzada ise, bölgesel ilişkilerden gidilerek gelecek için akım değerlerini bulmak mümkündür.

Bu verilerin uygulanması sırasında, uzun süreli ve kısa süreli tahminler olmak üzere iki ana yol izlenmiştir. Hidrolojik tahmin metotlarının geliştirilmesi, hidrolojik ve meteorolojik gözlem verileri kullanılarak grafikler ve formüller yardımıyla yapılmıştır.

Çalışmaların sonunda gözlenen değerler ile hesaplanan değerler karşılaş-tırılıp bir tahmin hatası bulunarak, bu havzaların gelecekte oluşabilecek su akım miktarları hesaplanmıştır.

<u>Anahtar Kelimeler</u>: Hidrolojik Tahmin Metotları, Su akım tahminleri, Havza

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A	Discharge Area
B_e	Average Basin Elevation
D_1	Discharge Density
F_v	Plant Cover
K	Deviation of the Predicted Values
L	Main Channel Length
m	Index number
n	Number of forecasts
p	Confidence Limit
P_e	Total Length of the Basin
P_m	Average Annual Precipitation
R_m	Average Flow
R_r	Relief Ratio
R_s	Shape of the Basin
S	Land Slope
T_m	Average Temperature
y_a	Actually observed values
y_p	Predicted values
y_{pr}	Predicted quantity
η	Correlation ratio
σ	Standard deviation from the mean of the predicted quantity
σ'	Standard error of control forecasts
σ'_y	Standard deviation of empirical points

σ_Λ	Mean norm of the predicted quantity
Δ	Forecast Series
Δ_i	Expected Mean Value of the Predicted quantity
Δ_{per}	Permissible error in deviation

1. INTRODUCTION

1.1. Scope and Objective

River flow models are used as components in actual flood forecasting schemes, where stream flow forecasts for a particular location are required in order to issue warnings, and to permit the evaluation of populations threatened by rising water levels. Also, they are used, although less spectacularly, in providing efficient operation of storage reservoirs for hydro-electric or other purposes. Such stream flow forecasts are invariably based on observations or forecasts of rainfall on the upper catchment, or of river flows at upstream points on the main river or tributaries. Discharge forecasts are obtained in real time, by using a model to transform the input functions into a corresponding discharge function of time. These forecasts may be subsequently be modified, or updated, in accordance with the errors observed in previous forecasts up to the time of making the new forecasts.

The aim of this research is to investigate the most common hydrological forecasting methods that were previously established in other countries, and apply it on available hydrological data obtained for Ceyhan River Basin, then, to observe and comment on the goodness of fit by comparing the calculated variables with the real ones.

A thirty years collection of water flow data has been obtained for Ceyhan River flow for five stations.

Another objective of the study is to predict the flow of Ceyhan River for following years. This forecast of discharge was evaluated in different ways, such as, short range forecasting, long range forecasting, seasonal forecasting etc.

At the end of the study the goodness of fit was calculated for different range of forecasts. These calculations were shown on tables and figures. And so, the best method can be seen clearly on figures and tables.

1.2. Outline of the Study

Forecasts of flow volumes and water elevations are essential to making use of rivers and in minimizing damage due to floods. All potential uses of rivers can benefit from reliable river forecasts. Besides efficient operation multi-purpose reservoirs and issuance of flood warnings, navigation and pollution control benefits can accrue. Ceyhan River is a one of the multi-purpose river in Turkiye. There are many irrigation projects on it, and some dams. there fore it is quite important to evaluate the flow rate of this river in future years.

30 years water discharge of five stations were observed for this river. First of all, this data were taken from State Water Works (DSİ), then Discharge-Time curves was drawn by computer application.

The forecasting is classified such as short range forecasting, long range forecasting, seasonal forecasting. There are different methods for these forecasts, there fore this data was applied to methods differently.

Actual values are compared with real ones and some optimum formulas were found for these forecasts ranges, [2].

The best-fit curve is chosen from the following alternatives :

-Linear

-Logarithmic

-Exponential

-Power

-Polynomial

-Cubic Spline

Clearly, the predicted extent and time of occurrence of a forecast differ to some degree from the actual values observed. In other words, almost every forecast has a definite error. The difference between the predicted and actual values is defined as the forecast error. This error is calculated and discussed in this research.

The relationship of forecast and the basin requirement for a method of estimating this relationship are important. Such a method should be objective.

The accuracy and the possible forewarning period of forecasting depend on :

- the extent to which the predicted hydrological phenomenon has been investigated.
- the effect of hydrometeorological conditions (primarily weather) on the phenomenon during a given forewarning period.

2. HYDROLOGICAL FORECASTING

2.1. The Content and Purpose of Hydrological Forecasting

Hydrological forecasting implies the application of laws which govern hydrological phenomena to the prediction of the state of a certain type of a body of water, (river, lake, reservoir etc.). Therefore, forecasting should contain data on quantitative characteristics of the phenomenon and its predicted occurrence.

The first attempts to predict the regime of water bodies go back to ancient history. However, Scientific hydrological forecasting only began in the middle of the 19 th century particularly for the purpose of flood warnings. Subsequently, the development of navigation, irrigation, and hydroelectric power structures, exerted an increasing demand on hydrological forecasting which resulted in their expansion and widened scope. Thus, the need arose to predict summer river stages, the time of freezing and thawing of rivers, maximum discharges and runoff volumes, as well as other hydrological phenomena.

Hydrological forecasting facilitates first of all the most economical use of water bodies in their natural condition and secondly, the most economical control of runoff by means of hydraulic structures. Thus, the prediction of the summer stages on a navigable river and of the time of its freezing enables better planning both of cargo transport and harboring of the river fleet during the winter; knowing the expected water inflow into a storage reservoir permits optimum discharges during subsequent periods.

2.2. The General Basis of Hydrological Forecasting

Water Currents move considerably slower than air currents. The relatively slow motion of water allows forecasting a series of phenomena in a river and the variation of the amount of water flowing in it comparatively easily. Initial data for the preparation of the forecast consist of hydrological observation from stations situated upstream from the site for which the forecast is being prepared.

Data on precipitation or snow melt permit the calculation of the amount of natural replenishment over a drainage basin. In order to know which part of this runs off into a river, it is necessary to know how much of it evaporates and how much of it is retained in the ground.

Hydrological forecasting is based on the study of the physical characteristics of the processes which cause the occurrence and development of these phenomena. These include first of all the inflow to a basin, flow of rainfall and snow melt, their movement on and below the ground surface, the flow of water in river channels, evaporation, heat exchange between bodies of water and surrounding media, freezing and thawing of open water bodies, etc. Physiographical differences between various basins frequently affect the development of hydrological phenomena in different rivers. The study of some of these phenomena, namely that of flow of water in a basins that of flow of water in a basin that of heat exchange between water and other media, has been aided by thermodynamic laws of heat balance.

As yet, however, all the above listed subjects have not been sufficiently examined. In some cases theories have been developed enabling calculations of certain phenomena.

2.3. Methods of Application

Hydrological forecasts are prepared by using approximate relationships between the various factors of the phenomenon to be predicted. Thus, flood flows are predicted from the water equivalent of the snow pack of a basin and of a percolation losses during the autumn. Infiltration capacities of soils in the spring depend on the degree of saturation during preceding autumn.

River runoff during dry periods and depletion of reservoirs from basins are also calculated from these data and from the discharge at a given point on a river. All these relationships are rather less empirical. It is only natural that in their derivation mathematical statistics, particularly linear correlation, have been employed.

Sometimes forecasts are prepared with the aid of several relationships. These relationships are applied according to the duration and aerial distribution of the investigated phenomenon.

Finally, as mentioned earlier, a hydrological forecast is sometimes the prediction of a phenomenon based on the theory of its formation. The development of additional theories of various hydrological phenomena will result in an increasing number of forecasting methods. The main obstacle in the application of these methods, however will be insufficient accuracy of initial hydrometeorological data, particularly of those pertaining to the forewarning periods of the forecasts.

Forecasting methods should be used for predicting hydrological phenomena in advance with their occurrence using specific hydrometeorological data. The technique of forecasting of some phenomena requires the application of specific relationships derived from a definite method of forecasting prepared with the aid of these relationships. The phenomena are based on hydrological data.

The derivation of a forecasting method is closely related with a theoretical physical analysis of the predicted hydrological phenomenon. If such an analysis does not exist in the scientific literature, it becomes necessary to use available results of investigations of stream patterns, snow melt, runoff processes, heating and cooling of reservoirs, as well as freezing and thawing of rivers, all or any of which may have a bearing on the phenomenon involved. Frequently, basic investigations are required to develop forecasting methods which, however, are beyond the scope of usual forecasts.

It is important to have several such methods of forecasting of a hydrological phenomenon, which enables its prediction with different forewarning periods on the basis of various data. Obviously, the accuracy of the forecast should increase as the forewarning period decreases. Thus forecasting floods according to the water equivalent of the snow pack in the second half of the winter will be less accurate than a forecast based on the amount of snow in the basin before the beginning of snow melt. Similarly, a flood forecast based on channel storage will be even more accurate. This forecast, however, can only be prepared after most of the snow has already melted and runoff into the rivers. A method refining an early forecast based on scientific principles, should be supplied in practice.

The technique of forecasting a given phenomenon for a particular river is established on the basis of a particular method of forecasting suitable for this phenomenon. The development of the technique involves processing of hydrological and meteorological observation data according to a definite system, and the determination of the relationships between various factors by means of graphs or formulas.

Also, it is necessary to prepare a brief report about the estimation of the accuracy of the established relationships and the forecasting technique. This report should describe the essence of the technique, the relationships according to which the forecast is to be prepared, an estimate of its accuracy and the basic hydrological and meteorological observation data used.

Forecasting by means of techniques starts with the careful processing and analysis of pertinent observation data gathered from the stations, which characterize hydrometeorological conditions developed in a basin. Sometimes, data from adjoining areas and time of occurrence of the phenomena should also be investigated. Then, the expected magnitudes are determined by means of techniques which have been developed. After issuing the forecast, observations of the variations in hydrometeorological conditions in the basin are continued, and if necessary an improved forecast should be prepared.

As a result in experience in forecasting, the techniques used may be refined and their accuracy improved, [1].

2.4. Determination of Forewarning Periods

The forewarning period of a forecast is defined as the time elapsed between the forecast of the event and its actual occurrence. If the event lasts for some time, the calculation of the forewarning period should consider the beginning of this phenomenon. Depending on the requirements of the agencies which use the forecasts and the laws governing the development of the phenomena, forewarning periods of hydrological forecasts usually vary from 1 or 2 days to several months.

2.5. Classification of Hydrological Forecasts:

In order to develop methods for early forecasts, it is necessary to consider the various factors that affect the occurrence of the predicted hydrological phenomenon. Two basic types of classification are described. In the first group, forecasts are classified according to the predicted phenomena, and in the second group forecasts are classified in accordance with the processes which lead to the occurrence of the phenomena.

According to the first classification, forecasts are divided into two main groups :

1- forecasts of phenomena associated with water (runoff, discharges, stages etc.).
2- forecasts of phenomena associated with ice formation on reservoirs, freezing and thawing of rivers and lakes, and variations in the thickness of ice covers.

According to the second classification, forecasts are divided as follows:

1- forecasts based on phenomena which occur in streams or channels, such as stages, channel storage, etc. for which hydrometric observation constitute the raw data.
2- forecasts based on the phenomena which take place in a basin (such as spring runoff resulting from the water release of the snow or summer and fall runoff of land rivers, resulting from ground water storage, etc.). Meteorological and hydrological observations constitute the basic raw data.
3- forecasts based on laws of atmospheric circulation over a vast territory, which determine the time of fall (or rise) of the air temperature, leading to freezing (or thawing) of one or many rivers in a given region, or give rise to variations in seasonal or annual precipitation over a given basin. The basic

data for the precipitation of these forecasts are observations from meteorological stations and weather charts. Forecasts are therefore often termed hydrosynoptical.

It should be added that there exist a number of methods in which forecasting is based on phenomena occurring both in channels and in basins.

In presenting the material, it was not feasible to adopt the first or the second classification only, since different problems, such as forecast based on channel storage or ground water storage, forecasts based on total water inflow to the rivers within a drainage basin, or on precipitation and snow melt, etc. , are solved basically in the same way. Certain hydrological forecasting methods are applicable both to long range forecasting of the phenomena associated with ice and to river runoff forecasts. Thus it was possible to avoid repetitions, [1].

2.6. Accuracy and Reliability of Forecasting Techniques

Clearly, the predicted extent and time of occurrence of a given hydrological phenomenon will frequently differ to some degree from the actual values observed. In other words, almost every forecast has a definite error. The difference between the predicted and actual values is defined as the forecast error.

The probability that a forecasting error will not exceed some given value will not be the same in all cases; it will increase with the increase in the given limit of the error. For a large limit of data, the data will be more scattered, therefore, the probability of forecasting error increases and it does not give an accurate result

The reliability of a forecast and the basic requirements for a method of estimating this reliability are important. Such a method should be objective; it should permit a comparison of the accuracy of forecasts of various hydrological phenomena, or of forecasts of the same phenomenon, predicted by different techniques. These requirements can be satisfied if the estimate of the reliability is based on statistical methods.

The magnitude of the permissible error of a forecast should be determined according to the degree of the natural variation of the predicted quantity during the forewarning period. Thus, if discharge is predicted five days in advance during a continues high-water recession, the observed variation in discharge rates during periods of five days within the given high water period should be taken into consideration. If, on the other hand, spring break up of a river was found to occur earlier than any date on record, past observations of many years should be used to evaluate the natural variation of this phenomenon in turn to determine the forecast error.

The basic statistical measure of variation of random variable is the standard deviation from the mean. Therefore, it is statistically completely justified to use in the determination of the permissible forecast error some fraction of the standard deviation from the mean norm of the predicted quantity or of the standard deviation σ from the mean variation of the predicted quantity during forewarning period of the forecast. Long experience in preparing forecasts, and the development of techniques in this field has made it possible to estimate the accuracy of prediction of hydrological phenomena. It has been established that it is advisable to use (Δ_{per}) the probable deviation from the mean of the predicted quantity or its variation during the warning period as the permissible error for each forecast, i.e.,

$$\Delta_{per} = 0.674\ \sigma_1 \qquad (2.1)$$

or

$$\Delta_{per} = 0.674\ \sigma_\Delta \qquad (2.2)$$

Frequently, the variation of a given phenomenon should be calculated for separate seasons since the variation differs with each season. For example, the variation of the water stages over five days is different in periods of high water, recession and low-water, etc. To calculate σ_Δ, it is usually sufficient to choose from observation data over three years about one hundred values characteristic of the variation of the predicted parameter, such as water stages.

In calculating the permissible forecasts errors one often meets special cases which should be considered briefly.

As mentioned earlier, forecasts of mean runoff for periods of ten days or a month are sometimes prepared on the basis of empirical relations between subsequent and preceding volumes of water flowing in the river. For a considerable decrease in the flow from one ten-day period to another or from one month to another $\sigma_\Delta > \sigma_1$. In this case, σ and not σ_Δ is used in the calculation of the permissible errors.

Long range forecasts in certain cases, such as break up on a given river, indicate a later time than the earliest time on record. Standard deviation should then be calculated from break up dates previously recorded, excluding those in which this phenomenon occurred earlier than the data indicated in the present forecast.

A forecast is considered reliable if its error is equal to smaller than the permissible one. Such an estimate of the reliability of forecasts is, of course, not free from certain shortcomings. Thus, different reliable forecast having a given permissible error may frequently have different occurrences. In the case of a small value of the predicted event, the permissible forecast error may approach, or even exceed, this value. Forecasts of high water runoff, given with errors of 9 or 11 mm, are considered accurate or inaccurate respectively, if the permissible error equals ± 10 mm. However, these short comings are offset by the fact that the estimate is arrived at on a statistical basis, and that it results in comparable values of the accuracy of forecasts for various hydrological phenomena prepared by different techniques and with different warning periods.

When a forecasting technique worked out, it is always necessary to estimate its effectiveness and degree of accuracy. The degree of accuracy of a technique is estimated from the distribution of the forecast errors or from the confidence limits, i.e., from the probability that the forecast error will not exceed (or be below) some limiting values. It is important to know the permissible confidence limits of the error. Such an estimate of the accuracy of the technique is based on the assumption that the distribution of future forecasting errors according to a given developed technique will be the same as that of control forecasts prepared by the same technique from observation data of past years.

Calculations show that control-forecast errors are usually approximately normally distributed. Considering both these distributions normal, a functional relationship exists between the value of the confidence limits of the forecast errors and the correlation of the predicted phenomenon to the factors on which the forecast is based.

By the increase in the correlation ratio the confidence for a given value of forecast error also increases, and vice versa, therefore, it is possible to estimate the degree of accuracy of a technique according to the correlation ratio η of the above indicated relationship or the ratio σ'/σ. Recalling that the correlation ratio which characterizes the degree of accuracy of the relationship between the predicted phenomenon and its factors is

$$\eta = \sqrt{1 - (\sigma_y'/\sigma)^2} \tag{2.3}$$

where σ_y' is the standard deviation of the empirical points from the established relationship (i.e., the standard error of the control forecast) and σ is the standard deviation from the mean of the predicted quantity. For linear relationships, the correlation ratio is equal to the coefficient of the correlation. The standard error of forecasts is equal to :

$$\sigma'_y = \sqrt{\Sigma(y_p - y_a)^2 / n} \tag{2.4}$$

where; y_p and y_a are the predicted and actually observed values respectively. n is the number of forecasts.

For $\sigma'/\sigma \leq 0.4$, the permissible forecasting error, equal to 0.674σ or $0.674\sigma_\Delta$,has confidence limits of 90%.

For $0.4 < \sigma'/\sigma < 0.6$, the permissible forecasting error, equal to 90 to 75 %.

For $0.6 < \sigma'/\sigma \leq 0.8$, the permissible forecasting error, equal to 75 to 60 %.

For $\sigma'/\sigma > 0.8$, the permissible forecasting error, equal to 60%.

Table 2.1 Estimate of accuracy of forecasting techniques

σ'/σ	η	ACCURACY
≤ 0.4	≥ 0.9	Good
≤ 0.6	≥ 0.8	Satisfactory
≤ 0.8	≥ 0.6	Low
> 0.8	< 0.6	Unsatisfactory

As the number of terms in the series n is reduced, the error in the calculation of the correlation ratio increases. According to the values of this error, in the case of an insufficiently developed technique, if $n > 15$ it is advisable to use the limiting value of $\sigma'/\sigma = 0.7$, and not 0.8; and if $16 < n < 24$ use $\sigma'/\sigma = 0.75$.

The accuracy and the possible forewarning period of forecasts depend on :

a- the extent to which the predicted hydrological phenomenon has been investigated.

b- the effect of hydrometeorological conditions (primarily the weather) on the phenomenon during a given forewarning period.

c- on hydrometeorological conditions considered in the preparation of the forecast affect the occurrence of the predicted phenomenon only very slightly, it is virtually impossible to prepare a forecast, [1, 15].

2.7. The Form of Issuing Hydrological Forecasts

The form in which a hydrological forecast is issued is important, since the actual values of the predicted phenomenon may differ from the forecasted values with various degrees of probability.

At present, a forecast includes the average value and a range of values of the predicted quantity. The probability that the actual value of the phenomenon will not fall outside this range should be determined and communicated to the persons using the forecast. An account of the methods for issuing a forecast in this form follows.

Let the number of forecasts be sufficiently large. Further, suppose that the distribution of future forecast errors not only remains normal but is characterized by σ'_y, calculated from data errors in the control forecasts. With the aid of Gauss' probability integral it is then easy to determine the probability of the actual value of the predicted phenomenon y_a not falling outside the limits

$$y'-k\sigma'_1 < y_a < y'+k\sigma' \quad (2.5)$$

where y′ is the mean value of the predicted quantity, σ'_y is the standard error of the forecasts, and k is the deviation of the predicted value from the actual value, expressed as a fraction of σ'_y

The range of the values of the predicted phenomenon in the issued forecast should be wide enough to ensure a sufficiently of finding the actual value of the phenomenon within this limits. On the other hand, this range should not be so wide as to make the use of the forecast difficult in practice. The experience in forecasts shows that a range equal to twice the permissible forecasting error, i.e. from $(y' - 0.67\sigma'_y)$ to $(y' + 0.67\sigma'_y)$ is acceptable. The probability that the actual value of a hydrological phenomenon predicted by the given technique will not fall outside these limits is 50%, and the confidence limits of the extreme value of the range are 25 and 75%. Accordingly, a long-range forecast of the high water stage at some point on a given river, for example, will have the following form:

A high water stage of 700 cm is expected and the probable forecast error is 60 cm or a high water stage between 640 and 760 cm is expected the mean value of which is 700 cm with a probability of 50%

After calculating the mean value of the predicted quantity for a given case, knowing the value of σ'_y and assuming different values of k, we can easily determine any values within the range and calculate the probabilities of their occurrence in this range. It is also possible to determine the confidence limits of extreme values for each range, and to present the forecast of any quantity in the form of a probability curve. As a result of the above made assumptions for the distribution of errors in the control forecasts, the reliability of the confidence limits for very small and very large values of the predicted quantity is appreciably reduced. A large number of forecasts make it possible to plot the curve of errors of confidence limits, and to compare this curve with the theoretical curve obtained from Gauss' curve for a given value of error, expressed in percent, is calculated by the well-known formula

$$p= (m-0.3)/(m+0.4) \times 100 \qquad (2.6)$$

where m s the index number of the term in the series, arranged in a decreasing order of magnitude, and n is the total number of terms in that series.

A small number of forecasts and short series of observations ($n < 25$-30) complicate the determination of the distribution of forecast errors by the given technique.

A further complication is encountered in the solution of the problem if the error depends on the magnitude of the predicted phenomenon. One approximate solution of a similar problem (where n is larger) reduces to the following.

From series of errors in forecasts (Δ_l) and the expected mean values of the predicted quantity (y_{pr}) corresponding to these forecasts, the empirical relationship

$$|\Delta| = (y_{pr}) \qquad (2.7)$$

has been derived. Next, y_{pr} is calculated from this relationship for each value of $|\Delta|$ and the values of $\Delta_l' = \Delta l / |\Delta|$

which do not depend on y_{pr}, are calculated.

From the series $\Delta_1, \Delta_2, \Delta_3, \ldots\ldots\ldots\ldots, \Delta n$

we calculate $\Delta' = \Sigma\Delta_l/n$ and

$$\sigma_{\Delta'} = \sqrt{\Sigma(\Delta l - \Delta')^2/n} \qquad (2.8)$$

The standard error of forecast will be

$$\sigma y' = |\Delta_l| . \sigma_{\Delta'} \qquad (2.9)$$

where; $|\Delta I|$ is taken from the relationship

$$|\Delta| = \varphi(y_{pr}) \tag{2.10}$$

Knowing $\sigma y'$, we can also find the distribution of forecast errors for each predicted value of y_{pr}, [1, 15].

The solution of the problem may also be reduced to the calculation of the values of from a series of values of errors in forecasts at individual intervals of the values of the predicted quantity. However, the number of forecasts required for this purpose is usually larger than that available.

Sometimes, forecast errors are not due to the approximate nature of the relationship used in forecasts, but largely result from the effects of the unknown weather conditions during the forewarning period. In this case it is possible to calculate from long time observations the confidence limits of such quantitative weather characteristics that are associated with the predicted phenomenon. For example, in the predicted value of river runoff, such a characteristic may be the amount of the prediction. Further, in a forecast, all the values of the factors influencing the predicted phenomenon are taken into account according to available observation data. Precipitation is estimated according to the confidence limits described to the values of the predicted event. These confidence limits correspond to those of the amount of precipitation adopted for the period for which the forecast is given, [1].

2.8. Basic Requirements of Hydrological Forecasts

Hydrological forecasts are mainly used for the solution of the following two basic problems :

1- planning economic utilization of water resources

2- issuing forewarning to the population and concerned agencies regarding sudden variations in the rivers and of other water bodies.

In accordance with the needs of the various branches of the national economy, forecast of the hydrological phenomena with different forewarning periods have to be prepared. The operation of hydroelectric power plants or irrigation systems requires forecasts of river runoff with long forewarning periods and subsequent refinement of these forecasts; navigation requires forecasting of the beginning of the autumn ice drift with warning periods sufficient for safe harboring of vessels.

The development of modern forecasting techniques is still not advanced enough to yield forewarning periods required by various agencies. A careful study of their requirements, however, allows preparation of programs geared for maximum benefits to the natural economy.

Despite the great diversity of forecasts, the following should be possible:

1- to prepare forecasts of phenomena which are of interest to the various agencies,

2- to issue forecasts at proper dates required by the agencies concerned,

3- to give sufficiently long forewarning periods as accurately as possible corresponding to existing methods,

4- to prepare forecasts concisely and accurately,

5- to base forecasts on appropriate data.

2.9. The Use of Hydrological Forecasts in the Design of Hydraulic Structures

Successful construction of large hydraulic structures depends a great deal on hydrological forecasts. Until recently it was often considered that hydrological forecasts and hydrological calculations have restricted applications. It was assumed that these calculations were the basis for the design of hydraulic structures, while hydrological forecasts were assumed to be the basis of the planning protective measures during construction and operation of these structures. This led, on one hand, the separation of investigation carried out in two adjacent fields of hydrology, on the other hand to less accurate designs of hydraulic structures. The separation of investigations also greatly affected the development of other branches of hydrology. In fact, formal statistical methods of determination of the characteristic values of hydrological elements sometimes began to dominate hydrological calculations. Analysis of probable ranges of values of hydrological phenomena, based on cause and effect relations, were sometimes replaced by determinations made on the basis of a series of short observations of statistical characteristics.

The methods of hydrological forecasting were often developed without sufficient consideration of the engineering economics involved in the design and operation of hydraulic structures. this made it difficult to estimate the practical effectiveness of various forecasting methods, and to evaluate the length of warning periods and assurances of forecasts.

The most efficient use of hydrological data in design, construction and operation of hydro structures can only be achieved by systemization of the investigation results obtained both by hydrological forecasts and by hydrological calculations.

This principle has been verified beyond any doubt by the experience in the design and construction of large hydroelectric power plants.

As a result it was found possible to :

a- determine the possible maximum discharges for various combinations of amounts of water equivalents of snow packs and snow-melt duration (taking into account the errors in this relationship).
b- determine the proper combination of conditions which would lead to maximum discharge specified by the designs.
c- to plot probability curves for maximum discharge on the basis of confidence limit data of the various factors which affect the maximum runoff. This was done by means of the "composite method".

The insufficiently accurate prediction of runoff and discharges values requires as a precautionary measure the draw down of the storage reservoir prior to the arrival of the flood wave.

Sufficiently sustained hydrological forecasts should also be utilized as runoff control measures. In this respect, forecasts make it possible to:

a- draw down reservoirs in due time prior to the beginning of floods, thus reducing waste wages.

b- reduce and occasionally stop power plant operation during low discharges.

The design of hydraulic structures may often overlook operational details and hence the forecasts must be corrected and revised during the operation of hydraulic structures.

The most common types of forecasting at present are the following :

1- forecasting daily stages and rivers discharges.

2- forecasting elements of spring floods and rain floods.

3- forecasting monthly and seasonal river runoff.

4- forecasting minimum discharged and stages.

5- forecasting time and distribution of the spring runoff volume of mountain rivers.

6- forecasting dates of initial freezing and thawing.

7- forecasting ice-cover thickness.

8- forecasting break-up, thawing of rivers and storage reservoirs, and stages during ice blockages.

3. RIVER FLOW FORECASTING

3.1. Measurement Of Flow

Water resources of an area are dependent upon several factors, some are variable and others are relatively permanent. The variable factors are rainfall, temperature, humidity, soil moisture, and the state and nature of vegetation in the basin. The permanent factors are the geology and topography of the area in concern. Except to a small degree the permanent factors are outside the control of the man. In order to manage water resources, the means of exercising control over the runoff by storage or otherwise must be provided. Thus, the measurement of flow is necessary both for assessing water potential and managing water resources. In what follows it is proposed to look briefly at the principal methods of flow measurement and the problems associated with them.

3.1.1. Velocity-Area Method

The greatest number of flow-measurement stations in the world are based upon the velocity-area method. The reason for this is not that the method gives the best accuracy, but that it does not necessitate the building of a structure which, in the case of the large rivers, is prohibitive in cost. In theory the velocity-area is simple. It consists of measuring the velocity of water flowing in units of length per second, and multiplying it by the cross-sectional area of the body of water, in square measure, the product being in cubic units per second. In practice, the matter is not as simple as it sounds because at each step in the process there are some uncertainties to overcome and some degree of error is unavoidable.

The velocity of water in the cross-section of the river is not the same at all points. Even if a straight and regular stretch of the river is chosen with a smooth bed and sides in order to avoid turbulence, the velocity in a cross section varies considerably both with the depth and with the distance from the fluid boundaries. Therefore, it is impossible to measure the velocity of water in a cross-section. The best we can do is to sample the velocity at a number of points and to compute the average velocity for the cross-section. To do this, the cross-section is divided into a number of imaginary segments, and the velocity is measured at a number of points along the vertical between each segment. The choice of the number of points on each vertical has a bearing upon the accuracy of the determination of the velocity. But this is not all, for when the measuring device is exposed at any point, it will be found that the velocity fluctuates in time, and therefore the length of exposure of the instrument at each point also has a bearing upon the accuracy of the determination. If a large number of points were taken in each vertical, and a long exposure were given to the instrument at each point it would be impossible to get across the river before the rate of flow changed.

The device most generally used throughout the world for measurement of velocity is the current meter. Floats may give a rough approximation, but they are clearly not sufficiently accurate. Current meters in use are broadly of two types, the cup type having a vertical spindle, and the propeller or impeller type having a horizontal spindle.

3.1.2. Measurement Structures

Measurement structures possess three advantages. Firstly, they give immediate measurement of discharge, whereas a velocity-area station cannot produce records until nature has provided the various rates of discharge and observations have been made of them. In the case of extreme values, it may be some time before the stage-discharge relationship can be established. In the second case, structures can give accurate measurements of low discharges if the design follows a standard on which laboratory tests have been carried out. Low discharges cannot be measured by Current Meter if velocities are low. Thirdly, structures should not be subject to changes in geometry and therefore the calibration should stand provided that they are well maintained, and the bed conditions upstream and downstream are not allowed to alter significantly.

The disadvantages of structures is that they are costly, particularly in a large river. There are other disadvantages of structures which sometimes cause difficulties in subsidence; such as the afflux in separable from any obstruction in the bed of a river, and the obstruction which they offer to the movement of migratory fish or to navigation. For smaller rivers, the cost of a structure may be less than the cost of repeated calibration required by the velocity-area method. The most common used structures are; flumes, weirs and notches.

Notches, generally flat plate weirs cut to one of several standard shapes, are useful for the measurement of very small discharges. Flumes are useful for the measurement of relatively larger discharges, and weirs are useful in rivers of moderate size.

3.1.3. Dilution Methods

The dilution methods depend upon the principle of introducing a known quantity of substance into the river, and of measuring the concentration of that substance after it has become dissipated uniformly in the water. An analysis of the water then gives the degree of dilution, and hence a measure of the quantity of the diluent, in this case the river.

In order to obtain good results from this method, it is essential for there to be good mixing of the injected substance with the river water. For this reason, the method may be useful in rocky streams where other methods of measurement have not been found possible, because the nature of rocky mountainous streams ensures good mixing. The application of the method to large rivers has the disadvantage that it is not easy to secure good mixing, and if the injected substance remains in the river for too long a period before samples are taken for the analysis, changes may take place due to various causes(i.e., the diluent material decreases by the time and some other material due to erosion may mixing within the water) which can upset the results. The injection of the tracer substance may either be over a period of time, usually measured in minutes, or in one sudden injection. The withdrawal of water at the sampling base involves taking samples at regular intervals of time, usually in minutes, and carefully arranging these in sequence. The period of sampling must cover the whole of the range from the natural river water to maximum concentration of injected substance back to natural river water. When the results have been analyzed and plotted, the passage of the "cloud" of the substance can be seen, [5].

3.1.4. Flow-Measurement Stations

A flow measurement station may consist of a combination of the above methods. For instance, a structure will give a high degree of accuracy at low discharges. For high to flood discharges velocity-area methods may be employed, in which case the same structure may be used as a control up to the point of drowning, and the natural characteristics of the river above that stage as a control for higher discharges. It is essential if a station is based upon this method, that the geometry of the river downstream of the point of the measurement should remain substantially the same. If changes take place recalibration of the upper portion of the stage-discharge curve must be carried out.

3.1.5. Flow Meters

In what has been written above, the main concern was about the measurement of discharge at a single point of time. For water-resources purposes, the requirement is not only a knowledge of discharge at a given moment, but a continuous and accurate record of discharge and time. The principle commonly employed to secure this, is that of relating stage (level) to discharge. This means that flow-measurement stations should be sited where the whole flow of the river is contained in a single channel at all stages.

A few flow-measurement stations were equipped with so-called "flow meters" which in effect converted stage to discharge by some mechanism, usually a cam or spiral, specially cut to the calculated stage discharge relationship for the individual station. The advantage of such an instrument was that it saved the labor of computing the discharge. the stage should be read from the chart at intervals corresponding to one hour. Each stage reading must be converted to discharge, and the daily mean discharge calculated.

The first generation of fully automatic instruments is represented by the punched tape recorder. This type of recorder, which is operated by a small dry battery, punches the stage (level) of the water at present intervals of time.

3.1.6 Chemical materials

The flow is evaluated by some chemical materials. To do that, the chemical material, $Na0_2$, is mixing with the surface of the river. Samples are taken from the river, and concentration of the water is calculated by correlation methods. This method, specially, is used in small and turbulent rivers, [4].

In Ceyhan river basin, the flow is measured by the flow-measurement stations. To do that, there are nearly 12 stations on the river. In recent years, the flow have been measured by the flow-meters. A detail of this instrument is in the appendix B, [3].

3.2 Processing of Hydrological Data

3.2.1. Forms of Original Data

Data may be obtained in the following form:

1. A written note of the visual reading of a meter or gauge, e.g. the card containing daily readings rainfall.
2. An autograph chart.
3. A paper tape punched in a binary or decimal-binary form with readings at fixed intervals.
4. A magnetic tape of commercial variety which is marked by electrical means, which give either a simple on-off record needing a pulse count, or a record of varying intensity needing magnitude measurement.
5. By telephone, land line, or radio feeding to a device which produces a punched paper tape, a set of punched cards, or via teletalk or even a note on a scrap of paper.

Data in categories (3) and (4) must be converted to a form usable by man or computer

Ceyhan River flow data is prepared by report papers by technicians everyday. The results of these data are published in water year books in Turkiye every year.

3.2.2. Preparation of Data for Computer

The data will be the readings of a staff gauge, and probably around 9 am each day, and noted for further action. This method of data collection will be adequate for many parameters, for many years. A second form of data is the autograph chart which was the ultimate sophistication of some years ago, and is probably the most valuable record in most cases today.

There are two principal form methods of analyzing charts to get data into a usable form. The first is the hand method, where readings are abstracted by simple measurement of ordinates at intervals dictated forecasting methods, or by experience relating to the particular form of the graph. The values are written down, translated if necessary, e.g. from river stage to river flow, by reference to a table or by computation, and the mean value of the parameter over the required period determined. The mean may be a simple arithmetic mean, or perhaps a value obtained by approximate-area methods.

The second method, of quite recent origin, is the chart tracer or pencil follower. In this method, the chart is placed on a special table and the chart trace is re-traced by hand using a magnetic follower or pencil device. The machine reads the coordinates of the pencil relative to the axis of the table at predetermined intervals.

The data are now evaluated through computers. Computer is a useful instrument in performing calculations precisely, and in many cases it would be a waste of time if the data is not carefully checked. It should be ensure that :

1- the data are clean, or, in other words, do not contain characters which the computer will not recognize.

2- the values of the data are correct or reasonably as far as can be ascertained.

3- the data are in the form which the programmer expects, e.g. have correct indications for changes of tables, alternative routines, etc.

3.3. Analysis of Hydrological Data

Generally, the data received will be of considerable amount which requires a routine tidying-up for subsequent complex analysis. The analysis of river flow is the mean, maximum and minimum values of flow for each day are printed out together with a monthly summary. Then, taking these data to evaluate some parameters of river basin, e.g. forecasting discharge amount etc. Generally, an analysis of any kind of hydrological data includes following :

1- frequency distribution of daily mean values (or other intervals) of any hydrological parameter.
2- Gumbel estimates of flood frequencies
3- sliding average values of flow for various periods, one month, two months, etc.
4- number of consecutive days on which a value is greater, or less, than a given value.
5- unit-Hydrography coordinates, or plotting of the hydrography by means of a graph plotter operated by the computer.
6- computing storage yield of a catchment using the data collected or possibly synthetic data.
7- river-regulation studies, and correlation of simultaneous data on soil moisture, river stage and rainfall for regulation and flood-warning purposes.
8- ground-water models to simulate effects of recharge into, and abstractions from, wells and applying the results to existing data.
9- surface-water network analysis of pipe and river flow to determine optimum arrangement for distribution of water resources. etc., [11].

3.4. Principles Of River Flow Forecasting

River flow forecasts for a particular location are required in order to issue warnings and to permit the evacuation of populations threatened by rising water levels. Also, they are required, although less spectacularly, in providing for the efficient operation of storage reservoirs for the hydro-electric or other purposes. Such stream flow forecasts are invariably based on observation or forecasts of rainfall on the upper catchment, or of river flows at upstream points on the main river or tributaries, often supplemented by rainfall measurements on the intervenity catchment. Discharge forecasts are obtained in real time, by using a model to transform the input functions into a corresponding discharge function of time. These forecasts may subsequently be modified, or up-dated in accordance with the errors observed in previous forecasts up to the time of making the new forecasts.

At the design stage of many hydrological works, simulations of possible discharge series may be required. These are not "real" in the sense of being actual or even expected, but they are examples of what could occur and are treated by the designers. as being typical of the conditions under which their structures must operate. Such simulations are usually obtained from time series analyses of the observed historical records of discharge, but alternatively they may be obtained by similar storage of the input functions, which may then be simulated and subsequently transformed into the corresponding output function discharges.

The "system analyses" or "black-box approach" depends on the prior assumption of a general and flexible relationship, (e.g., linear and time invariant), the expression of which may be obtained by the application of systems analysis methods to the records. Examples in the hydrological context include the unit hydrography method, the simple linear model, linear difference equation models, the constrained linear system models and the linear perturbation model, [7,8,9,10,11].

3.5. Short Term Forecasts

3.5.1. Coaxial Graphic Method

This method is also known as "runoff-precipitation model" In order to estimate the direct runoff a correlation a significant factors affecting runoff such as antecedent precipitation index, API, duration of rainfall, amount of rainfall, and time of year. Complexity of such a correlation makes use of a graphical approach to the problem, this method is called coaxial graphical technique. In this method, the discharge is evaluated from previous day precipitation. Coaxial graphic method should be applied to basins differently, for each basin, a graphic must be drawn. An application of this method to Ceyhan River Basin is shown on figure 3.1.

Antecedent precipitation index, API, can be calculated from :

$$API = kP_{-1} + K^2P_{-2} + ...+k^iP_{-i} \qquad (3.1)$$

where, $k = 0.85 - 0.95$

$i = 30$ days

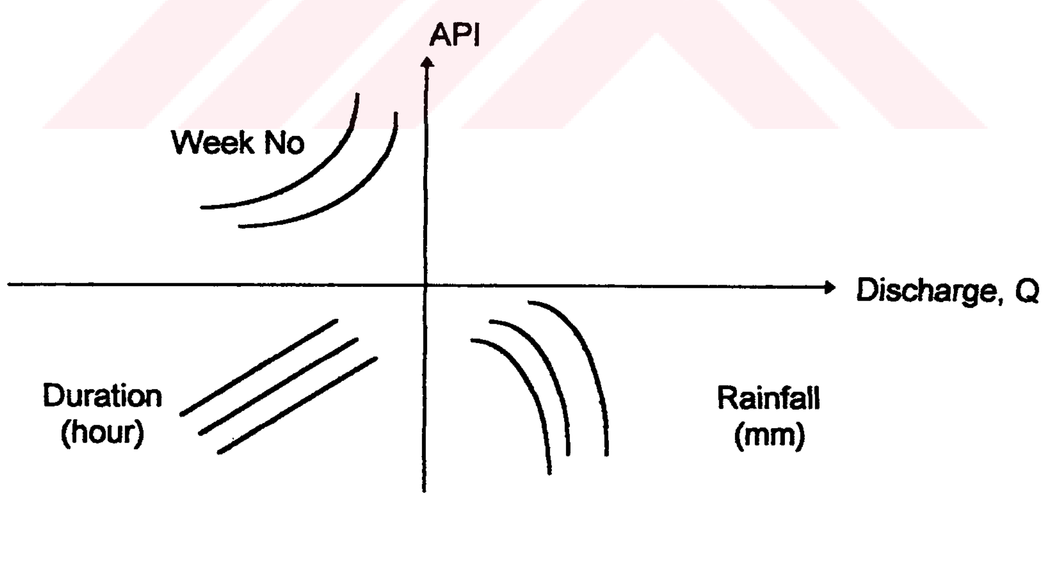

Figure 3.1 A typical application of coaxial graphical method

3.5.2. Regional Relationship Method

In the absence of runoff observation data of a basin, the use of regional relationships method is made for hydrologic planning.

