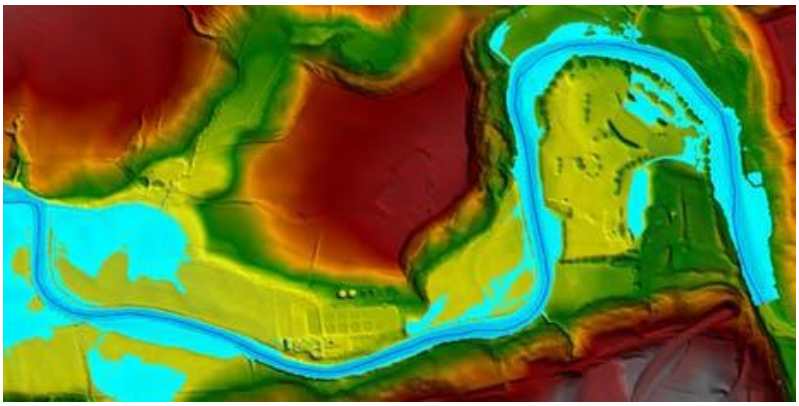


2018

# ENGINEERING HYDROLOGY

## DOGANPINAR POND

## AND

## IRRIGATION PROJECT

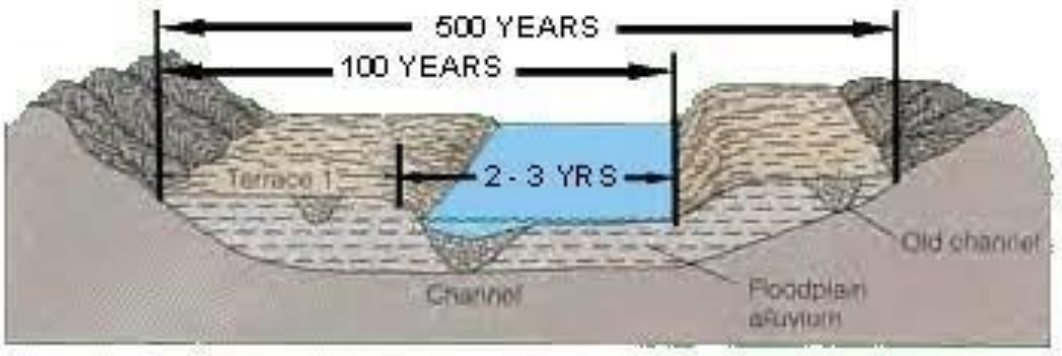



HYDROPOLITICS ACADEMY



Hydropolitics Academy

1.5.2018




**Summarized for Second International Advanced**

**Course on Renewable Energies**

**May 2007, Istanbul/Turkey**

By Harun Yaşar KUTOĞLU

Hydropolitics Academy

2018

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HYDROPOLITICS ACADEMY

HYDROPOLİTICS ASSOCIATION
PROJECT and CONSULTANCY CENTER

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HYDROPOLITICS ASSOCIATION

PROJECT and CONSULTANCY CENTER

*SECTION 1*

# LOCATION OF PROJECT AREA AND ITS PURPOSE

## 1. Introduction

The original report in Turkish consists of 7 sections and those sections are summarized in the same order as follows .

### 1.1. Location of Project Area

Doğanpınar pond(small dam) is located in Gediz River catchment in the geographycal region of Agean Sea. Its catchment area is 59,9 $km^2$ at the pond axis on the Geçtin creek, shown in Figure 1.

The project area was visited by the engineering company's experts of hydrologist, agriculture engineer, geological engineer and civil engineer at the early initial stage of engineering services for the Project.

### 1.2. Purpose of the Project

The project will suply irrigation water to the agricultural area close to Doğanpınar village.

## *SECTION 2*

## *CLIMATE*

### 2.1. General

(i) Mediterranean climate is predominant on the project area, with hot and dry summer season and warm and rainy winter.

(ii) The hypsometric curve for the pond catchment can be seen in Figure 2.

(iii) The rainfall regime over the catchment can be represented by the mean montly rainfall data at the meteorological stations presented in Table 1. These stations are illustrated in Figure 1.

(iv) Thiessen polygons method is applied to the pond catchment as shown in Figure 3, and from the view of these polygons it is concluded that Güneşli station's rainfall data represent the whole catchment area.

(v) Yearly and daily max. rainfall data series at Güneşli are given in Table 2 and 3 with the results of frequency analyses.

(vi) Mean monthly temperature data at the surrounding meteorological stations are presented in Table 4.

(vii) Mean monthly temperature values at Simav were transferred to Güneşli station altitude and the reservoir water surface elevation by the use of temperature lapse rate of 0.5ºC/100 m and latitude correction factor of 1ºC/60'.

(viii) Mean monthly evaporation data from class A pan at Güneşli station is presented in Table 5 for the observation period from years 1987 to 1995.

Net evaporation values from the reservoir water surface in the last row of Table 5 are resulted from the step by step calculations shown in Table 5 and use of relationship in Figure 4.

The mean monthly temperature values in Table 5 for Güneşli station are obtained from the transfer of temperature values in Table 5 for Simav station.

*SECTION 3*

# WATER SUPPLY

## 3.1. Stream Gauging Station

The Doğanpınar stream gauging station (SGS) No: 5-65 equipped with recording water stage gauge was established on the Geçtin creek at pond site in January 2005

The monthly flows at SGS No: 5-65 are presented in Table 6 for the obsevarion period of years 2005 to 2006.

Some characteristic figures for SGS No: 5-65 and others within the same river drainage system are given in Table 7, for which monthly flows and annual peak discharges data can be used in estimating similar values at the pond site.

To do these, the following approaches are taken into account:

a) Correlation and regressions analysis
b) Hydrological similarity
c) Frequency analyses of peak discharge data series at SGSs in Table 7
d) Regional frequency analyses of peak discharge data series at SGSs in Table 7

## 3.2. Water Potential Calculation

Monthly flow data at SGS No:5-65, 5-35, 5-43 and 5-26 are given in Tables 6, 8, 9 and 10 respectively and pairs of these stations are correlated for the common obervation periods as shown in Figures 5, 6, 7 and 8.

The extended values of SGS No: 5-65 from Figure 5 are presented in Table 6.

The missed monthly flow values at SGS No: 5-35 are filled from figures 6 and 7, and then the results are given Table 8.

The missed monthly flow values for year 1995 at SGS No: 5-26 are completed from the relationship in Figure 8 and the results are presented in Table 10.

Finally the monthly flows in Table 6 are adopted for Doğanpınar pond with annual mean flow value of 19.187 $hm^3$.

On the other hand, water potential at the pond axis is estimated by:

i) Hydrological similarity approach, $Q = CA^n$

$$Q_{Dog} = \left( \frac{A_{Dog}}{A_{5\text{-}35}} \right)^{2/3} \times Q_{5\text{-}35} = 0.774 \times Q_{5\text{-}35} = 13.11 \text{ hm}^3$$

where:

Q = annual mean flow, hm3

A = catchment size, km2

C = runoff coefficent

n = power

ii) Empirical Approaches

Turc and Coutagne equations are applied and annual mean flow is obtained from these equations as 10.97 hm3 and 9.84 hm3 respectively for the Doğanpınar pond axis.

The flow values given in Table 6 are assumed as most reliable ones and used in hydraulic design step(Section 4).

## *SECTION 4*

## SEDIMENT AND LOSSES

i) Total yearly sediment yield at pond site is estimated r=280$m^3/km^2$/year and then the dead storage is calculated as 59.9x280x50=838 600 m3

Water quality of Geçtin creek at pond site is determined as $C_1S_1$ from the analyses of water samples.

ii) Evaporation loss:

Mean volume=Dead volume+1/2 Active Volume(see Figure 8A)

= 0.8386 + ½ x 1.678 $hm^3$ = 1.678 $hm^3$

The surface area corresponding to this mean volume is read off from Figure 8A as 0.225 $km^2$

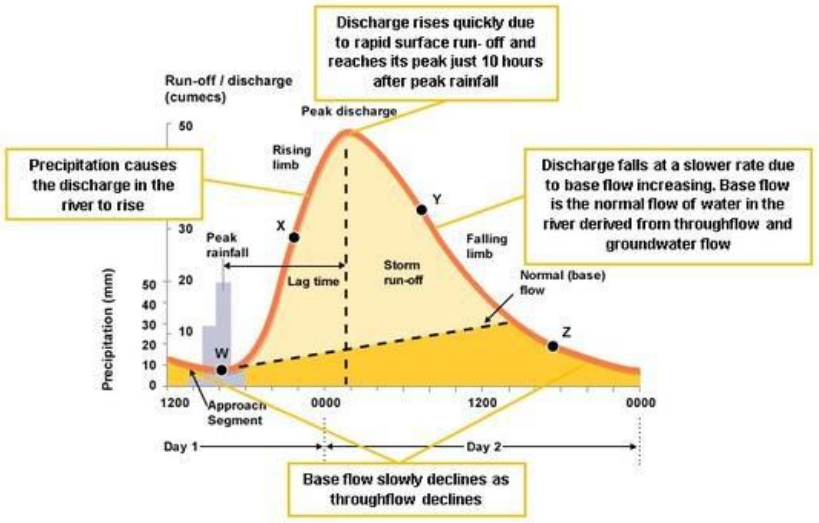
Reservoir elevation- volume-area curves for Doğanpınar pond in Figure 8A are constructed by the use of data obtained from 1/5000 scaled reservoir map.

Evaporation loss from reservoir = 0.225 x 758.1 = 0.171$hm^3$

Infiltration loss = Total volume x Loss coefficient = 2.516 x 0.08 = 0.201 $hm^3$

Total losses = Evaporation loss + Infiltration loss

= 0.171 + 0.201 = 0.372 $hm^3$




***SECTION 5***

## IRRIGATION WATER REQUIREMENT

According to the crop pattern in Table 11, irrigation water requirement is calculated by the use of Blaney-Criddle method, rainfall data at Güneşli and temperature data at Simav are considered in the calculations.

The irrigation scheme consists of pipes, sprinkler and drop irrigation .

Annual total irrigation water requirement is calculated as 4446 $hm^3$/ha

***SECTION 6***

## OPERATION STUDIES

These studies have been carried out for the last 3 years, calculations can be seen in Table 12, which is self-explained.