The necessary data for applying this method are as follows;

- Average Annual Precipitation (mm), P_m
- Average Flow (mm), R_m
- Average Temperature (°C), T_m

and the required basin Characteristics :

-Discharge area (KM^2), A
-Land Slope, S
-Main channel length (km), L
-Discharge density (1/km), D_d
-Plant Cover coefficient, F_v
-The Shape of the basin, R_s
-Relief ratio (m/Km), R_r
-Total length of the basin (Km), P_e
-Average Basin elevation (m), B_e

There are two common method for the examination of this data, the turc method, and coutagne method.

Turc Method:

This model contains Annually average discharge, Annual average Precipitation and Annual average temperature.

$$D = P/(\sqrt{(0.9+P/l)})^2 \quad (3.2)$$

$$h = P-D \quad (3.3)$$

where, D: Basin losses, P: Annual average Precipitation (mm), and h: Flow height.

Coutagne Method

$$U = P - (nP_2) \quad (3.4)$$

$$n = 0.001/(0.8 + (0.14t)$$

$$h = P - U \quad (3.5)$$

where, U: Basin losses, n: Coutagne coefficient depends on temperature, [4].

3.6. Long Term Forecasting

In hydrological and water-management calculations, the relationship between two series of values (e.g., between discharge and water levels in a river cross-section, between runoff and years) is widely used. This kind of relationships is usually established graphically from the pertinent points, which do not always lie on a smooth curve or a straight line but are more or less "scattered" about them. This means that there is no exact relationship between the quantities concerned. Graphic techniques of plotting these relationships with the least deviation from the cluster of points usually yield acceptable solutions, [13].

3.6.1. Multiple linear Correlation

Possibly the most common model used in hydrology is based on the assumption of a linear relationship between two variables. Generally the objective of such a model is to provide a mean of predicting or estimating one variable, the dependent variable, from the knowledge of a second variable, the independent variable. This case will be discussed in later chapters.

Before proceeding with a correlation analysis it is often useful to make a graphical examination of data and to sketch in the apparent relation. A plot of the measurements of one variable against the corresponding measurements of the second variable will result in a scatter diagram. The shape of the pattern indicates the nature of the relation. If this shape is a straight line, the relation is said to be linear; if curved, the relation is said to be curvilinear, [2].

In a simple correlation, the regression equation is :

$$Y = A + B.X \tag{3.6}$$

one intuitive criteria would be to estimate A and B by a and b so as to minimize the deviation e_i between the observed values of Y, Y_i and the predicted values of Y, Y_i'. In this way values for a and b would be accepted that minimize sum

$$\Sigma(Y_i - Y_i') = \Sigma\, e_i = \Sigma\, (Yi\text{-}A\text{-}BXi) = \Sigma\, (Y_i \text{-a-bX}) \tag{3.7}$$

3.6.2. Logarithmic Correlation Method

Sometimes it is not possible to find the best fitting and correlation factor when using linear correlation method, therefore logarithmic correlation give more accurate results.

The coordinates X = log(x), and Y= log(y) are convenient for plotting curve of the form $y^r = ax^n$. By taking the logarithms of both sides, the following equation results :

$$r.\log(y)=n.\log(x)+\log(a) \tag{3.8}$$

The graph on paper using the coordinate axes X, Y is the straight line rY = nX + log(a). Casting this equation into usual form Y = mX+b, it is observed that the slope of this straight line is n/r and the intercept on the vertical axis is log(a)/r.

It is more useful to consider a curve of the form $y = Ax^N$, Here the resulting straight line Y = N.x+log(A) permits a direct measurement of A, N.

Take two points on the straight line (which are not necessarily data points), (X1,X2),(Y1,Y2). The resulting slope is :

$$N = \frac{(Y1-Y2)}{(X1-X2)} = \frac{(\log Y1-\log Y2)}{(\log X1-\log X2)} \tag{3.9}$$

and the intercept on the vertical axis is :

Y1= log(A)=log(Y1)
Thus, A = Y1

Here, it does not matter to what base the logarithms are taken. There are only two bases that are important for our purposes: logarithms to the base 10 denoted by "logx"; Napierian or natural logarithms to the base e = 2.71828183.... denoted by "lnx", [4].

3.6.3. Periodical Regression And Harmonically Analysis Methods:

Generally, multiple linear correlation methods have been used for long term forecasts. Sometimes, due to lack of data, it is not possible to find the correlation coefficients. In this situation, periodical regression and harmonically analysis method is used. For seasonal forecasting, this method is more useful than the others. It is possible to find the discharge of a particular season by using data of another season.

The regression function of this model is as follows:

$$Y_t = a_0 + \sum a_i \, Cos.(2\Pi it/k) + b_i Sin((2\Pi it/k) \qquad (3.10)$$

where a_0 is a constant, and a_i is a variable.

This model can be applied for any basin. The number of samples are changeable. Another use of this model is that; it is possible to see observed values and calculated values on the same graph, and so it is easy to see the forecast error difference, [4].

4. DESCRIPTION OF THE BASIN

The study area is located within a continental climatic zone. Maximum temperature in the summer is over 30 °C and minimum temperature in the winter is below freezing. Annual mean precipitation is 400 mm, and is concentrated within the period from November to May. Almost no precipitation occurs within July to September.

As precipitation is small and concentrated in winter, most of the farmers in the area are engaged in dry and low productive agriculture. Chronic water shortages occur particularly in summer. Hence, the expansion of irrigation facilities and securing of a stable irrigation water supply is a basic condition to the development of highly productive farming in the area.

Although some limited irrigation by groundwater and canals constructed by farmers is practiced in the area. It is concluded that the construction of a large scale and economically viable irrigation system is essential for any significant improvement of farm productivity in this area.

4.1. Location

The study area is located in the south east of Turkiye. A general appearance of the basin is shown on Fig. 4.1, [3].

4.2. Topography

In terms of geology, the study area is located in the southern part to the Anatolia plate on which most of the Republic of Turkiye is included. Mountain and hydrologic systems are controlled by the distribution of formations of various geological age. Broadly speaking, an overall hydrologic system and mountain system arcing to the north is recognized. The smaller hydrologic system of each sedimentation basin converges into one flow upon existing the basin. The flow then enters the next basin, where it is further fed by additional tributary flows, and so on.

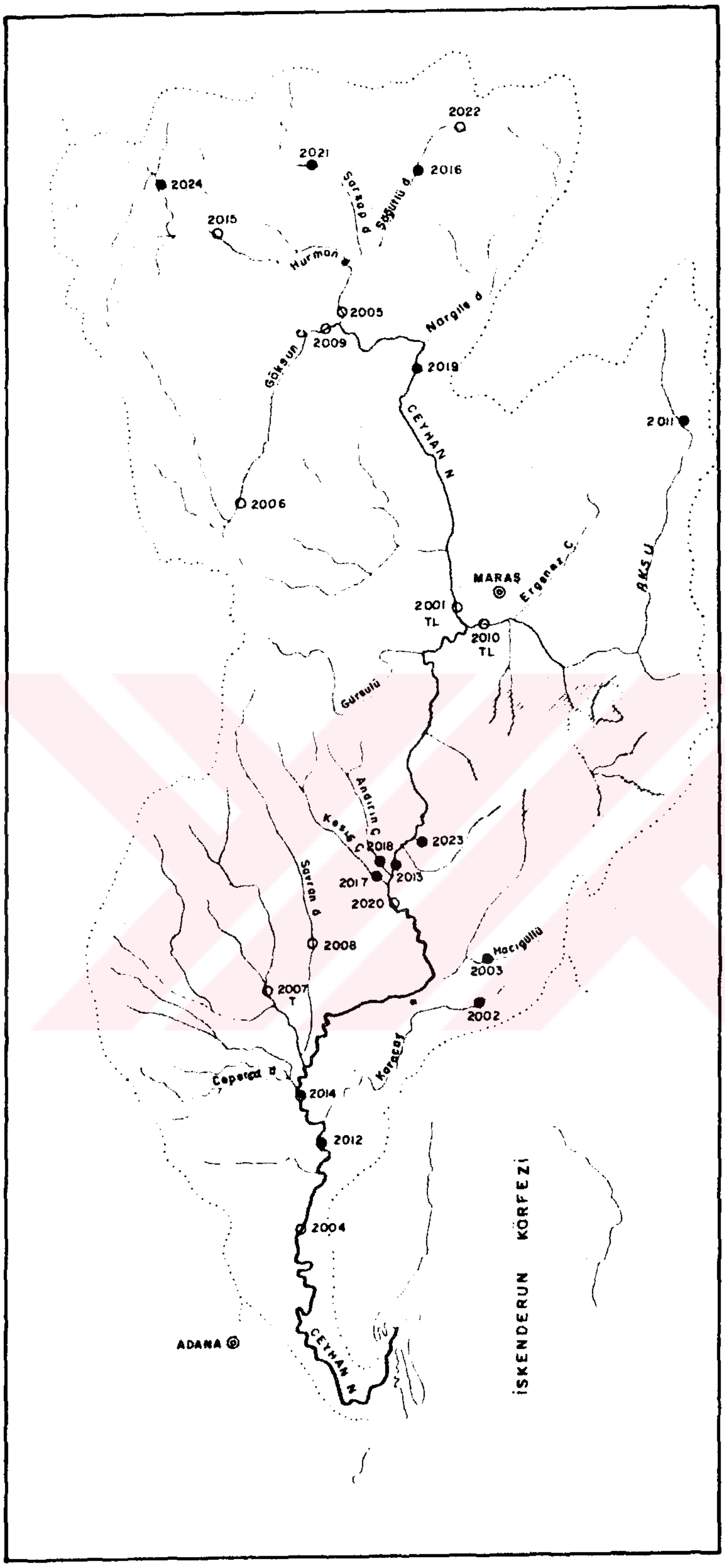

Figure 4.1 A general appearance of the Ceyhan River Basin

4.3. Meteorology

Weather observation in the study area started in 1938 in Elbistan, and in Göksun and Afşin in 1953. Later, 8 precipitation stations were added. Currently, a total of 11 stations exist in the area.

The Study area elevation ranges between 1,150 and 1,300m. The plain is surrounded by mountains which are more than 2,000 m in elevation. Extreme daily and annual changes in climatic occur.

Area precipitation is 400 mm per year. Rainy and dry seasons are clearly defined. Precipitation in the dry season is extremely small, at only around 30 mm for the 4 month period from June to September.

Annual mean temperature is 10 °C. Maximum temperature in the summer surpasses 30 °C, and minimum temperature in winter is below freezing. Consequently, precipitation in the winter is largely snow.

Annual mean humidity is 60%. Climate is particularly dry in the summer where humidity drops below 50%.

Annual mean evaporation is 1,000 mm

Prevailing winds are from the northwest. Higher wind velocities occur during the summer.

As can be concluded from the above, the climate of the area is semi-arid, characterized by dry summers, and sub-freezing winters with snow accumulation.

Table 4.1 General Climate of Basin

Annual Precip.		390mm	Wind	Direction: North west
Average Temp	Daily Max.	17.8°C		Velocity: 1.6 m/s
	Daily Mean	10.3°C	Sunshine hours:	7.0 hours/day
	Daily min.	3.0°C	Evaporation:	1.273 mm/year
Humidity:				61.7%

4.4. Hydrology

4.4.1. Precipitation

The rainfall pattern for the upper Ceyhan basin, including the study area, is indicated in Fig. 4.1. Rainfall ranges from slight to none during July to September. Duration of this dry period is generally 1-2 months, and at most 4 months. Rainfall exhibits one peak from the end of the dry season to December, and 1-2 peaks from January to the start of the dry season.

Rainfall is greatest in the western part of the basin of the Ceyhan River, with annual mean at 640 mm and daily maximum rainfall at 85.4 mm. In eastern parts, the annual mean rainfall is 400 mm.

4.4.2. Discharge

Daily, monthly and annual discharges are available since 1940. Discharge values of 1961 to 1990 are taken for evaluations. Daily and annual discharge data of the basin are shown through table 4.2 in appendix A, [2].

4.4.3. Groundwater

DSİ has carried out continuous survey to determine groundwater reserves throughout Turkiye. In addition to this, land and water use cooperatives have carried out independent surveys. On the basis of survey results as of 1985, irrigation of 600,000 ha is judged to be irrigable using groundwater. At present, about 350,000 ha are irrigated throughout Turkiye by groundwater sources.

4.5. Geology

The basement rocks forming mountain in the study area can be divided into the following four major units :

- Paleozoic sedimentary rock series.
- Mesozoic sedimentary series.
-Mesozoic ophiolite series.
-Mesozoic granitoids.

The flatland is mainly composed of quaternary sediments which can be grouped into following three units :

- Lake sediments.
- Fan and terrace sediments.
- Alluvial sediments.

In 1975, the General Directorate of Village Service of The Ministry of Agriculture, Forestry & Rural Affairs conducted a nationwide survey of land use. Data for the study area was revised in 1985.

According to the survey, land use in the area is classified in to the following 10 categories :

- Mainly irrigated farm land with sufficient water.
- Mainly irrigated farm land without sufficient water.
- Pasture (mainly natural vegetation as opposed to cultivated pasturage).
- Non-irrigated farm land with rotational cropping including fallow.
- Non-irrigated farm land with rotational cropping not including fallow.
- Grape vineyard.
- Forestry product area (cultivation of large scale trees for lumber production).
- Scrub brush (natural vegetation utilizable for fuel food).
- Swamp and Exposed rock(no vegetation), [6].

4.6. Current Water Use

Base industries in the study area are crop cultivation and animal husbandry. A secondary industry is lignite mining in adjacent area to supply the thermal generating plant in the north of the area. Also, there is a sugar plant at the south of the area which processes sugar beet cultivated in the area. Production of other various goods on a minor cottage industry scale is also seen in the area.

Accordingly, the bulk of water use in the area is for agriculture. Diversion is by extremely simple intake facilities along the Ceyhan and its tributaries. Small scale use is also made of spring discharge and groundwater.

Domestic water is obtained primarily from springs. Most towns and villages are located near springs. Shallows in rivers and wet areas caused by spring discharge are used for laundry and livestock watering. Accordingly, it will be necessary in the future to maintain river discharge.

In addition, discharge in the area is also utilized for furnace cooling at the generating plant, and for washing sugar beets at the sugar plant.

With future population increase, improvement in living standards and introduction of other industries into the area, a change in the current water use pattern is possible, [6].

4.7. Population

According to the 1990 census, the total Turkish population is around 60 million. Annual mean population growth rate is 2.49% (1981-1990). Population density is 62 persons/ km^2. Birth rate is 3.1%.

Population is distributed 53% in urban areas, and 47% in rural areas. Population growth rate is 6.26% in urban areas, and 1.06% in rural areas. In Kahramanmaraş province: total population is 840 000; population density is 124 persons/km^2; population is distributed 40.7% in urban areas, and 59.3% in rural areas; and population growth rate is 3.93% in urban areas, and

1.47% in rural areas. Total population of the study area is shown on Table 4.3, and economical position of the population is shown on Table 4.4, [3].

Table 4.3 Population in Kahramanmaraş Districts

Towns and Districts	Total Population	Urban Area	Rural Area	Area km^2	Population Density person/km^2
K.maraş	360 481	228129	132352	2913	124
Afşin	99 321	28524	70797	1387	72
Andırın	44337	7506	36831	1178	38
Çağlıyancık	26914	10435	16479	685	39
Ekinözü	21633	8184	13449	642	34
Elbistan	112024	54741	57283	2554	44
Göksun	70616	22847	47769	1920	37
Nurhak	14990	7087	7903	832	18
Pazarcık	81644	25154	56490	1528	53
Türkoğlu	60922	7523	46384	688	89

4.8. Agriculture

4.8.1. Present Cropping Pattern

There are five major crops being grown in the study area. They are wheat, barley, sugar beet, dry bean and chick pea, accounting for over 80% of the total area. Although limited cultivation of fruit, mainly grape, is observed in some part, most of it is on the hilly sides and very little is included in the area.

Two pieces of information are available about the current cropping patterns in the study area: one has been obtained from the survey results conducted by DSİ, and the other by Agricultural Engineering office (AEO). The study of DSİ contains the results he survey conducted for the Project area. Present Cropping pattern of the area is shown on the Table 4.5.

Table 4.4 Economically Active Population

Type of Economy	Economically Active Population	Rate %
Agriculture and Forestry	257 577	76
Mining	2938	0.9
Manufacture	15 937	4.7
Electricity, Water	499	0.1
Construction	12 422	3.7
Commerce	13 511	3.9
Communication	5 862	1.8
Finance	2 077	0.6
Public Administration	27 217	8.0
Others	1 026	0.3
Total	338 726	100
Unemployed	17 668	

4.8.2. Cropping

Although there is approximately 400 mm of annual precipitation in the study area, about 30% of it comes in the form of snow during December, January and February. Therefore, only less than 300 mm of precipitation from March through November can be directly used for irrigating farm-land. However, it rains very little during June, July and August where the temperature is the highest. Under such conditions, it is not possible to supply water to crops to be grown in the land without adequate irrigation facilities. Under such environmental conditions, each farming unit in the study area decides on what crops to be grown based on such factors as the climatic conditions of the year, price of the crops and demand supply conditions. The farming in the area is basically one-crop-per-year rotation, but several variations exist. Table 4.6 shows the standard patterns.

Table 4.5 Present Cropping Pattern

Crop	Gravity Area ha	(%)	Pump Area ha	(%)	Whole Area ha	(%)
Wheat	1657	4.6	413	5.0	2.070	4.7
Barley	323	0.9	---	---	323	0.7
Sugar beet	2583	7.2	165	2.0	2748	6.2
Dry bean	2274	6.4	248	3.0	2522	5.7
Haricot	402	1.1	165	2.0	567	1.3
Potato	220	0.6	66	0.8	286	0.6
Vegetable	123	0.3	---	---	123	0.3
Sunflower	563	1.6	---	---	563	1.3
Fruit	418	1.2	41	0.5	459	1.0
Poplar	225	1.2	66	0.8	491	1.1
Fallow	2737	7.7	66	8.0	3399	7.7

Table 4.6 Typical Rotation Pattern (Present)

Area	First Year	Second Year	Third Year
Irrigated Area	Sugar beet (Mar.-Nov.)	Wheat (Oct.-July) Barley (Oct.-July) Dry bean (Apr.-Sept.)	Dry bean (Apr.-Sept.) Wheat (Oct.-July)
Dry Area	Wheat (Oct.-July)	Chick Pea (Apr.-Aug.) Barley (Oct.-July)	Wheat (Oct.-July)

As to farming of major crops in the area, information was gathered from agricultural Engineering Office and interview survey of farmers. Although the level of cropping technology in the study area is generally slightly lower than the nation as a whole, farm machinery is widely used. The results of survey centered on the farmers point out that some differences exist from one farmer to another in such matters as the amount of seeds to be sown, that of fertilizer to be used, the timing of the seeding and the period of harvesting. Vegetables and fruit, except grapes, are raised only in very limited areas and most of the production is for self-consumption.

4.9. Irrigation

Water is most frequently drawn from rivers, followed by the springs and underground sources. Most of the intake facilities at rivers, large and small, adopt the longitudinal separation works, i.e. water is obtained by piling up gravel on the riverbed or construction of coarse frameworks with wood in order to dam up the river water flow. The water available from natural springs is often utilized by constructing a small pool with stones and concrete materials. Ground water is pumped up with small diameter, deep well pumping facilities. The headrace canal from water source is partly walled with concrete, but it is basically of earth canal.

However, the above described irrigated area is subject to severe effects of climate due to unstable water supply and lack of diversion facilities. Furthermore, the large expense of non-irrigated area in the study area is restricted to either cultivation during the rainy season or cultivation of crops with low water consumption. Cultivation during dry season is extremely constrained.

Field irrigation is almost completely performed by the border and furrow methods. In the case of the extremely few large scale farms in the area, irrigation by pumps driven, transportable sprinkler is also performed. In all cases, the crops irrigated are sugar beet and dry bean.

4.10. Drainage

No particular attention has been given to the drainage facilities of the study area. Excessive water due to rainfalls in and around the area flows into the tributaries and rivers through ditches and streams. The tributaries are extremely meandering and have no artificial banking.

The lowland area along these streams is often inundated with flooding. During the rainy season, the function of the roads connecting the villages and farm roads is often obstructed due mainly to the inadequate drainage.

Poor drainage areas are estimated at approximately 11,000 ha in the study area. Such poor drainage areas can be divided into the following three areas:

1- lowland areas which inundate at the time of flood, because river flow obstructs due to the extreme meandering of the river.

2- artificial marsh areas that store excessive water in the rainy season to supplement irrigation water in the dry season.

3- area recommended to be drained by subsurface drains due to the soil conditions, [6].

5. FORECASTING METHODS

5.1 Analysis of Ceyhan River Data

5.1.1 Daily and Monthly River Flows

The graph of daily river flow and monthly river flow for 30 years is shown through figure 5.1 to 5.30 and 5.31 respectively. The trend line its equation give possible average flow for future months. The first step in the design of a hydraulic project is the collection of all possible sources of hydrologic data. Therefore, it is too important to have the accurate data. The second step is the determination of a model to analyze these data. The hydrologic data is collected and published by the DSİ in Turkiye.

Daily, monthly and annual Ceyhan river discharges, first of all, are plotted on figures before proceeding on a correlation analysis. A plot of the measurements of one variable, time, against the corresponding measurements of the second variable, discharge. The result is shown in a scatter diagram. The shape of the pattern indicates the nature of the relation. The water year is started from October and ended in September in Turkiye. Therefore, the values on the diagrams are from October to September. Generally the flow is peak in spring seasons and minimum in Summer.

The determination of a good model is highly hard because, the distribution of data on figures are rather scatter. During these study a good model was investigated from many alternatives and the results was taken as the implementation of the problem.

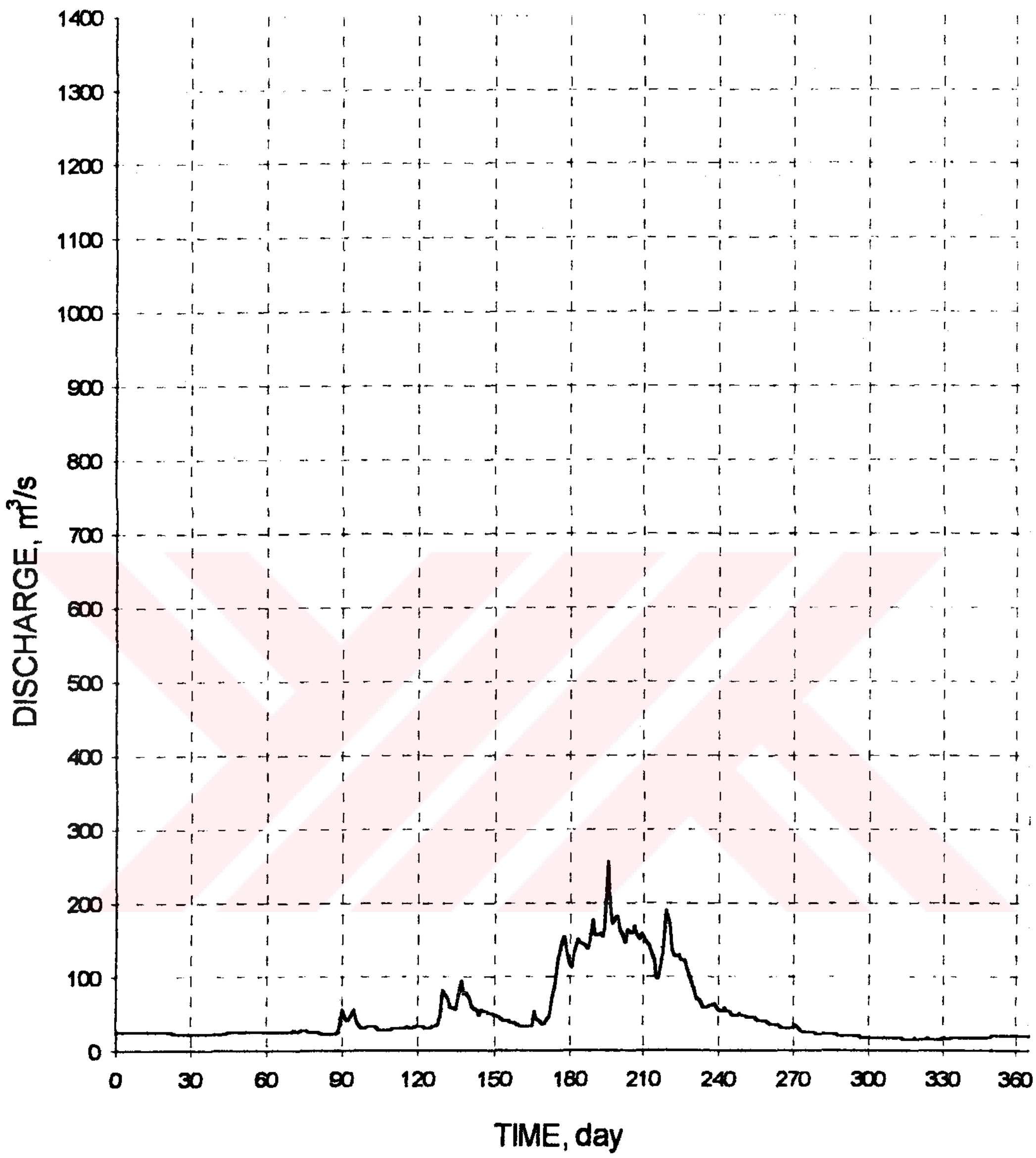

Figure 5.1 1961 Ceyhan River Flow

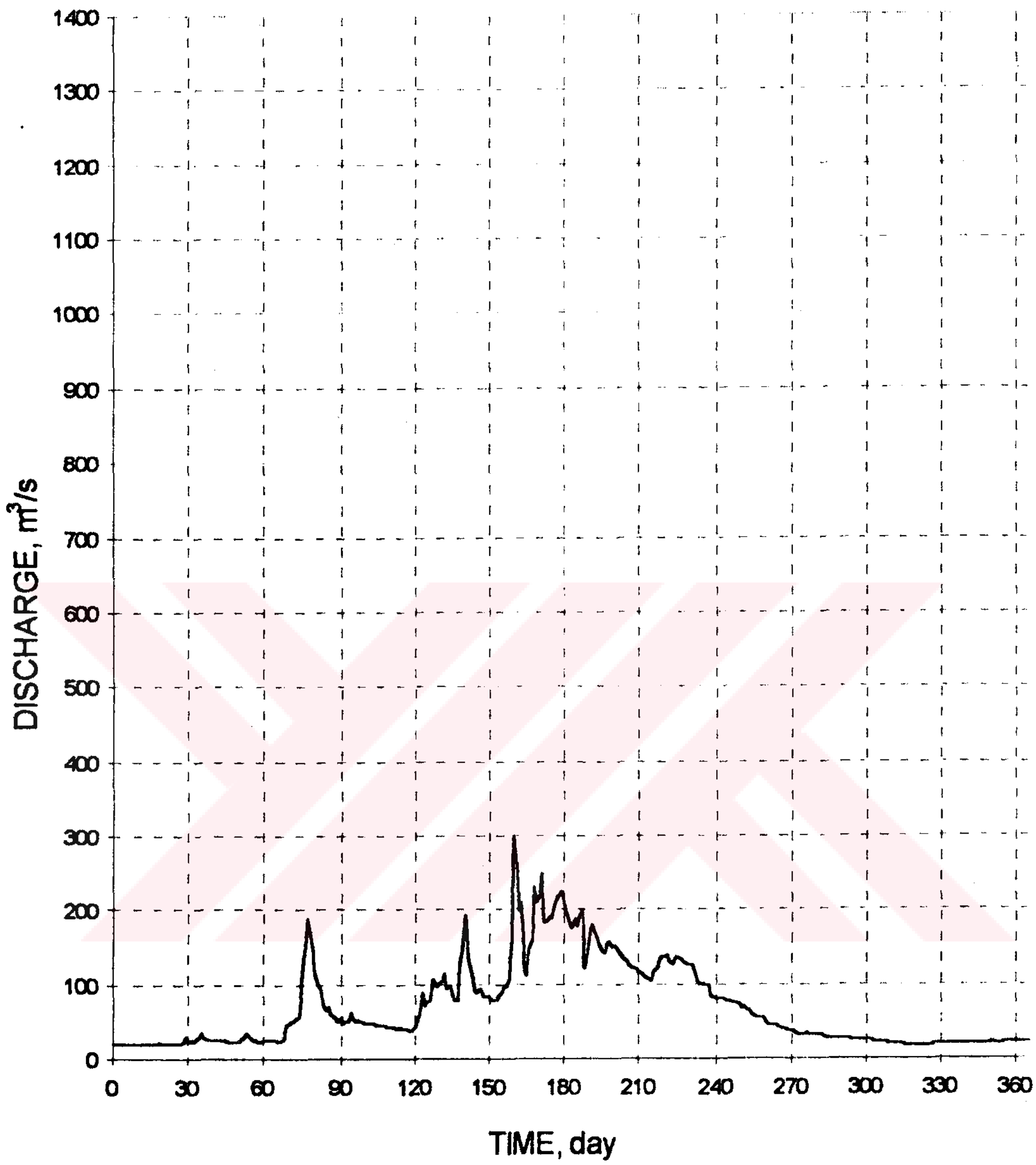

Figure 5.2 1962 Ceyhan River Flow

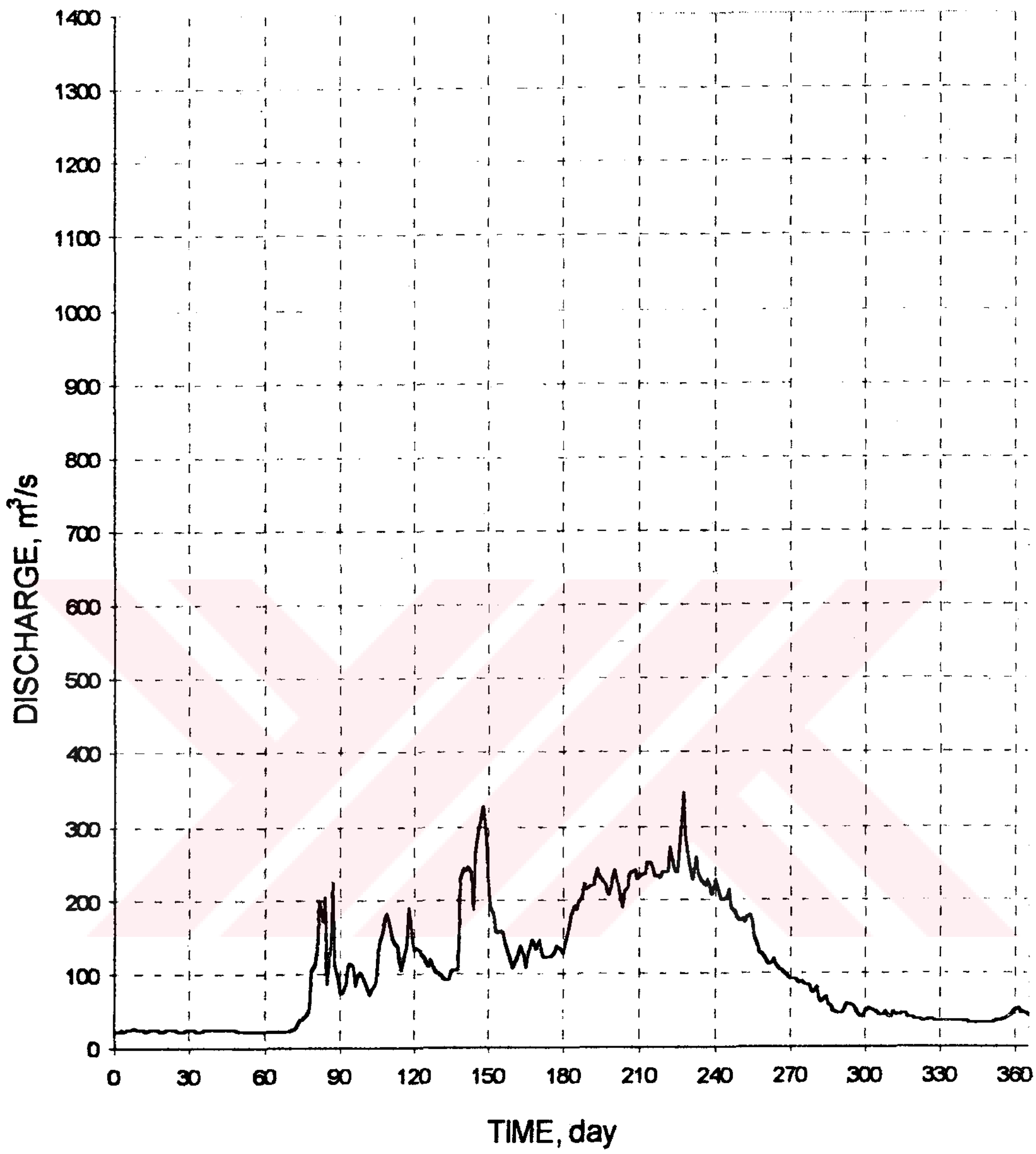

Figure 5.3 1963 Ceyhan River Flow

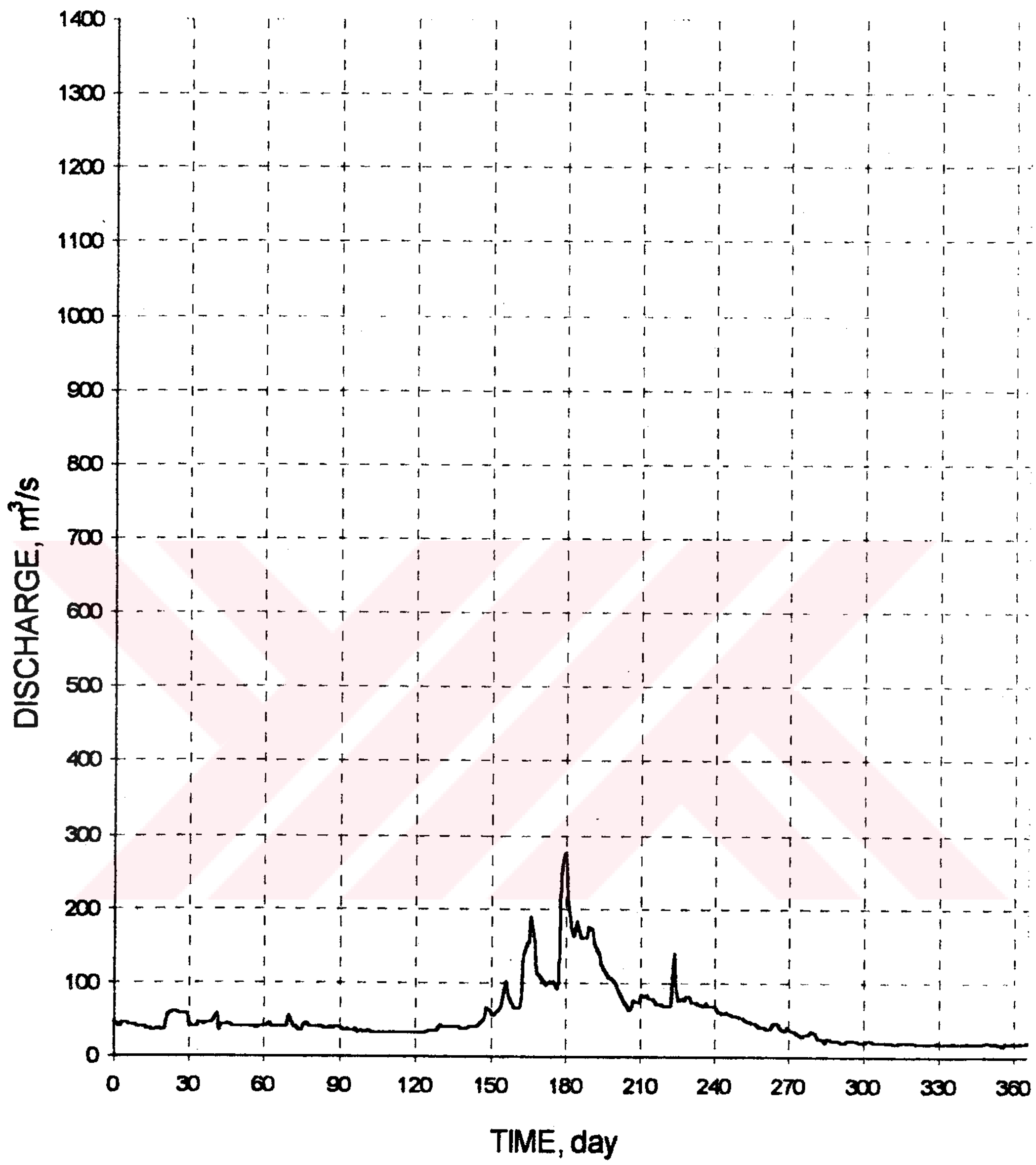

Figure 5.4 1964 Ceyhan River Flow

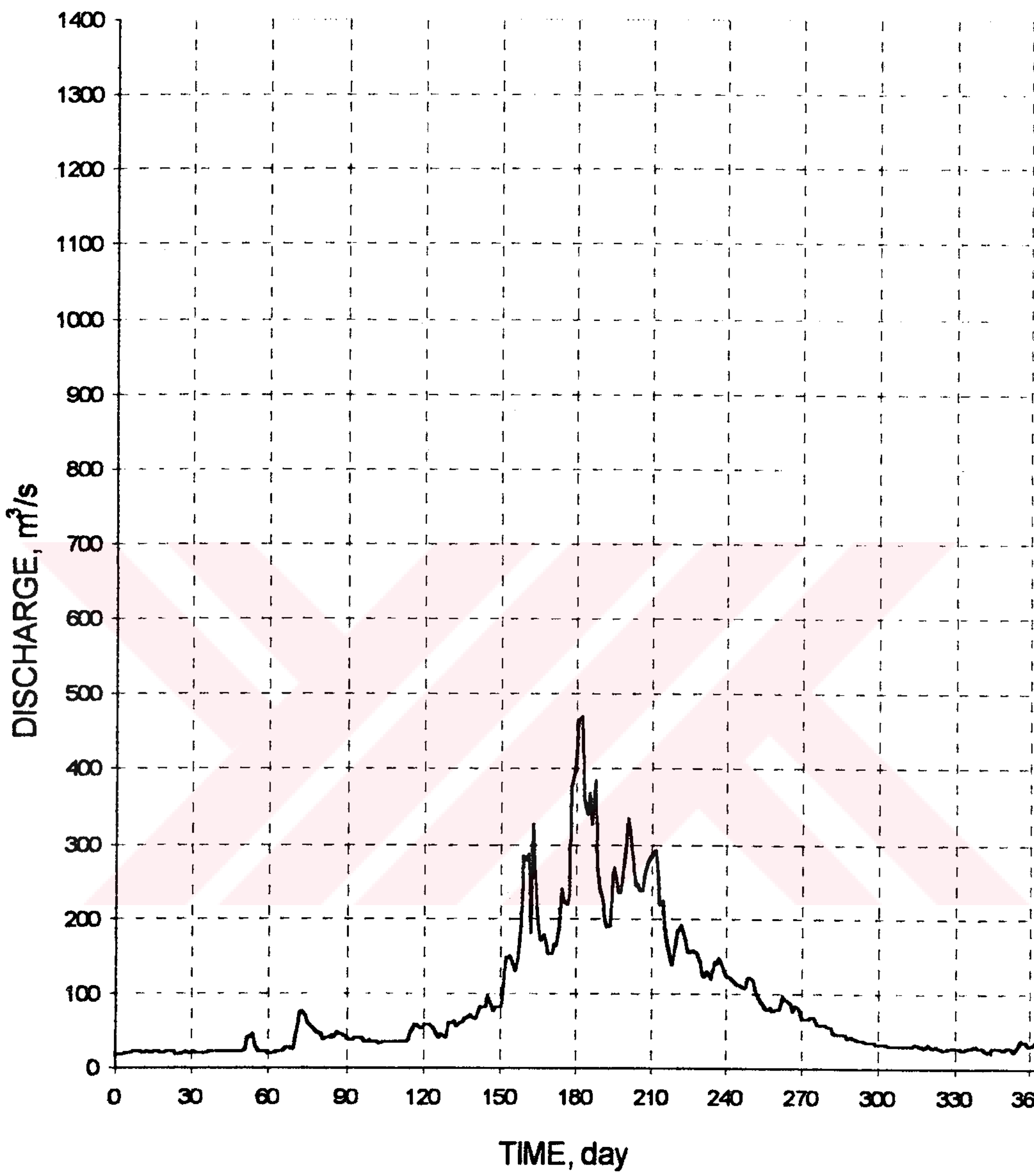

Figure 5.5 1965 Ceyhan River Flow

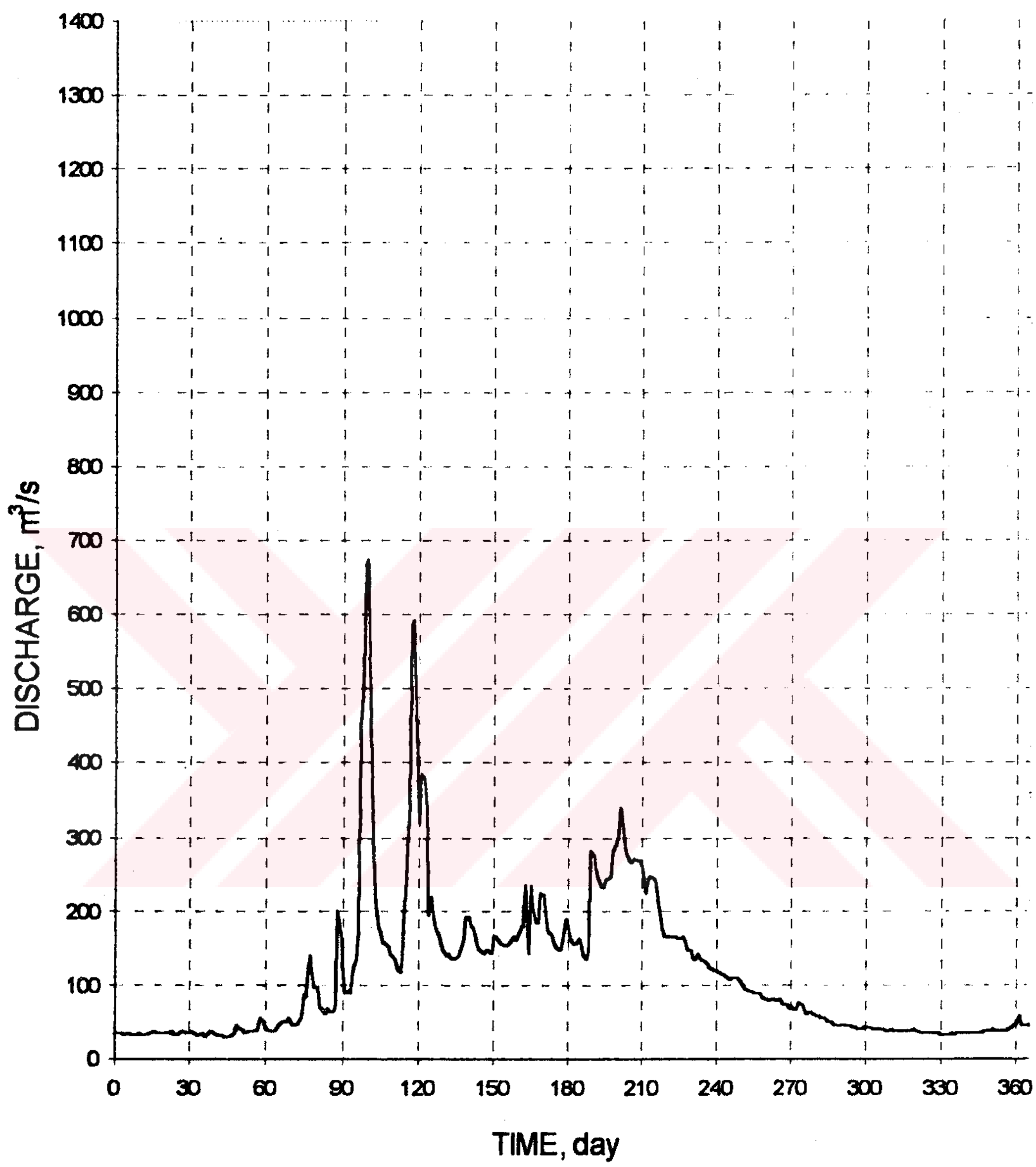

Figure 5.6 1966 Ceyhan River Flow

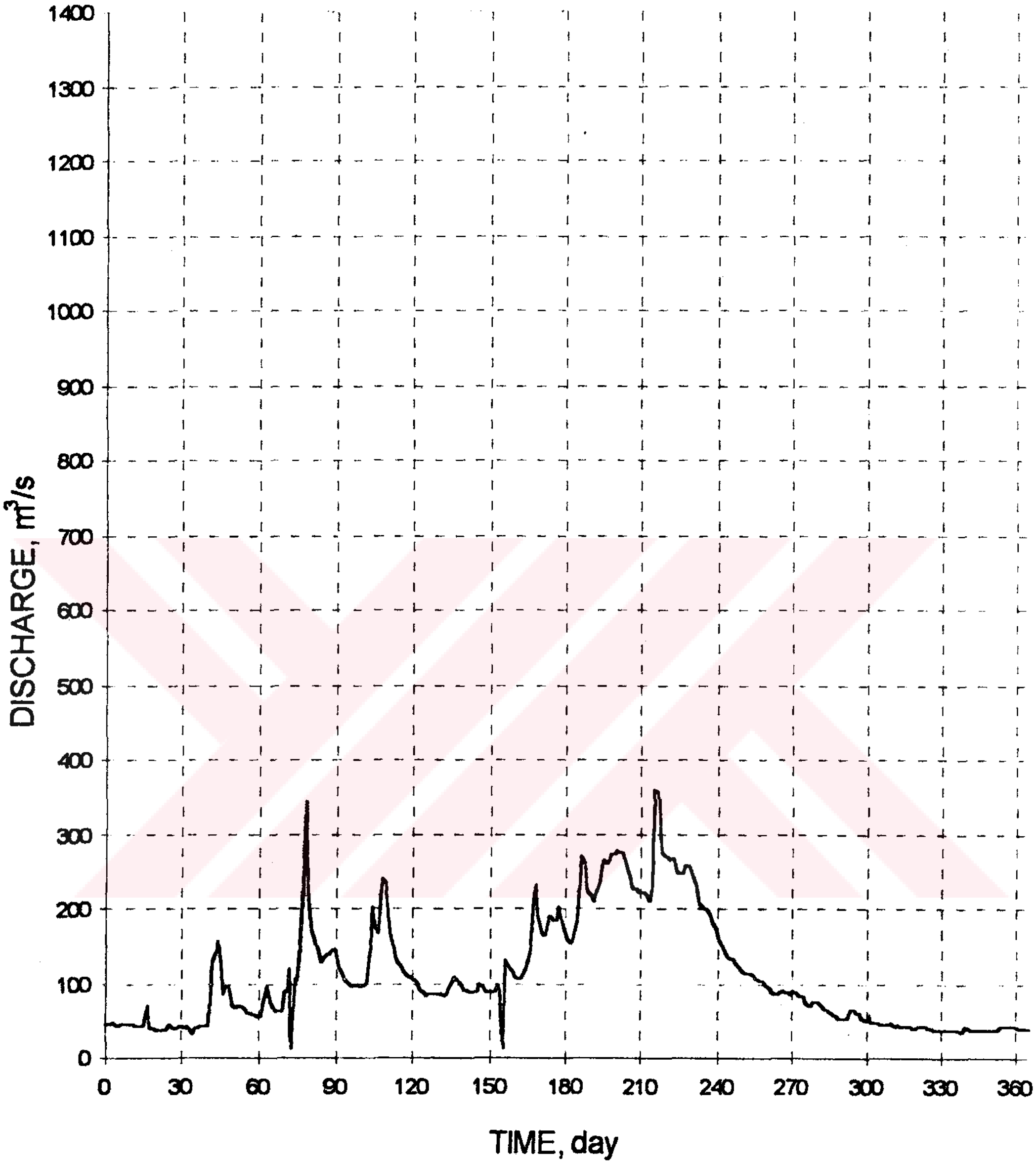

Figure 5.7 1967 Ceyhan River Flow

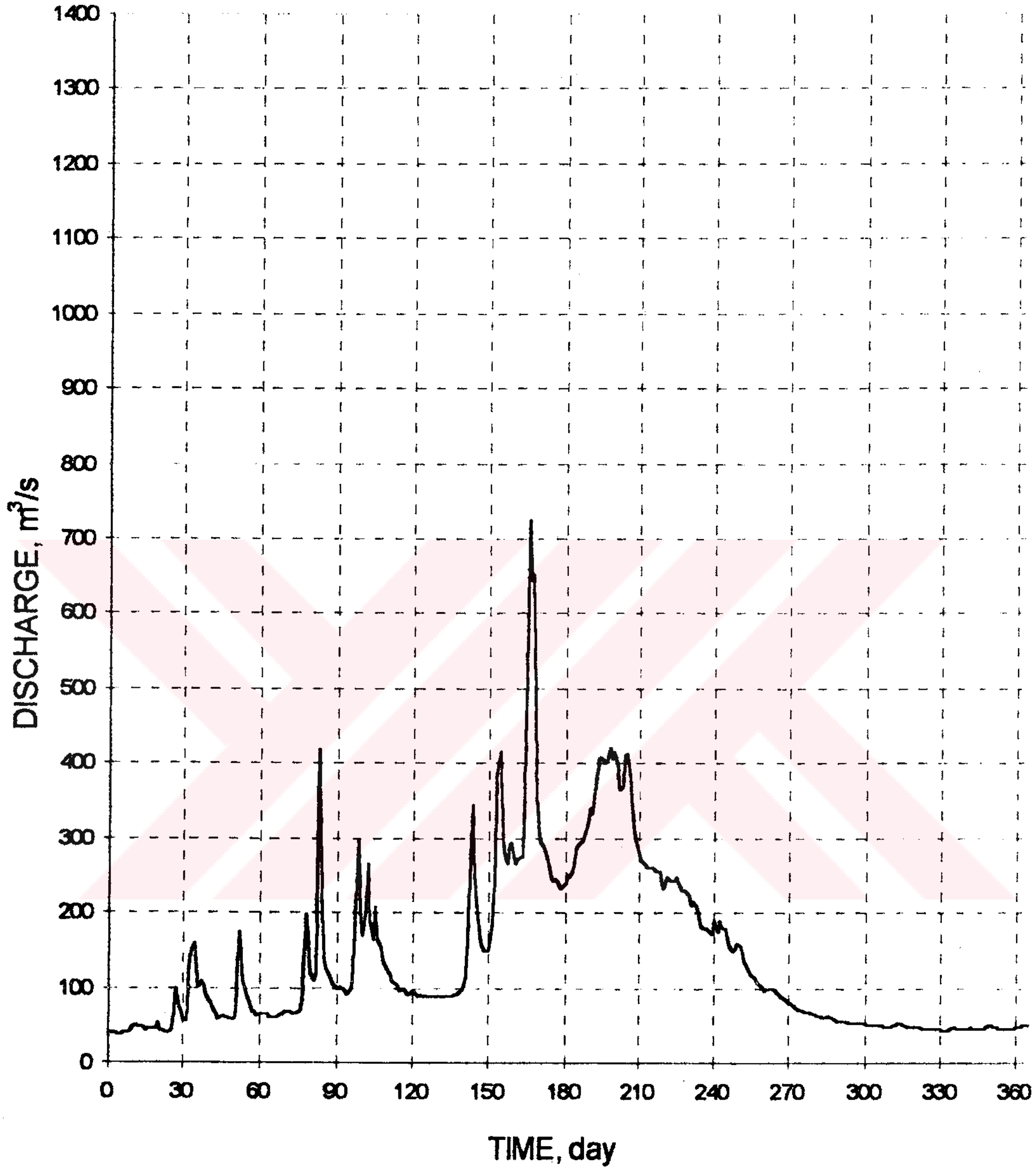

Figure 5.8 1968 Ceyhan River Flow

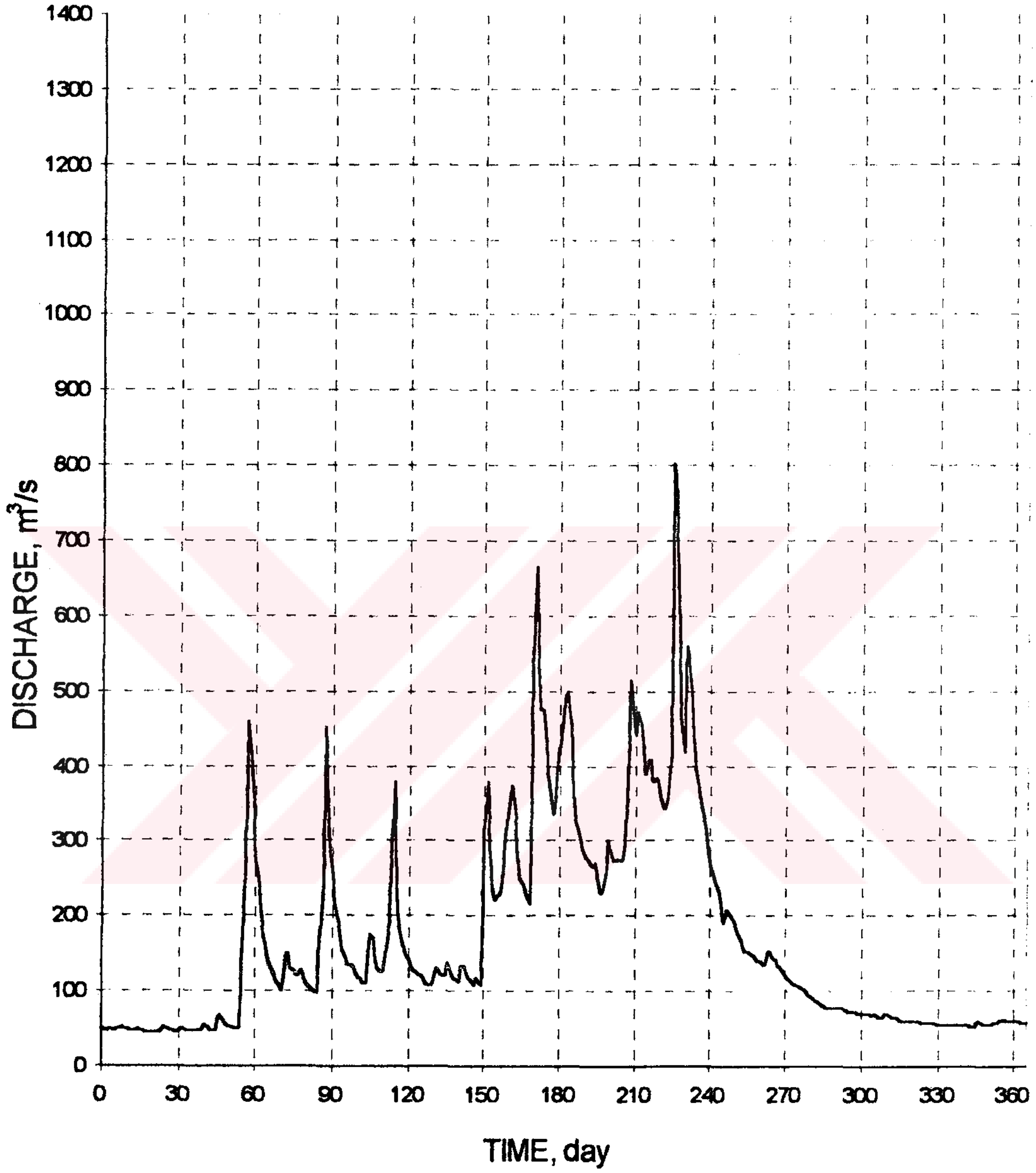

Figure 5.9 1969 Ceyhan River Flow

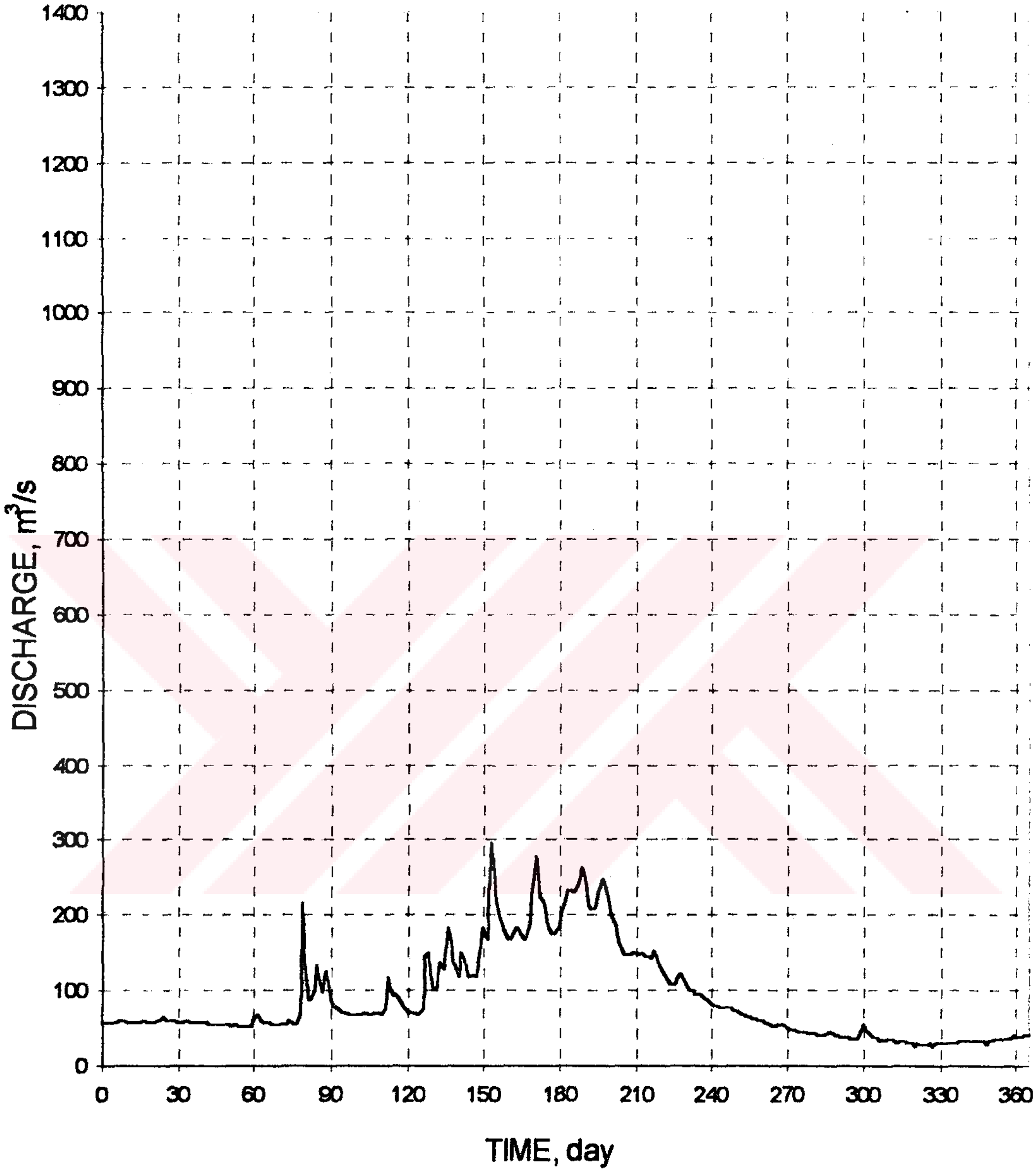

Figure 5.10 1970 Ceyhan River Flow

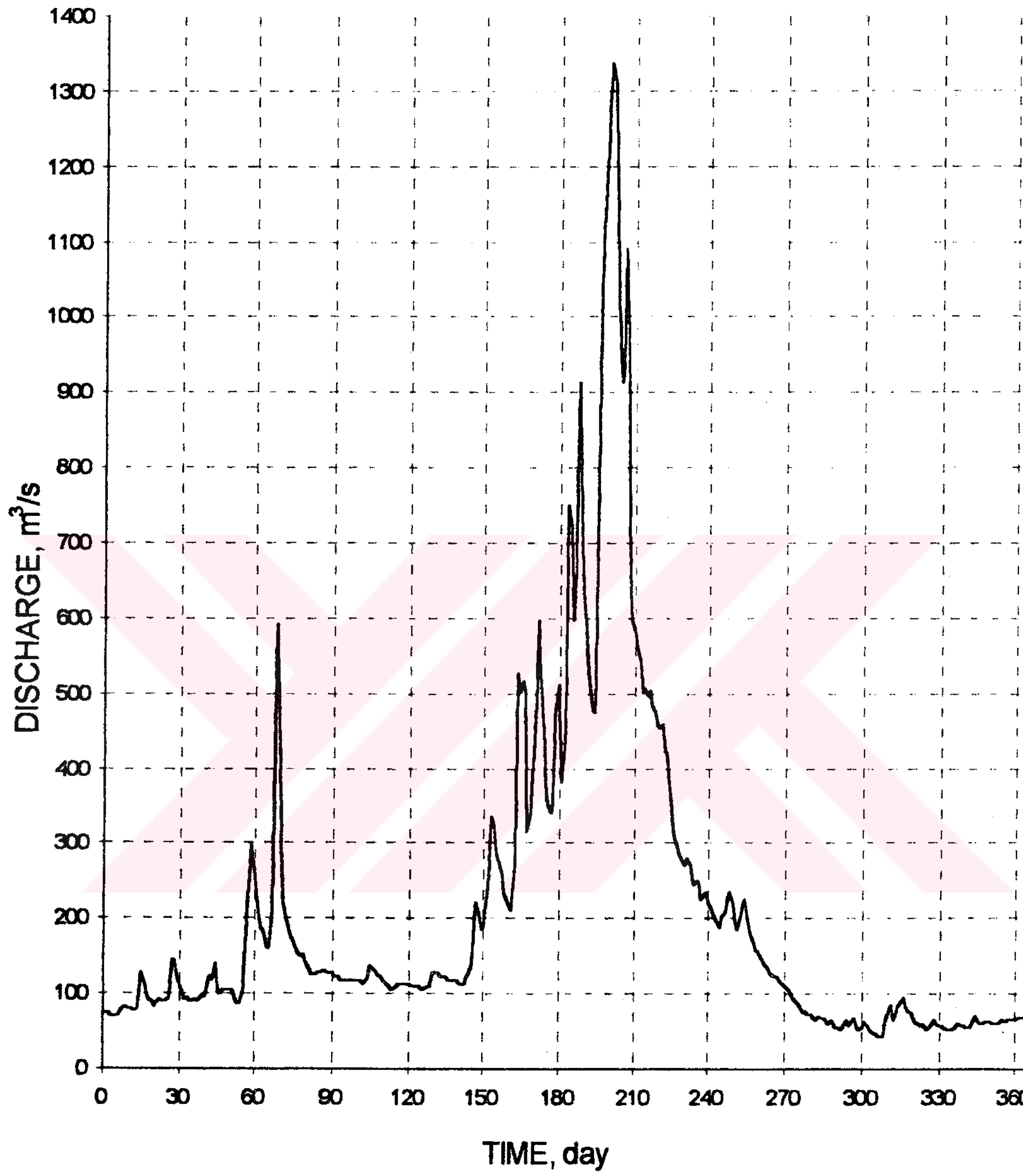

Figure 5.11 1971 Ceyhan River Flow

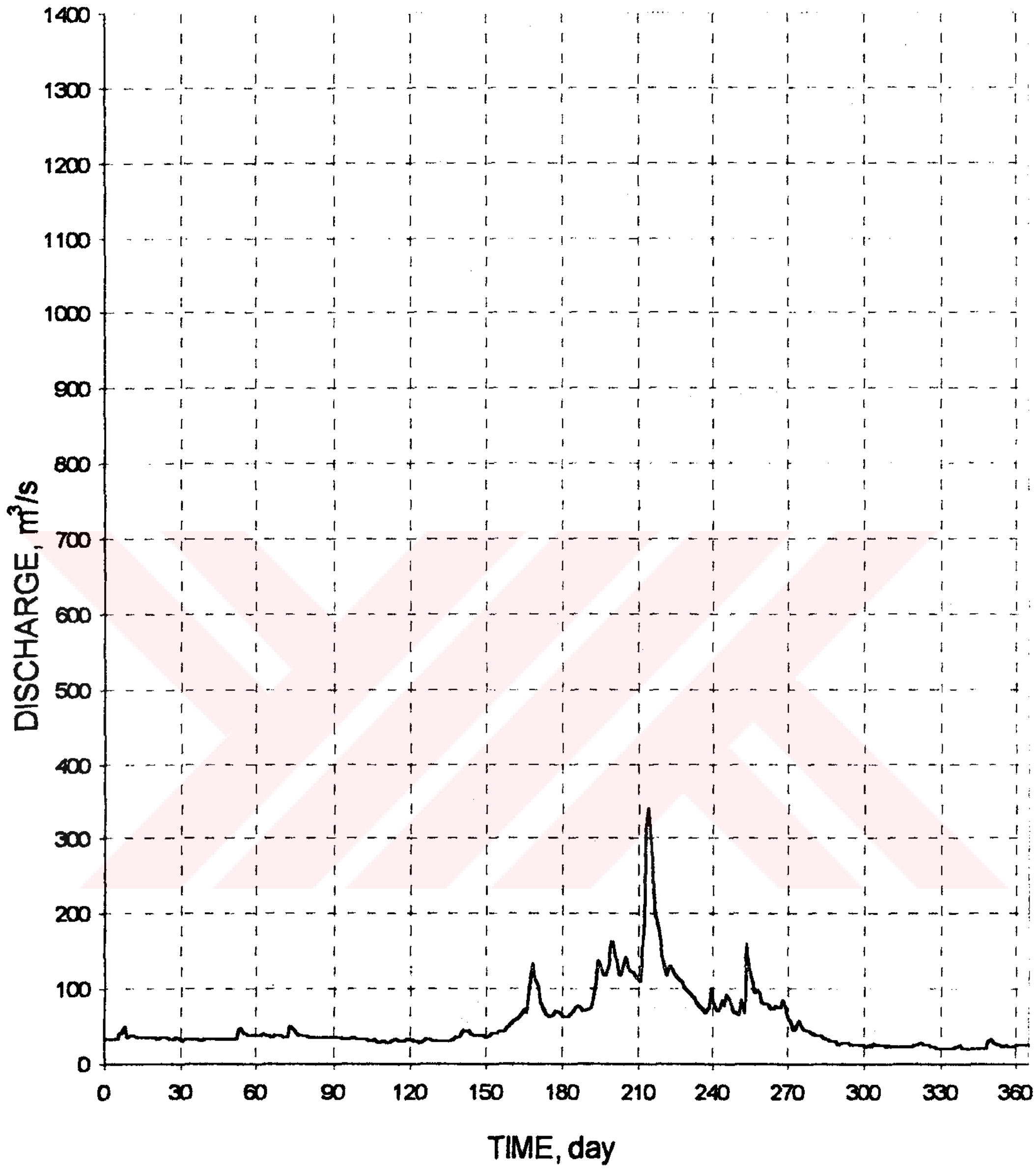

Figure 5.12 1972 Ceyhan River Flow

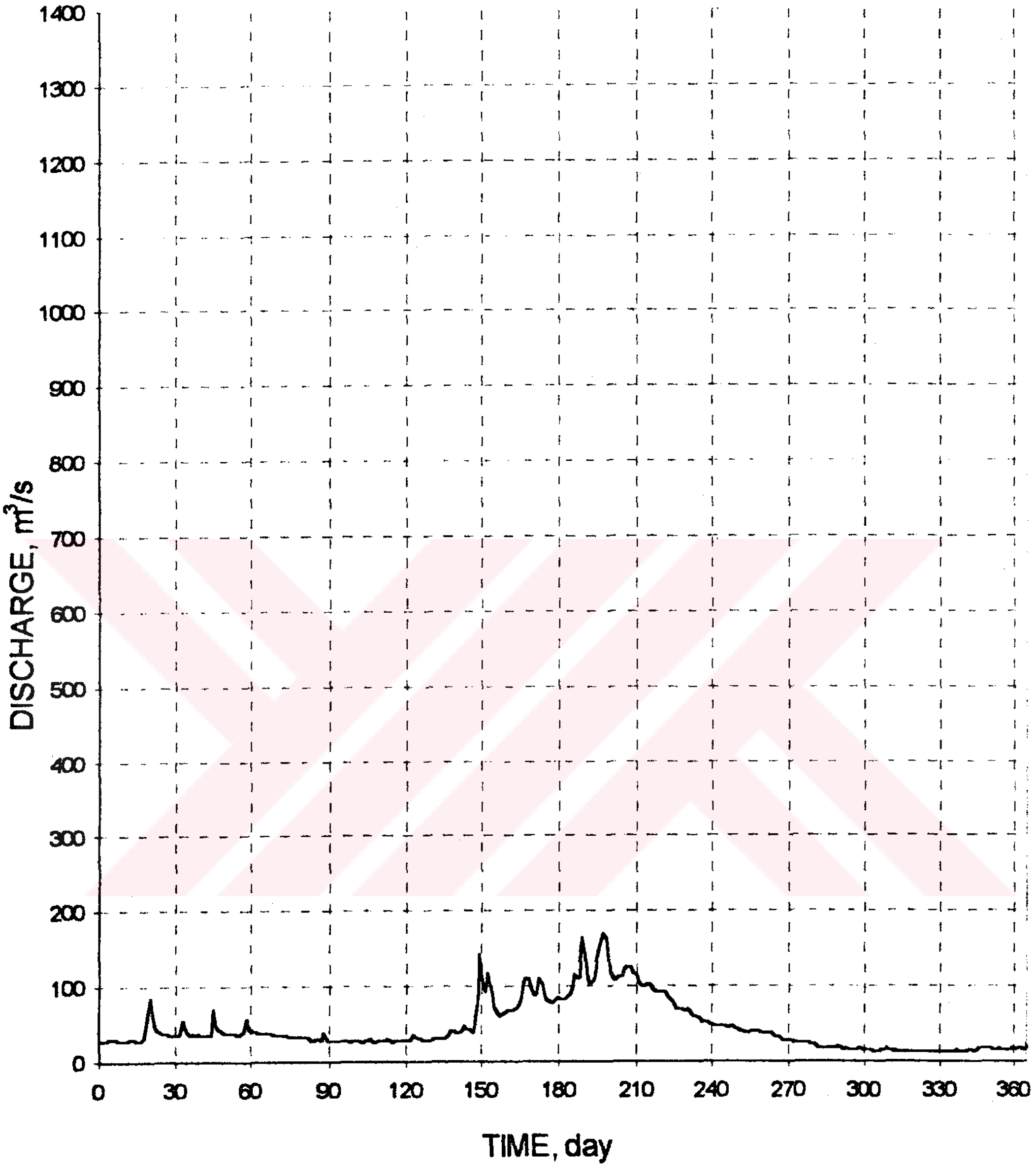

Figure 5.13 1973 Ceyhan River Flow

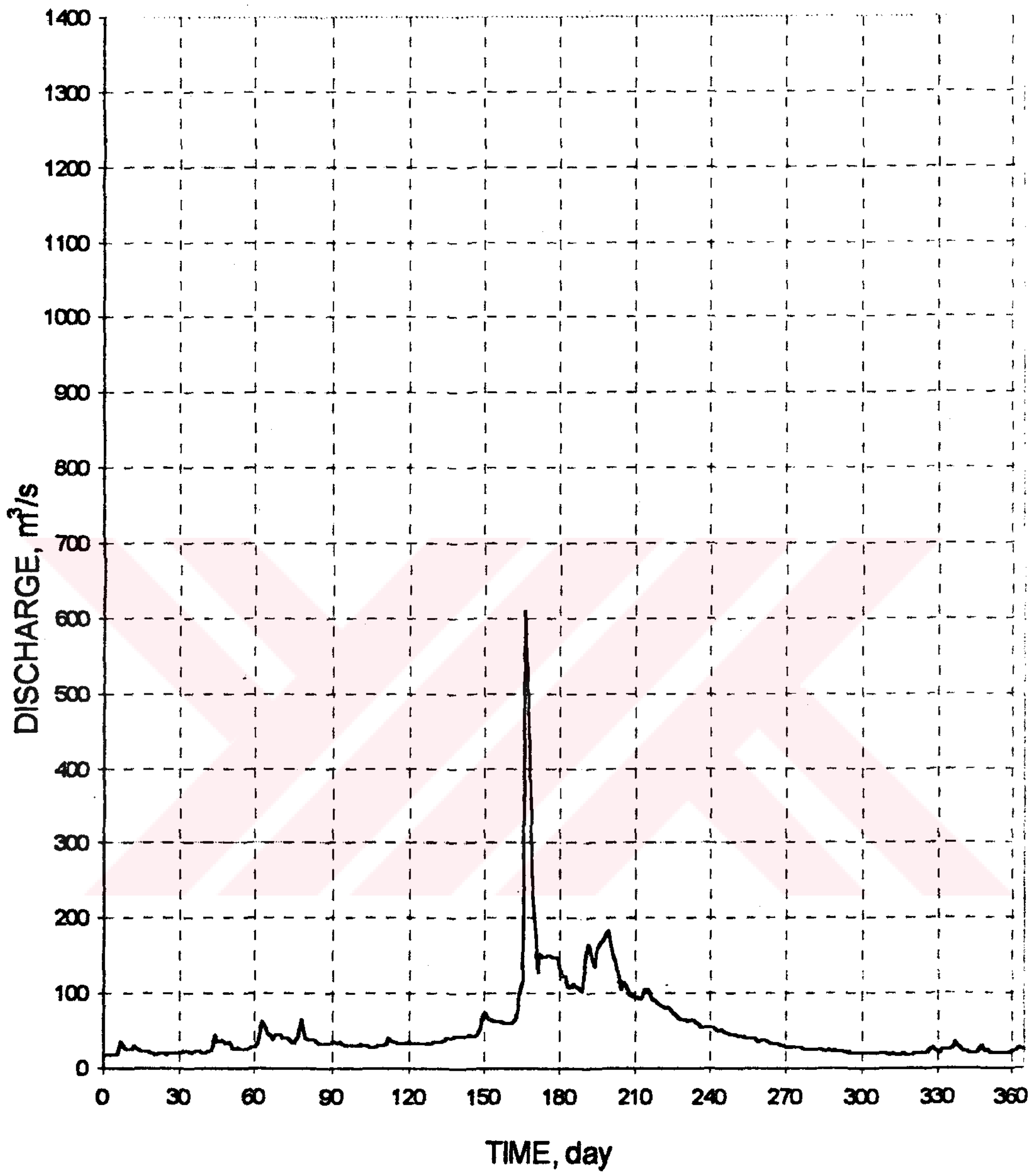

Figure 5.14 1974 Ceyhan River Flow

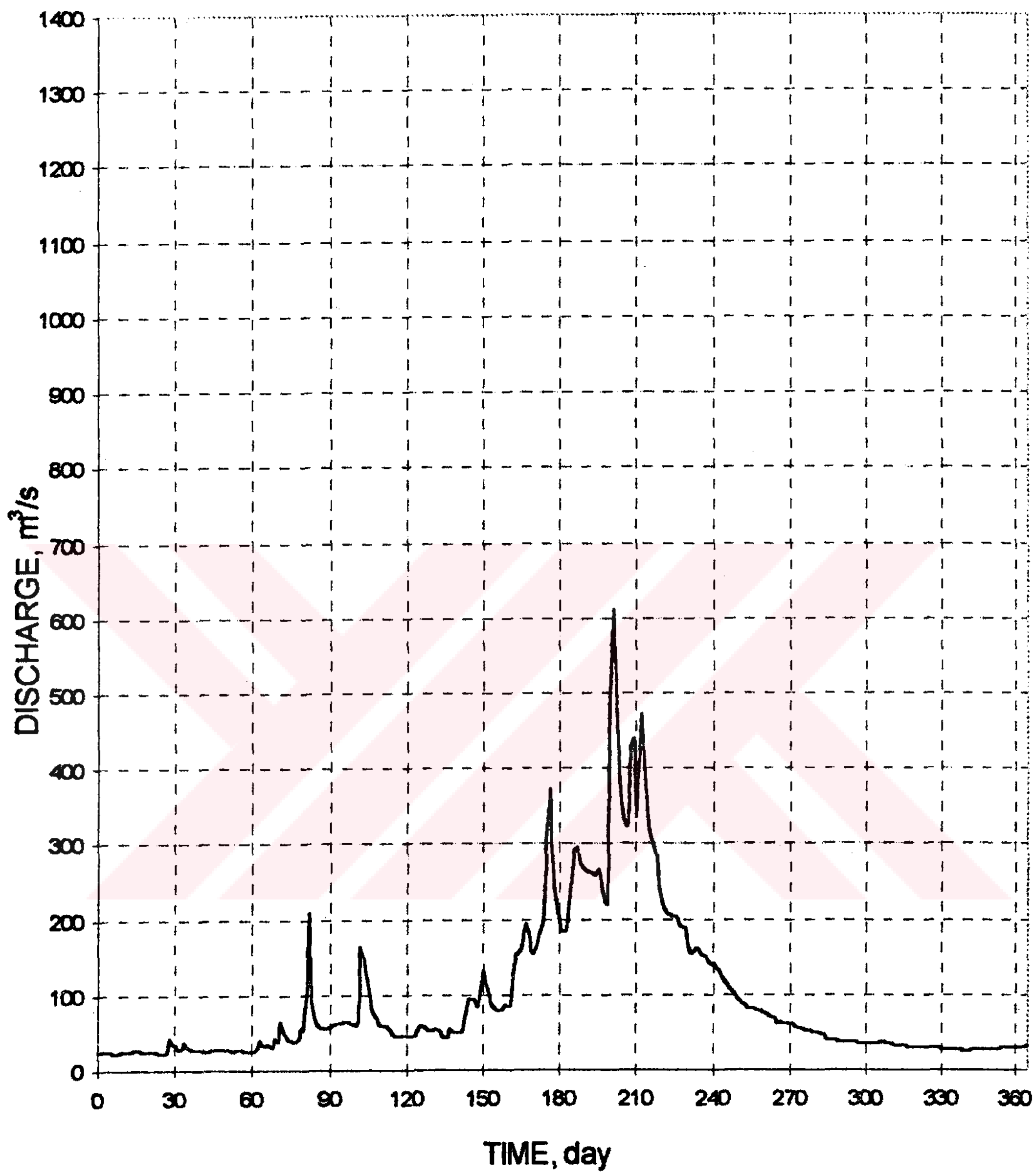

Figure 5.15 1975 Ceyhan River Flow

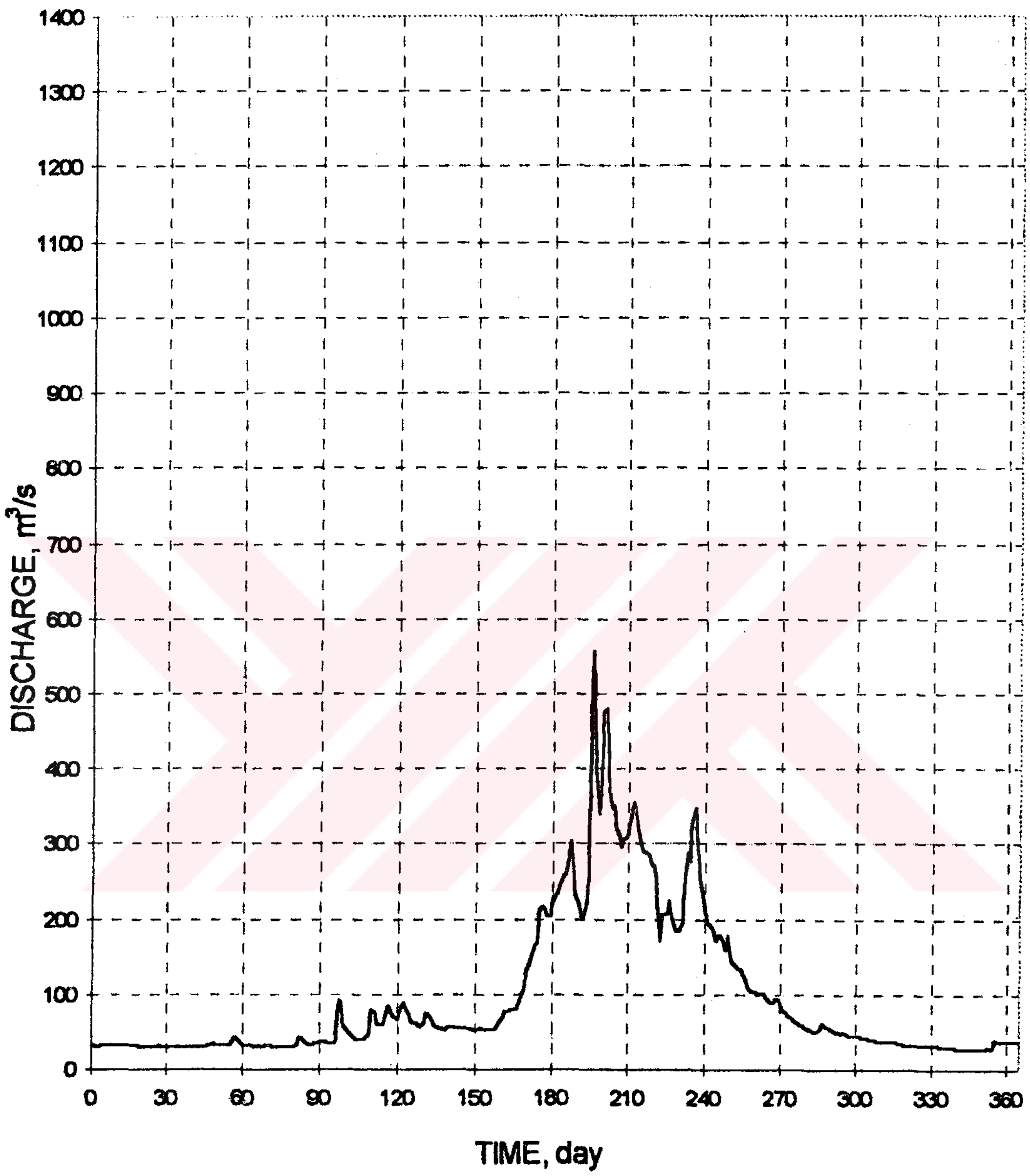

Figure 5.16 1976 Ceyhan River Flow

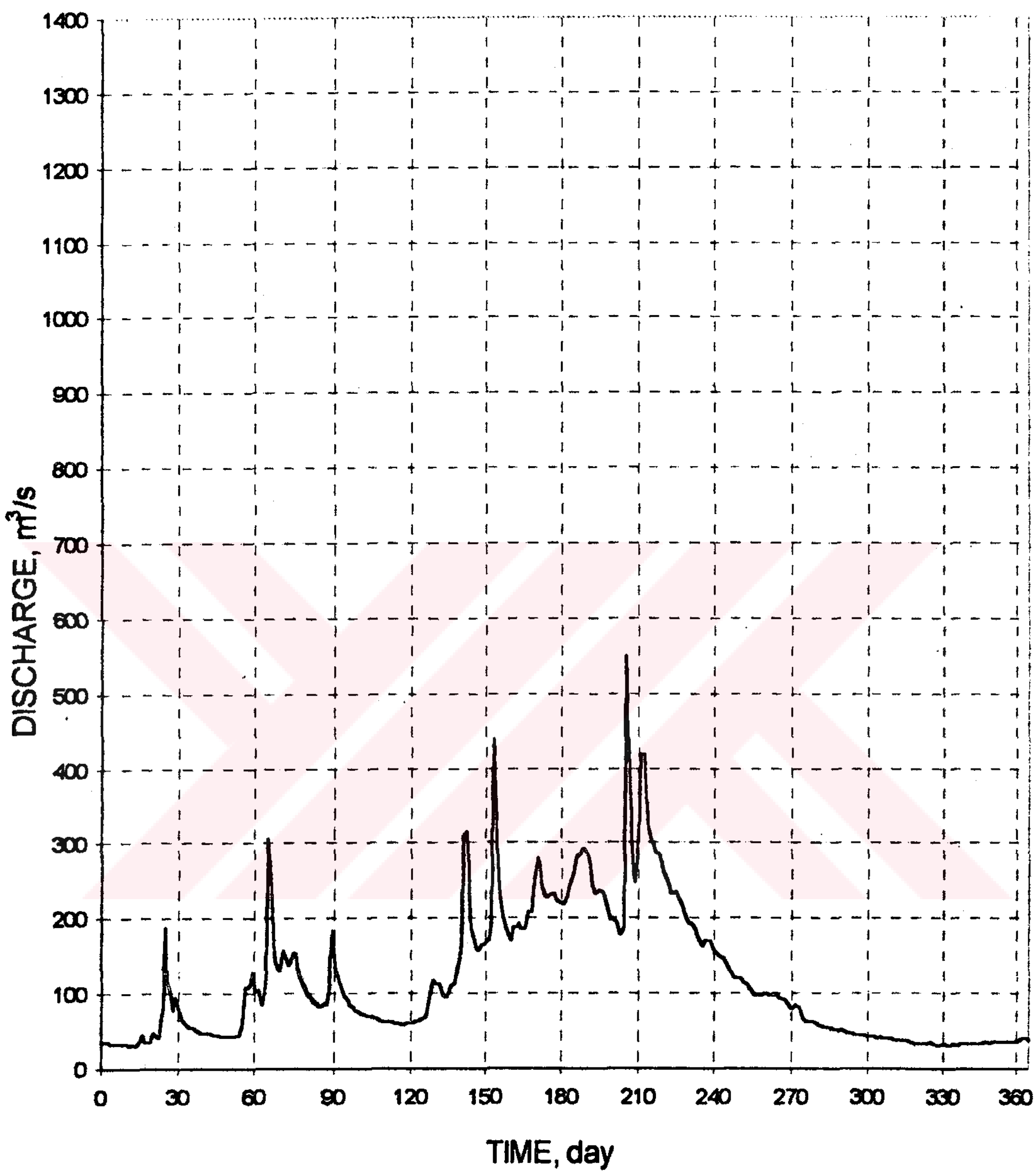

Figure 5.17 1977 Ceyhan River Flow

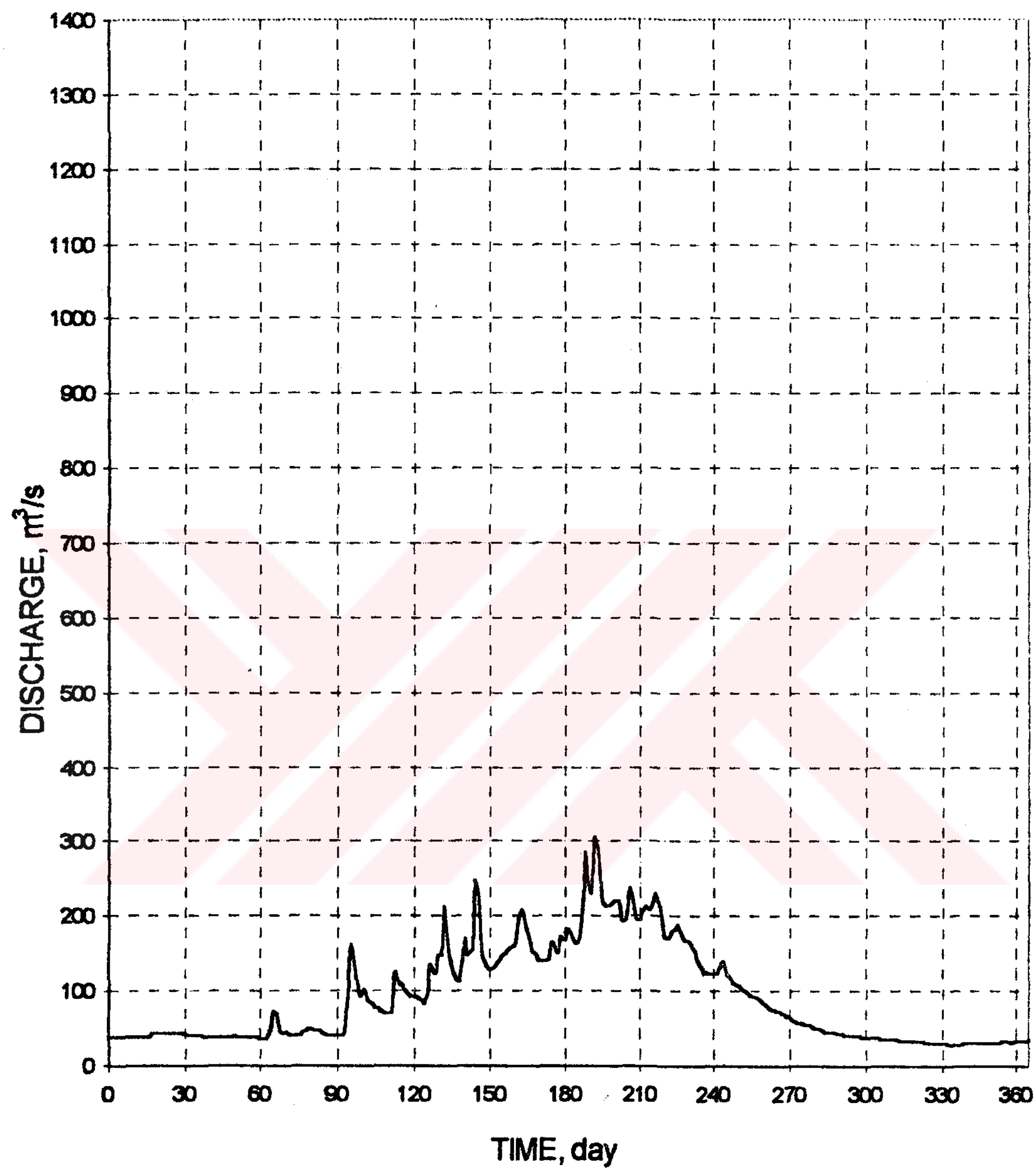

Figure 5.18 1978 Ceyhan River Flow

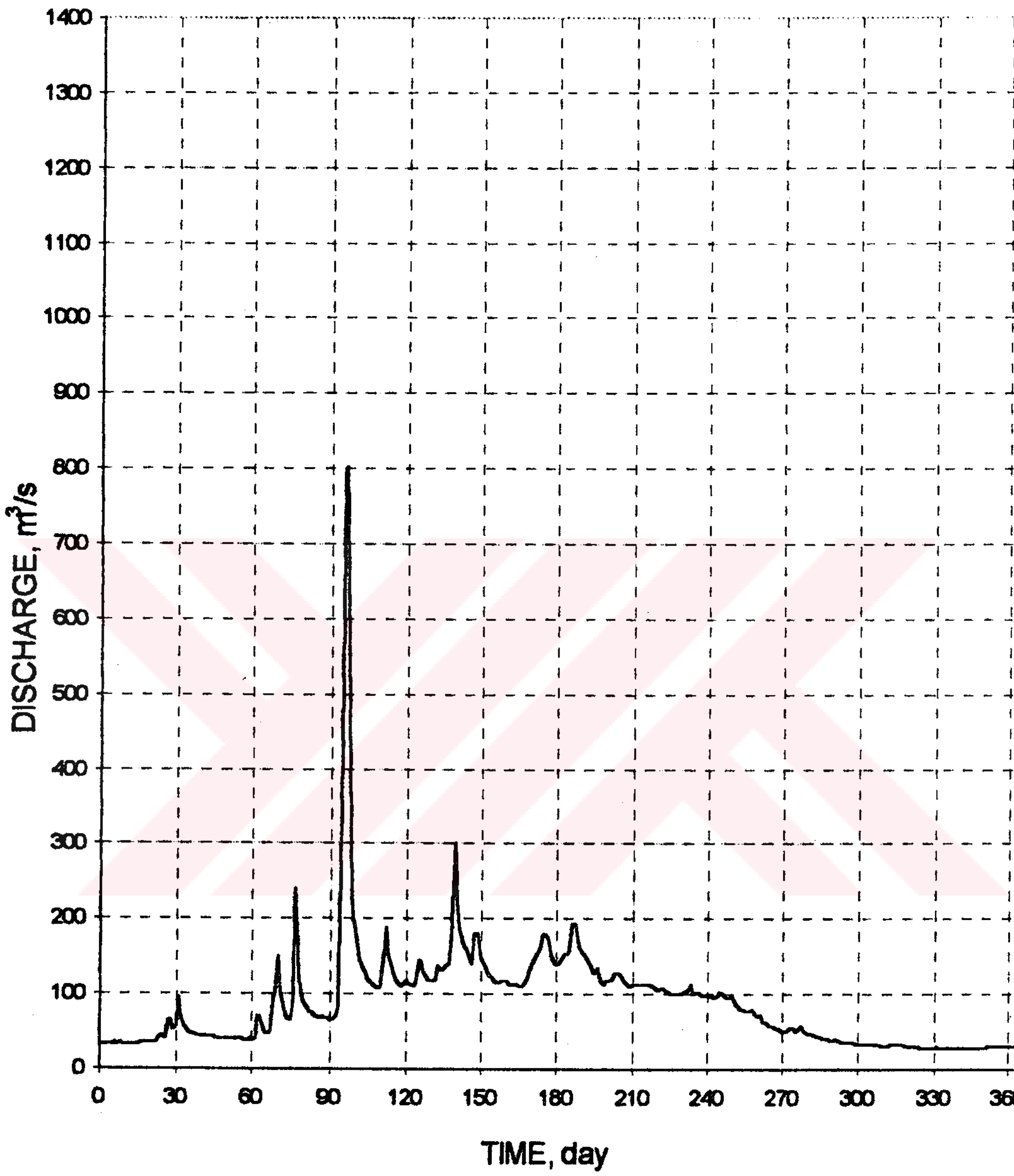

Figure 5.19 1979 Ceyhan River Flow

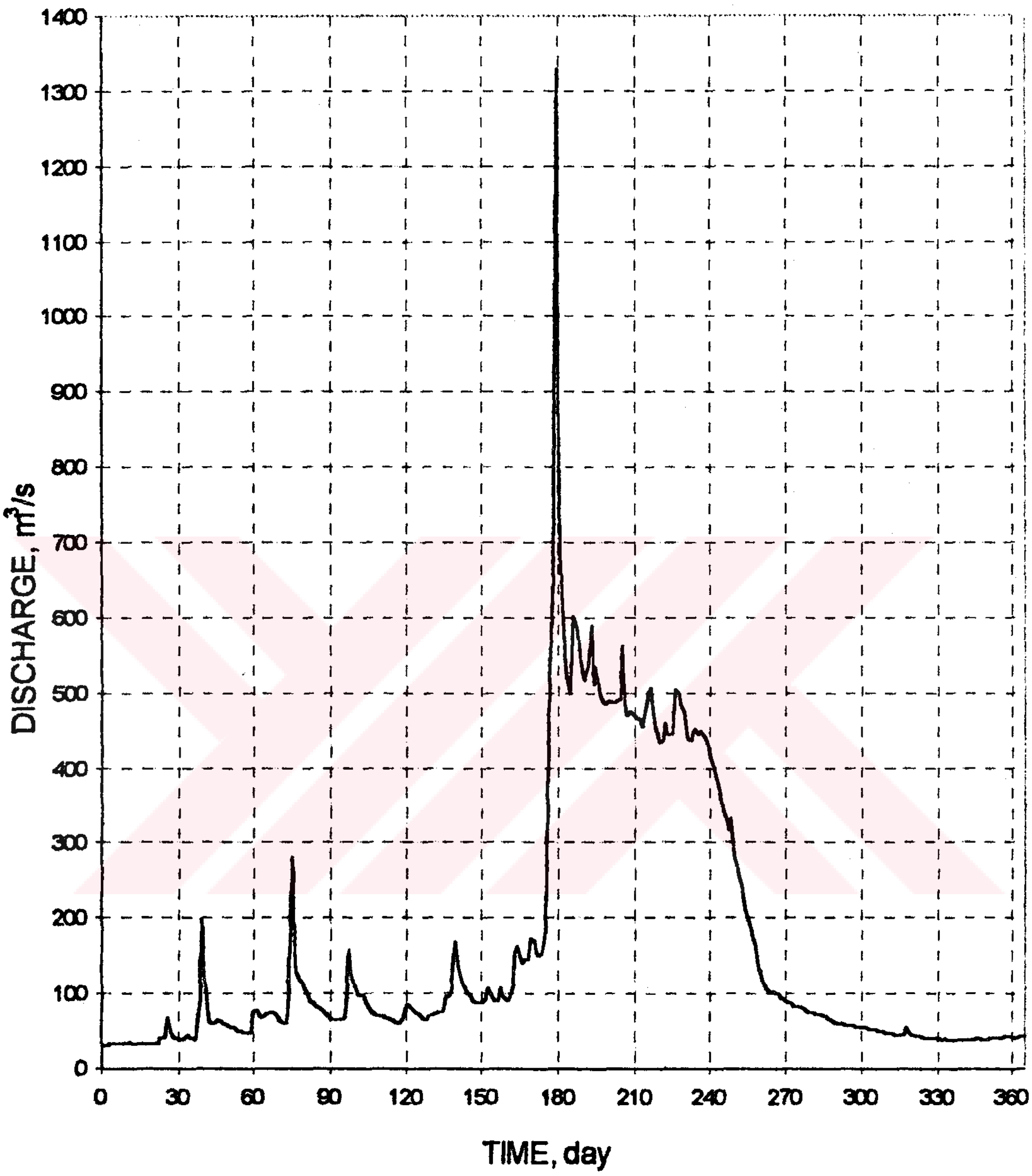

Figure 5.20 1980 Ceyhan River Flow

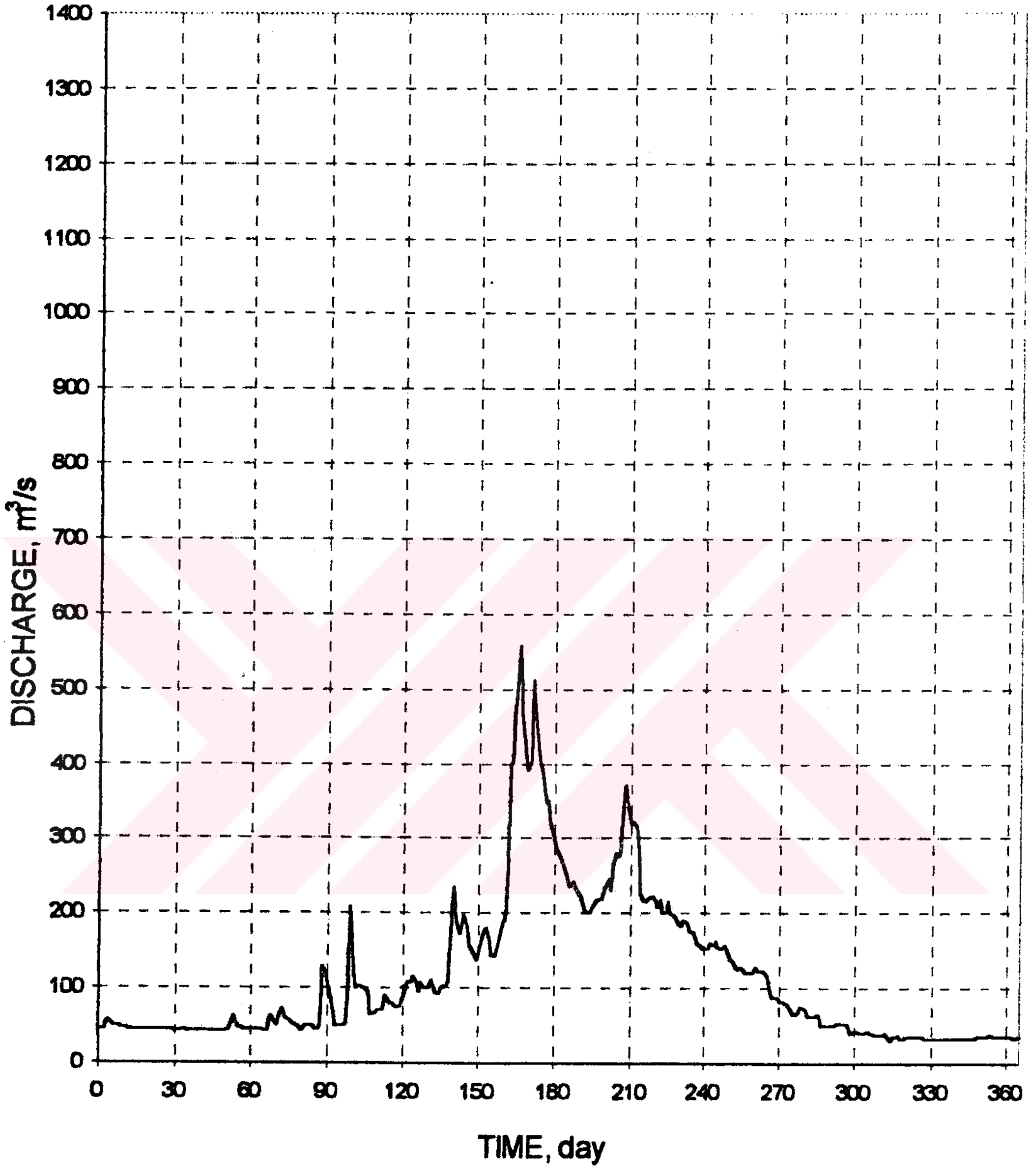

Figure 5.21 1981 Ceyhan River Flow

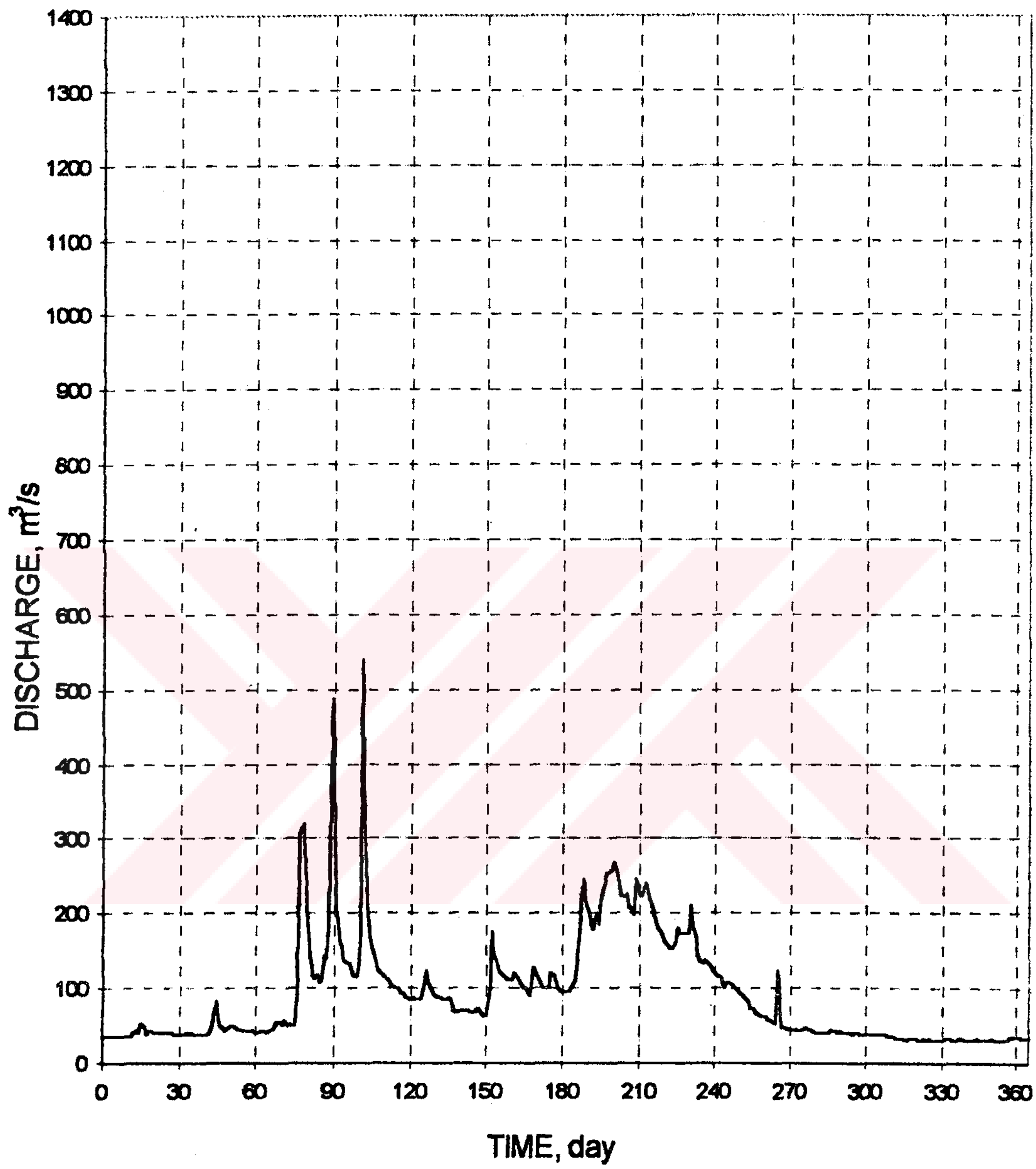

Figure 5.22 1982 Ceyhan River Flow

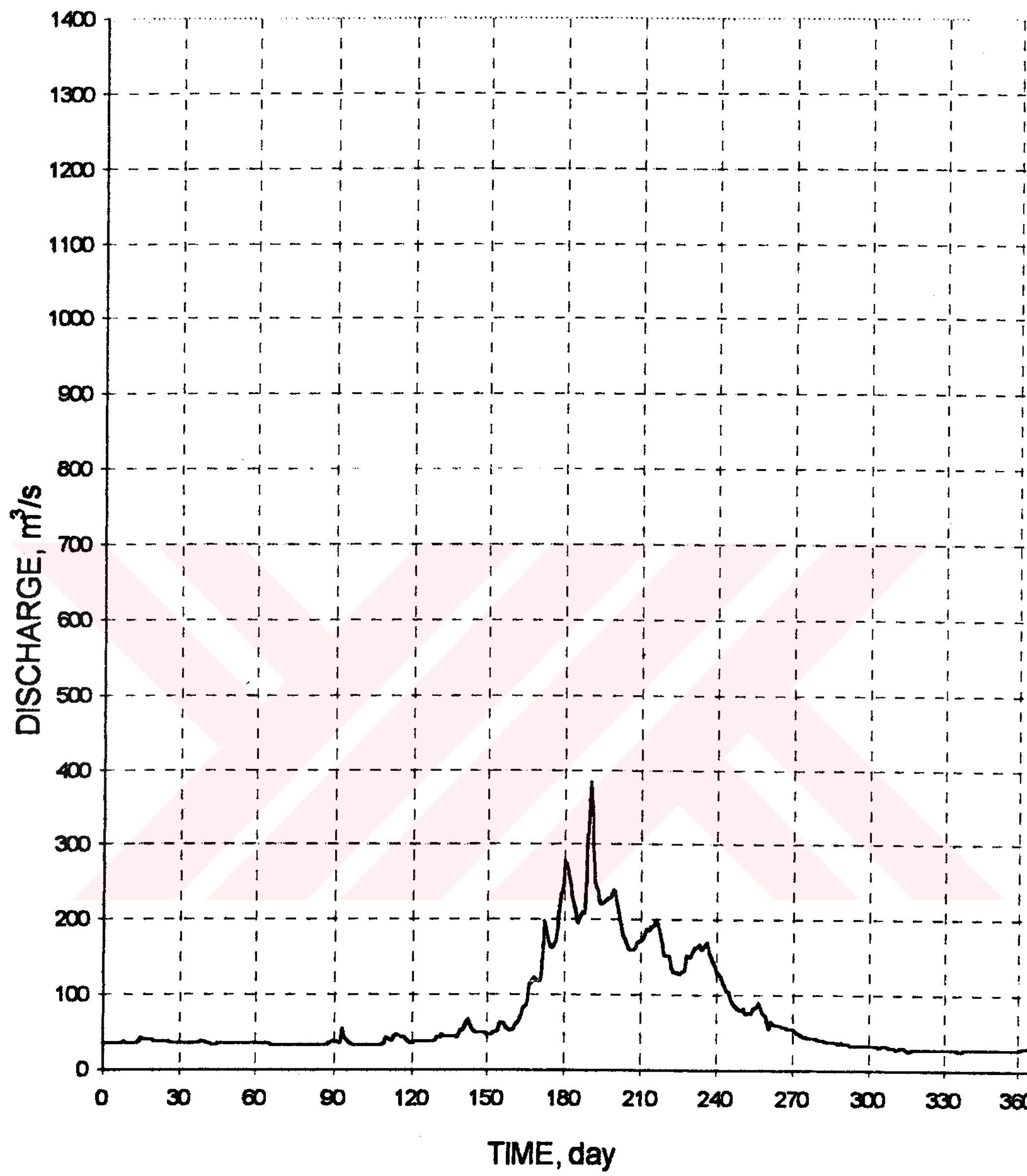

Figure 5.23 1983 Ceyhan River Flow

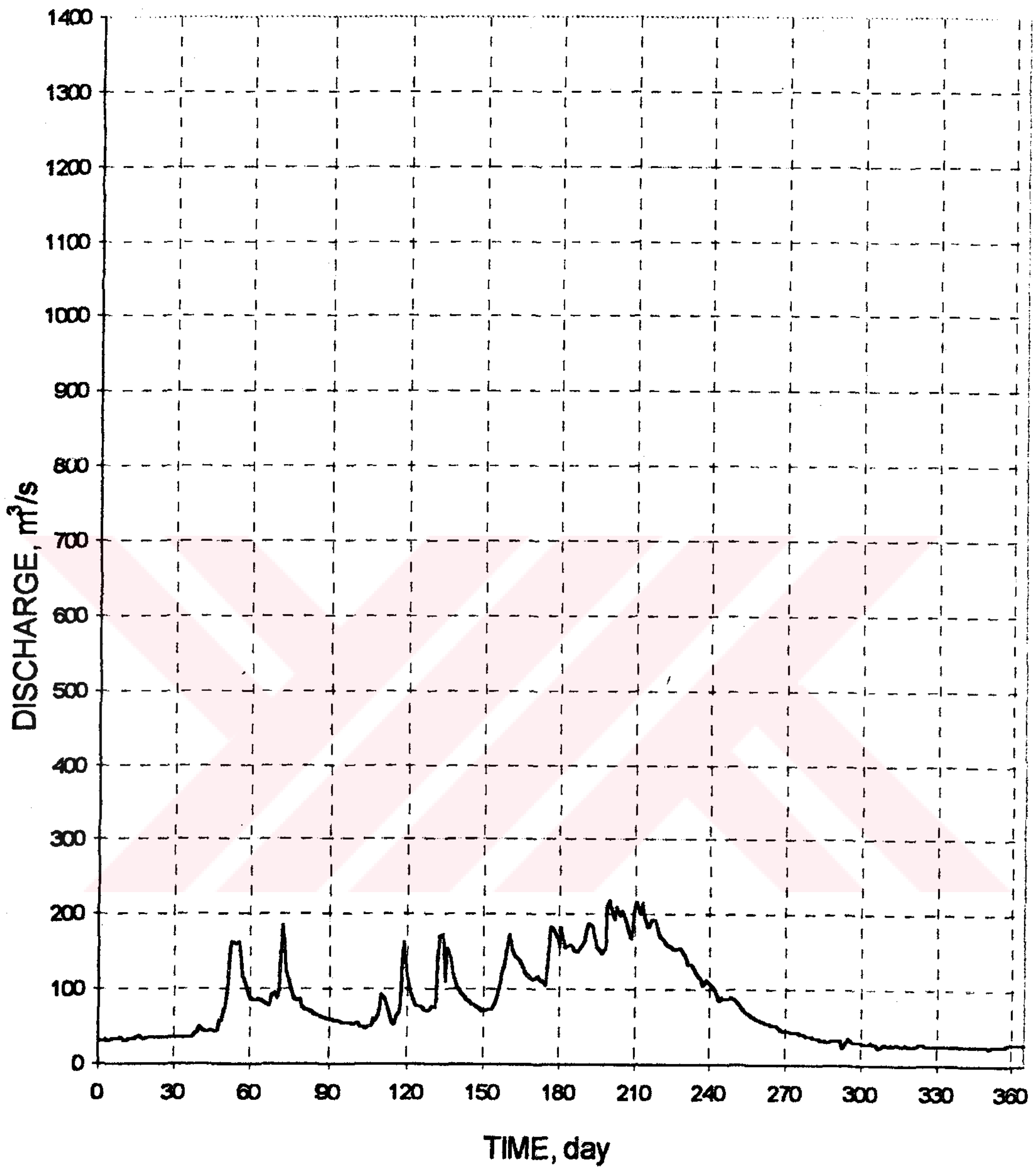

Figure 5.24 1984 Ceyhan River Flow

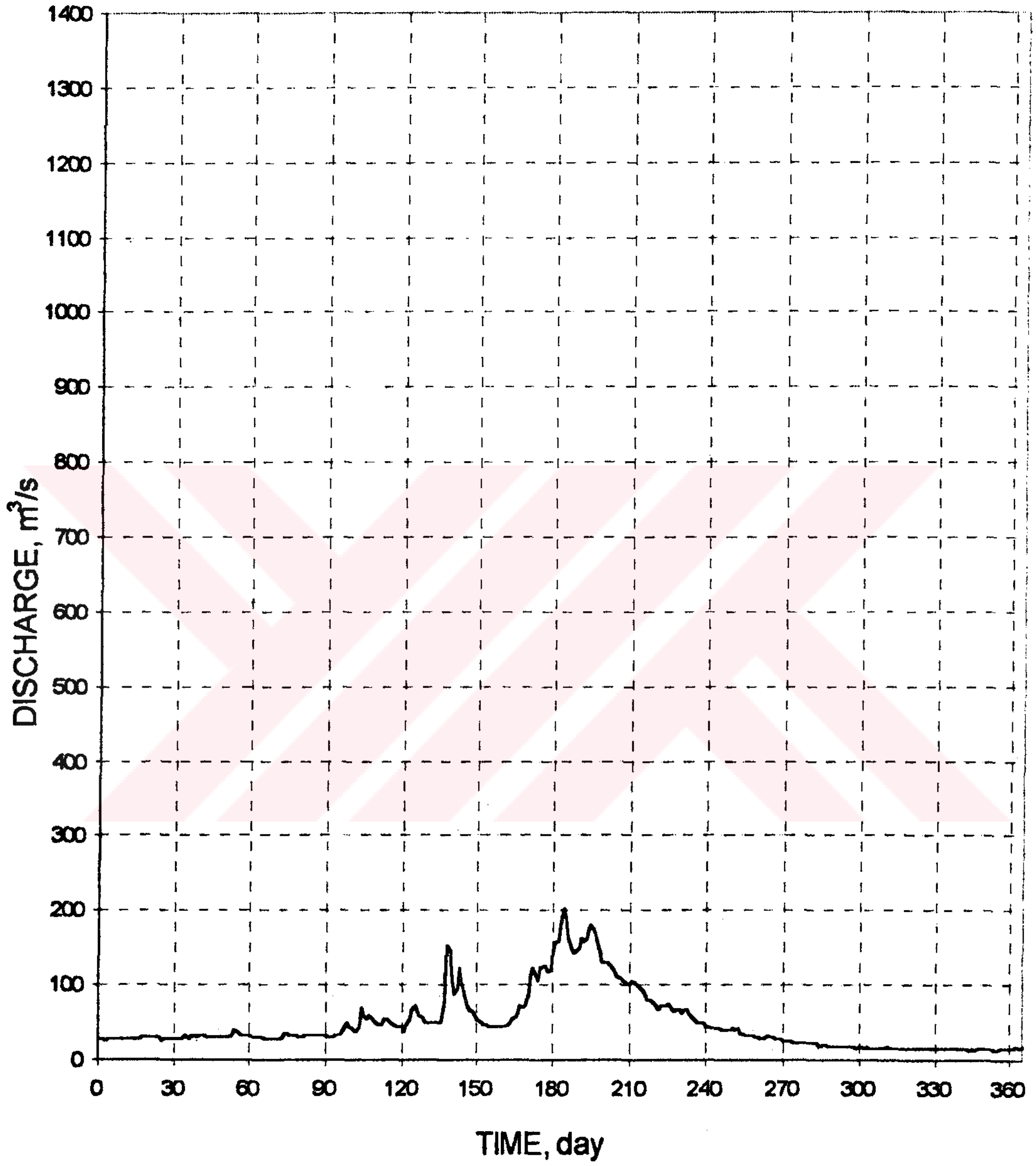

Figure 5.25 1985 Ceyhan River Flow

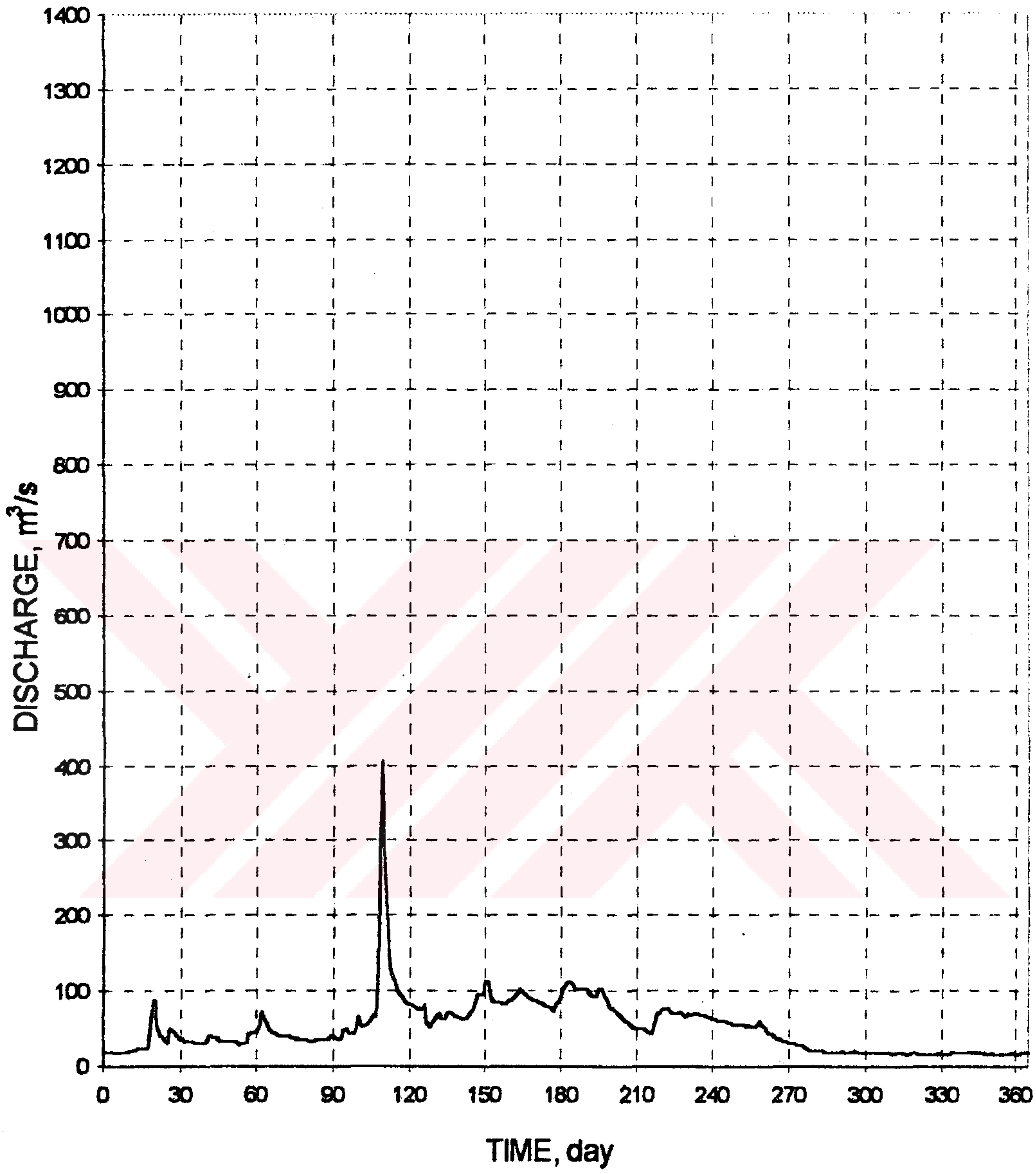

Figure 5.26 1986 Ceyhan River Flow

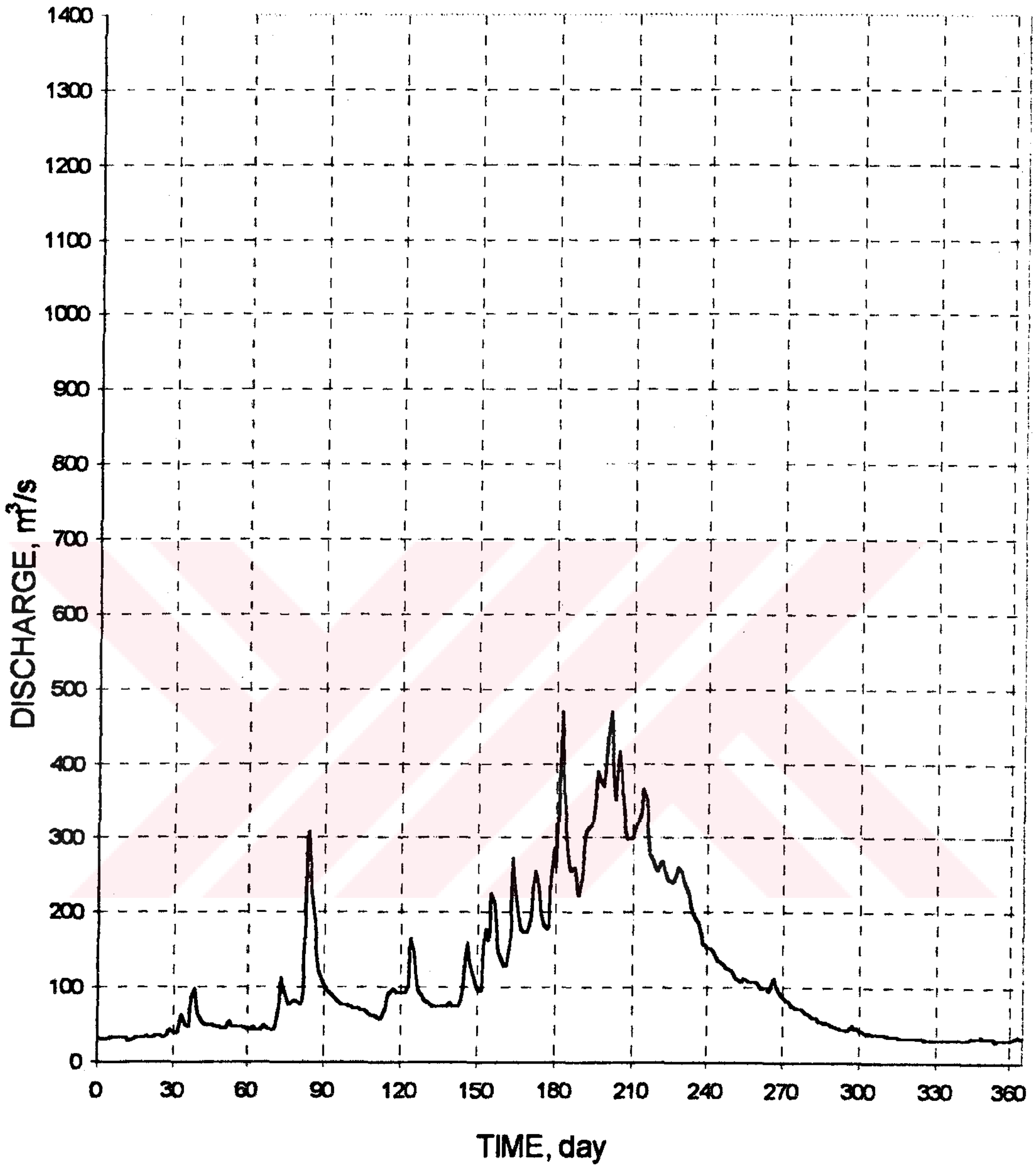

Figure 5.27 1987 Ceyhan River Flow

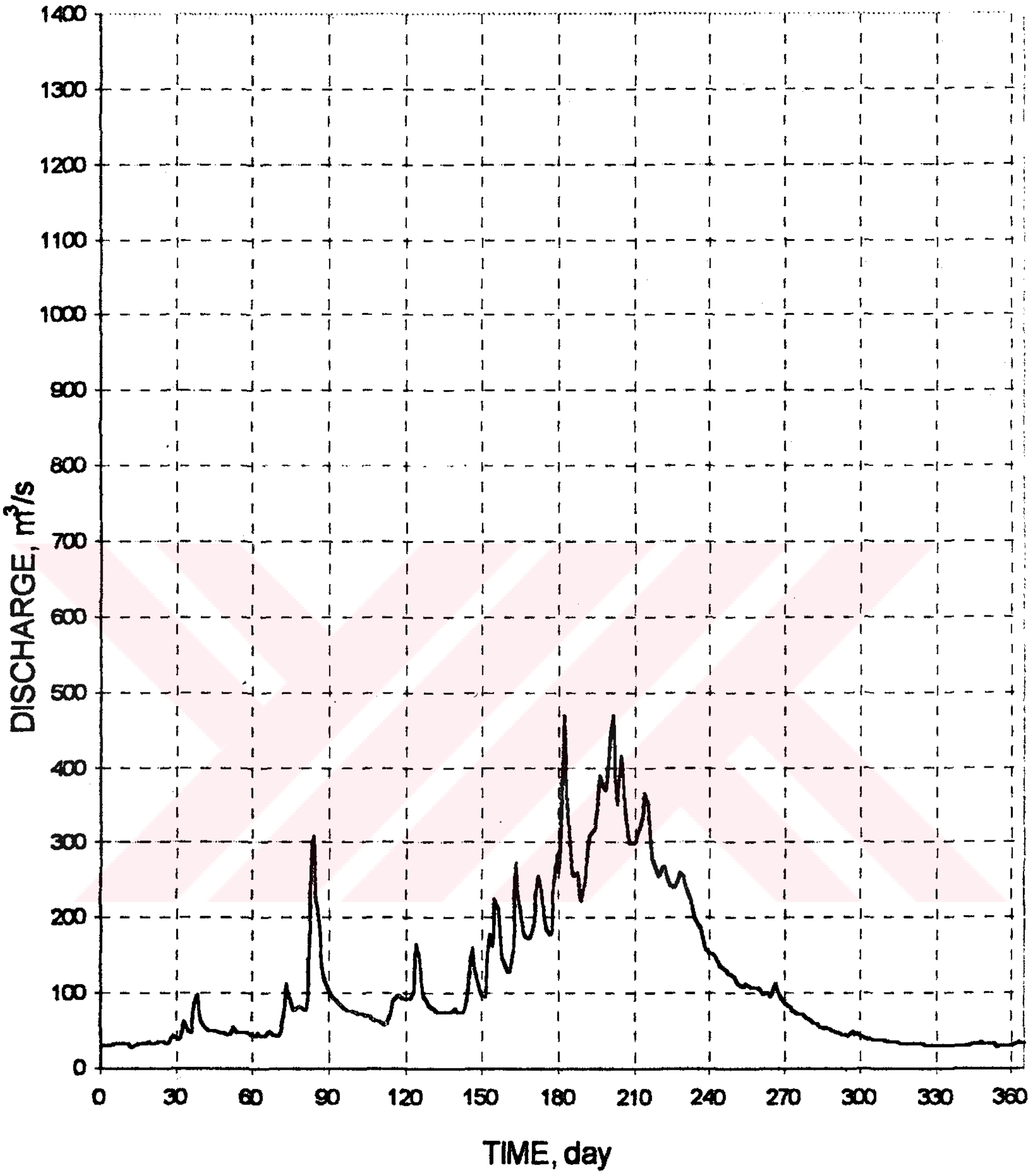

Figure 5.28 1988 Ceyhan River Flow

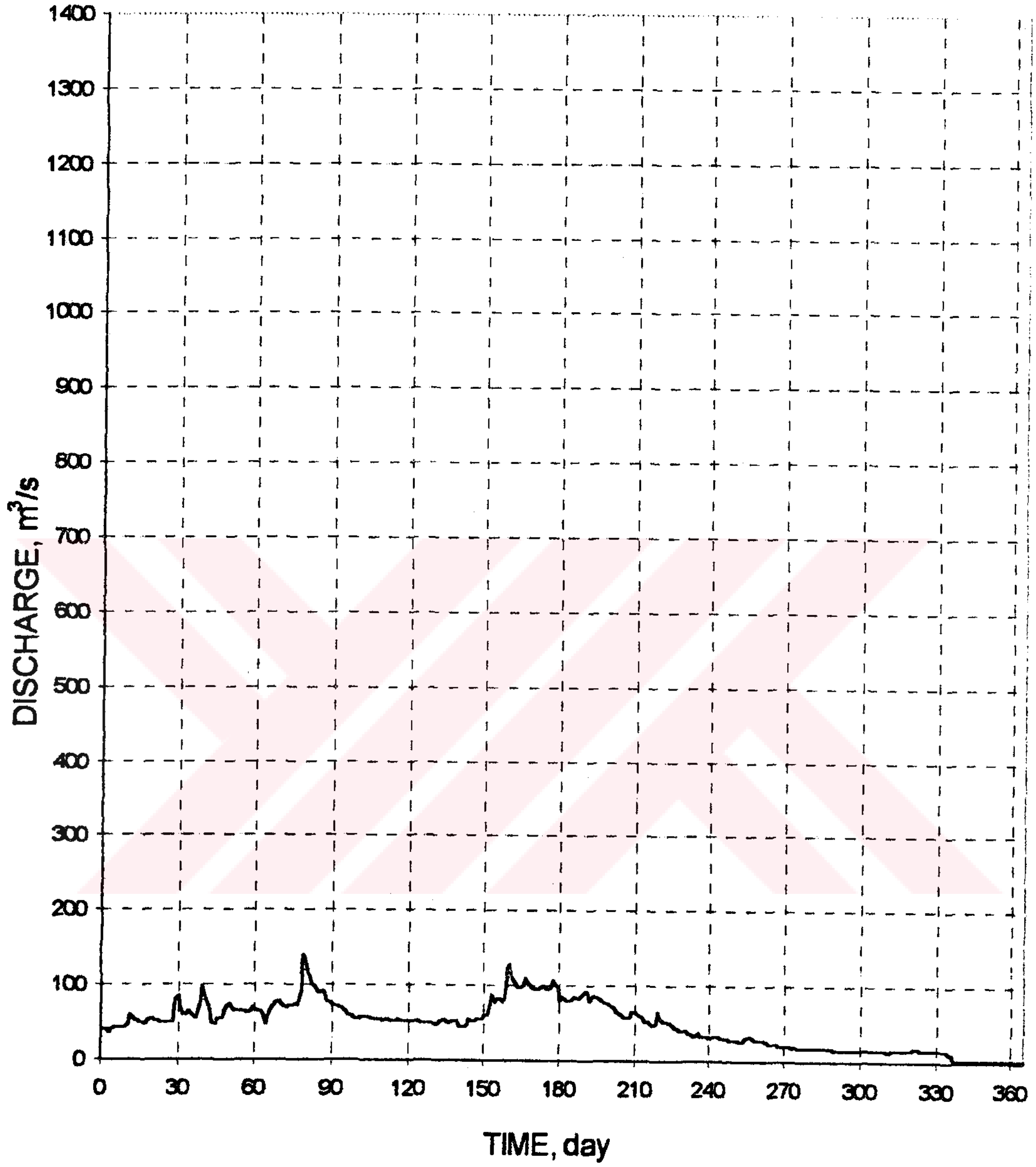

Figure 5.29 1989 Ceyhan River Flow

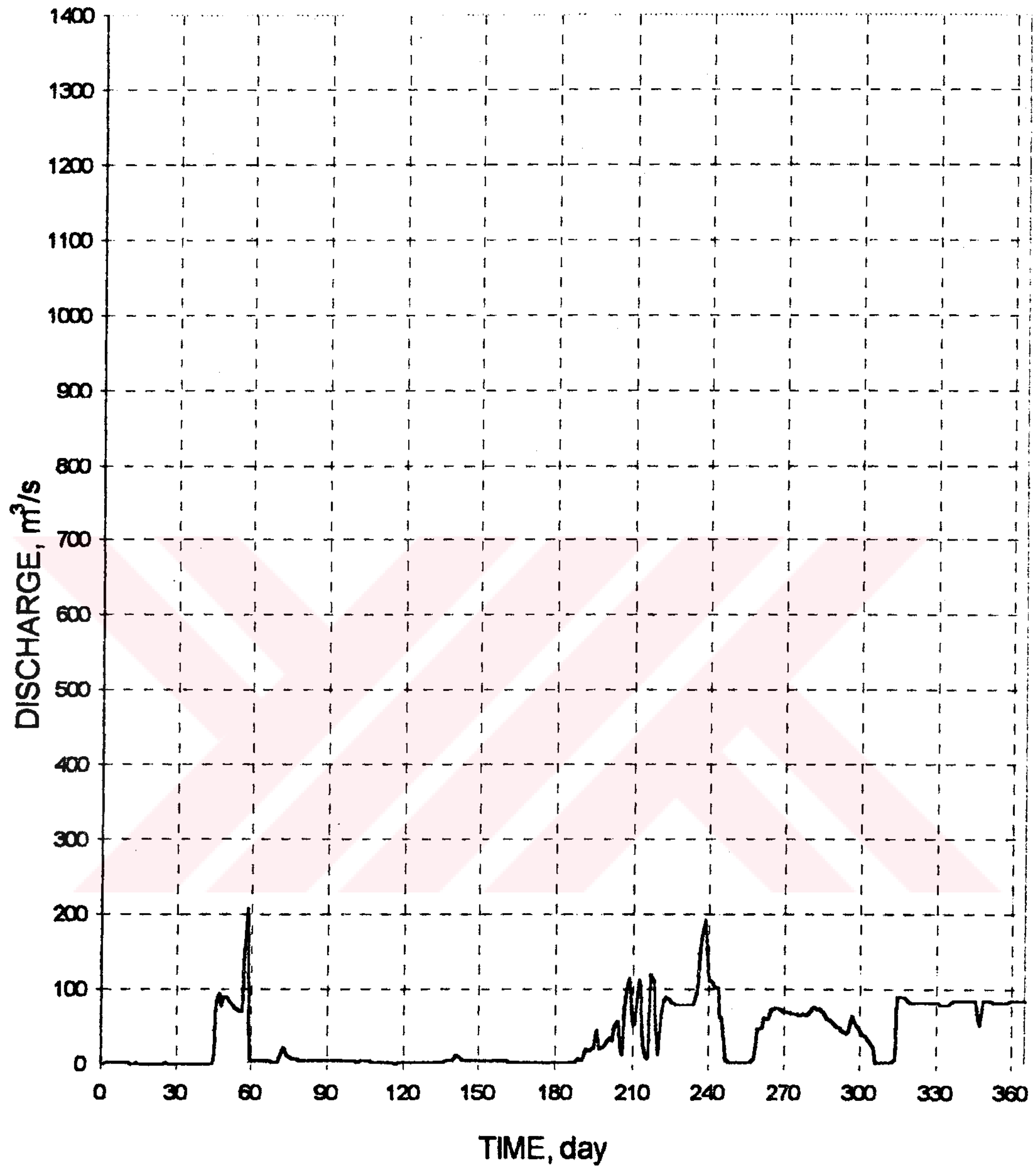

Figure 5.30 1990 Ceyhan River Flow

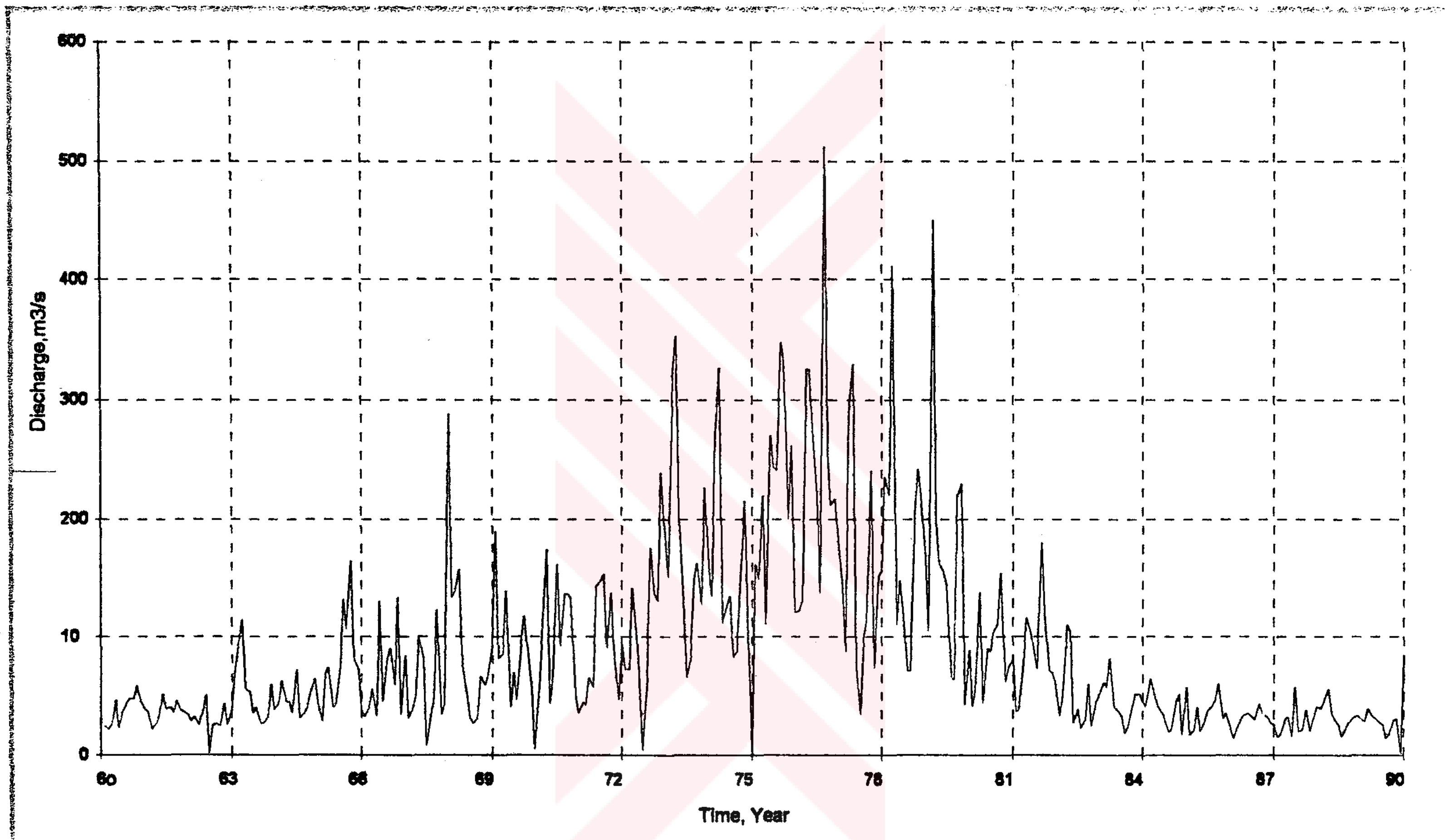

Figure 5.31 Months average flow of Ceyhan River (between 1961 and 1990)

5.1.2 Annual Ceyhan River Flow

5.1.2.1 Kılavuzlu Station

The observed and predicted values of this basin is given on the following figure :

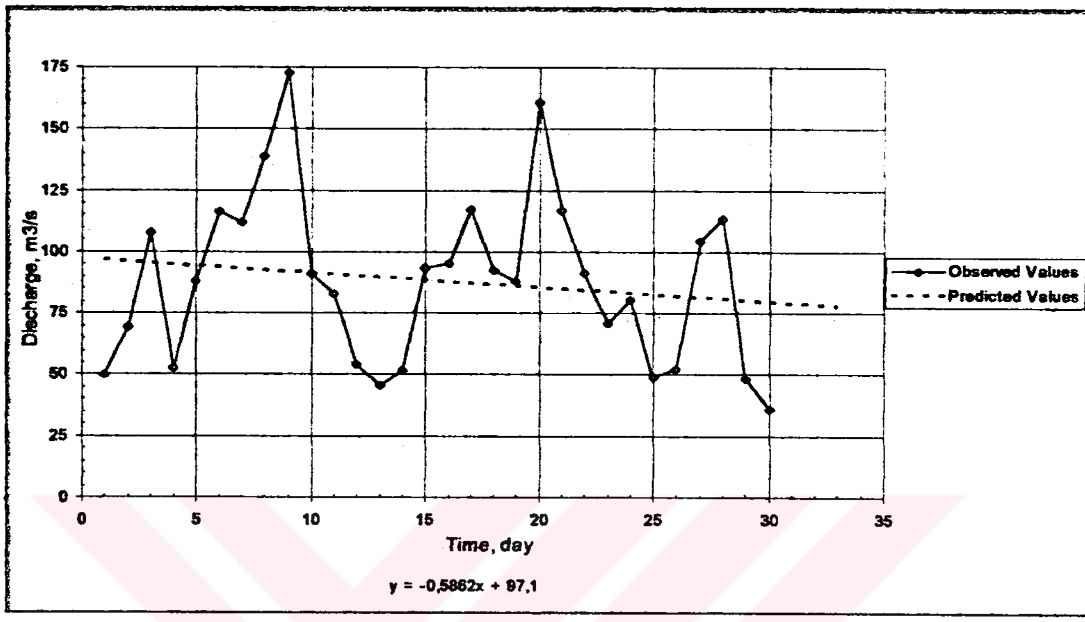

Figure 5.32 Annual flows of Ceyhan River Basin-Kılavuzlu Station (1961-1990)

Table 5.1 Statistical Results of Ceyhan River Basin-Kılavuzlu Station

Statistical Parameters	Actually Observed Values