The released water for irrigation $=V_{active} - V_{loss}$

$$= 1.678 - 0.372$$

$$= 1.306\ hm^3$$

Amount of irrigation water = Irrigation areax0.9x0.97x (4446/1 000 000)

$$= 0.00388\ hm^3/ha$$

Net irrigated area= 1.306/0.00388=336.6 ha

Net irrigated area obtained from operation studies in Table 12 is 493 ha which is more reliable than 336.6 ha value.

## *SECTION 7*

## DESIGN FLOODS

### 7.1. Rainfall Analysis

Annual maximum daily rainfall data series at Güneşli station is used for frequency analysis and the results obtained from this analysis are given in Table 3. The best fit distrubution function is Gama 2.

### 7.2. Catchment Curve Number

CN=79 is determined by considering the land use of pond catchment.

### 7.3. Catchment Characteristic Values

Size……A= 59.9 km2

Length of main channel……L= 11.1 km

Distance between nearest point to

the gravity center and outlet ……Lc=4.8 km

Harmonic slope……...S=0.041

Curve number……CN= 0.79

Harmonic slope calculation is shown in Figure 9

### 7.4. Design Floods Estimation

The following 3 approaches are used for the estimation of design floods.

#### 7.4.1. Rainfall – Runoff Relationship

DSI synthetic unit hydrograph ( UH ) and Mockus synthetic unit hydrograph(UH) methods are applied to the Doğanpınar pond catchment.

i) DSI UH method:

$qp=414/A^{0.225}(LxL_c/\sqrt{S})^{0.16}$ = 67.8 l/s/km$^2$/mm (yield)

$Q_p$=Ax qp =4.06 m$^3$/s/mm (peak discharge of $UH_2$)

$V_b$= Ax $h_a$= 59.9x1x10$^{-3}$=59 900 m$^3$ ( volume of $UH_2$)

$T_b$ = 3.65($V_b$ / $Q_p$ ) = 14.97 hr (base time of $UH_2$)

$T_p$ = $T_b$ /5 ≈ 3 hr (time to peak)

$UH_2$ graph is shown in Figure 10.

Computation of effective rainfall blocks with 2 hr duration is shown in Table 13. These blocks are converted to the total direct runoff hydrograph by the aid of $UH_2$ in Figure 10 and then superposed with 2 m$^3$/s base flow constant value obtained from the analysis of observed flows at SGS No: 5-65 and 5-35.

Hence total discharge hydrographs are obtained as shown in Figure 11, these hydrographs are produced by two consecutive 2 hr effective rainfall blocks.

ii) Mockus UH method

Application of this method to the pond catchment is as follows:

$T_c$= 0.00032x(L $^{0.77}$/S $^{0.385}$) ≈ 1.43 hr (time of concentration)

D=2$T_c$ $^{1/2}$=2.39 hr≈2.5 hr (effective rainfall duration)

D=ΔD=2.5 hr (unit hydrograph duration)

Tp=0.5x ΔD+0.6Tc=2.11 hr

1.2. Qp= Kx A x $h_a$ / Tp=5.90m3/s/mm(K=0.208) peak discharge of $UH_{2.5}$

Qp=4.83 m3/s( K=0.170) peak discharge of $UH_{2.5}$

$UH_{2.5}$ graph and its ordinates are presented in Figure 12.

Net rainfall blocks with 2.5 hr duration, and their surface runoff peak discharges compated by the aid of $UH_{2.5}$ are given Table 13.

Taking into account of A, Tp and D values, $UH_2$ obtained from DSI method is accepted as the most suitable one in the studies and hence the flood hyragraphs in Figure 11 are adopted in the hydraulic design studies of Doğanpınar pond.

### 7.4.2. Peak Discharge Frequency Analysis

The annual peak discharge data series and SGS No:5-35, closest to the pond axis, are analyzed by applying frequency analysis techniques and results are given in Table 14. The

values with different return periods obtained from best fit distribution, transferred to the pond site by the use of following relationship:

$Q_{Dog}= (A_{Dog} /A_{5-35})^{2/3}$ x $Q_{5-35}$ = 0.774x $Q_{5-35}$

The results are given in Table 15.

### 7.4.3. Regional Flood Frequency Analysis

Frequency analysis of the peak discharge data series with min. 10 years observation period at SGSs in Table 7 are carried out as shown in Table 14, 16, 17,…22 and summary results are given in Table 23 with dimensionless ratios.

A-$Q_2$ relationship for 6 station in Table 23 is shown in Figure 13.

From figure 13, $Q_2$=15 m3/s is determined for pond catchment size and multiplying this figure by average dimensionless ratios in Table 23, the values given in Table 15 are obtained for Doğanpınar pond axis.

### 7.4.4. Comparision of Design Floods

The peak discharge values in Table 15 are compared among themselves and the hydrographs in Figure 11 are adopted for the hydraulic design of the Doğanpınar pond, taking into account the economy, safety and reliability of the project.

### 7.4.5. Spillway Design Hydrograph

Considering downstream conditions and storage capacity of Doğanpınar pond, 1000 yr design flood is accepted as spillway design hydrograph.

The spillway design hydrograph illustrated in Figure 14 is calculated by the use of two consecutive 1000 yr rainfall blocks in Table 13 and $UH_2$ in Figure 10, its peak discharge and volume are $Q_p$= 102.1 $m^3/s$ and $V_{1000}$=2.05 $hm^3$ respectively.

# 8.TABLES

**Table 1: Mean Rainfall Depths at Meteorological Stations Within Catchment and Surrounding Area, mm**

| GÖZLEM PERİYODU | İSTASYON | AYLAR | | | | | | | | | | | | YILLIK TOPLAM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ocak | Şubat | | | Mayıs | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | 101.0 | 81.9 | 69.8 | 56.0 | 45.1 | 18.3 | 8.6 | 4.6 | 14.0 | 33.5 | 79.1 | 126.4 | 638.3 |

**Table 2: Annual Total Rainfall Depths Observed at Güneşli Meteorological Station**

| İSTASYON ADI | GÜNEŞLİ |
|---|---|
| İSTASYON KOTU (m) | 640 |
| İŞLETEN KURULUŞ | DSİ |
| YIL | Y TOP (mm) |
| 1962 | 916.3 |
| 1963 | 720.0 |
| 1964 | 691.3 |
| 1965 | 926.5 |
| 1966 | 785.1 |
| 1968 | 854.7 |
| 1969 | 608.2 |
| 1970 | 745.1 |
| 1971 | 637.8 |
| 1972 | 429.9 |
| 1973 | 620.2 |
| 1974 | 651.5 |
| 1975 | 666.5 |
| 1976 | 596.6 |
| 1977 | 523.4 |
| 1978 | 745.5 |
| 1979 | 768.9 |
| 1980 | 695.5 |
| 1981 | 971.8 |
| 1982 | 497.2 |
| 1983 | 672.1 |
| 1984 | 527.6 |
| 1985 | 608.6 |
| 1986 | 675.3 |
| 1987 | 625.1 |
| 1988 | 520.3 |
| 1989 | 340.1 |
| 1990 | 476.7 |
| 1991 | 389.3 |
| 1992 | 383.1 |
| 1993 | 551.6 |
| 1994 | 492.3 |

| | |
|---|---|
| N = | 32 |
| PORT.= | 634.82 |
| Sx = | 157.96 |
| P-M1 = | 971.8 |
| P-M2 = | 926.5 |
| Cs = | 0.000 |
| Cs Log = | -0.390 |
| UDF = | N |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 2 | 5 | 10 | 25 | 50 | 100 |
| Nor. Dağ. | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**Table 3: Annual Daily Max. Rainfall Depths Observad at Güneşli Station**

| İSTASYON ADI | |
|---|---|
| | |
| | |
| | Y MAX. (mm) |
| 1962 | 71.6 |
| 1963 | 32.5 |
| 1964 | 56.0 |
| 1965 | 56.3 |
| 1966 | 45.0 |
| 1968 | 63.9 |
| 1969 | 46.7 |
| 1970 | 62.8 |
| 1971 | 38.8 |
| 1972 | 38.2 |
| 1973 | 66.6 |
| 1974 | 45.5 |
| 1975 | 61.1 |
| 1976 | 38.5 |
| 1977 | 82.3 |
| 1978 | 53.2 |
| 1979 | 55.5 |
| 1980 | 36.6 |
| 1981 | 72.2 |
| 1982 | 28.7 |
| 1983 | 55.4 |
| 1984 | 52.1 |
| 1985 | 56.3 |
| 1986 | 109.5 |
| 1987 | 77.6 |
| 1988 | 33.6 |
| 1989 | 45.1 |
| 1990 | 54.6 |
| 1991 | 25.2 |
| 1992 | 30.0 |
| 1993 | 57.8 |
| 1994 | 42.0 |

| | |
|---|---|
| N = | 32 |
| PORT.= | 52.85 |
| Sx = | 17.813 |
| P-M1 = | 109.5 |
| P-M2 = | 82.3 |
| Cs = | 0.674 |
| Cs Log = | -0.030 |
| UDF = | G2 |

| YİNELENMELİ DEĞERLER | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | 1.11 | 1.25 | 2 | 5 | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## Table 4: Mean Monthly Temperature Values at Surrounding Area of Project ,ºC

| İSTASYON | GÖZLEM SÜRESİ | KOT (m) | | AYLAR | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ocak | Şubat | Mart | Nisan | Mayıs | Haziran | Temmuz | Ağustos | Eylül | Ekim | Kasım | Aralık | Yıllık |
| GÖRDES | 1980 - 1985, 1987 - 1997 (17 Yıl) | 550 | En Yüksek | 16.1 | 18 | 24.6 | 29.5 | 34 | 37.5 | 40.5 | 38.6 | 36 | 33.5 | 25.5 | 16.8 | 40.5 |
| | | | Ortalama | 3.7 | 3.7 | 6.7 | 11.2 | 15.7 | 20.7 | 22.6 | 22.9 | 19.6 | 14.9 | 8.7 | 5.3 | 13.0 |
| | | | En Düşük | | | | | | | | | | | | | |
| DEMİRCİ | 1991 - 2005 (15 Yıl) | 851 | En Yüksek | 17.1 | 17.3 | 26.1 | 28.3 | 30.5 | 35.2 | 38.6 | 37.8 | 35.5 | 30.8 | 26.8 | 20 | 38.6 |
| | | | Ortalama | 3.7 | 3.5 | 6.3 | 10.9 | 16.7 | 20.9 | 23.8 | 23.7 | 19.5 | 15.0 | 9.1 | 4.8 | 13.2 |
| | | | En Düşük | | | | | | | | | | | | | |
| SİMAV | 1960 - 2005 (46 Yıl) | 809 | En Yüksek | 19.1 | 20.7 | 27.1 | 30.4 | 33 | 35.9 | 38.7 | 38.1 | 36.4 | 33.2 | 27.1 | 21.7 | 38.7 |
| | | | Ortalama | 2.3 | 3.2 | 6.0 | 10.5 | 15.3 | 19.2 | 21.8 | 21.3 | 17.2 | 12.5 | 7.7 | 4.2 | 11.8 |
| | | | En Düşük | | | | | | | | | | | | | |
| Gölet Yağış Alanı | | | | | | | | | | | | | | | | |
| Gölet Yeri (NSS) | | | | | | | | | | | | | | | | |
| Sulama Alanı | | | | | | | | | | | | | | | | |