Mean	88.0149
Standard Deviaton	34.3826
Standard Error	6.2774
95 % Cofidence Interval	12.8389
99% Confidence Interval	17.3042
Total	2640.446
Min.	35.799
Max.	172.592
Skewness	0.5531

5.1.2.2 Ceyhan Basin-Karaahmet Station

The observed and predicted values of this basin is given on the following figure :

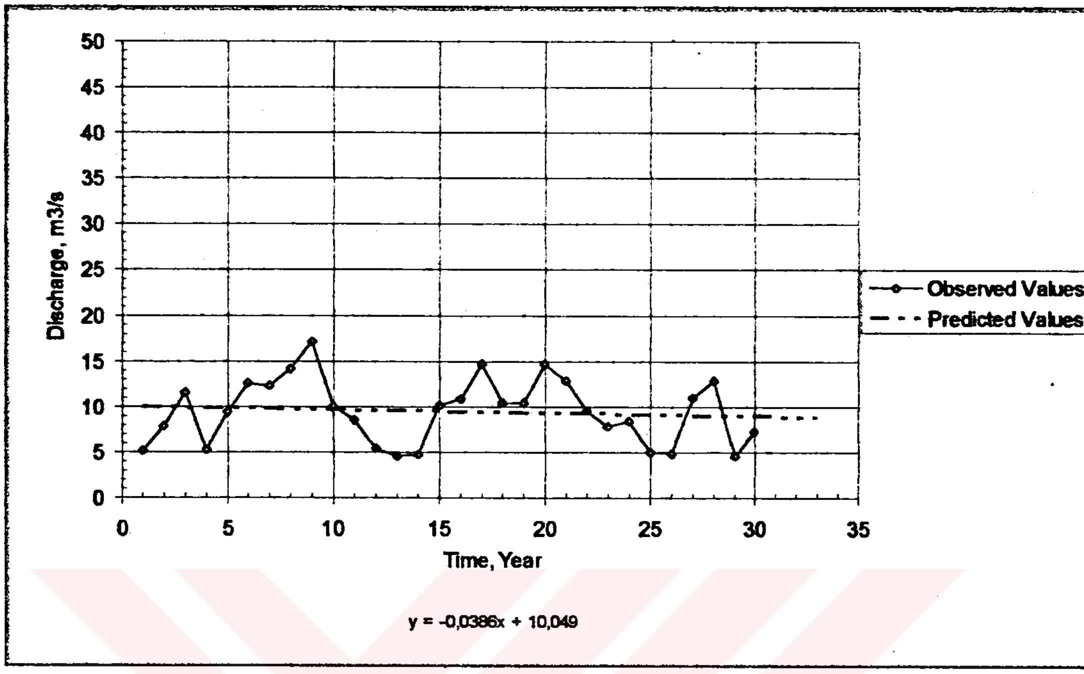

Figure 5.33 Annual flows of Ceyhan River Basin-Karaahmet Station (1961-1990)

Table 5.2 Statistical Results of Ceyhan River Basin-Karaahmet Station

Statistical Parameters	Actually Observed Values
Mean	9.4510
Standard Deviaton	3.5366
Standard Error	0.6457
95 % Cofidence Interval	1.3206
99% Confidence Interval	1.7799
Total	283.531
Min.	4.488
Max.	17.073
Skewness	0.1642

5.1.2.3 Ceyhan Basin-Kürtleravşarı Station

The observed and predicted values of this basin is given on the following figure :

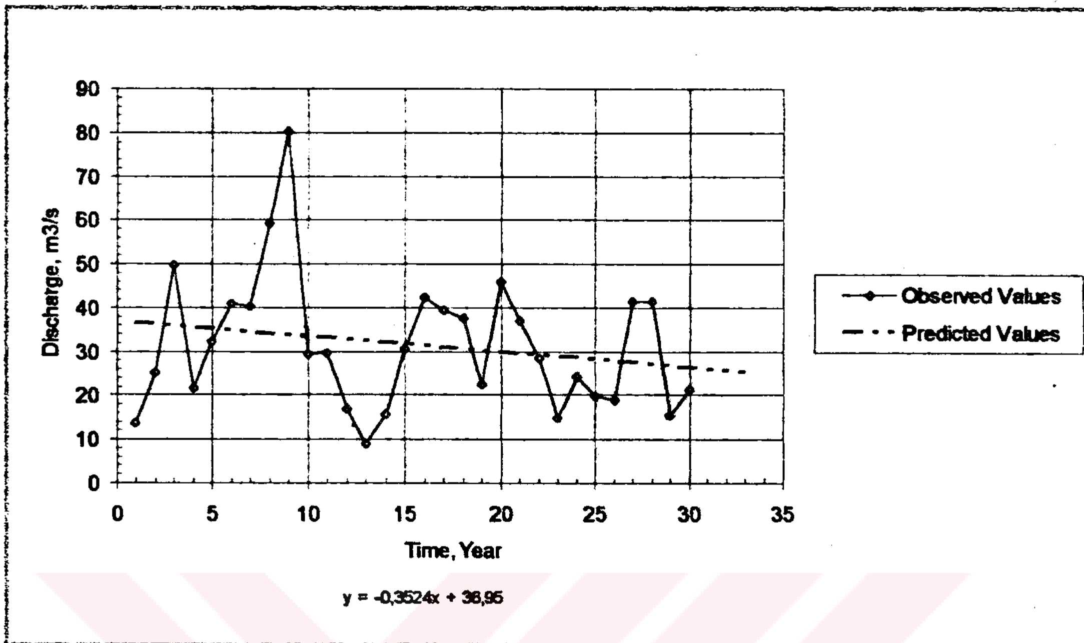

Figure 5.34 Annual flows of Ceyhan River Basin-Kürtleravşarı Station (1961-1990)

Table 5.3 Statistical Results of Ceyhan River Basin-Kürtleravşarı Station

Statistical Parameters	Actually Observed Values
Mean	31.5733
Standard Deviaton	15.3630
Standard Error	2.8049
95 % Cofidence Interval	5.7368
99% Confidence Interval	7.7319
Total	947.1988
Min.	8.9970
Max.	80.123
Skewness	1.069

5.1.2.4 Ceyhan Basin-Tanır Station

The observed and predicted values of this basin is given on the following figure :

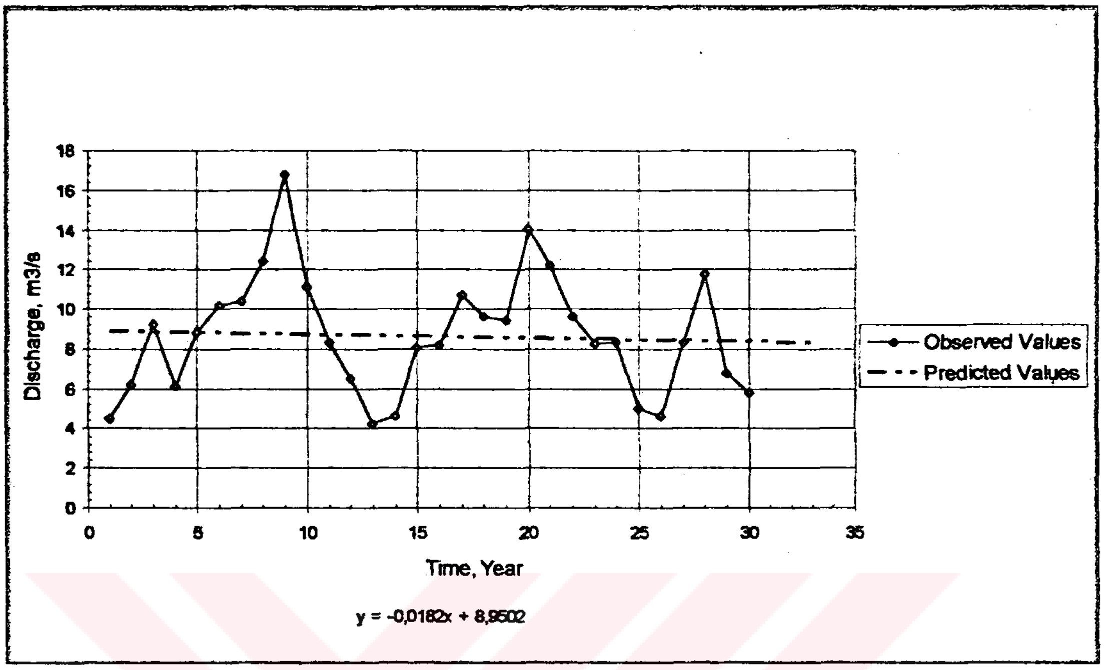

Figure 5.35 Annual flows of Ceyhan River Basin-Tanır Station (1961-1990)

Table 5.4 Statistical Results of Ceyhan River Basin-Tanır Station

Statistical Parameters	Actually Observed Values
Mean	8.6587
Standard Deviaton	2.9947
Standard Error	0.5468
95 % Cofidence Interval	1.1183
99% Confidence Interval	1.507
Total	259.76
Min.	4.224
Max.	16.740
Skewness	.5526

5.2. Seyhan Basin

5.2.1 Seyhan Basin- Himmetli Station

The observed and predicted values of this basin is given on the following figure :

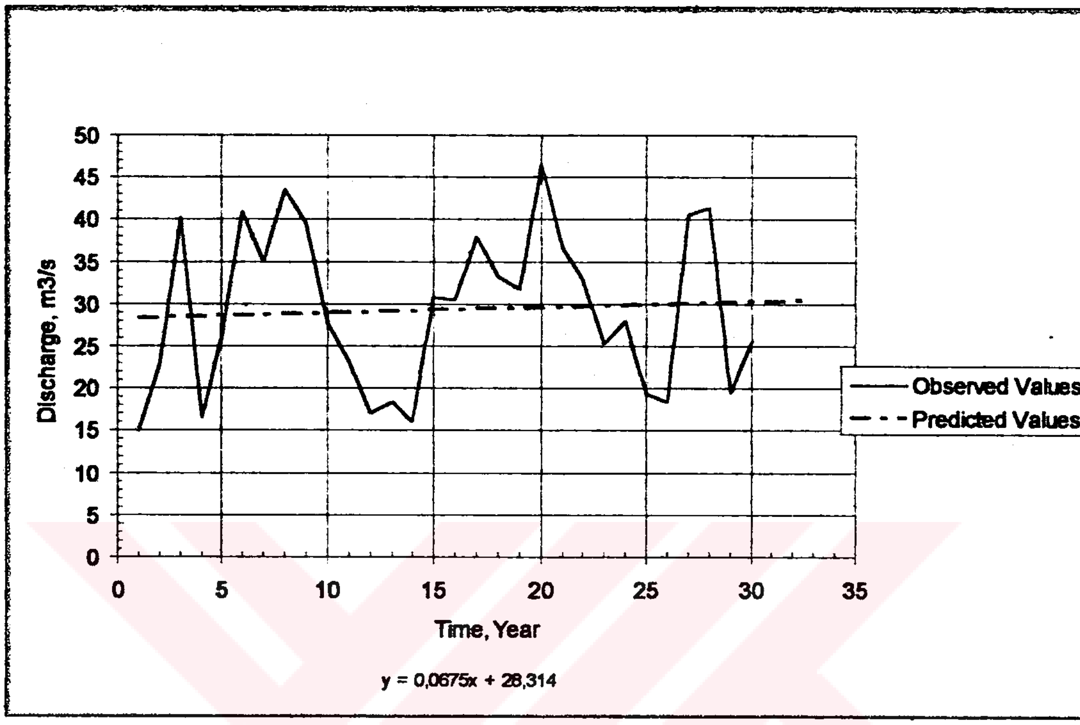

Figure 5.36 Annual flows of Seyhan River Basin-Himmetli Station (1961-1990)

Table 5.5 Statistical Results of Seyhan Basin-Himmetli Station

Statistical Parameters	Actually Observed Values
Mean	29.3508
Standard Deviaton	9.4598
Standard Error	1.7271
95 % Cofidence Interval	3.5324
99% Confidence Interval	4.7610
Total	880.533
Min.	14.492
Max.	96.579
Skewness	0.0672

5.2.2 Seyhan Basin-Gökdere Station

The observed and predicted values of this basin is given on the following figure :

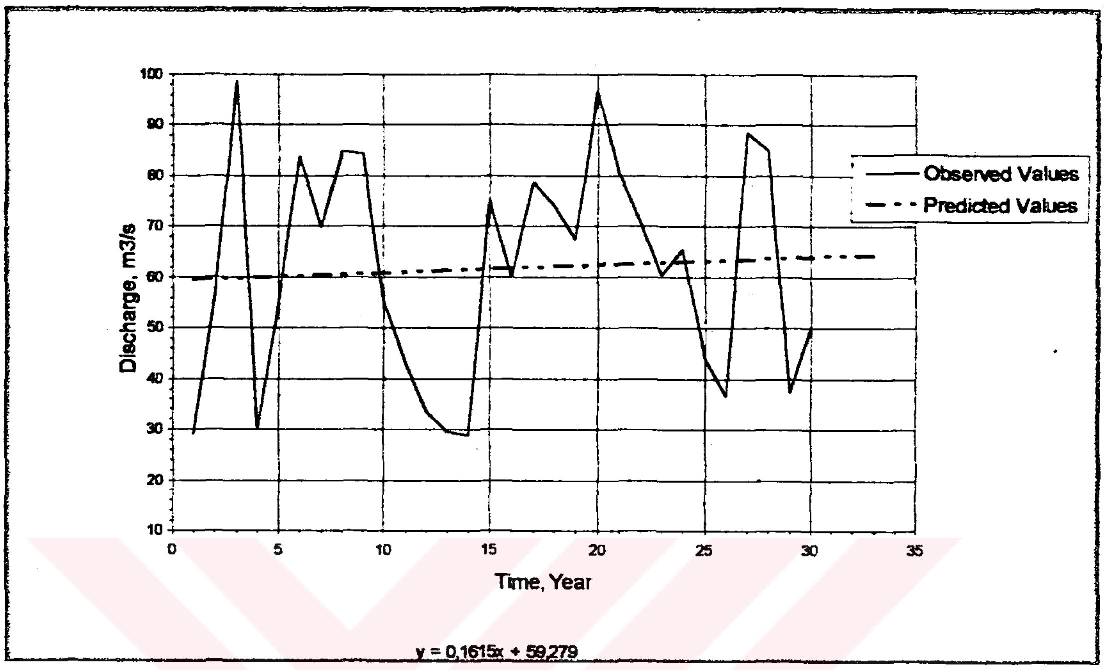

Figure 5.37 Annual flows of Seyhan River Basin-Gökdere Station (1961-1990)

Table 5.6 Statistical Results of Seyhan Basin-Gökdere Station

Statistical Parameters	Actually Observed Values
Mean	61.781
Standard Deviaton	21.7215
Standard Error	3.9618
95 % Cofidence Interval	8.1111
99% Confidence Interval	10.932
Total	1853.43
Min.	28.8696
Max.	98.714
Skewness	0.0991

6. SUMMARY AND CONCLUSION

1. The graphs on Figure 5.1 through 5.31 shows that, the Ceyhan River flows decreases by the time. The possible reasons for that are :

a- the development in irrigation systems, i.e., recently the farmers consume more water than before.

b- training and education of farmers in the basin area. As a result, more frequent crops, and the different types of plants(sometimes, with relatively high water consumption) are grown up in this area.

c- Ceyhan River is controlled by DSİ, primarily, by dams and conveyance structures.

d. DSİ has constructed some hydraulic structures on the river, such as weirs, flumes, and benches which change the natural distribution of stream flow in time, and of water in space.

2. Ceyhan River discharges is generally, in its peak during April, and shows minimum values in August. Figure 5.32.b shows the distribution of monthly discharge from 1961 to 1990.

3. Possible river discharge values for future years may be obtained from Figures 5.32, 5.33, 5.34, 5.35, 5.36, and 5.37.

4. The best fit curve for the available discharge vs. time data appears to be a simple linear regression. However all other possible degrees of polynomial (up to 6 th degree) were attempted, along with logarithmic, exponential, and power fittings as possible alternatives, (Figure 6.2 to 6.10). All curve fitting results, other than linear fitting, appear to give misleading trend. Linear fitting show a clear, but gentle, decrease in the discharge value by the progress of time. This conclusion coincide with paragraph (1) which is discussed previously.

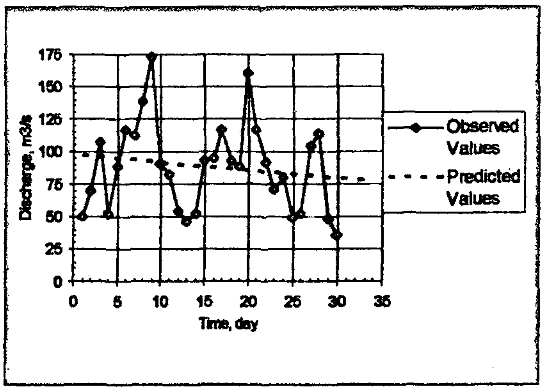

Figure 6.2 Linear fit curve

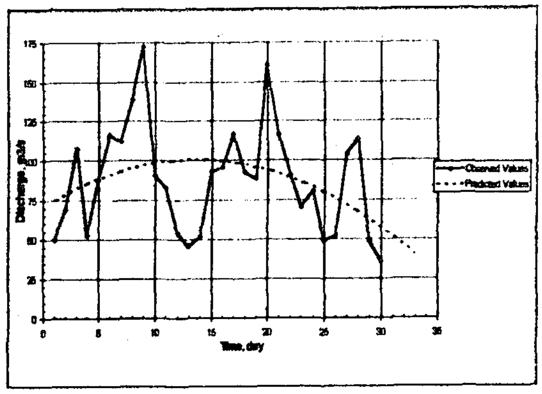

Figure 6.3 Polynomial best fit in 2 nd degree

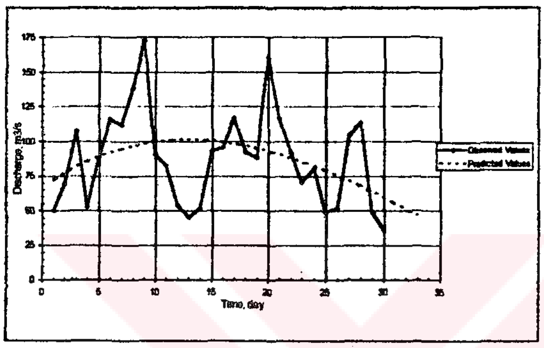

Figure 6.4 Polynomial best fit in 3 rd degree

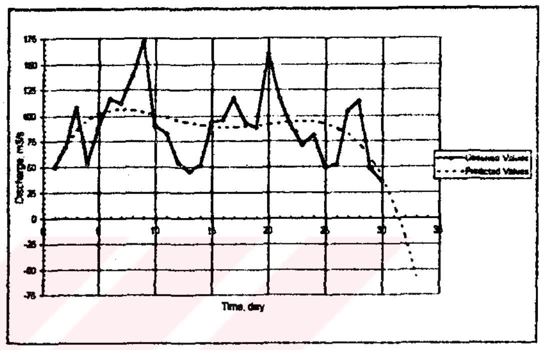

Figure 6.5 Polynomial best fit in 4 th degree

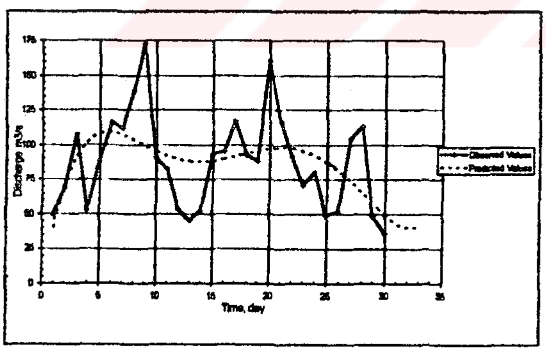

Figure 6.6 Polynomial best fit in 5th degree

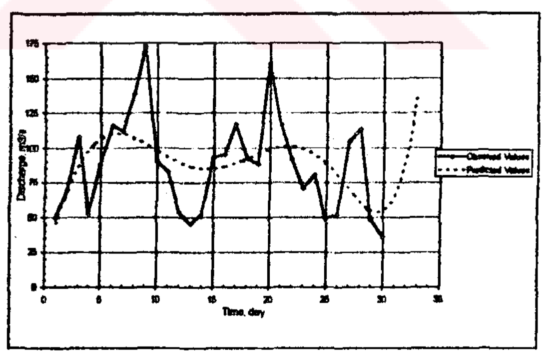

Figure 6.7 Polynomial best fit in 6th degree

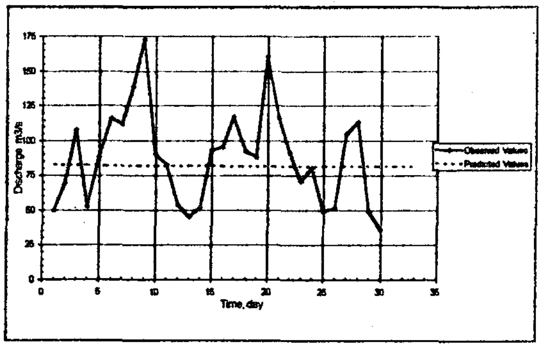

Figure 6.8 Power best fit curve

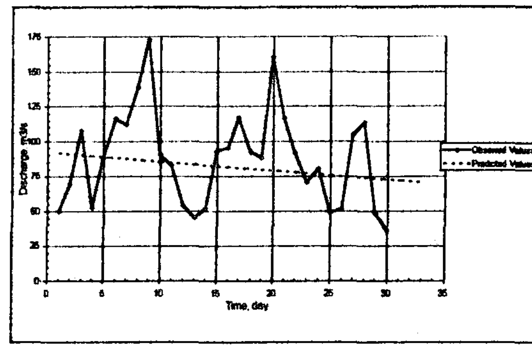

Figure 6.9 Exponential best fit curve

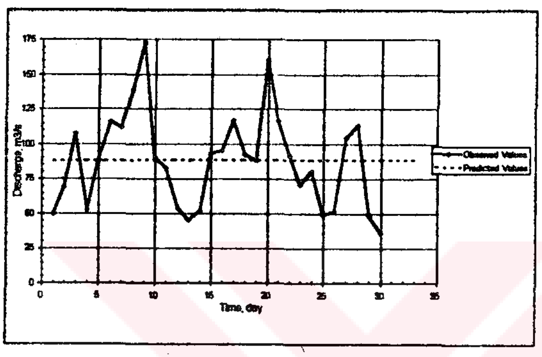

Figure 6.10 Logarithmic best fit curve

5. The best forecast period for the available discharge data for long range forecasting is 3 years. Through calculations, it was estimated that other selected periods give rather wrong results. Among the other selected periods that were experimented upon is 5 years period which is shown in Figures 6.11 to 6.19. This figure presentation may enable for a better comparison regarding both period and curve fitting selection as discussed in paragraph 5.