Gölet Yağış Alanı : $39^0$ 05'
Gölet Yeri (NSS) : $39^0$ 05'
Sulama Alanı : $39^0$ 01'

## Table 5: Net Evaporation from Doğanpınar Pond Reservoir , mm

| | Kot (m) | AYLAR | | | | | | | | | | | | YILLIK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ocak | Şubat | | | Mayıs | | | | | | | | |
| GÜNEŞLİ MET.İST.(DSİ) | 640 | | | | 111.6 | 162.2 | 234.3 | 297.1 | 300.9 | 220.8 | 118.4 | 44.2 | | 1489.4 |
| SİMAV MET. İST. (DMİ) | 809 | 2.3 | 3.2 | 6.0 | 10.5 | 15.3 | 19.2 | 21.8 | 21.3 | 17.2 | 12.5 | 7.7 | 4.2 | 11.8 |
| GÜNEŞLİ MET.İST.(DSİ) | 640 | 3.2 | 4.0 | 6.8 | 11.4 | 16.1 | 20.1 | 22.6 | 22.1 | 18.0 | 13.3 | 8.5 | 5.1 | 12.6 |
| PROJE YERİ (NSS) | 808 | 2.3 | 3.2 | 6.0 | 10.5 | 15.3 | 19.2 | 21.8 | 21.3 | 17.2 | 12.5 | 7.7 | 4.2 | 11.8 |
| PROJE YERİ (NSS) | 808 | | | | 79.7 | 163.7 | 234.5 | 279.8 | 271.2 | 197.9 | 113.8 | 28.8 | | |
| PROJE YERİ (NSS) | 808 | | | | 55.8 | 114.6 | 164.1 | 195.9 | 189.9 | 138.5 | 79.7 | 20.2 | | |
| PROJE YERİ YAĞIŞ | 640 | 104.9 | 78.6 | 72.3 | 56.4 | 46.7 | 19.6 | 7.6 | 4.3 | 14.5 | 31.9 | 74.7 | 120.9 | 632.4 |
| PROJE YERİ (NSS) | 808 | | | | | 67.9 | 144.5 | 188.3 | 185.6 | 124.0 | 47.8 | | | 758.1 |

**Table: 6 Montly Flows at SGS No: 5 - 65**

| DSİ ETÜD VE PLAN DAİRESİ BAŞKANLIĞI<br>RASATLAR ŞUBE MÜDÜRLÜĞÜ | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RASAT TABLOSU | | | | | | | | | | | | | |
| İSTASYON İSMİ | | | GEÇTİN D.-DOĞANPINAR | | | | | | İŞLT. İDARE | | DSİ | RAKIM | 786 |
| İSTASYON NO | | | 5-65 | | | | | | BÖLGE | | EGE | | |
| İL VE İLÇESİ | | | MANİSA-GÖRDES | | | | | | ENLM-BYLAM | | **° **' - **° **' | | |
| RASAT TÜRÜ | | | AYLIK AKIM ($hm^3$) | | | | | | | | | | |
| YIL | EKİM | KASIM | ARALK | OCAK | ŞUBAT | MART | NİSAN | MAYIS | HAZRN | TEMMZ | AĞSTS | EYLÜL | YILLIK |
| 1970 | 0.544 | 0.581 | 8.271 | 2.639 | 6.185 | 3.304 | 1.495 | 0.719 | 0.603 | 0.519 | 0.506 | 0.515 | 25.881 |
| 1971 | 0.625 | 0.723 | 1.415 | 2.156 | 5.548 | 6.947 | 1.625 | 0.650 | 0.556 | 0.522 | 0.529 | 0.665 | 21.961 |
| 1972 | 0.577 | 1.629 | 2.872 | 0.741 | 2.488 | 1.235 | 0.923 | 0.591 | 0.509 | 0.487 | 0.547 | 0.495 | 13.093 |
| 1973 | 0.668 | 0.586 | 0.578 | 0.946 | 3.918 | 1.890 | 1.353 | 0.648 | 0.531 | 0.501 | 0.513 | 0.528 | 12.659 |
| 1974 | 0.533 | 0.579 | 1.405 | 0.636 | 3.427 | 4.434 | 0.911 | 0.681 | 0.494 | 0.477 | 0.489 | 0.563 | 14.629 |
| 1975 | 0.524 | 0.964 | 3.533 | 3.568 | 2.848 | 1.115 | 0.880 | 0.783 | 0.540 | 0.493 | 0.493 | 0.494 | 16.236 |
| 1976 | 0.520 | 0.711 | 1.709 | 0.814 | 2.379 | 0.699 | 2.633 | 0.660 | 0.519 | 0.487 | 0.482 | 0.486 | 12.100 |
| 1977 | 0.945 | 1.399 | 3.141 | 2.344 | 1.440 | 1.056 | 0.694 | 0.545 | 0.492 | 0.477 | 0.477 | 0.490 | 13.501 |
| 1978 | 1.019 | 0.601 | 1.389 | 7.349 | 5.904 | 2.405 | 2.321 | 1.867 | 0.477 | 0.474 | 0.473 | 0.529 | 24.810 |
| 1979 | 0.547 | 0.760 | 0.642 | 3.233 | 1.252 | 0.659 | 0.589 | 0.638 | 0.533 | 0.502 | 0.501 | 0.507 | 10.362 |
| 1980 | 0.536 | 0.609 | 1.358 | 5.455 | 1.062 | 2.848 | 0.825 | 0.683 | 0.594 | 0.512 | 0.512 | 0.530 | 15.524 |
| 1981 | 0.537 | 0.672 | 3.064 | 11.861 | 1.604 | 1.753 | 0.564 | 0.531 | 0.485 | 0.476 | 0.481 | 0.502 | 22.531 |
| 1982 | 0.515 | 1.488 | 13.538 | 1.534 | 1.434 | 1.825 | 1.892 | 1.909 | 0.553 | 0.529 | 0.490 | 0.486 | 26.194 |
| 1983 | 0.543 | 0.599 | 1.544 | 1.019 | 2.643 | 0.753 | 0.649 | 0.587 | 0.523 | 0.519 | 0.503 | 0.504 | 10.387 |
| 1984 | 0.275 | 1.612 | 1.365 | 4.376 | 11.402 | 7.262 | 6.306 | 2.016 | 0.633 | 0.280 | 0.216 | 0.209 | 35.952 |
| 1985 | 0.216 | 0.732 | 0.623 | 4.290 | 2.212 | 2.849 | 1.250 | 0.579 | 0.234 | 0.058 | 0.025 | 0.044 | 13.112 |
| 1986 | 0.520 | 1.753 | 0.784 | 6.922 | 3.196 | 1.990 | 0.688 | 0.578 | 0.510 | 0.478 | 0.472 | 0.499 | 18.390 |
| 1987 | 0.537 | 0.575 | 1.218 | 4.781 | 2.027 | 1.045 | 0.954 | 0.786 | 0.602 | 0.518 | 0.472 | 0.502 | 14.017 |
| 1988 | 0.556 | 1.445 | 2.166 | 1.136 | 1.308 | 7.649 | 1.287 | 0.843 | 0.725 | 0.575 | 0.562 | 0.620 | 18.872 |
| 1989 | 0.153 | 0.722 | 2.643 | 1.209 | 0.729 | 1.364 | 0.659 | 0.605 | 0.126 | 0.027 | 0.019 | 0.046 | 8.301 |
| 1990 | 0.197 | 0.828 | 1.920 | 1.008 | 2.647 | 1.453 | 0.719 | 0.374 | 0.115 | 0.020 | 0.019 | 0.028 | 9.329 |
| 1991 | 0.039 | 0.107 | 2.858 | 0.925 | 1.004 | 0.826 | 1.940 | 2.355 | 0.894 | 0.264 | 0.137 | 0.178 | 11.527 |
| 1992 | 0.217 | 0.240 | 0.680 | 0.968 | 0.781 | 5.102 | 3.293 | 0.703 | 0.251 | 0.070 | 0.023 | 0.027 | 12.354 |
| 1993 | 0.134 | 0.659 | 0.888 | 0.992 | 4.355 | 6.701 | 3.866 | 1.101 | 0.303 | 0.440 | 0.063 | 0.032 | 19.531 |
| 1994 | 0.085 | 0.356 | 1.875 | 1.398 | 3.013 | 2.519 | 1.949 | 1.494 | 0.266 | 0.030 | 0.022 | 0.020 | 13.028 |
| 1995 | 0.159 | 0.384 | 1.361 | 6.024 | 2.002 | 7.183 | 6.304 | 1.222 | 0.251 | 0.101 | 0.022 | 0.100 | 25.111 |
| 1996 | 0.125 | 1.131 | 1.846 | 1.555 | 6.669 | 3.794 | 3.904 | 1.274 | 0.425 | 0.075 | 0.036 | 0.088 | 20.922 |
| 1997 | 0.188 | 0.876 | 1.084 | 2.935 | 0.873 | 2.161 | 10.475 | 1.104 | 0.158 | 0.019 | 0.019 | 0.019 | 19.911 |
| 1998 | 0.840 | 0.885 | 6.798 | 5.270 | 5.337 | 7.982 | 3.863 | 4.634 | 1.117 | 0.386 | 0.123 | 0.083 | 37.319 |
| 1999 | 0.335 | 3.027 | 4.944 | 4.964 | 15.589 | 7.290 | 3.365 | 0.787 | 0.566 | 0.090 | 0.039 | 0.048 | 41.045 |
| 2000 | 0.125 | 0.454 | 1.072 | 2.329 | 6.285 | 5.090 | 3.339 | 1.104 | 0.177 | 0.019 | 0.019 | 0.019 | 20.032 |
| 2001 | 0.230 | 0.243 | 0.557 | 0.330 | 0.461 | 0.462 | 0.985 | 0.723 | 0.158 | 0.019 | 0.019 | 0.022 | 4.209 |
| 2002 | 0.019 | 0.666 | 10.610 | 6.723 | 2.228 | 3.810 | 7.294 | 1.586 | 0.594 | 0.060 | 0.019 | 0.019 | 33.628 |

**Table 6 Continued:**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | **0.371** | **1.046** | **1.427** | **2.491** | **8.296** | **7.164** | **6.434** | **1.517** | **0.534** | **0.094** | **0.025** | **0.222** | 29.622 |
| 2004 | **0.251** | **0.616** | **1.192** | **4.060** | **5.002** | **6.188** | **1.086** | **0.583** | **0.218** | **0.070** | **0.022** | **0.019** | 19.308 |
| 2005 | 0.000 | 0.000 | 0.000 | 0.335 | 4.767 | 7.789 | 1.218 | 0.770 | 1.231 | 2.177 | 2.556 | 0.942 | 21.786 |
| 2006 | 0.071 | 0.266 | 1.233 | 2.781 | 7.254 | 8.975 | 1.226 | 0.344 | 0.449 | 0.058 | 0.044 | 0.043 | 22.744 |
| **Ort** | **0.386** | **0.825** | **2.530** | **3.030** | **3.772** | **3.718** | **2.426** | **1.043** | **0.485** | **0.349** | **0.324** | **0.301** | **19.187** |

Not: 1970 - 2004 yılları aylık akımları (5-65) AGİ ile (5-35) AGİ aylık akımları lineer korelasyonundan; (y = 1.1117 X + 0.0193: R= 0.991)

**Table 7: Characteristic Values of SGSs Located within Project Area and Surrounding Area**

| İSTASYON NO | İSTASYON ADI | İŞLETEN | AÇILIŞ TARİHİ | KAPANIŞ TARİHİ | YAĞIŞ ALANI ($km^2$) | İSTASYON KOTU | SEVİYE ÖLÇEĞİ | | Değerlendirilen Yıllar |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Eşel | Lim | |
| 5 - 65 | Geçtindere - Doğanpınar | DSİ | (14.05.2004' te Münferit) 15.01.2005 | | 59.9 | 786 | X | X | 2005 - 2006 |
| 5 - 35* | İn Deresi - Güneşli | DSİ | 10.01.1983 | | 88.0 | 598 | X | X | 1984 - 85, 1989 - 96, 1998 - 99, 2001, 2003 - 2006 |
| 5 - 43* | Cemaldere - Kayganlı | | | | | | | | 1991-2003 |
| 5 - 26 | Sarma Ç. - Sarma | DSİ | 1969 | | 52.3 | 117 | X | X | 1970-94, 1996-2005 |
| 5 - 28* | Gördes Ç. - Hacıhıdır | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | 1980 - 2004 |
| 520* | Gördes Ç. - Çömlekçi | EİE | | | | | | | 1969 - 1978 |
| 5 - 04 (512) | Kum Ç. - Çömlekçi | DSİ | | | | | | | 1952-1960 |
| 5 - 34* | Gördes Ç. - Maden Çeşmesi | DSİ | | | | | | | 1983-1998 |
| 5 - 44 | Demirbüken - Başlamış | | | | | | | | 1996-2001 |
| 5 - 15* | Medar Ç. - Medar Köprüsü | DSİ | | | | | | | 1967-1997 |
| 509 (5 - 14)* | Medar Ç. - Kayalıoğlu | | | | | | | | 1952-54, 1962-2004 |

**Table 8: Monthly Flows at SGS No: 5 - 35**

| DSİ ETÜD VE PLAN DAİRESİ BAŞKANLIĞI<br>RASATLAR ŞUBE MÜDÜRLÜĞÜ | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RASAT TABLOSU | | | | | | | | | | | | | |
| İSTASYON İSMİ | İN DERESİ-GÜNEŞLİ | | | | | | | İŞLT. İDARE | DSİ | RAKIM | 598 | | |
| İSTASYON NO | 5-35 | | | | | | | BÖLGE | EGE | | | | |
| İL VE İLÇESİ | MANİSA-GÖRDES | | | | | | | ENLM-BYLAM | 39° 03' - 28° 22' | | | | |
| RASAT TÜRÜ | AYLIK AKIM ($hm^3$) | | | | | | | | | | | | |
| YIL | EKİM | KASIM | ARALK | OCAK | ŞUBAT | MART | NİSAN | MAYIS | HAZRN | TEMMZ | AĞSTS | EYLÜL | YILLIK |
| 1970 | **0.472** | **0.505** | **7.423** | **2.356** | **5.546** | **2.955** | **1.327** | **0.629** | **0.525** | **0.450** | **0.438** | **0.446** | 23.072 |
| 1971 | **0.545** | **0.633** | **1.255** | **1.922** | **4.973** | **6.232** | **1.445** | **0.567** | **0.482** | **0.453** | **0.458** | **0.581** | 19.546 |
| 1972 | **0.502** | **1.448** | **2.566** | **0.649** | **2.221** | **1.093** | **0.813** | **0.514** | **0.441** | **0.421** | **0.475** | **0.428** | 11.570 |
| 1973 | **0.583** | **0.509** | **0.503** | **0.834** | **3.507** | **1.682** | **1.199** | **0.565** | **0.461** | **0.433** | **0.444** | **0.458** | 11.179 |
| 1974 | **0.462** | **0.503** | **1.246** | **0.555** | **3.065** | **3.972** | **0.802** | **0.595** | **0.427** | **0.412** | **0.423** | **0.489** | 12.951 |
| 1975 | **0.454** | **0.850** | **3.161** | **3.192** | **2.545** | **0.985** | **0.774** | **0.687** | **0.469** | **0.426** | **0.426** | **0.427** | 14.396 |
| 1976 | **0.450** | **0.622** | **1.520** | **0.715** | **2.123** | **0.612** | **2.351** | **0.576** | **0.449** | **0.421** | **0.416** | **0.420** | 10.676 |
| 1977 | **0.832** | **1.241** | **2.808** | **2.091** | **1.278** | **0.933** | **0.607** | **0.473** | **0.426** | **0.412** | **0.412** | **0.424** | 11.936 |
| 1978 | **0.899** | **0.523** | **1.232** | **6.594** | **5.294** | **2.146** | **2.070** | **1.662** | **0.412** | **0.409** | **0.408** | **0.459** | 22.109 |
| 1979 | **0.474** | **0.666** | **0.560** | **2.891** | **1.109** | **0.576** | **0.512** | **0.557** | **0.462** | **0.434** | **0.433** | **0.439** | 9.113 |
| 1980 | **0.465** | **0.530** | **1.204** | **4.890** | **0.938** | **2.545** | **0.725** | **0.597** | **0.517** | **0.443** | **0.443** | **0.459** | 13.756 |
| 1981 | **0.466** | **0.587** | **2.739** | **10.651** | **1.425** | **1.559** | **0.490** | **0.461** | **0.419** | **0.411** | **0.416** | **0.435** | 20.058 |
| 1982 | **0.446** | **1.321** | **12.160** | **1.362** | **1.272** | **1.624** | **1.685** | **1.700** | **0.480** | **0.459** | **0.424** | **0.420** | 23.354 |
| 1983 | **0.471** | **0.522** | **1.372** | **0.899** | **2.361** | **0.660** | **0.566** | **0.511** | **0.453** | **0.450** | **0.435** | **0.436** | 9.135 |
| 1984 | 0.230 | 1.433 | 1.210 | 3.919 | 10.239 | 6.515 | 5.655 | 1.796 | 0.552 | 0.234 | 0.177 | 0.171 | 32.131 |
| 1985 | 0.177 | 0.641 | 0.543 | 3.841 | 1.973 | 2.545 | 1.107 | 0.503 | 0.193 | 0.035 | 0.005 | 0.022 | 11.586 |
| 1986 | **0.450** | **1.559** | **0.688** | **6.209** | **2.858** | **1.773** | **0.601** | **0.503** | **0.442** | **0.413** | **0.408** | **0.431** | 16.334 |
| 1987 | **0.466** | **0.500** | **1.078** | **4.283** | **1.806** | **0.923** | **0.841** | **0.690** | **0.524** | **0.449** | **0.407** | **0.434** | 12.400 |
| 1988 | **0.483** | **1.283** | **1.931** | **1.004** | **1.160** | **6.863** | **1.140** | **0.741** | **0.634** | **0.500** | **0.488** | **0.540** | 16.768 |
| 1989 | 0.120 | 0.632 | 2.360 | 1.070 | 0.638 | 1.210 | 0.575 | 0.527 | 0.096 | 0.007 | 0.000 | 0.024 | 7.259 |
| 1990 | 0.159 | 0.728 | 1.710 | 0.889 | 2.364 | 1.290 | 0.629 | 0.319 | 0.086 | 0.001 | 0.000 | 0.007 | 8.183 |
| 1991 | 0.018 | 0.079 | 2.553 | 0.815 | 0.886 | 0.726 | 1.728 | 2.101 | 0.786 | 0.220 | 0.106 | 0.142 | 10.160 |
| 1992 | 0.178 | 0.198 | 0.594 | 0.853 | 0.685 | 4.572 | 2.945 | 0.615 | 0.209 | 0.046 | 0.003 | 0.007 | 10.905 |
| 1993 | 0.103 | 0.575 | 0.781 | 0.875 | 3.900 | 6.010 | 3.460 | 0.973 | 0.255 | 0.378 | 0.039 | 0.011 | 17.360 |
| 1994 | 0.059 | 0.303 | 1.670 | 1.240 | 2.693 | 2.248 | 1.736 | 1.327 | 0.222 | 0.010 | 0.002 | 0.001 | 11.511 |
| 1995 | 0.125 | 0.328 | 1.207 | 5.402 | 1.783 | 6.444 | 5.653 | 1.082 | 0.208 | 0.073 | 0.002 | 0.072 | 22.380 |
| 1996 | 0.095 | 1.000 | 1.644 | 1.381 | 5.982 | 3.396 | 3.494 | 1.128 | 0.365 | 0.050 | 0.015 | 0.062 | 18.612 |
| 1997 | **0.152** | **0.771** | **0.958** | **2.623** | **0.768** | **1.927** | **9.406** | **0.976** | **0.125** | **0.000** | **0.000** | **0.000** | 17.705 |
| 1998 | 0.738 | 0.779 | 6.098 | 4.723 | 4.783 | 7.163 | 3.457 | 4.151 | 0.988 | 0.330 | 0.093 | 0.057 | 33.361 |
| 1999 | 0.284 | 2.705 | 4.430 | 4.448 | 14.005 | 6.540 | 3.009 | 0.691 | 0.491 | 0.064 | 0.018 | 0.026 | 36.712 |
| 2000 | **0.095** | **0.391** | **0.947** | **2.078** | **5.636** | **4.561** | **2.986** | **0.976** | **0.142** | **0.000** | **0.000** | **0.000** | 17.811 |
| 2001 | 0.189 | 0.201 | 0.484 | 0.280 | 0.397 | 0.399 | 0.868 | 0.633 | 0.125 | 0.000 | 0.000 | 0.002 | 3.578 |