6. The maximum, minimum and average flow of Ceyhan River for 30 years, between 1961 to 1990, is given on the Figure 6.20. The maximum flow is 1338 m^3/s in 1971, and the minimum flow is 1 m^3/s in 1990.

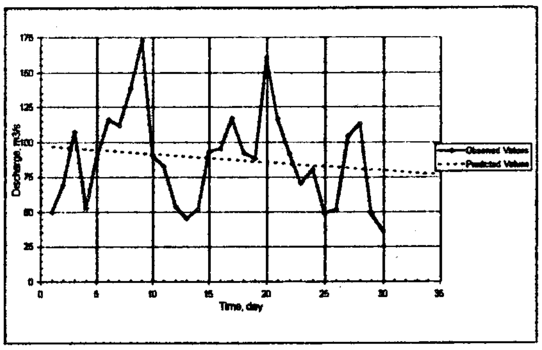

Figure 6.11 Linear fit curve

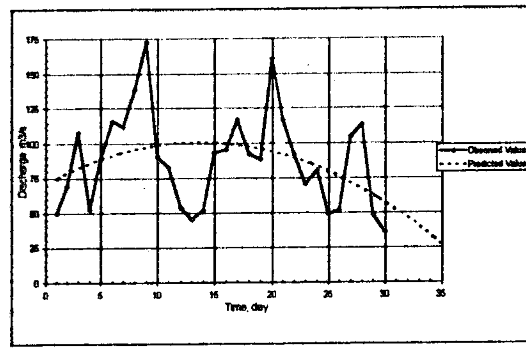

Figure 6.12 Polynomial in 2nd degree

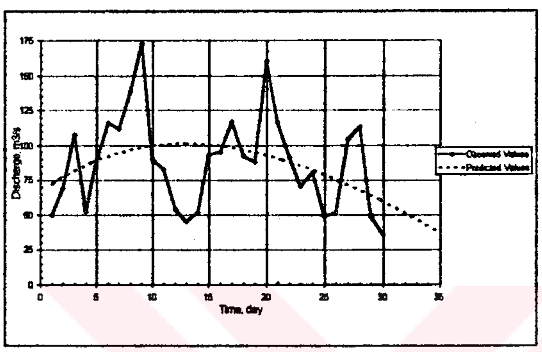

Figure 6.13 Polynomial in 3rd degree

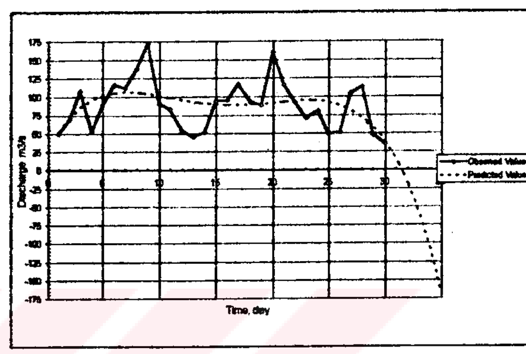

Figure 6.14 Polynomial in 4th degree

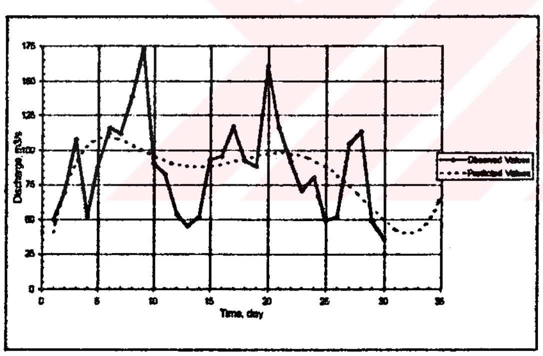

Figure 6.15 Polynomial best fit in 5th degree

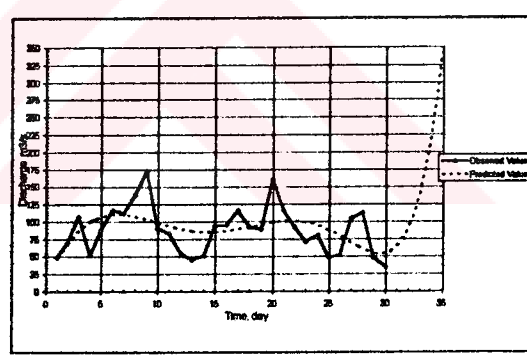

Figure 6.16 Polynomial best fit in 6th degree

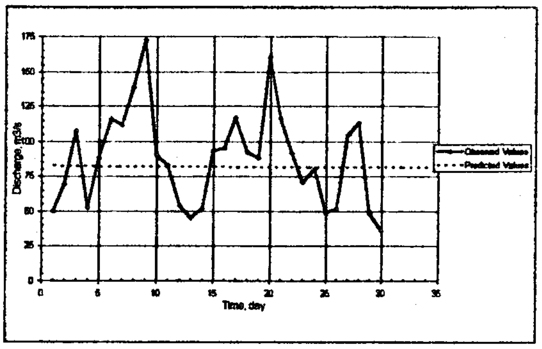

Figure 6.17 Power best fit curve

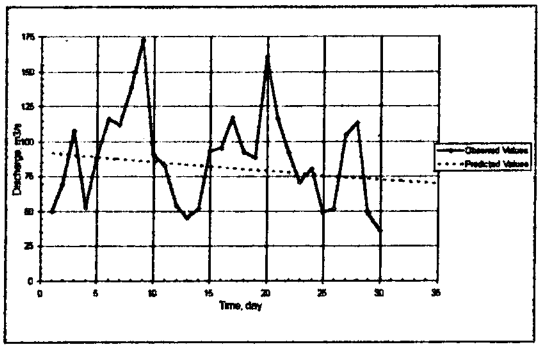

Figure 6.18 Exponential best fit curve

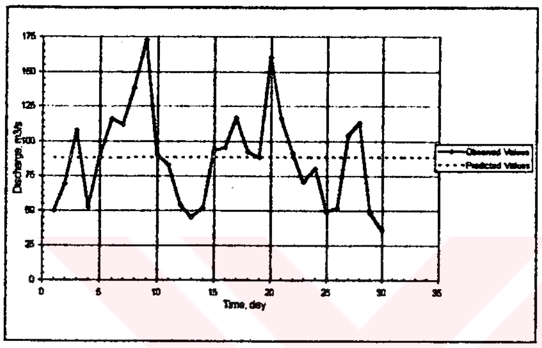

Figure 6.19 Logarithmic best fit curve

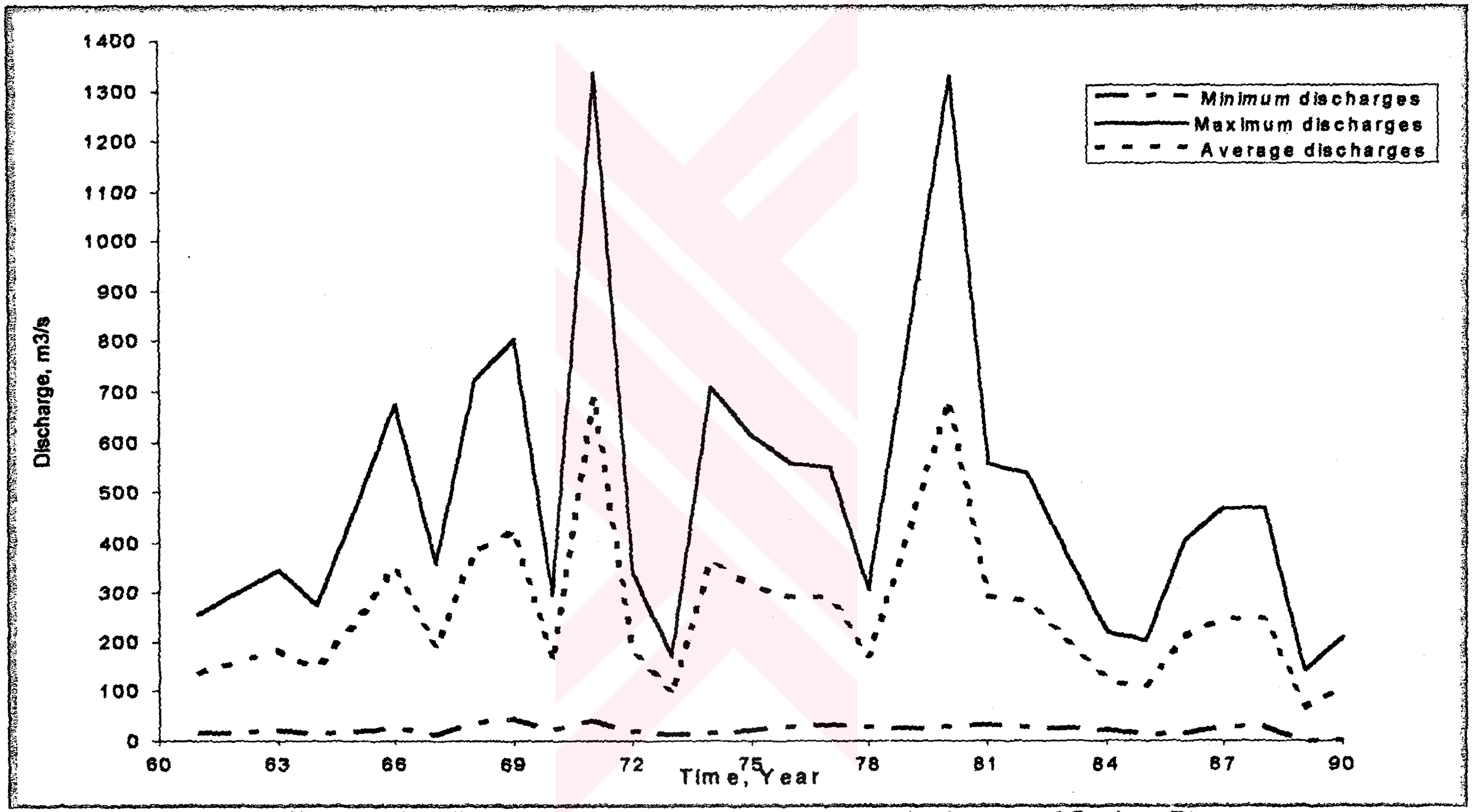

Figure 6.20 The maximum, minimum and average discharges of Ceyhan River

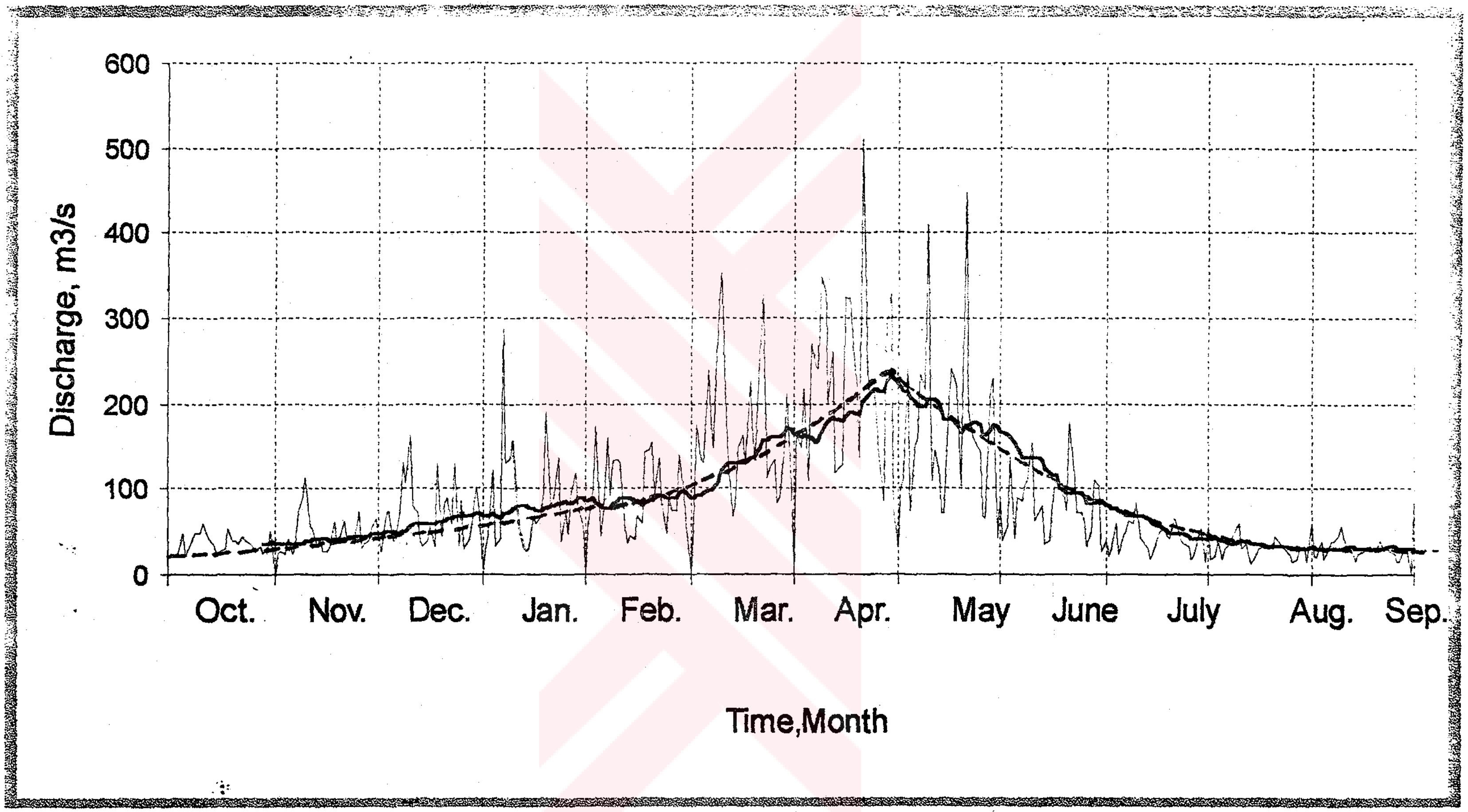

Figure 6.21. Thirty year month average of Ceyhan River flow

7. SUGGESTIONS FOR FUTURE WORK

There are not adequate research for Ceyhan River Basin. Following items should be carried out by researchers:

a- the feasibility of single-purpose and multi-purpose storage projects to reduce flood risk, to generate hydroelectric power, to store water for irrigation and, municipal and industrial purposes, to improve navigation channels, to improve water quality, to provide recreation opportunities, and to enhance fish and wildlife.

b- methods of improving the management of upstream land in order to reduce soil erosion and sediment deposition in streams, such as reforestation and control of grazing cropping.

c- management of groundwater resources to control the quality, quantity, distribution, utilization, and availability of water throughout the basin.

d- drainage systems to reclaim more lands for agriculture.

e. optimal use of runoff concentration points to increase water resources in the area.

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APPENDIX - A

DAILY AND ANNUAL DATA OF
CEYHAN RIVER

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1962
Max.and Min. Flows :Maximum Discharge :300 m^3/s
:Minimum Discharge :17.0 m^3/s

Table 4.2.2 1962 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	21.3	24.2	25.6	52.7	70.6	80.3	176.	110.	79.2	34.0	23.6	20.1
2	21.3	25.6	25.6	63.4	75.9	79.2	188.	107.	78.1	34.8	23.0	20.7
3	21.3	31.8	26.2	56.5	78.1	83.6	179.	104.	77.0	35.6	22.4	20.1
4	21.3	36.3	26.2	50.8	89.3	90.5	190.	117.	75.9	34.8	22.4	20.7
5	21.3	31.0	24.9	54.6	107.	96.8	200.	121.	75.9	34.0	21.8	20.1
6	21.3	29.0	25.6	52.7	96.8	96.8	121.	133.	73.8	34.0	21.3	20.1
7	21.3	26.2	26.9	51.8	101.	107.	130.	137.	69.5	34.0	21.3	20.7
8	21.3	25.6	45.3	48.0	105.	164.	174.	137.	70.6	34.0	21.3	20.7
9	21.3	26.2	48.9	49.9	114.	300.	181.	141.	67.4	33.3	20.7	21.3
10	21.3	26.2	50.8	49.9	94.3	251.	174.	131.	65.3	31.8	20.1	21.3
11	21.3	25.6	52.7	48.9	99.3	197.	159.	126.	62.4	30.3	20.1	20.7
12	21.3	25.6	57.5	48.9	90.5	212.	153.	135.	59.4	29.6	19.5	20.1
13	21.3	25.6	57.5	47.0	80.3	119.	147.	137.	57.5	29.0	18.9	20.1
14	21.3	25.6	96.8	45.3	80.3	113.	143.	135.	56.5	28.3	19.5	20.7
15	21.3	24.2	153.	45.3	124.	147.	155.	133.	56.5	28.3	19.5	22.4
16	21.3	23.6	188.	45.3	139.	161.	157.	130.	55.6	28.3	19.5	22.4
17	21.3	24.2	174.	43.6	192.	230.	151.	128.	50.8	28.3	19.5	21.3
18	21.3	24.2	145.	42.0	153.	210.	153.	126.	47.0	29.0	18.9	20.7
19	21.8	23.6	114.	42.0	133.	222.	149.	126.	46.2	28.3	18.3	21.8
20	21.3	25.6	98.0	42.0	113.	248.	143.	114.	46.2	27.6	17.9	22.4
21	20.7	30.3	95.5	41.1	93.0	183.	139.	104.	46.2	26.9	18.3	24.2
22	20.7	35.6	74.9	42.0	90.5	186.	135.	102.	44.5	26.2	19.5	23.6
23	21.3	34.0	67.4	40.3	93.0	190.	131.	101.	42.8	26.2	20.1	23.0
24	21.3	29.0	72.7	40.3	91.8	188.	128.	99.3	41.1	26.2	20.1	24.2
25	21.3	26.9	62.4	40.3	84.7	212.	124.	98.0	40.3	26.2	21.3	23..6
26	21.3	26.2	59.4	39.4	85.8	217	121.	83.6	39.4	26.2	21.3	23.0
27	21.3	23.6	55.6	39.4	84.7	220.	121.	84.7	39.4	26.2	21.3	23.6
28	22.4	23.6	52.7	42.0	79.2	225.	117.	81.4	37.8	26.2	21.8	23.6
29	31.0	26.9	57.5	51.8	--	210.	114.	81.4	36.3	25.6	21.3	23.6
30	24.2	25.6	49.9	58.5	--	197	113.	82.5	34.8	24.9	21.8	24.2
31	26.2	--	52.7	90.5	--	183.	--	81.4	--	23.6	21.3	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1963
Max.and Min. Flows :Maximum Discharge : 346 m^3/s
:Minimum Discharge: 21.8 m^3/s

Table 4.2.3 1963 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.
1	24.2	24.9	23.6	107.	124.	181.	179.	251.	205.	89.8	45.2	37.6
2	24.2	21.8	23.6	114.	116.	159.	192.	251.	215.	88.2	42.9	36.5
3	24.9	21.8	23.6	113.	110.	155.	186.	243.	190.	83.6	44.0	36.5
4	24.2	23.6	23.0	83.6	119.	159.	197.	232.	183.	85.1	47.5	36.5
5	24.9	26.2	23.0	94.3	108.	155.	205.	232.	176.	76.6	42.9	36.5
6	26.2	24.9	23.0	101.	102.	143.	222.	230.	172.	75.3	41.9	36.5
7	26.2	25.6	23.0	96.8	102.	128.	215.	238.	174.	82.0	49.9	34.4
8	27.6	24.9	23.6	90.5	98.0	120.	220.	238.	168.	67.2	45.2	33.3
9	26.2	24.9	24.2	80.3	94.3	108.	220.	238.	176.	67.2	44.0	33.3
10	25.6	25.6	24.9	70.6	91.8	119.	220.	272.	179.	67.2	44.0	34.4
11	25.6	24.9	24.9	79.2	93.0	124.	243.	245.	172.	68.5	47.5	34.4
12	25.6	24.9	26.9	86.9	102.	137.	232.	238.	151.	60.9	45.2	33.3
13	24.2	24.9	38.6	102.	104.	124.	230.	238.	137.	57.1	42.9	33.3
14	24.9	24.9	39.4	141.	105.	108.	222.	303.	128.	48.7	40.8	34.4
15	25.6	24.9	40.3	159.	107.	126.	212.	346.	129.	48.7	40.8	33.3
16	25.6	25.6	44.5	176.	227.	145.	207.	289.	122.	46.4	38.7	34.4
17	24.9	24.9	53.7	181.	243.	143.	230.	248.	117.	46.4	39.7	35.4
18	24.9	24.9	104.	161.	240.	133.	240.	238.	113.	46.4	38.7	35.4
19	23.6	24.2	113.	149.	245.	145.	230.	227.	115.	58.3	37.6	37.6
20	24.2	24.2	130.	143.	238.	133.	205.	259.	120.	60.9	37.6	39.7
21	24.9	24.2	200.	139.	186.	122.	190.	238.	113.	58.3	38.7	38.7
22	25.6	23.6	172.	121.	262.	122.	212.	230.	106.	55.8	39.7	40.8
23	25.6	23.0	205.	104.	300.	122.	217.	222.	106.	52.3	38.7	42.9
24	25.6	22.4	86.9	128.	314.	122.	235.	220.	101.	47.5	37.6	47.5
25	24.9	23.0	141.	143.	328.	129.	238.	227.	97.6	41.9	36.5	51.1
26	24.2	23.6	225.	188.	286.	137.	240.	207.	94.5	41.9	37.6	53.4
27	23.6	23.6	116.	145.	220.	135.	227.	217.	92.9	48.7	37.6	47.5
28	24.2	23.6	90.5	133.	190.	133.	232.	227.	91.4	54.6	36.5	48.7
29	24.9	23.6	73.8	135.	--	129.	235.	207.	91.4	52.3	36.5	45.2
30	24.9	23.6	73.8	133.	--	141.	235.	200.	88.2	51.1	35.4	42.9
31	24.9	--	86.9	124.	--	164.	--	200.	--	49.9	36.5	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1964
Max.and Min. Flows :Maximum Discharge:276 m^3/s
:Minimum Discharge :16.0 m^3/s

Table 4.2.4 1964 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45.2	42.9	45.2	37.6	33.3	66.0	171.	75.7	59.7	29.5	20.2	17.9
2	42.9	42.9	41.9	36.5	36.5	92.9	160.	71.8	56.3	29.5	20.2	19.1
3	45.2	46.4	40.8	35.4	35.4	101.	162.	71.8	57.4	34.2	20.2	19.1
4	45.2	46.4	40.8	38.7	36.5	82.0	160.	71.8	55.2	35.5	20.2	20.2
5	45.2	44.0	40.8	34.4	35.4	71.2	177.	68.0	54.1	33.5	20.2	19.7
6	44.0	45.2	39.7	35.4	37.6	66.0	173.	69.3	53.0	28.8	19.7	19.2
7	44.0	45.2	40.8	35.4	42.9	66.0	157.	68.0	51.1	25.1	19.7	18.5
8	44.0	45.2	41.9	34.4	39.7	67.2	148.	69.3	49.2	24.5	21.4	19.1
9	42.9	52.3	54.6	35.4	39.7	83.6	139.	140.	48.2	21.4	20.8	18.5
10	41.9	60.9	46.4	36.5	39.7	139.	125.	90.1	46.3	26.3	19.7	19.2
11	40.8	37.6	39.7	34.4	39.7	153.	119.	77.0	45.3	25.1	20.2	20.2
12	40.8	44.0	40.8	34.4	39.7	157.	113.	79.9	43.4	23.2	20.2	19.7
13	38.7	44.0	36.5	34.4	39.7	190.	108.	77.0	41.8	22.6	20.2	19.7
14	38.7	44.0	36.5	33.3	39.7	155.	107.	81.4	39.5	22.6	20.2	19.1
15	37.6	45.2	42.9	33.3	38.7	116.	101.	81.4	40.2	22.6	19.1	19.7
16	37.6	44.0	45.2	33.3	38.7	113.	97.7	75.7	38.7	21.4	19.1	19.7
17	38.7	41.9	41.6	33.3	39.7	105.	90.1	74.4	38.7	21.4	18.5	18.5
18	39.7	41.9	40.8	33.3	39.7	102.	79.9	73.1	44.4	22.0	17.9	16.7
19	37.6	41.9	39.7	33.3	39.7	97.7	73.1	71.8	46.3	22.6	17.9	21.4
20	38.7	41.9	39.7	33.3	39.7	102.	71.8	71.8	45.3	22.6	17.3	19.7
21	55.8	41.9	40.8	33.3	42.9	99.2	65.4	68.0	41.8	22.6	17.3	19.7
22	58.3	40.8	39.7	32.5	48.7	101.	66.7	73.1	37.9	22.6	17.3	20.2
23	62.2	39.7	38.7	33.3	52.3	93.1	75.7	69.3	36.3	20.2	19.7	19.7
24	62.2	39.7	38.7	34.4	67.2	104.	73.1	69.3	41.0	20.2	19.1	19.7
25	62.2	39.7	39.7	33.3	64.7	246.	74.4	69.3	37.9	21.4	17.9	21.4
26	60.9	38.7	38.7	33.3	59.6	273.	84.3	68.0	35.5	22.0	17.9	19.1
27	60.9	39.7	39.7	32.5	55.8	276.	82.8	62.0	36.3	22.0	16.7	20.2
28	58.3	39.7	39.7	32.5	60.9	215.	84.3	62.0	32.8	22.0	19.1	20.4
29	60.9	39.7	39.7	33.3	63.4	173.	79.9	58.6	30.1	20.8	19.7	20.4
30	47.5	40.8	39.7	33.3	--	164.	79.9	60.8	28.8	20.8	17.9	22.5
31	40.8	--	37.6	33.3	--	183.	--	58.6	--	20.8	19.1	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1965
Max.and Min. Flows :Maximum Discharge : 470 m^3/s
:Minimum Discharge : 18 m^3/s

Table 4.2.5 1965 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18.0	21.9	21.2	41.5	53.4	149.	364.	219.	113.	68.4	31.5	29.3
2	18.5	21.9	24.6	41.5	46.8	147.	640.	224.	113.	63.2	31.0	30.1
3	19.6	21.2	23.2	41.5	42.4	151.	367.	189.	110.	59.2	31.0	30.1
4	21.2	21.2	23.2	40.6	46.8	138.	326.	169.	108.	60.2	31.0	28.4
5	21.2	21.9	26.1	37.1	43.2	130.	287.	147.	121.	58.2	30.5	27.6
6	21.9	23.8	27.6	37.1	41.5	142.	271.	137.	123.	58.2	30.5	27.6
7	22.5	23.2	28.4	39.7	61.2	193.	242.	155.	119.	55.3	30.5	26.8
8	23.2	23.2	25.3	37.1	62.2	284.	226.	184.	108.	55.3	30.5	24.6
9	23.2	22.5	27.6	35.3	64.2	279.	198.	186.	100.	48.7	31.0	25.3
10	23.8	23.2	53.4	35.3	55.3	287.	189.	191.	90.9	47.8	31.8	29.3
11	20.6	23.2	73.9	34.4	61.2	381.	191.	173.	88.3	46.8	32.7	27.6
12	23.8	22.5	77.4	37.1	61.2	326.	255.	159.	83.4	45.0	33.6	27.6
13	23.8	22.5	71.7	36.2	67.4	220.	268.	157.	78.6	45.0	30.1	26.8
14	21.9	23.2	61.2	36.2	69.5	190.	234.	159.	81.0	45.0	30.1	28.4
15	22.5	22.5	59.2	37.1	71.7	170.	234.	157.	77.4	42.4	28.4	28.4
16	23.2	22.5	53.4	36.2	70.6	180.	252.	155.	78.6	43.2	32.7	27.6
17	23.2	23.2	52.9	36.2	66.3	165.	290.	142.	78.6	41.5	31.8	28.4
18	20.6	24.6	48.7	36.2	75.0	153.	335.	130.	78.6	41.5	29.3	24.6
19	21.9	24.6	47.8	36.2	83.4	153.	320.	123.	97.4	41.5	30.1	26.1
20	23.2	26.8	39.7	36.2	82.2	165.	279.	130.	93.5	39.7	28.4	33.6
21	22.5	40.6	40.6	37.1	81.0	163.	245.	128.	92.2	38.8	27.6	38.8
22	23.2	43.2	41.5	38.8	96.1	191.	245.	119.	87.0	38.0	26.1	37.1
23	22.5	46.8	43.2	48.7	85.8	239.	237.	142.	76.2	37.0	26.8	35.3
24	19.0	31.0	42.4	60.2	77.4	224.	232.	140.	85.8	36.0	29.3	31.8
25	19.0	22.5	48.7	60.2	81.0	219.	258.	147.	81.0	35.0	28.4	31.8
26	20.1	23.2	45.9	56.3	81.0	232.	276.	137.	75.0	35.0	29.3	32.7
27	20.6	22.5	45.9	54.3	83.4	375.	282.	130.	66.3	34.0	27.6	37.1
28	23.2	22.5	43.2	60.2	94.8	396.	284.	125.	66.3	33.5	25.3	36.2
29	21.9	21.9	41.5	59.2	--	419.	290.	123.	66.3	33.0	25.3	37.1
30	21.9	21.2	39.7	58.2	--	464.	273.	121.	68.4	32.5	27.6	37.1
31	22.5	--	38.0	56.3	--	470.	--	118.	--	32.0	29.3	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1966
Max.and Min. Flows :Maximum Discharge : 675 m^3/s
:Minimum Discharge : 30.1 m^3/s

Table 4.2.6 1966 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37.1	35.3	38.8	89.6	193.	161.	155.	247.	111.	75.0	41.5	36.2
2	36.2	34.4	38.0	118.	219.	157.	163.	245.	108.	69.5	40.6	36.2
3	35.3	33.6	39.7	135.	193.	155.	155.	242.	110.	62.2	40.6	36.2
4	34.4	35.3	45.9	175.	178.	153.	144.	226.	110.	64.2	39.7	36.2
5	37.1	31.8	48.7	446.	167.	157.	135.	191.	111.	65.3	39.7	36.2
6	35.3	34.4	50.5	524.	157.	159.	149.	175.	108.	62.2	40.6	37.1
7	33.6	39.7	50.5	667.	149.	165.	282.	167.	100.	59.2	39.7	36.2
8	33.6	38.0	57.2	675.	140.	161.	276.	167.	94.8	58.2	38.8	36.2
9	33.6	35.3	50.5	407.	142.	167.	252.	167.	94.8	57.2	39.7	35.3
10	37.1	34.4	47.8	303.	137.	178.	245.	167.	92.2	55.3	38.8	36.2
11	34.4	33.6	46.8	226.	135.	178.	232.	165.	92.2	53.4	38.8	37.1
12	32.7	32.7	48.7	180.	138.	234.	232.	163.	90.9	52.4	38.8	38.0
13	34.4	31.8	58.2	171.	137.	242.	242.	163.	89.6	51.5	38.8	38.0
14	36.2	30.1	88.3	159.	153.	234.	245.	165.	89.6	48.7	38.8	38.8
15	37.1	30.1	84.6	155.	163.	205.	247.	159.	84.6	45.0	40.6	38.8
16	38.0	32.7	140.	153.	191.	184.	282.	147.	82.2	45.0	38.0	40.6
17	36.2	36.2	119.	142.	191.	184.	292.	149.	81.0	45.9	38.0	39.7
18	36.2	45.9	96.1	138.	178.	224.	301.	137.	79.8	46.8	37.1	38.8
19	36.2	41.5	98.7	133.	178.	221.	340.	135.	82.2	45.9	37.1	39.7
20	36.2	41.5	69.5	123.	155.	193.	303.	142.	83.4	45.0	35.3	39.7
21	36.2	37.1	68.4	118.	149.	175.	282.	138.	79.8	45.9	37.1	38.0
22	37.1	38.0	61.2	131.	147.	169.	273.	135.	82.2	44.1	37.1	40.6
23	38.0	39.7	68.4	226.	144.	159.	265.	133.	77.4	44.1	35.3	43.2
24	34.4	38.8	63.2	346.	147.	153.	268.	130.	75.0	41.5	35.3	46.8
25	32.7	38.0	63.2	585.	147.	149.	271.	125.	75.0	40.6	35.3	47.8
26	36.2	40.6	72.8	592.	142.	151.	268.	123.	69.5	43.2	34.4	59.2
27	38.8	56.3	200.	413.	165.	165.	268.	121.	71.7	44.1	34.4	47.8
28	38.0	52.4	163.	320.	167.	189.	260.	119.	67.4	44.1	34.4	47.8
29	35.3	43.2	114.	387.	--	178.	226.	118.	68.4	44.1	34.4	47.8
30	35.3	42.4	90.9	378.	--	163.	242.	114.	77.4	42.4	35.3	45.9
31	38.0	--	93.5	340.	--	155.	--	114.	--	41.5	34.4	--

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1967
Max.and Min. Flows :Maximum Discharge :344 m^3/s
:Minimum Discharge :35.5 m^3/s

Table 4.2.7 1967 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45.9	42.2	77.2	107.	88.3	88.3	162.	211.	137.	84.5	47.5	38.1
2	45.9	40.9	96.5	103.	84.5	92.0	185.	228.	133.	77.5	46.5	37.2
3	48.8	34.4	84.5	99.5	85.8	98.0	219.	359.	133.	74.8	46.5	35.5
4	45.1	40.3	73.7	95.0	87.8	121.	271.	357.	130.	72.5	46.5	41.9
5	44.4	41.6	66.8	95.0	85.8	132.	262.	313.	123.	77.2	46.5	43.7
6	45.9	42.9	64.9	98.0	85.8	126.	228.	276.	118.	77.2	45.6	40.9
7	45.9	42.9	64.9	96.5	87.8	118.	223.	271.	117.	77.2	44.6	39.1
8	45.1	42.9	64.9	96.5	85.8	117.	217.	271.	115.	74.8	44.6	38.1
9	46.6	43.7	88.3	98.0	84.5	110.	211.	267.	115.	70.1	45.6	38.1
10	45.9	79.5	92.0	101.	87.8	106.	219.	269.	113.	67.8	43.7	37.2
11	45.9	128.	118.	149.	93.5	107.	236.	258.	112.	65.6	42.8	37.2
12	44.4	143.	121.	203.	104.	112.	256.	247.	107.	63.4	42.8	37.2
13	42.9	157.	107.	181.	110.	121.	265.	247.	106.	61.1	42.8	38.1
14	42.2	128.	104.	166.	106.	132.	262.	249.	104.	58.9	42.8	39.1
15	42.9	87.8	137.	197.	101.	143.	265.	258.	103.	58.9	41.9	37.2
16	70.1	95.0	276.	240.	96.5	211.	273.	258.	98.0	54.7	40.9	39.1
17	42.2	96.5	344.	236.	92.0	232.	273.	254.	95.0	54.7	42.8	39.1
18	41.6	84.5	236.	199.	90.8	193.	278.	245.	93.5	54.7	42.8	40.0
19	40.9	71.3	173.	170.	89.5	170.	276.	232.	89.5	53.6	43.7	42.8
20	37.8	69.0	164.	250.	88.3	164.	276.	219.	87.8	57.8	42.8	44.6
21	39.6	70.1	154.	137.	89.5	164.	269.	207.	87.8	66.7	41.9	43.7
22	39.0	70.1	142.	128.	89.5	191.	258.	203.	88.3	66.7	40.0	44.6
23	39.0	69.0	130.	123.	98.0	189.	243.	201.	90.8	61.1	39.1	43.7
24	39.6	61.9	133.	117.	95.0	185.	232.	199.	89.5	56.7	39.1	42.8
25	45.9	60.9	140.	113.	92.0	185.	228.	193.	88.3	54.7	38.1	42.8
26	42.2	60.0	140.	109.	89.5	203.	228.	183.	85.8	53.6	39.1	40.9
27	40.9	58.0	145.	109.	88.3	191.	223.	175.	92.0	51.6	39.1	40.9
28	41.6	57.2	147.	107.	88.3	175.	223.	164.	89.5	49.6	38.1	40.9
29	42.2	56.3	138.	103.	--	168.	223.	157.	87.8	49.6	37.2	40.0
30	42.2	56.3	125.	96.5	--	159.	219.	147.	83.3	48.5	37.2	40.9
31	40.3	--	115.	92.0	--	154.	--	142.	--	48.5	37.2	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - september 30,1968
Max.and Min. Flows :Maximum Discharge :726 m^3/s
:Minimum Discharge :39.1 m^3/s