**Table 8 Continued** :

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | **0.000** | **0.582** | **9.527** | **6.030** | **1.987** | **3.410** | **6.544** | **1.410** | **0.517** | **0.060** | **0.000** | **0.000** | 30.067 |
| 2003 | 0.317 | 0.924 | 1.266 | 2.223 | 7.445 | 6.427 | 5.770 | 1.347 | 0.463 | 0.067 | 0.005 | 0.182 | 26.437 |
| 2004 | 0.208 | 0.537 | 1.055 | 3.635 | 4.482 | 5.549 | 0.960 | 0.507 | 0.179 | 0.046 | 0.003 | 0.000 | 17.160 |
| 2005 | 0.000 | 0.204 | 0.191 | 1.212 | 4.880 | 6.462 | 1.280 | 0.887 | 0.419 | 0.293 | 0.168 | 0.000 | 15.996 |
| 2006 | 0.051 | 0.390 | 0.840 | 1.236 | 6.448 | 8.061 | 1.329 | 0.752 | 0.228 | 0.228 | 0.000 | 0.000 | 19.561 |
| Ort. | **0.330** | **0.735** | **2.257** | **2.699** | **3.391** | **3.313** | **2.177** | **0.939** | **0.397** | **0.258** | **0.216** | **0.230** | **16.941** |

Not: 1970 - 1983, 1986 - 1988, yılları aylık akımları; (5-35) AGİ ile (5-26) AGİ aylık akımları lineer korelasyonundan

**Table 9: Monthly flows at SGS No : 5 - 43**

| **DSİ ETÜD VE PLAN DAİRESİ BAŞKANLIĞI**<br>**RASATLAR ŞUBE MÜDÜRLÜĞÜ** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RASAT TABLOSU** | | | | | | | | | | | | | |
| **İSTASYON İSMİ** | | | **CEMAL D.-KAYGANLI** | | | | | **İŞLT. İDARE** | | **DSİ** | **RAKIM** | **290** | |
| **İSTASYON NO** | | | **5-43** | | | | | **BÖLGE** | | **EGE** | | | |
| **İL VE İLÇESİ** | | | | | | | | **ENLM-BYLAM** | | **39° 07' - 28° 00'** | | | |
| **RASAT TÜRÜ** | | | **AYLIK AKIM ($hm^3$)** | | | | | | | | | | |
| **YIL** | **EKİM** | **KASIM** | **ARALK** | **OCAK** | **ŞUBAT** | **MART** | **NİSAN** | **MAYIS** | **HAZRN** | **TEMMZ** | **AĞSTS** | **EYLÜL** | **YILLIK** |
| 1991 | 0.163 | 0.354 | 4.480 | 1.640 | 1.370 | 0.962 | 2.340 | 1.700 | 0.650 | 0.126 | 0.001 | 0.019 | **13.805** |
| 1992 | 0.123 | 0.290 | 0.923 | 0.961 | 0.560 | 2.670 | 1.620 | 0.329 | 0.133 | 0.052 | 0.018 | 0.000 | **7.679** |
| 1993 | 1.142 | 0.631 | 1.160 | 1.238 | 2.960 | 2.910 | 1.730 | 0.877 | 0.315 | 0.083 | 0.001 | 0.011 | **13.058** |
| 1994 | 0.039 | 0.069 | 0.996 | 0.676 | 1.760 | 0.639 | 0.377 | 0.185 | 0.041 | 0.001 | 0.000 | 0.000 | **4.783** |
| 1995 | 0.015 | 0.047 | 0.579 | 3.430 | 1.510 | 4.440 | 4.010 | 0.705 | 0.083 | 0.011 | 0.000 | 0.022 | **14.852** |
| 1996 | 0.039 | 0.613 | 0.968 | 0.851 | 3.990 | 3.316 | 2.662 | 0.492 | 0.154 | 0.018 | 0.000 | 0.148 | **13.252** |
| 1997 | 0.118 | 0.527 | 0.650 | 1.750 | 0.525 | 1.290 | 6.230 | 0.662 | 0.100 | 0.016 | 0.009 | 0.016 | **11.893** |
| 1998 | 0.903 | 0.294 | 4.750 | 3.790 | 3.120 | 2.310 | 1.490 | 2.840 | 0.268 | 0.052 | 0.021 | 0.027 | **19.865** |
| 1999 | 0.125 | 1.640 | 2.660 | 2.460 | 7.900 | 3.590 | 1.930 | 0.506 | 0.251 | 0.107 | 0.029 | 0.029 | **21.227** |
| 2000 | 0.080 | 0.276 | 0.643 | 1.390 | 3.740 | 3.030 | 1.990 | 0.662 | 0.111 | 0.005 | 0.000 | 0.000 | **11.927** |
| 2001 | 0.042 | 0.078 | 0.189 | 0.311 | 0.647 | 0.183 | 0.501 | 0.676 | 0.045 | 0.006 | 0.000 | 0.002 | **2.680** |
| 2002 | 0.015 | 0.402 | 6.310 | 4.000 | 1.330 | 2.270 | 4.340 | 0.949 | 0.359 | 0.057 | 0.014 | 0.049 | **20.095** |
| 2003 | 0.203 | 0.597 | 0.860 | 1.536 | 4.791 | 4.736 | 3.379 | 1.055 | 0.219 | 0.021 | 0.001 | 0.007 | **17.405** |
| **Ort.** | **0.231** | **0.448** | **1.936** | **1.849** | **2.631** | **2.488** | **2.508** | **0.895** | **0.210** | **0.043** | **0.007** | **0.025** | **13.271** |

**Table 10: Monthly Flows at SGS No : 5 - 26**

| DSİ ETÜD VE PLAN DAİRESİ BAŞKANLIĞI<br>RASATLAR ŞUBE MÜDÜRLÜĞÜ | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RASAT TABLOSU | | | | | | | | | | | | | |
| İSTASYON İSMİ | SARMA Ç.-SARMA | | | | | | | İŞLT. İDARE | DSİ | RAKIM | 117 | | |
| İSTASYON NO | 5-26 | | | | | | | BÖLGE | EGE | | | | |
| İL VE İLÇESİ | MANİSA | | | | | | | ENLM-BYLAM | 38° 46' - 27° 24' | | | | |
| RASAT TÜRÜ | AYLIK AKIM ($hm^3$) | | | | | | | | | | | | |
| YIL | EKİM | KASIM | ARALK | OCAK | ŞUBAT | MART | NİSAN | MAYIS | HAZRN | TEMMZ | AĞSTS | EYLÜL | YILLIK |
| 1970 | 0.062 | 0.093 | 6.532 | 1.816 | 4.785 | 2.373 | 0.858 | 0.209 | 0.111 | 0.041 | 0.031 | 0.038 | 16.950 |
| 1971 | 0.130 | 0.212 | 0.791 | 1.412 | 4.252 | 5.423 | 0.968 | 0.151 | 0.072 | 0.044 | 0.050 | 0.164 | 13.668 |
| 1972 | 0.090 | 0.971 | 2.011 | 0.227 | 1.690 | 0.641 | 0.380 | 0.101 | 0.033 | 0.014 | 0.065 | 0.021 | 6.244 |
| 1973 | 0.166 | 0.097 | 0.091 | 0.399 | 2.887 | 1.189 | 0.739 | 0.149 | 0.052 | 0.026 | 0.036 | 0.049 | 5.880 |
| 1974 | 0.053 | 0.091 | 0.783 | 0.139 | 2.476 | 3.319 | 0.370 | 0.177 | 0.020 | 0.006 | 0.016 | 0.078 | 7.529 |
| 1975 | 0.045 | 0.414 | 2.565 | 2.594 | 1.992 | 0.540 | 0.343 | 0.262 | 0.059 | 0.020 | 0.019 | 0.021 | 8.874 |
| 1976 | 0.042 | 0.202 | 1.038 | 0.289 | 1.599 | 0.192 | 1.811 | 0.159 | 0.041 | 0.015 | 0.010 | 0.014 | 5.412 |
| 1977 | 0.398 | 0.778 | 2.237 | 1.569 | 0.812 | 0.491 | 0.188 | 0.063 | 0.019 | 0.006 | 0.006 | 0.017 | 6.585 |
| 1978 | 0.460 | 0.110 | 0.770 | 5.760 | 4.550 | 1.620 | 1.550 | 1.170 | 0.006 | 0.004 | 0.003 | 0.050 | 16.053 |
| 1979 | 0.064 | 0.243 | 0.144 | 2.314 | 0.655 | 0.159 | 0.100 | 0.141 | 0.053 | 0.027 | 0.026 | 0.032 | 3.957 |
| 1980 | 0.056 | 0.116 | 0.744 | 4.174 | 0.496 | 1.991 | 0.298 | 0.179 | 0.104 | 0.036 | 0.035 | 0.050 | 8.279 |
| 1981 | 0.057 | 0.170 | 2.172 | 9.537 | 0.950 | 1.074 | 0.079 | 0.052 | 0.013 | 0.005 | 0.010 | 0.027 | 14.145 |
| 1982 | 0.038 | 0.853 | 10.941 | 0.891 | 0.807 | 1.135 | 1.191 | 1.205 | 0.070 | 0.050 | 0.017 | 0.014 | 17.212 |
| 1983 | 0.061 | 0.109 | 0.900 | 0.460 | 1.820 | 0.237 | 0.150 | 0.098 | 0.045 | 0.041 | 0.028 | 0.029 | 3.978 |
| 1984 | 0.068 | 2.889 | 2.813 | 6.571 | 2.503 | 2.412 | 3.222 | 0.236 | 0.089 | 0.072 | 0.030 | 0.029 | 20.934 |
| 1985 | 0.067 | 0.112 | 0.148 | 0.806 | 0.269 | 0.523 | 0.258 | 0.097 | 0.034 | 0.024 | 0.013 | 0.024 | 2.376 |
| 1986 | 0.042 | 1.074 | 0.263 | 5.402 | 2.283 | 1.273 | 0.182 | 0.091 | 0.034 | 0.007 | 0.002 | 0.024 | 10.678 |
| 1987 | 0.056 | 0.088 | 0.627 | 3.610 | 1.304 | 0.482 | 0.405 | 0.265 | 0.111 | 0.041 | 0.002 | 0.027 | 7.017 |
| 1988 | 0.072 | 0.817 | 1.420 | 0.558 | 0.702 | 6.011 | 0.684 | 0.313 | 0.213 | 0.088 | 0.078 | 0.126 | 11.082 |
| 1989 | 0.209 | 1.030 | 2.650 | 0.216 | 0.143 | 1.970 | 0.099 | 0.082 | 0.042 | 0.029 | 0.022 | 0.024 | 6.516 |
| 1990 | 0.074 | 0.193 | 2.045 | 0.215 | 1.018 | 0.194 | 0.569 | 0.077 | 0.063 | 0.039 | 0.039 | 0.061 | 4.586 |
| 1991 | 0.060 | 0.079 | 2.799 | 0.733 | 0.171 | 0.209 | 0.148 | 0.907 | 0.104 | 0.028 | 0.018 | 0.029 | 5.285 |
| 1992 | 0.061 | 0.089 | 0.423 | 0.107 | 0.111 | 0.312 | 0.153 | 0.064 | 0.033 | 0.032 | 0.013 | 0.024 | 1.420 |
| 1993 | 0.062 | 0.391 | 1.700 | 0.733 | 1.990 | 3.030 | 1.800 | 0.284 | 0.057 | 0.006 | 0.003 | 0.010 | 10.066 |
| 1994 | 0.036 | 0.102 | 2.277 | 0.658 | 1.701 | 0.387 | 0.141 | 0.079 | 0.025 | 0.009 | 0.000 | 0.004 | 5.420 |
| **1995** | **0.000** | **0.102** | **0.733** | **3.743** | **1.146** | **4.491** | **3.924** | **0.643** | **0.016** | **0.000** | **0.000** | **0.000** | **14.799** |
| 1996 | 0.038 | 1.968 | 0.969 | 0.233 | 6.520 | 0.738 | 1.327 | 0.104 | 0.028 | 0.008 | 0.022 | 0.114 | 12.070 |
| 1997 | 0.069 | 0.227 | 0.133 | 2.077 | 0.056 | 1.699 | 3.231 | 0.345 | 0.159 | 0.067 | 0.068 | 0.078 | 8.209 |
| 1998 | 0.234 | 0.460 | 7.003 | 5.075 | 2.111 | 2.833 | 0.236 | 1.385 | 0.095 | 0.027 | 0.015 | 0.036 | 19.511 |
| 1999 | 0.116 | 3.221 | 3.194 | 3.701 | 11.416 | 1.484 | 0.758 | 0.109 | 0.037 | 0.015 | 0.022 | 0.036 | 24.109 |
| 2000 | 0.158 | 1.131 | 1.601 | 1.610 | 3.546 | 1.256 | 1.861 | 0.223 | 0.050 | 0.018 | 0.023 | 0.043 | 11.522 |
| 2001 | 0.066 | 0.126 | 0.128 | 0.307 | 1.725 | 0.150 | 0.194 | 1.096 | 0.042 | 0.015 | 0.059 | 0.045 | 3.953 |
| 2002 | 0.042 | 0.053 | 4.560 | 1.280 | 0.217 | 1.340 | 1.060 | 0.150 | 0.086 | 0.031 | 0.000 | 0.122 | 8.941 |

**Table 10 Continued:**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2003** | 0.090 | 0.802 | 0.273 | 1.988 | 4.904 | 0.434 | 0.905 | 0.311 | 0.077 | 0.005 | 0.010 | 0.038 | 9.837 |
| **2004** | 0.055 | 0.142 | 0.235 | 3.336 | 0.725 | 0.254 | 0.145 | 0.095 | 0.053 | 0.017 | 0.022 | 0.047 | 5.126 |
| **2005** | 0.070 | 0.103 | 0.085 | 0.305 | 2.534 | 1.469 | 0.099 | 0.051 | 0.125 | 0.011 | 0.013 | 0.041 | 4.906 |
| **Ort.** | **0.096** | **0.546** | **1.883** | **2.079** | **2.135** | **1.482** | **0.845** | **0.309** | **0.063** | **0.026** | **0.023** | **0.044** | **9.531** |

Not: 1995 yılı aylık akım değerleri; (5-26) - (5-35) AGİ'lerin Aylık Akımları lineer Korelasyonundan (y = 0.7177 X - 0.1334, R= 0.878)

**Table 11 Crop Pattern Data**

| Bitki Cinsi | Büyüme Süreci | Bitki Deseni | Sulama Sistemi |
|---|---|---|---|
| Hububat | 25-10/15-7 | 19 | Yağmurlama |
| Mısır (1. ürün) | 10-05/20-09 | 8 | Yağmurlama |
| Hasıl Mısır (1. ürün) | 15-04/20-07 | 11 | Yağmurlama |
| Haşhaş | 15-10/20-07 | 8 | Damlatmalı |
| Fasulye ve Bakliyat | 15-04/20-08 | 6 | Damlatmalı |
| Sebze | 15-04/20-08 | 19 | Damlatmalı |
| Bostan | 01-04/31-07 | 5 | Damlatmalı |
| Yonca | 30-03/25-11 | 10 | Yağmurlama |
| Meyve | 30-03/25-11 | 8 | Damlatmalı |
| Bağ | 30-3/25-11 | 6 | Damlatmalı |
| Sebze 2. ürün | 20-07/15-11 | 6 | Damlatmalı |
| Hasıl Mısır 2. ürün | 20-07/15-10 | 6 | Yağmurlama |
| | | 112 | |

**Tablo 12: Operation Studies of Doğanpınar Pond**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | a1= 0.1756 | | Hmax | 25.00 m | |
| Max.Dep | 2.516 | Unit=hm3 | | b1= 0.5528 | | Hmin | 17.55 m | |
| Min. Dep | 0.838 | Alan(km2)=a1*(V)^b1 | | a2= 19.6010 | | Sulama Al | 493.0 ha | |
| Aktif Dep | 1.678 | H(m)=a2*(V)^b2 | | b2= 0.2882 | | Sulama Su | 1.887 hm³ | |
| | | Havzasın-dan Gelen su | Ay başı depolama | Buharlaşma | | Sızma | Dolusavak Suyu | Sulama suyu |
| Yıl | Ay | (hm3) | hm³ | mm | hm³ | hm³ | hm³ | hm³ |
| 2004 | 10 | 0.251 | 2.395 | 45.7 | 0.013 | 0.016 | 0.18 | 0.037 |
| | 11 | 0.616 | 2.516 | 0 | 0.000 | 0.017 | 0.60 | 0.000 |
| | 12 | 1.192 | 2.516 | 0 | 0.000 | 0.017 | 1.18 | 0.000 |
| | 1 | 4.060 | 2.516 | 0 | 0.000 | 0.017 | 4.04 | 0.000 |
| | 2 | 5.002 | 2.516 | 0 | 0.000 | 0.017 | 4.99 | 0.000 |
| | 3 | 6.188 | 2.516 | 0 | 0.000 | 0.017 | 6.17 | 0.000 |
| | 4 | 1.086 | 2.516 | 0 | 0.000 | 0.017 | 1.07 | 0.000 |
| | 5 | 0.583 | 2.516 | 67.9 | 0.020 | 0.017 | 0.44 | 0.109 |
| | 6 | 0.218 | 2.516 | 143.9 | 0.042 | 0.017 | 0.00 | 0.525 |
| | 7 | 0.070 | 2.150 | 183.0 | 0.049 | 0.014 | 0.00 | 0.620 |
| | 8 | 0.022 | 1.536 | 181.3 | 0.040 | 0.010 | 0.00 | 0.408 |
| | 9 | 0.019 | 1.099 | 118.8 | 0.022 | 0.007 | 0.00 | 0.187 |
| Toplam | | 19.307 | | 740.60 | 0.186 | 0.182 | 18.67 | 1.887 |
| 2005 | 10 | 0.000 | 0.902 | 45.7 | 0.008 | 0.006 | 0.00 | 0.037 |
| | 11 | 0.000 | 0.851 | 0 | 0.000 | 0.006 | 0.00 | 0.000 |
| | 12 | 0.000 | 0.845 | 0 | 0.000 | 0.006 | 0.00 | 0.000 |
| | 1 | 0.335 | 0.840 | 0 | 0.000 | 0.006 | 0.00 | 0.000 |
| | 2 | 4.767 | 1.169 | 0 | 0.000 | 0.008 | 4.76 | 0.000 |
| | 3 | 7.789 | 2.516 | 0 | 0.000 | 0.017 | 7.77 | 0.000 |
| | 4 | 1.218 | 2.516 | 0 | 0.000 | 0.017 | 1.20 | 0.000 |
| | 5 | 0.770 | 2.516 | 67.9 | 0.020 | 0.017 | 0.62 | 0.109 |
| | 6 | 1.231 | 2.516 | 143.9 | 0.042 | 0.017 | 0.65 | 0.525 |
| | 7 | 2.177 | 2.516 | 183 | 0.054 | 0.017 | 1.49 | 0.620 |
| | 8 | 2.556 | 2.516 | 181.3 | 0.053 | 0.017 | 2.08 | 0.408 |
| | 9 | 0.942 | 2.516 | 118.8 | 0.035 | 0.017 | 0.70 | 0.187 |
| Toplam | | 21.785 | | 740.60 | 0.211 | 0.148 | 19.27 | 1.887 |
| 2006 | 10 | 0.071 | 2.516 | 45.7 | 0.013 | 0.017 | 0.00 | 0.037 |
| | 11 | 0.266 | 2.516 | 0 | 0.000 | 0.017 | 0.25 | 0.000 |
| | 12 | 1.233 | 2.516 | 0 | 0.000 | 0.017 | 1.22 | 0.000 |
| | 1 | 2.781 | 2.516 | 0 | 0.000 | 0.017 | 2.76 | 0.000 |
| | 2 | 7.254 | 2.516 | 0 | 0.000 | 0.017 | 7.24 | 0.000 |
| | 3 | 8.975 | 2.516 | 0 | 0.000 | 0.017 | 8.96 | 0.000 |
| | 4 | 1.226 | 2.516 | 0 | 0.000 | 0.017 | 1.21 | 0.000 |
| | 5 | 0.344 | 2.516 | 67.9 | 0.020 | 0.017 | 0.20 | 0.109 |
| | 6 | 0.449 | 2.516 | 143.9 | 0.042 | 0.017 | 0.00 | 0.525 |
| | 7 | 0.058 | 2.381 | 183 | 0.052 | 0.016 | 0.00 | 0.620 |
| | 8 | 0.044 | 1.751 | 181.3 | 0.043 | 0.012 | 0.00 | 0.408 |
| | 9 | 0.043 | 1.331 | 118.8 | 0.024 | 0.009 | 0.00 | 0.187 |
| Toplam | | 22.744 | | 740.60 | 0.195 | 0.187 | 21.84 | 1.887 |