Table 4.2.8 1968 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	40.0	123.	65.6	96.5	88.3	385.	271.	262.	168.	70.1	49.5	45.9
2	40.9	147.	65.6	92.0	89.5	416.	289.	260.	157.	69.0	49.5	45.9
3	40.0	159.	60.0	98.0	89.5	328.	294.	258.	150.	67.8	48.8	45.9
4	39.1	138.	62.3	109.	88.3	285.	298.	256.	152.	67.8	48.8	45.1
5	39.1	101.	61.1	175.	88.3	267.	301.	256.	161.	66.8	48.0	45.9
6	40.0	110.	62.3	298.	88.3	292.	323.	243.	157.	65.8	51.2	47.3
7	40.0	103.	63.4	203.	88.3	294.	341.	234.	149.	63.9	50.4	45.9
8	40.0	92.0	66.7	170.	88.3	267.	333.	249.	138.	62.9	52.1	45.9
9	41.9	83.3	67.8	203.	88.3	271.	370.	247.	126.	61.9	52.1	45.1
10	48.5	79.5	67.8	267.	88.3	273.	390.	243.	123.	61.9	50.4	45.1
11	49.6	73.7	67.8	189.	88.3	276.	409.	243.	120.	62.9	50.4	45.9
12	48.5	64.5	66.7	166.	89.5	422.	406.	249.	113.	60.9	48.8	48.0
13	46.5	58.9	65.6	207.	90.8	726.	401.	240.	109.	60.0	48.0	50.4
14	46.5	60.0	66.7	166.	92.0	645.	406.	230.	106.	58.0	48.0	50.4
15	43.7	63.4	69.0	155.	93.5	452.	422.	230.	101.	57.2	48.0	48.0
16	44.6	61.1	85.8	140.	99.5	354.	406.	230.	96.5	56.3	47.3	46.6
17	44.6	60.0	199.	132.	107.	316.	416.	223.	98.0	56.3	47.3	45.9
18	44.6	58.9	157.	123.	117.	296.	398.	211.	98.0	55.5	45.9	45.9
19	44.6	57.8	123.	118.	271.	289.	364.	215.	98.0	55.5	45.9	45.1
20	51.6	58.9	109.	110.	344.	282.	370.	207.	98.0	53.8	45.9	45.1
21	43.7	175.	121.	107.	251.	273.	411.	195.	95.0	53.8	45.9	45.1
22	41.9	149.	419.	103.	195.	249.	414.	183.	90.8	52.9	45.9	45.1
23	40.9	110.	197.	96.5	168.	243.	383.	181.	88.3	52.9	45.9	45.9
24	40.0	89.5	143.	98.0	157.	245.	338.	179.	85.8	52.9	45.9	48.0
25	41.9	83.3	126.	96.5	150.	240.	311.	175.	83.3	53.8	45.1	47.3
26	58.9	69.0	117.	92.0	149.	234.	289.	173.	79.5	52.1	44.4	48.8
27	98.0	69.0	110.	93.5	152.	236.	278.	189.	78.3	50.4	44.4	49.5
28	72.5	63.4	104.	96.5	187.	240.	271.	175.	76.0	49.5	44.4	49.5
29	67.8	64.5	98.0	95.0	240.	251.	267.	189.	73.7	49.5	45.1	49.5
30	58.9	65.6	101.	87.8	--	249.	262.	179.	71.3	49.5	47.3	49.5
31	54.7	--	99.5	90.8	--	258.	--	181.	--	49.5	46.6	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1969
Max.and Mın. Flows :Maximum Discharge :803 m^3/s
:Minimum Discharge :45.5 m^3/s

Table 4.2.9 1969 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	49.5	49.5	209.	171.	124.	295.	500.	422.	215.	109.	67.6	54.3
2	48.7	48.7	179.	156.	121.	243.	454.	388.	190.	108.	65.7	54.3
3	49.5	48.7	156.	146.	115.	221.	365.	409.	209.	106.	65.7	54.3
4	49.5	47.9	140.	136.	111.	226.	331.	409.	205.	103.	68.5	54.3
5	48.7	47.9	128.	136.	109.	230.	316.	380.	200.	99.5	70.8	54.3
6	49.5	47.9	122.	134.	109.	249.	307.	383.	192.	96.2	67.6	54.3
7	49.5	47.9	113.	126.	113.	286.	291.	380.	186.	93.1	65.7	53.3
8	52.4	51.4	108.	119.	130.	340.	279.	360.	179.	90.2	64.7	53.3
9	49.5	54.3	101.	117.	128.	358.	277.	343.	169.	88.7	63.8	57.1
10	49.5	52.4	113.	111.	124.	373.	270.	348.	158.	85.8	61.9	59.0
11	48.7	48.7	150.	111.	121.	333.	265.	358.	152.	82.9	60.9	57.1
12	48.7	47.9	150.	140.	124.	277.	272.	417.	152.	81.5	60.9	56.2
13	48.7	47.9	130.	175.	138.	252.	254.	803.	150.	78.9	60.0	56.2
14	49.5	61.9	128.	171.	122.	243.	232.	786.	148.	77.7	60.0	56.2
15	48.7	67.6	124.	142.	117.	236.	234.	587.	144.	77.7	59.0	55.2
16	47.9	62.8	121.	130.	115.	228.	258.	463.	140.	77.7	60.0	57.1
17	46.3	57.1	128.	126.	113.	215.	302.	419.	140.	77.7	59.0	58.1
18	46.3	54.3	121.	126.	132.	545.	288.	560.	136.	76.6	59.0	59.0
19	46.3	53.3	111.	156.	134.	664.	274.	548.	136.	76.6	58.1	59.0
20	45.5	52.4	106.	175.	122.	539.	274.	489.	152.	76.6	58.1	62.8
21	46.3	51.4	103.	256.	117.	447.	277.	438.	152.	75.4	58.1	60.9
22	46.3	49.5	97.8	378.	113.	474.	274.	401.	146.	74.3	57.1	60.0
23	46.3	53.3	97.8	245.	109.	443.	279.	368.	142.	73.1	57.1	60.0
24	52.4	209.	169.	194.	117.	391.	297.	348.	134.	72.0	57.1	59.0
25	50.5	284.	228.	167.	111.	353.	401.	338.	134.	72.0	56.2	59.0
26	49.5	460.	451.	161.	109.	336.	515.	316.	126.	70.8	56.2	59.0
27	47.9	401.	350.	150.	314.	355.	489.	288.	121.	70.8	56.2	58.1
28	47.1	360.	274.	142.	378.	424.	441.	268.	115.	69.7	55.2	57.1
29	46.3	274.	256.	136.	--	427.	471.	254.	113.	68.5	55.2	57.1
30	48.7	245.	217.	128.	--	446.	454.	245.	111.	67.6	55.2	58.1
31	50.5	--	190.	126.	--	495.	--	234.	--	69.7	54.3	--

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940 - September 30,1970
Max.and Min. Flows :Maximum Discharge :297 m^3/s
:Minimum Discharge :26.1 m^3/s

Table 4.2.10 1970 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	58.1	58.1	64.7	74.3	68.5	256	234	148	76.6	46.3	36.4	30.7
2	58.1	59.0	59.0	72.0	73.1	297	234	146	76.6	44.7	33.5	31.4
3	58.1	59.0	57.1	69.7	76.6	247	230	146	78.9	44.7	34.2	32.8
4	58.1	57.1	57.1	69.7	146	219	234	142	76.6	44.7	33.5	32.8
5	58.1	58.1	58.1	68.5	150	196	245	152	75.4	43.9	34.2	32.8
6	58.1	57.1	56.2	68.5	117	186	263	144	73.1	42.3	34.2	32.8
7	60.0	57.1	55.2	67.6	104	177	258	134	72.0	42.3	34.9	32.8
8	60.0	57.1	55.2	67.6	99.5	169	236	128	69.7	41.5	33.5	32.8
9	59.0	57.1	54.3	68.5	128	167	213	121	68.5	40.8	30.0	33.5
10	58.1	57.1	54.3	68.5	138	173	207	115	67.6	40.0	32.1	33.5
11	58.1	56.2	54.3	70.8	128	184	209	111	65.7	39.3	32.1	32.8
12	58.1	56.2	54.3	69.7	154	184	217	108	64.7	41.5	32.1	32.8
13	57.1	55.2	60.0	68.5	184	177	232	109	62.8	44.7	30.0	28.0
14	57.1	55.2	58.1	68.5	163	171	249	115	61.9	44.7	30.7	33.5
15	57.1	55.2	55.2	70.8	138	167	243	122	60.9	42.3	30.7	33.5
16	59.0	55.2	55.2	70.8	126	175	228	119	60.0	40.8	25.5	34.9
17	59.0	54.3	68.5	69.7	119	192	213	109	59.0	40.0	29.3	36.6
18	58.1	54.3	215	68.5	150	238	200	103	58.1	38.5	28.7	34.9
19	57.1	54.3	132	77.7	140	279	188	101	57.1	36.4	28.0	34.9
20	57.1	53.3	88.7	117	126	252	173	99.5	55.2	37.1	28.0	34.9
21	58.1	54.3	88.7	104	119	226	163	96.2	52.4	36.4	28.7	35.6
22	60.0	54.3	101	93.1	121	219	152	94.5	52.4	35.6	29.3	34.9
23	60.9	53.3	132	94.5	121	209	148	96.2	54.3	34.2	26.1	37.8
24	64.7	53.3	119	93.1	119	186	148	93.1	55.2	34.9	29.3	40.0
25	63.8	52.4	97.8	85.8	154	175	148	90.2	54.3	36.4	29.3	37.8
26	60.0	53.3	119	80.0	184	175	148	88.7	52.4	46.3	30.0	38.5
27	60.0	52.4	126	76.6	179	179	150	85.5	50.5	56.2	30.0	36.4
28	60.0	53.3	97.8	73.1	167	186	150	82.9	48.7	47.1	30.0	39.3
29	59.0	61.9	84.4	70.8		192	148	81.5	47.9	41.5	30.7	40.8
30	58.1	67.6	80.0	70.8		205	150	80.0	47.1	39.3	29.3	40.0
31	58.1		78.9	70.8		221		78.9		37.1	30.7	

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30, 1971
Max.and Min. Flows :Maximum Discharge :1338 m^3/s
:Minimum Discharge :42.4 m^3/s

Table 4.2.11 1971 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	76.0	92.8	185	119	110	274	750	502	188	90.4	47.2	54.4
2	76.0	95.2	185	119	105	335	719	508	202	88.0	44.8	59.2
3	71.2	90.4	164	119	107	321	598	496	207	83.2	42.4	59.2
4	71.2	90.4	161	119	107	288	632	505	223	76.0	42.4	56.8
5	71.2	92.8	212	119	110	269	914	483	237	78.4	61.6	56.8
6	71.2	90.4	415	119	117	261	793	474	220	73.6	71.2	54.4
7	78.4	95.2	592	117	129	237	660	459	196	73.6	85.6	54.4
8	83.2	97.6	403	117	129	223	586	455	185	71.2	71.2	59.2
9	83.2	95.2	264	117	129	215	545	459	204	66.4	66.4	71.2
10	80.8	119	220	114	122	210	508	424	218	71.2	85.6	66.4
11	80.8	122	196	117	122	280	477	421	226	68.8	88.0	59.2
12	78.4	119	185	124	122	527	474	370	193	68.8	95.2	59.2
13	80.8	141	177	139	117	502	660	335	180	64.0	83.2	61.6
14	107	102	169	134	119	517	1044	313	169	59.2	78.4	61.6
15	129	100	161	131	117	502	1120	296	159	64.0	76.0	61.6
16	112	105	156	126	117	316	1223	285	159	59.2	68.8	59.2
17	97.6	105	151	122	114	341	1293	277	151	54.4	61.6	59.2
18	92.8	105	154	117	112	388	1338	272	146	54.4	59.2	59.2
19	90.4	105	144	114	114	483	1310	280	141	52.0	56.8	61.6
20	83.2	105	134	110	122	598	1181	272	136	56.8	59.2	64.0
21	88.0	90.4	126	105	126	527	1021	258	129	64.0	52.0	61.6
22	92.8	88.0	126	107	141	452	914	247	126	56.8	54.4	64.0
23	90.4	88.0	129	110	193	382	930	250	124	61.6	56.8	66.4
24	90.4	107	129	112	220	355	1092	247	122	68.8	64.0	66.4
25	92.8	166	131	112	202	341	951	226	119	56.8	59.2	64.0
26	92.8	215	131	112	185	361	660	234	114	52.0	56.8	68.8
27	146	299	129	112	191	468	598	237	110	54.4	56.8	68.8
28	146	274	129	112	234	511	579	220	105	61.6	54.4	68.8
29	129	250	129	110	---	446	561	210	100	56.8	52.0	68.8
30	107	202	122	110	---	382	542	204	95.	52.0	52.0	71.2
31	102	---	122	110	---	452	---	193		49.6	52.0	---

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km^2
Observation Duration : March 11,1940 - September 30,1972
Max.and Min. Flows :Maximum Discharge :340 m^3/s
:Minimum Discharge :19.5 m^3/s

Table 4.2.12 1972 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	32.9	32.4	37.9	34.3	28.1	40.8	70.6	340	93.3	53.1	24.9	21.7
2	33.6	32.4	40.8	33.3	28.9	40.8	74.4	290	86.2	48.8	24.1	24.1
3	33.6	32.4	38.8	32.4	31.5	41.8	78.3	234	77.0	45.8	24.1	20.2
4	33.6	33.3	37.9	32.4	31.5	42.8	74.4	197	69.3	44.8	23.3	20.2
5	33.6	33.3	34.3	34.3	32.4	41.8	70.6	179	66.9	41.8	24.1	19.5
6	38.9	32.4	37.0	34.3	30.6	46.8	69.3	164	64.4	40.8	23.3	20.2
7	155	28.9	37.9	32.4	29.7	52.0	71.8	137	84.8	38.8	22.5	20.2
8	49.9	32.4	37.0	31.5	29.7	54.2	73.1	119	66.9	37.9	22.5	19.5
9	34.3	32.4	37.0	31.5	30.6	57.4	80.9	127	161	37.0	21.7	19.5
10	37.0	31.5	36.1	32.4	30.6	59.5	110	130	130	36.1	21.7	19.5
11	37.9	32.4	36.1	31.5	30.6	62.0	139	121	110	33.3	21.7	19.5
12	37.0	32.4	50.9	30.6	30.6	65.7	134	118	96.2	32.4	21.7	20.2
13	37.9	33.3	50.9	30.6	33.3	73.1	119	114	97.6	30.6	21.7	30.6
14	36.1	32.4	45.8	32.4	34.3	66.9	118	110	94.7	29.7	21.7	32.4
15	36.1	32.4	40.8	29.7	35.2	101	132	102	83.5	28.9	24.1	28.1
16	36.1	32.4	37.9	28.1	39.8	134	163	99.0	80.9	25.7	24.1	27.3
17	34.3	33.3	38.8	28.9	45.8	113	163	96.2	79.6	27.3	27.3	24.9
18	34.3	33.3	37.9	28.9	43.8	104	137	91.9	79.6	27.3	26.5	24.1
19	34.3	33.3	37.0	26.5	44.8	83.5	121	87.6	73.1	26.5	24.9	23.3
20	34.3	33.3	36.1	26.5	40.8	77.0	118	83.5	71.8	26.5	24.1	24.1
21	32.4	32.4	36.1	28.9	37.9	68.1	139	80.9	77.0	24.9	24.9	23.3
22	33.4	45.8	36.1	31.5	37.9	64.4	143	75.7	75.7	25.7	23.3	23.3
23	33.4	47.8	36.1	32.4	38.8	62.0	127	71.8	75.7	25.7	22.5	23.3
24	35.2	40.8	36.1	30.6	37.9	65.7	123	68.1	86.2	24.1	20.2	24.1
25	35.2	39.8	36.1	29.7	37.0	70.6	123	75.7	75.7	24.9	20.2	24.9
26	33.3	38.8	36.1	29.7	36.1	69.3	118	101	62.0	24.9	20.2	24.9
27	33.3	37.9	35.2	31.5	38.8	66.9	114	83.5	55.2	23.3	19.5	25.7
28	34.3	37.9	35.2	31.5	39.8	64.4	110	73.1	44.8	24.1	19.5	24.9
29	34.3	37.9	35.2	31.5	---	63.2	191	69.3	47.8	23.3	19.5	24.1
30	33.3	37.0	35.2	30.6	---	62.0	315	84.8	57.4	28.1	20.2	24.9
31	30.6	---	34.3	28.9		65.7	---	77.0	---	25.7	21.7	---

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km^2
Observation Duration : March 11,1940 - September 30,1973
Max.and Min. Flows :Maximum Discharge :166 m^3/s
:Minimum Discharge :11.8 m^3/s

Table 4.2.13 1973 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept
1	26.5	34.3	39.8	26.5	33.3	119	86.2	101	47.8	25.7	13.7	13.7
2	26.5	55.2	37.9	26.5	29.7	105	90.5	102	48.8	24.9	13.7	14.4
3	28.1	44.8	37.9	26.5	28.9	89.1	97.6	104	44.8	24.9	14.4	13.7
4	29.7	40.8	37.9	26.5	28.1	71.8	116	99.0	46.8	24.9	15.9	13.7
5	29.7	36.1	37.9	26.5	28.1	64.1	111	96.2	46.8	24.1	18.8	13.7
6	30.6	37.0	37.0	25.7	27.3	59.5	114	93.3	43.8	23.3	15.9	13.7
7	28.9	36.1	37.0	27.3	28.1	62.0	166	91.9	42.8	23.3	15.1	14.4
8	27.3	37.9	36.1	27.3	29.7	64.4	141	93.3	40.8	20.2	13.7	15.1
9	28.1	36.1	36.1	26.5	29.7	68.1	111	91.9	39.8	18.8	14.4	12.4
10	28.1	36.1	36.1	28.1	29.7	66.9	102	87.6	37.9	18.8	13.7	15.9
11	28.1	35.2	35.2	24.9	30.6	66.9	107	86.2	37.9	17.3	13.7	18.1
12	28.9	35.2	34.3	28.1	30.6	69.3	116	80.9	39.8	18.1	13.7	18.1
13	28.9	36.1	34.3	27.3	30.6	70.6	137	74.4	40.8	18.1	13.1	18.1
14	28.9	70.6	33.3	28.9	36.1	82.2	161	70.6	39.8	18.1	13.7	17.3
15	28.1	49.9	33.3	27.3	40.8	102	170	70.6	39.8	18.8	13.7	16.6
16	28.1	43.8	33.3	25.7	39.8	100	164	69.3	37.9	18.8	13.1	16.6
17	28.9	41.8	31.5	26.5	37.0	111	137	68.1	37.0	19.5	13.1	15.9
18	31.5	39.8	31.5	26.5	37.9	97.6	119	70.6	38.8	18.1	13.7	15.9
19	63.2	38.8	31.5	26.5	39.8	87.6	107	66.9	37.9	15.9	12.4	16.6
20	84.8	37.9	32.4	28.1	46.8	90.5	110	59.5	37.0	16.6	13.7	15.9
21	75.7	37.9	31.5	28.9	42.8	110	114	60.7	35.2	15.9	13.7	15.9
22	47.8	37.0	28.1	26.5	42.8	104	114	60.7	33.3	15.9	13.7	15.1
23	41.8	37.0	28.1	25.7	39.8	90.5	123	57.4	31.5	15.1	13.1	15.9
24	39.8	36.1	29.7	26.5	38.8	83.5	125	52.0	30.6	15.9	12.4	16.6
25	37.9	37.0	28.9	26.5	77.0	79.6	125	53.1	28.1	16.6	13.1	15.9
26	37.0	37.0	28.1	26.5	143	83.3	125	52.0	26.5	16.6	13.7	17.3
27	37.9	58.4	27.0	27.3	111	80.9	119	49.9	26.5	15.9	13.7	16.6
28	36.1	42.8	27.3	27.3	91.9	84.8	116	49.9	26.5	15.1	13.7	16.6
29	36.1	42.8	26.5	27.3	---	84.8	105	47.8	24.9	14.4	13.1	15.9
30	35.2	40.8	26.5	28.1	---	82.2	101	48.8	25.7	15.9	11.8	20.2
31	35.2	---	27.3	34.3	---	82.2	---	48.8	---	13.7	13.7	---

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway

Precipitation Area :8608.8 km^2

Observation Duration : March 11,1940 - September 30,1974

Max.and Min. Flows :Maximum Discharge :610 m^3/s

:Minimum Discharge :17.3 m^3/s

Table 4.2.14 1974 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16.6	21.7	48.8	34.3	33.3	65.3	111	97.4	52.4	27.2	19.7	28.0
2	17.3	23.3	62.0	31.5	32.4	64.2	109	106	50.5	27.2	19.7	34.0
3	16.6	22.5	55.2	30.6	32.4	63.2	112	105	48.6	26.4	19.0	31.7
4	17.3	21.0	47.8	29.7	32.4	63.2	111	98.9	47.7	25.6	19.0	27.2
5	17.3	21.7	43.8	29.7	32.4	63.2	109	92.0	45.8	25.6	19.0	24.8
6	25.7	21.7	38.8	28.9	33.3	62.1	106	89.5	45.8	24.8	19.0	23.3
7	36.1	21.7	45.8	29.7	34.3	61.1	103	87.0	44.8	24.8	18.2	23.3
8	26.5	21.0	44.8	29.7	34.3	60.0	147	85.8	43.9	24.8	19.0	21.8
9	24.9	21.0	44.8	33.3	34.3	61.1	166	83.3	43.9	24.8	19.0	20.4
10	25.7	22.5	40.8	30.6	34.3	60.0	161	79.7	42.9	24.0	18.2	21.8
11	24.1	21.7	39.8	28.9	37.9	66.3	143	82.0	41.0	24.0	18.2	19.7
12	28.9	22.5	40.8	28.9	39.8	72.8	135	77.4	41.0	23.3	19.0	28.9
13	24.9	45.8	37.9	26.5	39.8	74.4	161	75.1	40.1	23.3	19.0	31.4
14	24.1	35.2	31.5	28.1	40.8	118	168	71.7	39.3	24.8	18.2	23.3
15	22.5	36.1	37.9	28.1	43.8	610	171	67.4	38.1	23.3	18.2	24.0
16	22.5	37.0	40.8	28.9	43.8	550	181	65.3	35.8	24.0	18.2	21.8
17	22.5	34.3	64.4	30.6	41.8	368	183	64.2	36.7	22.6	19.0	21.8
18	22.5	31.5	49.9	28.9	42.8	233	168	64.2	36.7	23.3	19.0	21.8
19	20.2	34.3	40.8	33.3	43.8	170	149	63.2	36.7	22.6	20.4	21.8
20	21.0	26.5	37.9	40.8	43.8	129	143	64.2	34.0	21.8	20.4	21.8
21	17.3	25.7	38.8	37.9	44.8	154	129	64.2	33.2	21.1	20.4	21.8
22	20.2	26.5	37.0	36.1	43.8	145	106	63.2	32.3	21.8	19.7	21.8
23	21.0	24.9	34.3	36.1	43.8	145	115	60.0	31.4	21.1	24.0	21.8
24	19.5	24.9	34.3	33.8	45.8	150	112	56.2	31.4	20.4	26.4	21.1
25	18.8	25.7	32.4	31.5	56.3	150	115	56.2	30.6	20.4	25.6	21.8
26	19.5	25.7	32.4	32.4	68.1	149	98.9	54.3	28.9	20.4	22.6	22.6
27	19.5	26.5	32.4	32.4	74.4	149	97.4	54.3	28.0	20.4	21.1	23.3
28	19.5	27.3	32.4	34.3	67.4	147	96.0	54.3	28.0	20.4	24.0	25.6
29	20.2	28.1	34.3	33.3	---	135	94.5	55.3	28.0	19.7	24.0	28.9
30	20.2	21.3	34.3	32.4	---	124	93.3	52.4	28.0	20.4	24.8	25.4
31	21.0	----	34.3	32.4	----	124	---	50.5	----	----	24.0	24.8

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1975
Max.and Min. Flows :Maximum Discharge :497 m^3/s
:Minimum Discharge :21.8 m^3/s

Table 4.2.15 1975 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	24.8	28.0	28.9	63.2	55.2	101	187	417	118	55.3	34.0	26.4
2	25.6	28.9	39.3	63.2	59.5	90.5	234	341	114	54.3	38.4	26.4
3	24.8	38.4	34.0	64.2	60.7	83.5	264	320	109	53.4	36.7	26.4
4	24.8	30.6	31.4	65.3	57.4	80.9	290	308	105	52.4	35.8	25.6
5	24.8	28.9	34.0	64.2	55.2	79.6	295	294	102	51.5	34.9	25.6
6	21.8	28.0	32.3	62.1	53.1	79.6	276	282	96.0	49.6	34.0	25.6
7	22.6	28.0	30.6	61.1	52.0	82.2	271	246	92.0	48.6	33.2	27.2
8	23.3	26.4	42.9	60.0	55.2	86.2	266	222	89.5	48.6	33.2	26.4
9	24.0	26.4	37.5	67.4	55.2	84.8	264	215	85.8	46.7	33.2	26.4
10	25.6	26.4	65.3	164	53.1	86.2	264	207	83.3	46.7	31.4	26.4
11	25.6	25.6	56.2	150	44.8	128	262	207	80.9	41.0	32.3	26.4
12	24.8	25.6	45.8	130	42.8	155	259	205	82.0	41.0	31.4	26.4
13	25.6	27.2	41.0	101	43.8	154	266	205	82.0	41.0	30.6	27.2
14	27.2	27.2	40.1	84.8	54.2	161	257	198	79.7	41.0	30.6	26.4
15	27.2	26.4	38.4	77.0	48.8	185	241	192	79.7	39.3	29.7	27.2
16	26.4	26.4	38.4	69.3	49.9	193	222	190	77.4	38.4	28.9	27.2
17	25.6	26.4	42.9	63.2	48.8	179	218	190	76.3	38.4	29.7	27.2
18	24.8	26.4	54.3	60.7	49.9	159	497	170	74.0	38.4	28.9	28.0
19	24.8	26.4	51.5	59.5	52.0	155	611	154	72.8	37.5	28.9	28.9
20	24.8	26.4	109	59.5	68.1	164	530	157	70.5	37.5	28.9	28.9
21	24.0	26.4	209	58.4	94.7	179	395	162	68.4	37.5	28.9	28.9
22	24.0	25.6	94.5	50.9	93.3	195	355	162	63.2	37.5	28.0	28.9
23	24.0	26.4	69.5	44.8	93.3	214	338	157	64.2	36.7	28.0	30.6
24	23.3	27.2	62.1	44.8	89.1	308	323	152	62.1	35.8	28.9	29.7
25	22.6	26.4	58.1	43.8	84.8	372	328	152	62.1	35.8	28.9	29.7
26	23.3	25.6	56.2	43.8	114	281	428	143	62.1	35.8	28.0	29.7
27	25.6	25.6	55.3	43.8	132	245	440	140	62.1	34.9	27.2	29.7
28	42.0	25.6	56.2	43.8	116	211	335	142	61.1	34.9	27.2	29.7
29	34.9	25.6	58.1	43.8	----	199	389	137	58.1	34.9	26.4	32.3
30	34.9	25.6	60.0	43.8	----	185	473	132	56.2	34.0	27.2	31.4
31	28.9	----	62.1	45.8	----	183	----	124	----	34.0	26.4	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1976
Max.and Min. Flows :Maximum Discharge :276 m^3/s
:Minimum Discharge :35.5 m^3/s

Table 4.2.16 1976 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	31.4	30.6	33.2	38.9	72.8	52.4	259	310	178	66.9	39.8	28.9
2	30.6	29.7	32.3	34.0	65.3	51.5	261	298	178	65.7	38.8	28.9
3	30.6	30.6	32.3	34.0	62.1	53.4	271	290	168	63.2	37.9	28.9
4	31.4	30.6	30.6	34.9	62.1	53.4	303	288	159	60.7	37.0	28.9
5	32.3	30.6	31.4	90.8	59.1	53.4	268	286	179	59.5	37.0	28.1
6	33.2	30.6	30.6	88.3	58.1	55.3	233	276	145	55.2	37.0	28.1
7	33.2	29.7	30.6	60.0	62.1	59.1	224	269	141	54.2	37.0	27.3
8	32.3	30.6	31.4	53.4	74.0	67.4	213	247	137	53.1	37.9	27.3
9	32.3	30.6	31.4	49.6	74.0	70.3	200	172	134	50.9	36.1	27.3
10	32.3	30.6	31.4	47.7	67.4	77.4	213	207	134	50.9	36.1	27.3
11	32.3	30.6	30.6	42.9	60.0	77.4	226	207	123	53.1	36.1	27.3
12	32.3	29.7	29.7	41.0	57.2	78.6	515	207	118	56.3	35.2	27.3
13	31.4	29.7	30.6	41.0	55.3	78.6	556	207	110	63.2	34.3	27.3
14	31.4	30.6	30.6	41.0	54.3	79.7	398	225	105	58.4	33.2	27.3
15	32.3	32.3	29.7	40.1	53.1	87.0	341	185	105	56.3	33.3	27.3
16	32.3	33.2	30.6	43.9	54.3	102	189	185	104	54.2	32.4	28.1
17	31.4	34.0	30.6	47.7	57.2	106	476	185	102	52.0	32.4	28.9
18	32.3	34.3	30.6	78.6	57.2	132	480	198	101	50.9	32.4	28.1
19	30.6	33.3	30.6	76.3	56.2	142	368	159	101	49.9	32.4	28.9
20	29.7	32.3	33.2	62.1	55.3	152	349	188	97.6	47.8	32.4	39.8
21	30.6	32.3	42.0	59.1	54.3	166	350	276	94.7	48.8	32.4	37.0
22	30.6	32.3	42.0	59.1	54.3	170	323	330	90.5	47.8	32.4	36.1
23	29.7	32.3	36.7	67.4	54.3	211	310	348	90.5	45.8	32.4	36.1
24	29.7	33.2	34.0	84.5	54.3	217	295	398	94.7	45.8	32.4	36.1
25	30.6	42.0	31.4	75.6	54.3	213	305	254	93.3	43.8	31.5	36.1
26	29.7	42.0	32.0	71.7	53.2	205	308	234	87.6	43.8	31.5	36.1
27	31.4	41.0	34.2	69.5	53.2	205	313	216	79.6	43.8	31.5	37.9
28	30.6	34.0	34.9	66.3	53.4	222	330	197	77.0	42.8	30.6	37.0
29	30.6	33.2	35.8	78.6	53.2	226	355	191	73.1	42.8	30.6	36.1
30	30.6	33.2	37.5	89.7	---	235	343	189	70.6	41.8	29.7	36.1
31	30.6	---	36.7	83.3	---	246	---	172	---	40.8	28.9	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1977
Max.and Min. Flows :Maximum Discharge :550 m^3/s
:Minimum Discharge :30.6 m^3/s

Table 4.2.17 1977 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	35.2	65.7	93.3	105	65.7	199	243	360	142	68.9	41.9	31.2
2	35.2	60.7	86.2	97.5	66.9	440	259	323	137	66.2	40.8	32.0
3	35.2	58.4	123	91.9	68.1	330	274	303	129	62.4	40.8	32.0
4	33.3	56.3	305	86.2	82.2	254	283	298	124	62.4	40.8	32.0
5	33.3	54.2	225	82.2	110	211	286	289	121	62.4	40.8	32.0
6	33.3	53.1	166	78.3	119	197	290	287	121	63.7	39.7	33.1
7	32.4	49.9	146	77.0	114	187	293	271	120	61.1	38.6	32.0
8	32.4	48.8	130	74.4	113	176	286	261	115	58.5	38.6	32.0
9	31.5	48.8	137	73.1	105	170	271	252	112	57.3	38.6	32.0
10	32.4	47.8	159	71.8	97.6	189	247	244	109	56.0	37.5	33.1
11	30.6	46.8	145	70.6	96.2	187	234	233	105	54.7	37.5	33.1
12	31.5	46.8	139	70.6	102	193	236	237	98.9	54.7	36.4	34.2
13	30.6	45.8	141	69.3	111	185	238	235	98.9	53.5	35.3	34.2
14	31.5	44.8	155	66.9	114	185	236	228	97.4	53.5	34.2	34.2
15	34.3	44.8	152	66.9	125	195	229	219	98.9	53.5	33.1	33.1
16	44.8	43.8	128	65.7	143	209	209	207	100	51.2	33.1	35.3
17	36.1	42.8	113	62.0	168	207	199	196	100	52.4	33.1	35.3
18	34.3	42.8	107	63.2	308	252	201	192	98.9	50.0	33.1	34.2
19	36.1	41.8	101	63.2	315	281	195	194	98.9	48.9	33.1	35.3
20	44.8	41.8	96.2	62.0	238	269	185	186	98.9	47.7	33.1	34.2
21	46.8	41.8	90.5	62.0	187	243	178	179	100	46.5	34.2	34.2
22	42.8	41.8	87.6	60.7	170	231	187	173	96.0	45.3	33.1	35.3
23	39.8	42.8	83.5	59.5	161	229	550	164	93.2	45.3	33.1	34.2
24	82.2	60.7	82.2	59.5	159	231	443	170	91.8	45.3	31.2	34.2
25	187	108	87.6	58.4	166	234	335	170	89.1	44.2	31.2	34.2
26	118	107	86.2	59.5	166	234	261	170	83.7	44.2	32.0	37.5
27	96.2	113	104	60.7	168	225	248	164	81.0	43.0	32.0	39.7
28	78.3	127	183	60.7	172	222	305	157	86.4	41.9	31.2	39.7
29	96.2	102	155	60.7	----	220	420	154	83.7	41.9	31.2	39.7
30	80.9	105	130	62.0	----	218	420	150	82.4	41.9	32.0	37.5
31	71.8	----	114	63.2	----	229	----	149	----	40.8	32.0	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location	:Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area	:8608.8 km2
Observation Duration	: March 11,1940 - September 30,1978
Max.and Min. Flows	:Maximum Discharge :285 m^3/s
	:Minimum Discharge :28.2 m^3/s

Table 4.2.18 1978 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37.5	40.8	35.3	48.9	84.4	134	170	211	134	57.9	37.0	28.2
2	38.6	40.8	36.4	82.4	97.0	139	163	209	122	57.0	36.2	28.2
3	38.6	40.8	50.0	162	134	142	165	219	118	56.0	36.2	28.2
4	38.6	40.8	74.3	156	136	148	175	231	111	55.1	36.2	29.6
5	37.5	39.7	71.6	118	122	151	225	227	111	54.1	36.2	29.6
6	37.5	39.7	54.7	99.7	122	156	285	211	108	53.2	36.2	29.6
7	38.6	38.6	46.5	94.2	147	158	248	190	105	51.3	35.4	29.6
8	36.4	38.6	43.0	102	147	160	231	174	102	50.3	34.6	30.3
9	37.5	37.5	45.3	97.0	213	165	266	170	99.7	49.5	34.6	31.0
10	36.4	37.5	43.0	89.3	183	192	306	174	98.3	48.6	33.8	31.0
11	37.5	37.5	40.8	85.6	147	209	289	181	95.6	46.9	33.8	31.0
12	36.4	37.5	40.8	83.1	136	203	250	183	91.7	45.2	33.8	30.3
13	36.4	38.6	39.7	79.6	125	188	221	188	91.7	44.4	33.1	30.3
14	37.5	37.5	39.7	77.3	112	174	213	184	90.5	44.4	32.4	30.3
15	37.5	37.5	41.9	74.9	112	163	213	174	88.1	44.4	32.4	30.3
16	41.9	37.5	44.2	72.6	145	153	217	168	84.4	43.5	33.1	29.6
17	41.9	37.5	48.9	71.5	170	150	219	167	83.1	43.5	33.1	29.6
18	41.9	38.6	51.2	71.5	148	143	221	165	80.7	42.7	32.4	31.0
19	41.9	39.7	48.9	71.5	153	140	221	160	78.4	41.8	32.4	33.8
20	43.0	38.6	47.7	118	156	140	211	153	76.1	41.8	31.7	32.4
21	43.0	38.6	47.7	125	248	140	192	143	76.1	41.8	31.7	32.4
22	43.0	38.6	47.7	108	225	142	196	137	73.8	41.0	30.3	33.1
23	41.9	37.5	46.5	111	174	165	211	130	72.6	40.2	30.3	31.7
24	41.9	37.5	43.0	104	148	165	238	124	71.5	39.4	31.0	33.1
25	41.9	36.4	41.9	99.7	136	153	227	125	69.3	39.4	31.0	32.4
26	41.9	36.4	40.8	95.6	130	150	207	124	66.1	37.8	30.3	32.8
27	41.9	36.4	40.8	94.2	128	172	196	122	64.0	37.0	30.3	33.1
28	41.9	36.4	40.8	94.2	130	167	196	122	61.9	37.8	29.6	33.1
29	41.9	35.3	40.8	94.2	----	168	205	124	60.9	37.8	28.9	33.8
30	41.9	35.3	39.7	90.5	----	184	213	130	58.9	37.0	28.9	34.6
31	40.8	----	41.9	88.1	----	179	----	140	----	37.0	28.9	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1979
Max.and Min. Flows :Maximum Discharge :804 m^3/s
:Minimum Discharge :26.4 m^3/s

Table 4.2.19 1979 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	33.8	73.8	71.5	81.9	117	130	153	113	102	55.4	32.1	27.1
2	33.8	58.9	69.3	253	146	125	153	113	102	50.2	32.1	27.1
3	33.1	54.1	54.1	792	143	122	168	114	97.5	52.3	32.1	26.4
4	33.1	51.3	48.6	804	130	119	192	114	96.0	57.4	31.4	27.1
5	31.7	48.6	46.9	392	122	116	192	114	96.0	53.3	30.6	27.1
6	34.6	46.9	52.2	246	119	116	176	110	99.0	49.3	29.9	26.4
7	32.4	46.1	89.3	200	117	119	162	107	92.4	48.4	29.9	26.4
8	34.6	45.2	119	176	117	119	156	105	87.6	47.4	29.9	26.4
9	33.1	43.5	150	157	121	117	154	107	84.0	46.5	31.4	27.1
10	33.8	44.4	99.7	145	137	114	149	107	80.0	45.6	32.1	27.1
11	33.1	42.7	80.7	133	130	113	140	105	79.2	43.8	33.6	27.8
12	33.1	42.7	73.8	127	133	113	132	102	76.8	42.8	32.8	27.8
13	33.8	41.8	68.2	121	138	113	129	101	76.8	41.0	31.2	27.8
14	33.8	41.8	64.0	116	141	111	135	101	79.2	40.2	31.4	28.5
15	33.8	41.0	95.6	113	178	111	121	101	75.6	39.4	30.6	28.5
16	35.4	40.2	242	110	300	113	113	101	72.0	38.5	29.2	28.5
17	35.4	40.2	127	108	226	121	119	101	70.9	38.5	29.9	29.9
18	35.4	40.2	101	113	187	130	119	102	73.2	40.2	29.2	29.9
19	36.2	39.4	89.3	154	171	143	117	102	62.8	38.5	29.9	30.6
20	35.4	39.4	81.9	187	164	149	124	108	62.8	36.9	29.2	30.6
21	35.4	39.4	78.4	156	161	154	127	113	59.5	36.1	27.8	29.9
22	36.2	39.4	74.9	137	148	164	129	101	58.4	36.1	28.7	29.9
23	41.0	39.4	71.5	129	141	178	125	102	58.4	35.6	27.1	29.9
24	46.1	39.4	69.3	121	181	181	121	102	56.4	34.4	27.1	29.9
25	42.7	39.4	68.2	114	181	176	116	101	54.3	34.4	27.8	30.6
26	41.0	38.6	70.3	111	161	164	113	99.0	52.3	34.4	27.8	29.9
27	66.0	38.6	67.2	114	148	151	111	97.5	50.2	33.6	29.2	29.9
28	64.0	39.4	67.2	117	137	141	113	97.5	51.2	33.6	28.5	29.9
29	51.3	38.6	66.1	114	----	140	113	97.5	52.3	33.6	27.8	30.6
30	57.9	41.0	65.1	113	----	141	113	94.8	56.4	32.8	27.8	29.9
31	94.2	----	69.3	111	----	148	----	99.0	----	32.8	26.4	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location	:Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area	:8608.8 km2
Observation Duration	: March 11,1940 - September 30,1980
Max.and Min. Flows	:Maximum Discharge :1329 m^3/s
	:Minimum Discharge :29.9 m^3/s

Table 4.2.20 1980 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	29.9	38.5	72.0	65.1	74.4	107	537	455	357	84.0	52.8	38.7
2	30.6	43.8	68.6	66.3	72.0	104	499	470	343	82.5	51.5	38.7
3	31.4	44.7	69.7	66.3	69.7	94.8	528	499	332	84.0	50.3	38.7
4	31.4	40.2	73.2	70.9	67.4	91.2	603	508	318	79.5	49.0	38.7
5	31.4	39.4	75.6	157.	66.3	97.5	586	486	304	78.0	49.0	38.7
6	31.4	38.5	75.6	129	68.6	107	569	452	287	76.5	47.9	38.7
7	31.4	93.6	74.4	117	69.7	97.5	544	446	273	75.0	47.9	38.7
8	31.4	198	69.7	105	70.9	93.6	518	434	258	75.0	47.9	38.7
9	31.4	130	66.3	97.5	72.0	91.2	528	437	243	73.7	46.7	38.7
10	31.4	84.0	62.8	99.0	73.2	94.8	534	458	226	72.3	45.6	38.7
11	34.4	66.3	60.5	96.6	75.6	113	589	443	210	72.3	44.4	39.8
12	32.8	60.5	60.5	90.0	75.6	156	512	443	195	71.0	44.4	39.8
13	32.1	59.5	104	85.2	76.8	164	534	446	180	69.6	45.6	38.7
14	32.1	61.7	282	78.0	94.8	148	499	505	166	66.9	54.0	38.7
15	32.1	65.1	173	74.4	96.6	141	492	499	152	64.2	46.7	38.7
16	32.8	62.8	127	73.2	102	146	483	483	136	62.9	44.4	39.8
17	32.8	60.5	117	69.7	168	145	486	473	123	61.5	44.4	39.8
18	32.1	59.5	116	69.7	153	174	489	455	113	60.3	43.3	39.8
19	32.8	57.4	108	69.7	133	171	486	440	108	59.0	43.3	39.8
20	32.8	56.4	97.5	68.6	113	157	486	437	104	59.0	42.1	39.8
21	32.8	55.4	91.2	67.4	107	151	489	446	104	57.8	41.0	41.0
22	33.6	52.3	87.6	66.3	102	154	492	452	103	57.8	41.0	42.1
23	39.4	51.2	84.0	65.1	99.0	171	563	443	101	57.8	41.0	42.1
24	40.2	50.2	81.6	62.8	93.6	190	486	449	99.6	56.5	41.0	42.1
25	42.8	48.4	80.4	60.5	91.2	518	470	446	94.8	55.3	41.0	42.1
26	68.6	48.4	78.0	61.7	88.9	576	473	440	93.2	55.3	39.8	41.0
27	47.4	47.4	75.6	64.0	88.9	656	473	428	90.0	55.3	39.8	41.0
28	41.9	50.4	70.9	85.2	88.9	1329	470	417	88.5	55.3	38.7	42.1
29	40.2	78.0	67.4	86.4	93.6	908	467	402	87.0	54.0	39.8	42.1
30	39.4	76.8	65.1	81.6	----	684	464	391	84.0	52.8	38.7	42.1
31	38.5	----	65.1	76.8	----	583	----	374	----	52.8	38.7	----

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1981
Max.and Min. Flows :Maximum Discharge :1105 m^3/s
:Minimum Discharge :43.5 m^3/s

Table 4.2.21 1981 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	82.6	73.0	85.8	103	301	496	475	413	259	127	60.6	54.9
2	82.6	73.0	85.8	89	235	556	456	380	252	121	63.5	52.1
3	117	73.0	85.8	85.8	184	496	448	361	252	118	66.3	54.9
4	135	69.8	85.8	89.0	163	434	436	357	249	116	60.6	52.1
5	117	69.8	85.8	89.0	156	371	444	372	242	130	57.8	52.1
6	107	69.8	121	280	163	350	413	409	236	121	52.1	52.1
7	103	73.0	220	213	184	385	394	398	229	113	49.2	52.1
8	98.2	69.8	135	413	371	434	391	383	219	110	46.4	52.1
9	93.6	103	112	184	357	441	372	376	213	107	46.4	52.1
10	89.0	76.2	198	163	322	502	361	409	219	110	43.5	52.1
11	89.0	73.0	308	177	280	670	357	368	216	110	43.5	52.1
12	89.0	73.0	170	117	250	750	350	368	204	107	43.5	54.9
13	85.8	76.2	126	82.6	250	921	357	357	204	98.1	46.4	69.2
14	82.6	73.0	117	63.4	243	1001	361	350	204	92.3	49.2	69.2
15	82.6	73.0	107	54.8	350	1105	361	357	216	89.4	52.1	66.3
16	79.4	69.8	98.2	73.0	616	1089	365	346	226	83.6	52.1	72.0
17	76.2	69.8	89.0	177	658	973	365	324	239	80.7	52.1	74.9
18	76.2	69.8	82.6	177	514	816	372	302	229	77.8	49.2	77.8
19	76.2	66.6	79.4	107	562	776	387	294	213	72.0	49.2	77.8
20	76.2	66.6	76.2	163	690	803	387	291	200	72.0	49.2	77.8
21	73.5	98.2	76.2	496	705	865	394	287	191	69.2	46.4	77.8
22	69.8	156	76.2	308	556	753	402	309	185	63.5	54.9	77.8
23	66.6	121	76.2	170	490	695	413	331	174	63.5	60.6	77.8
24	76.2	112	79.4	135	455	695	432	313	171	63.5	60.6	80.7
25	85.8	103	76.2	98.2	406	663	463	302	168	63.5	60.6	77.8
26	82.6	98.2	79.4	98.2	378	632	475	287	159	60.6	57.8	77.8
27	79.4	93.6	156	121	371	600	463	294	150	60.6	57.8	80.7
28	76.2	89	350	213	357	569	448	291	142	57.8	63.5	77.8
29	79.4	89	243	336	----	543	440	280	133	57.8	72.0	83.6
30	76.2	85.8	163	205	----	519	444	273	130	57.8	63.5	86.5
31	73.0	----	126	329	----	503	----	266	----	57.8	57.8	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1982
Max.and Min. Flows :Maximum Discharge :540 m^3/s
:Minimum Discharge :30.0 m^3/s

Table 4.2.22 1982 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	35.0	38.4	42.2	157	86.0	176	101	233	109	43.2	36.7	30.7
2	34.1	39.3	43.2	138	109	149	107	222	107	45.1	36.7	31.6
3	34.1	37.6	41.2	132	122	132	121	206	106	47.1	37.6	31.6
4	35.0	39.3	43.2	132	107	122	142	194	104	44.2	36.7	30.0
5	35.0	37.6	46.1	119	98.0	118	226	184	99.5	44.2	35.9	30.0
6	35.0	38.4	50.1	115	93.5	115	247	176	95.0	42.2	35.0	30.0
7	35.9	38.4	54.5	115	90.5	113	217	170	92.0	41.2	35.0	29.2
8	34.1	38.4	54.5	149	89.0	110	200	162	90.5	39.3	33.3	29.2
9	35.9	38.4	51.2	540	87.5	112	186	159	86.0	39.3	33.3	31.6
10	35.9	37.6	58.9	328	86.0	121	178	153	84.0	39.3	33.3	30.7
11	35.0	42.2	50.1	196	86.0	112	200	153	73.4	41.2	33.3	30.7
12	39.3	51.2	52.3	170	87.5	107	186	161	72.0	41.2	30.7	30.7
13	42.2	83.2	51.2	157	86.0	104	215	180	68.4	44.2	32.4	30.0
14	41.2	63.6	51.2	142	69.5	101	238	172	66.0	42.2	32.4	30.7
15	53.4	51.2	115	126	67.5	95.0	254	174	63.6	42.2	32.4	31.6
16	49.0	47.1	305	122	69.6	90.5	256	172	63.6	41.2	31.6	30.7
17	36.7	43.2	320	118	70.8	127	258	172	62.4	42.2	30.7	30.7
18	43.2	45.1	266	115	69.6	122	268	210	58.9	40.3	30.7	30.7
19	42.2	51.2	188	110	69.6	110	254	184	56.7	40.3	31.6	30.7
20	41.2	49.0	136	106	69.6	106	233	168	54.5	39.3	30.7	30.7
21	40.3	47.1	112	104	68.4	101	224	145	52.3	39.3	31.6	30.7
22	40.3	45.1	118	101	58.4	101	224	138	124	38.4	30.7	32.4
23	39.3	44.2	107	99.5	72.0	101	226	134	49.0	40.3	30.7	34.1
24	39.3	43.2	110	95.0	72.0	121	208	138	48.0	39.3	30.0	34.1
25	39.3	42.2	143	92.0	66.2	118	206	136	47.1	38.4	30.0	34.1
26	39.3	42.2	140	89.0	62.4	107	198	127	45.1	36.7	30.7	35.0
27	39.3	42.2	206	87.5	62.4	101	245	124	44.2	36.7	33.3	33.3
28	38.4	42.2	482	86.0	103	96.5	226	121	43.2	36.7	32.4	33.3
29	38.4	41.2	315	87.5	----	95.0	224	115	44.2	38.4	31.6	33.3
30	38.4	41.2	206	86.0	----	95.0	240	116	42.2	38.4	30.0	32.4
31	38.4	----	161	86.0	----	95.0	----	101	----	36.7	30.0	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1983
Max.and Min. Flows :Maximum Discharge :108 m^3/s
:Minimum Discharge :11.8 m^3/s

Table 4.2.23 1983 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	19.8	22.8	23.3	26.3	21.8	20.8	66.8	52.8	44.5	20.8	17.8	13.9
2	19.3	23.3	22.8	25.8	21.3	20.8	65.3	53.8	41.9	20.3	17.8	13.9
3	18.8	23.8	22.8	25.3	20.8	21.3	63.2	53.8	38.4	19.8	17.8	13.9
4	18.3	23.8	22.3	25.3	21.3	21.3	63.7	54.4	36.8	19.8	17.8	13.5
5	18.3	23.8	22.3	25.3	21.3	21.3	64.8	53.8	34.8	19.3	17.8	13.5
6	18.3	23.8	22.3	25.3	20.8	20.8	66.8	53.3	32.8	19.3	17.8	13.5
7	18.3	23.8	22.3	24.8	20.8	20.8	72.8	52.3	32.8	18.8	17.3	13.5
8	17.8	23.8	22.8	24.8	20.8	21.3	108	51.8	33.8	18.8	17.3	13.1
9	17.8	24.3	23.3	24.3	20.3	21.3	95.8	51.8	33.8	18.3	16.8	13.1
10	17.8	24.3	23.8	24.3	20.3	21.8	80.9	50.7	34.3	18.3	16.8	13.1
11	17.3	24.3	23.8	24.3	19.8	21.8	78.2	49.7	33.8	17.8	16.3	13.1
12	17.3	24.3	23.8	23.8	19.3	22.3	76.5	49.2	33.8	17.8	16.3	12.7
13	17.3	24.3	23.8	23.8	19.8	22.8	74.9	48.1	33.3	17.8	16.3	12.7
14	17.3	24.3	23.8	23.3	20.3	23.8	73.8	47.6	32.8	17.8	15.8	12.2
15	17.3	24.3	23.8	23.3	20.8	24.8	72.7	46.6	31.8	17.8	15.8	11.8
16	16.8	24.3	23.8	23.3	21.3	26.8	72.1	47.1	30.8	17.8	15.8	11.8
17	16.8	24.3	24.3	23.3	21.3	29.3	75.4	46.6	29.8	17.8	16.3	11.8
18	16.8	24.3	24.3	23.3	21.3	30.8	79.3	46.0	28.8	17.8	16.3	11.8
19	16.8	24.3	24.3	23.3	21.3	31.8	65.8	51.8	27.8	17.8	16.3	11.8
20	16.8	24.3	24.3	22.8	21.3	34.3	62.2	51.2	27.8	17.8	16.3	11.4
21	17.3	25.3	24.8	22.8	20.8	45.0	60.1	50.2	27.3	17.8	16.3	11.4
22	17.8	25.3	24.8	22.8	20.3	45.0	57.5	61.6	27.3	17.8	16.3	11.4
23	18.3	24.8	24.8	22.8	20.8	43.5	55.9	59.6	26.8	17.8	16.3	11.4
24	18.8	24.3	24.8	22.3	21.3	40.9	53.8	55.4	26.3	17.8	15.8	11.8
25	19.3	24.3	24.8	22.3	21.3	43.5	52.8	52.8	25.8	17.8	15.8	11.8
26	19.8	24.3	25.3	22.3	21.3	49.2	52.8	50.7	24.8	18.3	14.8	12.2
27	20.3	24.3	25.3	22.3	21.3	53.8	52.8	49.2	23.8	18.3	14.4	12.2
28	20.8	24.8	24.8	22.3	20.8	59.6	53.3	48.6	22.8	18.3	14.4	12.7
29	21.3	23.8	25.3	22.3	----	71.6	53.3	48.1	21.8	18.3	14.4	12.7
30	21.8	23.8	25.8	22.3	----	72.7	52.8	47.6	21.3	18.3	14.4	12.7
31	22.3	----	26.3	22.3	----	70.0	---	46.6	----	18.3	13.9	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1984
Max.and Min. Flows :Maximum Discharge :198 m^3/s
:Minimum Discharge :21.6 m^3/s

Table 4.2.24 1984 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30.9	36.1	86.0	58.1	78.2	73.0	161	198	88.8	41.5	28.8	24.2
2	30.9	36.1	88.8	57.1	76.9	80.8	157	184	87.4	40.7	21.6	24.2
3	31.6	35.3	86.0	56.1	75.6	88.8	153	188	88.8	40.7	25.5	24.8
4	30.9	35.3	83.4	55.1	73.0	110	151	194	90.2	37.6	27.5	24.8
5	31.6	35.3	79.5	54.1	70.6	125	155	192	88.8	36.8	27.5	24.8
6	31.6	35.3	76.9	54.1	73.0	130	159	182	86.0	36.8	26.1	24.2
7	31.6	39.2	93.0	52.2	76.9	162	168	172	82.1	36.1	26.8	24.8
8	31.6	41.5	94.4	55.1	75.6	172	180	168	75.6	36.1	26.1	24.8
9	36.1	50.2	88.8	55.1	133	155	188	164	73.0	34.6	26.8	24.2
10	30.9	44.2	100	50.2	170	144	186	161	70.6	33.8	26.8	24.2
11	30.9	41.5	186	49.1	174	144	174	157	68.2	33.8	26.1	24.2
12	32.4	42.4	157	48.1	110	140	159	155	64.6	29.5	26.1	24.2
13	32.4	45.1	125	49.1	155	131	153	153	62.2	30.9	26.8	24.2
14	32.4	45.1	105	50.2	140	123	149	155	61.0	33.3	24.8	24.2
15	36.1	42.4	94.4	59.0	121	121	155	155	59.0	33.1	25.5	23.5
16	38.4	44.0	88.8	57.1	103	116	212	147	58.1	32.4	26.1	24.8
17	34.6	57.1	84.7	67.0	100	113	219	142	57.1	32.4	25.5	24.8
18	33.1	57.1	80.8	91.6	94.4	116	204	133	56.1	33.1	27.5	24.8
19	35.3	76.9	76.9	87.4	90.2	119	194	133	54.1	22.2	27.5	24.8
20	35.3	98.6	73.0	79.5	86.0	114	210	131	52.2	30.9	27.5	24.8
21	36.1	162	71.8	71.8	84.7	110	198	125	52.2	36.1	26.1	25.5
22	35.3	164	69.4	55.1	80.8	106	206	119	52.2	32.4	25.5	26.8
23	35.3	161	67.0	52.2	79.5	126	198	116	50.2	30.9	25.5	26.8
24	34.6	164	65.8	63.4	76.9	182	186	105	48.1	30.9	25.5	26.8
25	34.6	149	64.6	70.6	75.6	182	176	113	46.0	30.2	25.5	26.8
26	35.3	119	63.4	121	69.4	178	168	111	45.1	29.5	24.8	27.5
27	36.1	103	62.2	164	70.6	168	208	108	44.2	28.8	24.8	27.5
28	35.3	93.0	61.0	116	73.0	159	215	102	43.3	28.8	24.8	27.5
29	35.3	86.0	60.0	100	71.8	184	200	97.2	42.4	28.8	24.8	27.5
30	35.3	84.7	59.0	91.6	----	155	217	84.7	41.5	29.5	24.2	28.2
31	36.1	----	58.1	80.0	----	157	----	90.2	----	28.8	24.2	----

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :1985
Max.and Min. Flows :Maximum Discharge :202 m^3/s
:Minimum Discharge :11.8 m^3/s

Table 4.2.25 1985 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	28.2	28.8	30.2	30.2	67.0	50.2	180	100	41.5	23.5	16.0	14.1
2	27.5	28.8	30.2	31.6	73.0	48.1	202	97.2	41.5	22.9	16.0	14.1
3	26.1	30.2	30.2	32.4	64.6	47.0	188	93.0	39.9	22.9	16.0	14.1
4	27.5	32.4	29.5	36.1	61.0	46.0	164	88.8	39.9	22.2	16.0	14.1
5	28.8	27.5	28.8	45.1	57.1	45.1	149	80.8	39.9	21.6	15.5	14.1
6	28.8	32.4	28.2	49.1	52.2	46.0	144	80.8	39.2	22.9	15.5	14.1
7	28.8	32.4	28.2	45.1	51.2	46.0	146	76.9	42.4	21.6	17.1	14.1
8	28.8	30.9	28.2	41.5	51.2	45.1	151	75.6	39.9	22.2	16.0	14.1
9	28.8	31.6	28.8	39.2	50.2	45.1	164	67.0	42.4	22.2	15.5	13.6
10	28.8	31.6	28.8	37.6	50.2	46.0	159	73.0	36.1	21.6	15.5	14.1
11	28.8	31.6	28.8	44.2	50.2	47.0	162	71.8	35.5	17.6	15.5	13.6
12	28.8	30.9	29.5	69.4	50.2	51.2	176	71.8	33.8	20.3	15.0	14.1
13	27.5	30.9	34.6	61.0	51.2	55.1	180	74.3	33.8	19.8	15.0	14.1
14	28.8	30.9	34.6	54.1	78.2	58.1	174	73.0	33.1	19.2	15.0	14.1
15	28.8	30.2	32.4	60.0	153	63.4	161	64.6	33.6	18.7	15.0	14.1
16	28.8	30.2	32.4	58.1	146	71.8	144	68.2	30.2	18.7	14.5	14.1
17	29.5	30.2	33.8	52.2	108	70.6	131	68.2	29.5	18.7	14.5	14.1
18	30.2	30.9	32.4	50.2	87.4	73.0	130	63.4	28.8	18.1	14.5	14.1
19	30.2	30.9	30.9	48.1	94.4	87.4	130	67.0	27.5	18.1	15.0	13.6
20	30.2	30.2	30.2	47.0	123	113	128	68.2	30.2	18.1	14.5	11.8
21	30.2	30.2	31.6	55.1	103	123	125	63.4	31.6	18.1	14.5	15.0
22	30.2	32.4	31.6	54.1	83.4	113	118	61.0	30.9	17.6	15.0	15.5
23	30.2	39.9	31.6	52.2	71.8	106	111	56.1	29.5	17.1	14.5	15.5
24	30.2	36.8	33.8	49.1	67.0	123	111	53.2	28.8	17.1	14.1	16.0
25	24.2	34.6	33.1	47.0	64.6	125	108	51.2	27.5	17.1	14.1	16.0
26	26.8	33.1	33.1	46.0	59.0	125	105	49.1	26.8	16.0	14.5	16.0
27	28.8	33.1	33.1	45.1	54.1	119	102	49.1	25.5	16.6	14.5	16.6
28	28.8	32.4	32.4	44.2	52.2	121	100	46.0	24.8	16.6	15.0	16.6
29	28.8	31.6	31.6	38.4	----	146	105	44.2	24.8	16.0	14.5	15.5
30	28.8	30.9	30.9	48.1	----	159	102	43.3	24.8	16.6	14.1	17.6
31	28.2	----	29.5	55.1	----	159	----	41.5	----	16.0	14.5	----

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1986
Max.and Min. Flows :Maximum Discharge :110 m^3/s
:Minimum Discharge :16.4 m^3/s

Table 4.2.26 1986 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18.9	33.8	73.0	36.8	78.9	112	102	51.3	62.7	30.5	16.9	16.9
2	18.9	33.1	65.8	36.8	76.5	96.5	110	49.3	61.6	30.0	17.3	17.3
3	18.9	33.1	55.1	48.1	77.7	89.9	114	49.3	60.6	28.6	17.3	17.3
4	18.9	33.1	49.1	49.1	82.6	85.0	110	50.3	59.5	27.9	17.3	17.3
5	19.4	30.2	46.0	45.1	59.5	85.0	106	47.3	59.5	27.2	17.3	17.3
6	19.4	30.2	44.2	42.4	52.2	85.0	103	44.7	58.4	25.1	17.3	17.3
7	18.9	30.2	42.4	42.4	57.3	82.6	103	43.8	57.3	23.7	17.3	17.9
8	18.9	30.2	40.7	50.2	59.5	83.8	103	52.2	56.2	21.9	17.3	17.9
9	18.9	30.2	40.7	64.9	67.2	87.9	103	69.5	55.1	21.9	17.3	17.9
10	19.4	39.2	40.7	55.1	69.5	88.7	103	71.9	55.1	20.7	16.9	17.9
11	20.0	40.7	39.9	53.2	63.8	91.2	99.1	76.5	54.1	20.2	17.3	17.3
12	20.5	38.4	39.2	54.1	63.8	95.1	96.5	77.7	54.1	19.0	17.3	16.9
13	22.1	37.6	38.4	57.3	69.5	97.8	93.8	77.7	53.2	19.0	17.9	16.9
14	22.7	36.1	37.6	59.5	73.0	102	92.5	76.5	55.1	18.4	17.3	17.3
15	22.1	33.8	36.8	68.3	69.5	99.1	102	71.9	53.2	17.9	16.9	17.3
16	22.7	33.1	36.8	64.9	67.2	96.5	104	70.7	52.2	17.9	16.4	17.4
17	22.7	33.1	36.8	131	66.0	93.8	96.5	69.5	56.2	17.9	17.6	16.4
18	37.6	33.1	36.1	407	64.9	91.2	87.5	73.0	60.6	17.9	17.3	16.9
19	87.1	33.1	35.3	294	63.8	89.9	81.4	71.9	56.2	17.9	17.3	16.4
20	88.8	32.4	33.1	187	62.7	89.9	77.7	66.0	52.2	18.4	16.9	16.4
21	56.1	32.4	33.1	147	64.9	86.2	75.4	69.5	48.4	19.0	16.4	16.0
22	40.7	27.5	35.3	126	72.9	85.0	74.2	68.3	45.5	18.4	16.4	15.5
23	39.9	31.6	35.3	133	78.9	82.6	71.9	70.7	43.1	18.1	16.4	15.5
24	32.4	31.6	34.6	104	87.5	80.1	66.0	70.7	39.9	17.9	16.4	15.5
25	30.9	31.6	34.6	97.8	96.5	80.1	62.7	69.5	38.3	17.3	16.4	17.3
26	49.1	43.3	35.3	93.8	95.1	78.9	59.5	68.3	35.3	19.0	16.4	16.9
27	48.1	44.2	36.1	99.9	95.1	74.2	57.3	67.2	35.3	17.9	16.9	16.4
28	45.1	46.0	39.2	86.2	113	83.8	55.1	67.2	33.8	17.3	17.3	16.4
29	39.9	45.1	40.7	83.9	----	87.5	53.2	66.0	32.3	16.9	16.9	16.9
30	36.1	54.1	39.2	82.6	----	92.5	53.2	64.9	31.5	16.9	16.9	16.9
31	35.3	----	38.4	81.4	----	97.8	----	63.8	----	16.9	16.9	-----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration :March 11,1940- 30 September, 1987
Max.and Min. Flows :Maximum Discharge :344 m^3/s
:Minimum Discharge :16.9 m^3/s

Table 4.2.27 1987 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16.9	26.5	31.5	92.5	161	114	221	257	161	59.5	34.5	29.3
2	17.9	29.3	30.8	87.5	145	109	255	252	169	60.5	34.5	29.3
3	24.4	33.8	30.0	74.2	152	103	294	239	177	58.4	34.5	29.3
4	26.5	38.3	29.3	82.6	189	99.1	284	227	157	56.2	33.8	27.9
5	26.5	34.5	29.3	87.5	169	150	262	232	145	54.1	33.0	29.3
6	24.4	33.8	29.3	107	167	232	252	241	135	53.2	33.0	31.5
7	22.4	49.3	28.6	102	140	197	252	248	128	54.1	34.5	30.8
8	23.0	49.3	28.6	163	138	212	271	260	126	54.1	31.5	30.0
9	22.4	92.5	28.6	327	148	191	296	269	120	54.1	31.5	30.0
10	23.0	80.1	28.6	416	133	187	327	260	119	44.7	29.3	29.3
11	23.7	62.7	28.6	223	143	173	333	237	116	51.3	28.6	29.3
12	25.8	52.2	28.6	165	147	156	357	219	112	49.3	27.9	28.6
13	23.7	47.4	27.9	135	142	147	401	212	112	50.3	27.9	28.6
14	27.9	43.9	26.5	117	143	138	383	212	109	48.4	27.9	28.6
15	30.8	42.3	27.2	106	143	128	335	219	103	45.5	27.2	28.6
16	27.9	40.7	27.2	99.1	138	122	319	219	107	44.7	27.2	29.3
17	27.2	39.1	27.2	92.5	126	123	344	214	109	44.7	28.6	28.6
18	26.5	37.5	27.2	88.7	133	131	327	212	103	43.9	32.3	28.6
19	25.1	37.5	27.9	86.2	147	142	309	212	99.1	42.3	30.0	29.3
20	24.4	36.8	29.3	83.8	133	128	291	210	99.1	40.7	30.0	30.0
21	23.7	36.0	48.4	81.4	122	120	264	214	97.8	40.7	29.3	31.5
22	24.4	30.8	42.3	73.0	116	123	257	214	92.5	39.1	29.3	26.5
23	28.6	32.3	45.5	70.7	113	128	267	210	89.9	38.3	29.3	29.3
24	25.8	33.8	69.5	68.3	112	128	281	201	86.2	37.5	29.3	29.3
25	25.8	33.8	59.5	69.5	126	143	294	193	82.6	36.0	28.6	30.0
26	25.8	32.3	56.2	69.5	154	165	274	183	77.7	37.5	28.6	30.0
27	25.1	26.5	135	64.9	142	171	252	175	73.0	36.0	26.5	31.5
28	25.1	31.5	104	63.8	125	173	243	185	69.5	36.0	30.0	30.8
29	24.4	32.3	191	77.7	----	173	250	181	66.0	34.5	30.0	30.8
30	24.4	30.0	161	117	----	183	255	179	59.5	35.3	29.3	30.8
31	24.4	----	107	167	----	199	----	167	----	34.5	29.3	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1988
Max.and Min. Flows :Maximum Discharge :398 m^3/s
:Minimum Discharge :29.3 m^3/s

Table 4.2.28 1988 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30.0	39.9	46.5	89.9	165	179	291	366	136	71.8	36.8	29.3
2	30.8	61.6	42.3	87.5	147	163	264	352	131	71.9	36.8	30.0
3	30.8	58.4	41.5	83.5	116	225	255	309	126	71.9	38.3	29.3
4	30.0	50.3	43.9	80.1	99.1	210	260	279	125	70.7	37.5	30.0
5	31.5	48.4	49.3	78.9	91.2	169	241	269	122	68.3	36.8	30.8
6	32.5	85.0	48.4	77.7	86.2	148	223	260	117	66.0	36.0	30.8
7	32.5	97.8	45.5	77.7	82.6	135	248	255	112	63.8	35.3	30.8
8	32.5	75.4	43.9	75.4	80.1	128	289	269	110	60.6	34.5	30.8
9	32.5	63.8	43.9	74.2	77.7	129	309	269	109	59.5	34.5	31.5
10	32.5	56.2	48.4	73.0	76.5	159	317	255	112	56.2	34.5	33.8
11	31.5	53.2	71.9	73.0	75.4	274	319	243	110	54.1	33.8	33.0
12	27.9	51.3	114.	73.0	74.2	241	338	243	109	53.2	32.3	33.0
13	30.0	49.3	103.	70.7	74.2	199	389	241	109	54.1	32.3	34.5
14	30.8	49.3	87.5	69.5	74.2	181	380	252	109	52.2	31.5	32.3
15	31.5	49.3	78.9	67.2	75.4	175	368	262	109	50.3	32.3	32.3
16	33.0	47.4	77.7	66.0	79.9	173	392	255	104	49.3	31.5	31.5
17	32.3	46.5	83.8	63.8	76.5	177	435	243	97.8	47.4	31.5	31.5
18	33.0	46.5	82.6	62.7	74.2	199	468	239	100	46.5	32.3	31.5
19	34.3	46.5	80.1	60.6	74.2	239	389	227	100	44.7	31.5	27.9
20	33.8	46.5	77.7	58.4	80.1	257	352	214	96.5	45.5	31.5	29.3
21	33.0	54.1	95.1	59.5	92.5	234	416	201	100	43.0	31.5	30.0
22	33.8	50.3	299	73.0	140	199	398	191	113	45.5	30.8	30.0
23	35.0	48.4	309	91.2	161	185	352	189	104	51.3	30.8	29.3
24	34.5	47.4	234	92.5	133	179	312	179	97.8	45.5	29.3	30.0
25	34.5	47.4	185	97.8	113	183	299	157	91.2	47.4	29.3	30.8
26	33.8	47.4	143	95.1	103	246	299	159	87.5	43.9	29.3	33.0
27	34.5	46.5	122	93.8	97.8	286	301	154	83.8	42.3	30.0	33.8
28	39.9	45.5	109	93.8	96.5	260	312	152	82.6	40.7	30.0	34.5
29	42.3	44.7	102	92.5	152	317	327	150	77.7	38.3	29.3	33.8
30	39.1	43.9	99.1	92.5	---	468	333	140	74.2	39.1	30.0	33.8
31	38.3	----	92.5	103	---	366	----	135	----	38.3	30.0	----

CEYHAN BASIN
2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30, 1989
Max.and Min. Flows :Maximum Discharge :110 m^3/s
:Minimum Discharge :1.53 m^3/s

Table 4.2.29 1989 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	40.3	61.1	64.0	70.0	51.7	74.0	80.0	57.3	30.7	19.5	14.7	11.1
2	40.3	59.2	63.0	69.0	50.8	86.8	80.0	53.5	30.7	17.7	14.7	3.47
3	35.2	66.0	48.3	66.0	50.0	79.0	82.0	51.7	30.7	18.5	14.3	2.67
4	40.3	62.0	60.1	59.2	50.0	82.0	84.4	49.1	29.4	18.5	14.7	2.51
5	41.8	58.2	70.0	60.1	50.0	82.0	83.2	47.4	28.7	18.5	14.7	1.73
6	41.8	55.4	74.0	58.2	50.8	78.0	84.4	49.1	28.7	17.7	14.3	1.53
7	42.5	74.0	78.0	56.3	50.8	82.0	88.0	66.0	27.5	17.7	11.4	1.53
8	42.5	97.9	77.0	56.3	47.4	124.	91.6	57.3	27.5	17.7	13.9	1.53
9	42.5	88.0	75.0	58.2	50.8	127.	94.0	53.5	26.2	17.7	15.1	1.53
10	47.4	75.0	72.0	58.2	52.5	110.	80.4	53.5	26.2	17.2	14.7	1.53
11	60.1	69.0	71.0	57.3	54.4	102.	86.8	51.7	30.0	17.7	15.1	1.53
12	57.3	50.0	72.0	58.2	51.7	97.9	85.6	49.1	32.6	16.8	13.9	1.53
13	53.5	48.3	73.0	57.3	50.8	96.6	84.4	46.6	32.6	16.8	14.7	1.53
14	51.7	55.4	73.0	55.4	51.7	101.	82.0	44.0	30.0	17.2	15.1	1.53
15	50.8	55.4	76.0	54.4	51.7	110.	80.0	42.5	27.5	17.2	15.1	1.53
16	50.0	55.4	72.0	54.4	53.5	106.	78.0	41.0	27.5	16.4	16.0	1.53
17	46.6	62.0	92.8	54.4	45.7	101.	78.0	41.0	26.9	16.0	18.1	1.53
18	52.5	70.0	141	53.5	45.7	96.6	75.0	40.3	28.1	16.0	16.8	1.53
19	56.3	75.0	139	54.5	45.7	95.3	72.0	37.3	27.5	16.0	18.1	1.53
20	55.4	70.0	114	54.4	47.4	95.3	68.0	35.2	25.6	15.6	15.6	1.53
21	53.5	66.0	102	53.5	54.4	97.9	64.0	33.9	23.7	16.0	14.7	1.53
22	51.7	65.0	97.9	53.5	53.5	99.2	61.6	32.6	23.2	15.6	14.7	1.53
23	50.8	66.0	94.0	53.5	53.5	97.9	60.1	36.5	22.1	16.0	14.7	1.53
24	50.0	65.0	89.2	54.4	54.4	95.3	58.2	32.6	22.7	15.1	14.7	1.53
25	49.1	64.0	92.8	53.5	55.4	96.6	57.3	33.3	21.1	15.6	14.3	1.53
26	49.1	63.0	88.0	53.5	56.3	107.	58.2	32.6	21.1	15.6	14.3	1.53
27	49.1	64.0	79.0	52.5	59.2	102.	66.0	32.6	20.1	16.0	14.3	1.53
28	50.8	69.0	77.0	52.5	61.1	96.6	64.0	31.3	19.5	15.6	15.6	1.53
29	80.0	68.0	75.0	53.5	----	80.4	61.6	32.0	19.5	15.6	15.1	1.53
30	84.4	66.0	74.0	52.5	----	85.6	60.1	32.0	18.5	15.1	15.1	1.53
31	69.0	----	73.0	51.7	----	82.0	----	32.0	---	15.1	13.6	1.53

CEYHAN BASIN

2001-CEYHAN RIVER - KILAVUZLU

Location :Under the Kılavuzlu Bridge on the K.Maraş- Göksu Highway
Precipitation Area :8608.8 km2
Observation Duration : March 11,1940 - September 30,1990
Max.and Min. Flows :Maximum Discharge :197 m^3/s
:Minimum Discharge :1.44 m^3/s

Table 4.2.30 1990 River Flows (m^3/sn)

Days	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.63	1.94	6.95	4.88	2.67	4.88	3.31	103	63.0	68.0	23.7	83.2
2	2.14	1.94	5.62	5.06	2.67	5.04	3.31	25.6	62.0	67.0	3.31	68.8
3	2.15	1.94	5.05	4.69	2.67	3.88	3.79	8.62	5.25	66.0	2.83	86.8
4	2.15	1.94	4.69	4.69	2.67	4.88	3.47	13.6	4.69	68.0	2.83	86.8
5	2.15	1.94	4.12	4.51	2.67	4.69	3.11	121	3.79	68.0	2.67	86.8
6	2.51	1.94	4.14	4.51	2.51	4.69	6.26	111	3.63	65.0	2.83	86.8
7	2.15	1.81	3.94	4.51	2.51	4.61	7.64	47.4	3.63	69.0	2.67	86.8
8	2.25	1.81	3.19	4.51	2.15	4.30	5.75	43.9	3.63	76.0	2.67	86.8
9	2.14	1.73	3.79	4.51	2.35	4.14	13.6	68.0	3.63	72.0	2.67	86.8
10	2.14	1.73	3.41	3.95	2.15	4.14	21.1	85.6	3.63	72.0	7.18	86.8
11	2.04	1.85	22.1	4.14	2.25	3.95	12.7	91.6	3.63	74.0	90.4	86.8
12	1.94	1.71	19.5	4.14	2.35	3.79	20.1	88.0	3.79	70.0	91.6	52.5
13	1.94	1.94	12.1	4.11	2.35	3.79	19.5	82.0	3.63	60.0	91.6	64.0
14	3.31	16.8	9.40	4.11	2.32	3.61	95.7	82.0	7.41	63.0	91.6	84.4
15	1.42	82.0	7.41	4.14	5.41	3.61	20.1	81.0	26.9	61.1	86.8	64.4
16	1.44	94.0	7.87	3.95	5.43	3.63	33.7	81.0	47.4	57.3	82.0	84.4
17	1.43	78.0	7.64	3.95	8.10	3.47	25.6	81.0	47.4	54.4	82.0	84.4
18	1.93	90.4	6.95	3.45	13.6	3.47	29.4	82.0	50.8	51.5	82.0	83.2
19	1.32	90.4	6.49	3.79	9.40	3.47	36.5	81.0	62.0	50.0	82.0	83.2
20	1.32	85.4	6.81	3.61	7.41	3.47	30.0	81.0	61.1	45.7	82.0	83.2
21	1.42	80.8	6.03	3.63	6.9	3.47	50.8	81.0	64.0	42.5	82.0	83.2
22	1.51	75.0	5.80	3.63	5.8	3.47	50.2	81.0	72.0	40.3	82.0	83.2
23	1.73	75.0	5.60	3.47	5.41	3.79	22.7	101	76.0	48.3	82.0	83.2
24	1.84	69.0	5.43	3.41	5.06	3.61	12.1	132	75.0	65.0	82.0	84.4
25	1.94	71.0	5.25	1.15	4.69	3.47	88.0	165	74.0	57.1	82.0	84.4
26	2.03	115	5.04	3.15	4.69	3.47	107	197	72.0	50.8	82.0	84.4
27	1.94	209	4.88	3.15	4.51	3.47	115	161	71.0	45.7	82.0	84.4
28	1.74	8.88	4.88	2.22	4.51	3.47	53.9	117	70.0	41.0	81.0	84.4
29	1.94	6.26	4.69	3.83	---	3.47	54.4	111	69.0	37.3	81.0	84.4
30	1.94	6.95	4.69	2.67	---	3.11	113	107	68.0	33.9	81.0	86.8
31	1.94	----	4.69	2.67	----	3.31	----	102	----	31.3	81.0	-----

Table 4.2 Annual Discharge Values of Ceyhan River Basin

YEAR	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
1961	25.10	25.20	28.40	33.80	57.60	66.20	162.0	98.90	40.60	22.10	17.10	20.00
1962	21.88	27.05	69.78	48.59	101.4	174.8	148.9	113.8	55.78	29.41	20.57	21.83
1963	25.05	24.22	74.89	123.3	173.4	135.5	218.9	240.4	137.5	60.45	40.91	38.85
1964	47.08	43.27	40.81	34.23	44.39	130.7	110.0	73.49	43.75	24.19	19.18	19.71
1965	21.75	25.17	43.12	43.17	68.07	238.5	269.7	152.1	90.19	44.87	29.65	30.44
1966	35.84	37.83	76.65	288.9	160.8	178.0	243.2	157.7	87.97	51.08	37.69	40.54
1967	43.96	71.04	131.1	132.7	91.63	150.2	240.1	234.2	103.8	62.71	42.25	40.21
1968	48.18	89.71	106.1	137.9	135.4	317.9	347.7	218.9	111.4	58.10	47.65	46.92
1969	48.54	114.6	163.6	157.6	135.4	354.0	331.4	411.3	154.9	82.17	60.48	57.12
1970	58.90	56.10	81.80	76.10	132.0	203.0	200.0	111.0	61.90	41.30	30.80	34.80
1971	46.37	53.37	72.41	50.37	52.53	130.2	261.2	147.0	74.86	38.30	35.11	30.05
1972	39.01	34.87	38.02	30.95	35.05	67.11	120.7	122.6	80.81	31.86	22.64	23.42
1973	36.24	41.01	33.01	27.16	44.63	84.47	121.0	72.85	37.19	18.71	13.84	15.86
1974	21.74	27.09	40.94	31.71	42.71	149.0	129.5	72.26	38.19	23.03	20.54	24.32
1975	26.01	27.31	55.96	67.65	67.03	163.2	325.9	204.0	79.65	41.69	30.64	27.89

Table 4.2 (cont.) Annual Discharge Values of Ceyhan River Basin

YEAR	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
1976	31.30	32.5	33.02	59.67	58.72	127.3	325.8	241.7	115.7	51.94	33.96	31.20
1977	52.54	61.1	130.7	69.83	143.2	226.8	274.7	219.8	103.8	52.24	35.27	34.36
1978	39.74	38.1	45.66	95.47	146.7	161.1	219.7	166.5	88.15	45.09	32.77	31.14
1979	40.49	43.8	83.60	189.2	153.4	133.9	136.2	104.3	73.85	41.34	29.82	28.57
1980	35.59	63.9	90.33	81.48	91.23	271.4	511.6	450.2	179.1	65.74	44.57	39.98
1981	46.36	45.1	59.87	86.45	136.8	326.4	256.5	194.7	120.5	55.57	35.52	34.29
1982	38.84	44.7	132.9	138.7	81.74	112.1	210.3	161.3	71.73	40.60	32.61	31.48
1983	36.98	35.5	33.69	38.02	47.14	126.3	216.0	153.7	70.65	36.83	28.30	27.94
1984	33.80	74.1	85.51	70.06	95.13	135.0	182.0	143.1	62.97	32.93	25.89	25.34
1985	28.64	31.6	31.06	47.31	74.09	83.04	141.7	67.15	33.05	19.22	15.06	14.62
1986	32.59	35.4	40.95	95.25	73.14	89.41	87.22	64.75	50.55	20.56	17.05	16.88
1987	24.77	40.8	51.34	118.0	141.0	151.2	291.7	217.8	110.0	45.66	30.23	29.56
1988	33.29	53.2	100.0	78.96	98.91	215.6	329.2	229.3	105.2	52.69	32.64	31.43
1989	51.17	65.4	82.16	56.48	51.82	95.71	74.96	42.85	26.20	16.70	14.91	1.991
1990	1.980	45.8	6.780	3.890	4.540	3.900	34.30	89.70	39.40	57.50	58.50	83.30

APPENDIX-B

THE DETAIL OF THE INSTRUMENT