Not= Sulama suyu miktarı (hm3) = Sulama alanı(ha) *3827.24/1000000

**Notice: Net evaporation values listed in above table must be replaced by the similar values in Table 5.**

**Table 13: Calculation of 2 hr and 2.5 hr Duration Effective Rainfall Blocks**

| | | | | | | | Günlük Yağış Yineleme Değerleri | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2 | 5 | 10 | 25 | 50 | 100 | 500 | 1000 |
| Uygulanan Yöntem | T (sa) | % | MF | YADK | PLV (Simav) | Son Çarpım | 50.9 | 67 | 76.6 | 87.8 | 95.5 | 102.8 | 118.7 | 125.2 |
| DSİ Sentetik Birim Hidrograf | 2 | 1 | 1.13 | 0.92 | 0.48 | 0.499 | 25.4 | 33.4 | 38.2 | 43.8 | 47.7 | 51.3 | 59.2 | 62.5 |
| | 4 | 1 | 1.13 | 0.95 | 0.59 | 0.633 | 32.2 | 42.4 | 48.5 | 55.6 | 60.5 | 65.1 | 75.2 | 79.3 |
| | 6 | 1 | 1.13 | 0.96 | 0.68 | 0.738 | 37.5 | 49.4 | 56.5 | 64.8 | 70.4 | 75.8 | 87.6 | 92.4 |
| | 12 | 1 | 1.13 | 0.97 | 0.81 | 0.888 | 45.2 | 59.5 | 68.0 | 78.0 | 84.8 | 91.3 | 105.4 | 111.2 |
| Mockus Birim Hidrograf | 2.5 | 1 | 1.13 | 0.935 | 0.51 | 0.539 | 27.4 | 36.1 | 41.3 | 47.3 | 51.5 | 55.4 | 64.0 | 67.5 |

**2 ve 2.5 SAAT SÜRELİ NET AKIŞ BLOKLARI**

| Yineleme (Yıl) | Toplam Süre 2 sa | Toplam Süre 2.5 sa | Toplam Süre 4 sa | | Toplam Süre 6 sa | | | Toplam Süre 2 sa | Toplam Süre 2.5 sa | | Toplam Süre 4 sa | Toplam Süre 6 sa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | $K_1$=0.208 $Q_p$=5.90 | $K_2$=0.17 $Q_p$=4.83 | | |
| | 1. Blok | 1. Blok | 1. Blok | 2. Blok | 1. Blok | 2. Blok | 3. Blok | Pik Debi $m^3/s$ | Pik Debi $m^3/s$ | Pik Debi $m^3/s$ | Pik Debi $m^3/s$ | Pik Debi $m^3/s$ |
| 2 | 1.78 | 2.37 | 1.37 | 2.69 | 1.15 | 2.80 | 2.37 | 7.2 | 14.0 | 11.4 | 13.7 | 17.5 |
| 5 | 4.53 | 5.67 | 3.74 | 4.92 | 3.30 | 5.18 | 4.01 | 18.4 | 33.5 | 27.4 | 27.6 | 32.8 |
| 10 | 6.61 | 8.11 | 5.57 | 6.37 | 4.97 | 6.72 | 5.05 | 26.8 | 47.8 | 39.2 | 37.3 | 43.0 |
| 25 | 9.38 | 11.28 | 8.02 | 8.13 | 7.24 | 8.60 | 6.30 | 38.1 | 66.6 | 54.5 | 49.6 | 55.6 |
| 50 | 11.50 | 13.68 | 9.88 | 9.38 | 8.96 | 9.94 | 7.17 | 46.7 | 80.7 | 66.2 | 59.3 | 64.8 |
| 100 | 13.56 | 16.04 | 11.75 | 10.58 | 10.71 | 11.22 | 8.01 | 55.1 | 94.6 | 77.5 | 68.9 | 73.9 |
| 500 | 18.44 | 21.61 | 16.17 | 13.25 | 14.84 | 14.08 | 9.85 | 74.9 | 127.5 | 104.4 | 91.0 | 95.5 |
| 1000 | 20.60 | 24.00 | 18.09 | 14.25 | 16.64 | 15.27 | 10.60 | 83.6 | 143.8 | 115.9 | 100.1 | 104.6 |

**Table 14: Peak Discharges Observed at SGS No: 5 – 35 ( $m^3$ / s )**

| İSTASYON NO | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| 1984 | 31.0 |
| 1985 | 11.00 |
| 1989 | 2.60 |
| 1990 | 6.65 |
| 1991 | 8.20 |
| 1992 | 8.89 |
| 1993 | 8.43 |
| 1994 | 8.20 |
| 1995 | 9.81 |
| 1996 | 9.35 |
| 1998 | 9.81 |
| 1999 | 9.81 |
| 2001 | 1.34 |
| 2003 | 36.5 |
| 2004 | 6.22 |
| 2005 | 11.2 |
| 2006 | 40.5 |
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| | |
|---|---|
| N = | 17 |
| QORT.= | 12.912 |
| Sx = | 11.45 |
| Q-M1 = | 40.5 |
| Q-M2 = | 36.5 |
| Cs = | 3.358 |
| Cs Log = | -0.286 |
| UDF = | LN2 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Gumbel | 11.25 | 23.73 | 31.99 | 42.44 | 50.18 | 52.87 | 75.64 | 83.28 |

**Table 15: Peak Discharges of Different Return Period for Doğanpınar Pond Catchment ($m^3/s$)**

| Yineleme Yılı | DSİ Sentetik B.H. | Mockus BH Yöntemi (K=0.170, 2.0 $m^3/s$ baz akım ilaveli) | Hidrolojik Benzeşim | Bölgesel Taşkın |
|---|---|---|---|---|
| $Q_2$ | 15.7 | 13.4 | 7.50 | 15.0 |
| $Q_5$ | 29.6 | 29.4 | 14.2 | 27.2 |
| $Q_{10}$ | 39.3 | 41.2 | 19.9 | 36.3 |
| $Q_{25}$ | 51.6 | 56.5 | 28.4 | 48.8 |
| $Q_{50}$ | 61.3 | 68.1 | 35.7 | 58.7 |
| $Q_{100}$ | 70.9 | 79.5 | 44.0 | 69.0 |
| $Q_{500}$ | 93.0 | 106.4 | 67.0 | 95.3 |
| $Q_{1000}$ | 102.1 | 117.9 | 78.7 | 107.7 |

**Table 16:Peak Discharges Observed at SGS No: 5 – 43 ( $m^3$ / s )**

| İSTASYON NO | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| 1991 | 15.1 |
| 1992 | 4.60 |
| 1993 | 7.13 |
| 1994 | 6.13 |
| 1995 | 20.4 |
| 1996 | 8.66 |
| 1997 | 11.5 |
| 1998 | 16.0 |
| 1999 | 14.5 |
| 2000 | 14.5 |
| 2001 | 1.30 |
| 2002 | 23.0 |
| 2003 | 4.92 |
| 2005 | 66.6 |
| 2006 | 26.4 |
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| | |
|---|---|
| N = | 15 |
| QORT.= | 16.049 |
| Sx = | 15.723 |
| Q-M1 = | 66.6 |
| Q-M2 = | 26.4 |
| Cs = | -0.478 |
| Cs Log = | -0.478 |
| UDF = | LP3 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
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**Tablo 17:Peak Discharges Observed at SGS No: 509 ( $m^3$ / s )**

| İSTASYON NO | |
|---|---|
| 1952 | 95.3 |
| 1953 | 45.30 |
| 1954 | 14.40 |
| 1962 | 112.00 |
| 1963 | 230.00 |
| 1964 | 120.00 |
| 1965 | 406.00 |
| 1966 | 140.00 |
| 1967 | 138.00 |
| 1968 | 262.00 |
| 1969 | 73.60 |
| 1970 | 247.00 |
| 1971 | 243.00 |
| 1972 | 130.0 |
| 1973 | 83.80 |
| 1974 | 240.0 |
| 1975 | 88.1 |
| 1976 | 87.4 |
| 1977 | 46.3 |
| 1978 | 180.0 |
| 1979 | 184.0 |
| 1980 | 98.5 |
| 1981 | 350.0 |
| 1982 | 433.0 |
| 1983 | 52.3 |
| 1984 | 135.0 |
| 1985 | 20.7 |
| 1986 | 46.1 |
| 1987 | 199.0 |
| 1988 | 69.0 |
| 1989 | 16.9 |
| 1990 | 49.0 |
| 1991 | 124.0 |
| 1992 | 19.0 |
| 1993 | 55.0 |
| 1994 | 58.0 |
| 1995 | 115.0 |
| 1996 | 88.0 |
| 1997 | 109.0 |
| 1998 | 152.0 |
| 1999 | 155.0 |
| 2000 | 152.0 |
| 2001 | 15.0 |
| 2002 | 152.0 |
| 2003 | 134.0 |
| 2004 | 131.0 |

| | |
|---|---|
| N = | 46 |
| QORT.= | 132.490 |
| Sx = | 96.668 |
| Q-M1 = | 433 |
| Q-M2 = | 406 |
| Cs = | 1.365 |
| Cs Log = | -0.683 |
| UDF = | LN3 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
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**Tablo 18: Peak Discharges Observed at SGS No: 520**

| İSTASYON NO | |
|---|---|
| | |
| | |
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| | |
| | |
| | |
| 1969 | 86.8 |
| 1970 | 514.00 |
| 1971 | 240.00 |
| 1972 | 252.00 |
| 1973 | 294.00 |
| 1974 | 466.00 |
| 1975 | 276.00 |
| 1976 | 46.20 |
| 1977 | 213.00 |
| 1978 | 224.00 |
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|---|---|
| N = | 10 |
| QORT.= | 261.200 |
| Sx = | 144.54 |
| Q-M1 = | 514 |
| Q-M2 = | 466 |
| Cs = | 0.431 |
| Cs Log = | -1.196 |
| UDF = | LN3 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
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**Tablo 19: Peak Discharges Observed at SGS No:5 - 34**

| İSTASYON NO | |
|---|---|
| 1983 | 56.0 |
| 1984 | 520.00 |
| 1985 | 125.00 |
| 1986 | 135.00 |
| 1987 | 490.0 |
| 1988 | 58.00 |
| 1989 | 71.8 |
| 1990 | 190.0 |
| 1991 | 234.0 |
| 1992 | 31.0 |
| 1993 | 119.00 |
| 1994 | 73.1 |
| 1995 | 136.00 |
| 1996 | 136.0 |
| 1997 | 126.0 |
| 1998 | 164.0 |

| | |
|---|---|
| N = | 16 |
| QORT.= | 166.556 |
| Sx = | 142.182 |
| Q-M1 = | 520 |
| Q-M2 = | 490 |
| Cs = | 3.183 |
| Cs Log = | 0.254 |
| UDF = | LN2 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
| Gumbel | 146.02 | 302.39 | 405.92 | 536.73 | 633.77 | 730.09 | 952.68 | 1048.36 |

**Tablo 20 : Peak Discharges Observed at SGS No: 5 - 15**

| SUYUN ADI | Medar ç. |
|---|---|
| İSTASYON ADI | |
| | |
| | |
| | |
| | |
| 1967 | 140.0 |
| 1971 | 97.00 |
| 1972 | 150.00 |
| 1973 | 46.00 |
| 1974 | 260.0 |
| 1975 | 61.00 |
| 1976 | 76.0 |
| 1977 | 60.0 |
| 1978 | 125.0 |
| 1979 | 68.0 |
| 1980 | 125.00 |
| 1981 | 200.0 |
| 1982 | 360.00 |
| 1983 | 105.0 |
| 1984 | 165.0 |
| 1985 | 25.0 |
| 1986 | 75.0 |
| 1987 | 330.0 |
| 1988 | 120.0 |
| 1989 | 44.8 |
| 1990 | 56.6 |
| 1991 | 163.0 |
| 1992 | 20.1 |
| 1993 | 72.0 |
| 1994 | 10.6 |
| 1995 | 176.0 |
| 1996 | 77.0 |
| 1997 | 117.0 |
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| | |
|---|---|
| N = | 16 |
| QORT.= | 118.754 |
| Sx = | 86.239 |
| Q-M1 = | 360 |
| Q-M2 = | 330 |
| Cs = | -0.686 |
| Cs Log = | -0.686 |
| UDF = | LP3 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Gumbel | 105.66 | 194.14 | 252.72 | 326.74 | 381.65 | 436.16 | 562.11 | 616.26 |

**Tablo 21 : Peak Discharges Observed at SGS No: 5 - 28**

| İSTASYON NO | |
|---|---|
| 1979 | 175.0 |
| 1980 | 280.00 |
| 1981 | 165.00 |
| 1982 | 380.00 |
| 1983 | 49.0 |
| 1984 | 195.00 |
| 1985 | 44.0 |
| 1986 | 86.0 |
| 1987 | 270.0 |
| 1988 | 90.0 |
| 1989 | 41.00 |
| 1990 | 61.0 |
| 1991 | 72.00 |
| 1992 | 33.0 |
| 1993 | 85.1 |
| 1994 | 21.3 |
| 1995 | 93.0 |
| 1996 | 97.5 |

| | |
|---|---|
| N = | 18 |
| QORT.= | 124.378 |
| Sx = | 100.158 |
| Q-M1 = | 380 |
| Q-M2 = | 280 |
| Cs = | 0.084 |
| Cs Log = | 0.084 |
| UDF = | LP3 |

| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
| Gumbel | 109.73 | 218.04 | 289.76 | 380.37 | 447.59 | 514.31 | 668.50 | 734.79 |

**Tablo 22 : Peak Discharges Observed at SGS No: 527**

| İSTASYON NO | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| 1980 | 390.0 |
| 1981 | 653.00 |
| 1982 | 1555.00 |
| 1983 | 170.00 |
| 1984 | 469.00 |
| 1985 | 86.00 |
| 1986 | 129.00 |
| 1987 | 444.00 |
| 1988 | 145.00 |
| 1989 | 68.70 |
| 1990 | 176.00 |
| 1991 | 202.00 |
| 1992 | 28.30 |
| 1993 | 176.0 |
| 1994 | 60.10 |
| 1995 | 107.0 |
| 1996 | 149.0 |
| 1997 | 144.0 |
| 1998 | 268.0 |
| 1999 | 353.0 |
| 2000 | 169.0 |
| 2001 | 23.1 |
| 2002 | 209.0 |
| 2003 | 380.0 |
| 2004 | 160.0 |
| | |
| | |
| | |
| | |
| | |

| | |
|---|---|
| N = | 25 |
| QORT.= | 268.568 |
| Sx = | 308.886 |
| Q-M1 = | 1555 |
| Q-M2 = | 653 |
| Cs = | 4.972 |
| Cs Log = | -0.114 |
| UDF = | LN2 |

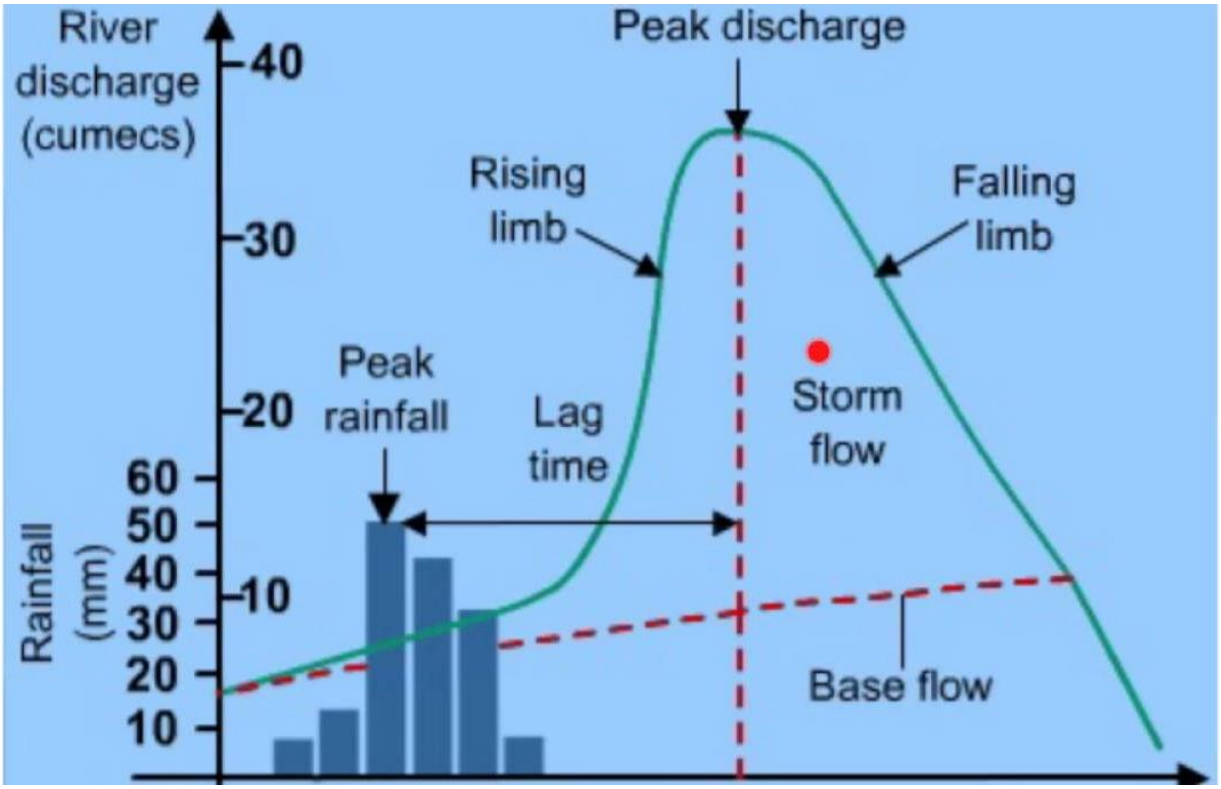
| YİNELENMELİ DEĞERLER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAĞ. İSMİ | | | 10 | 25 | 50 | 100 | 500 | 1000 |
| Nor. Dağ. | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

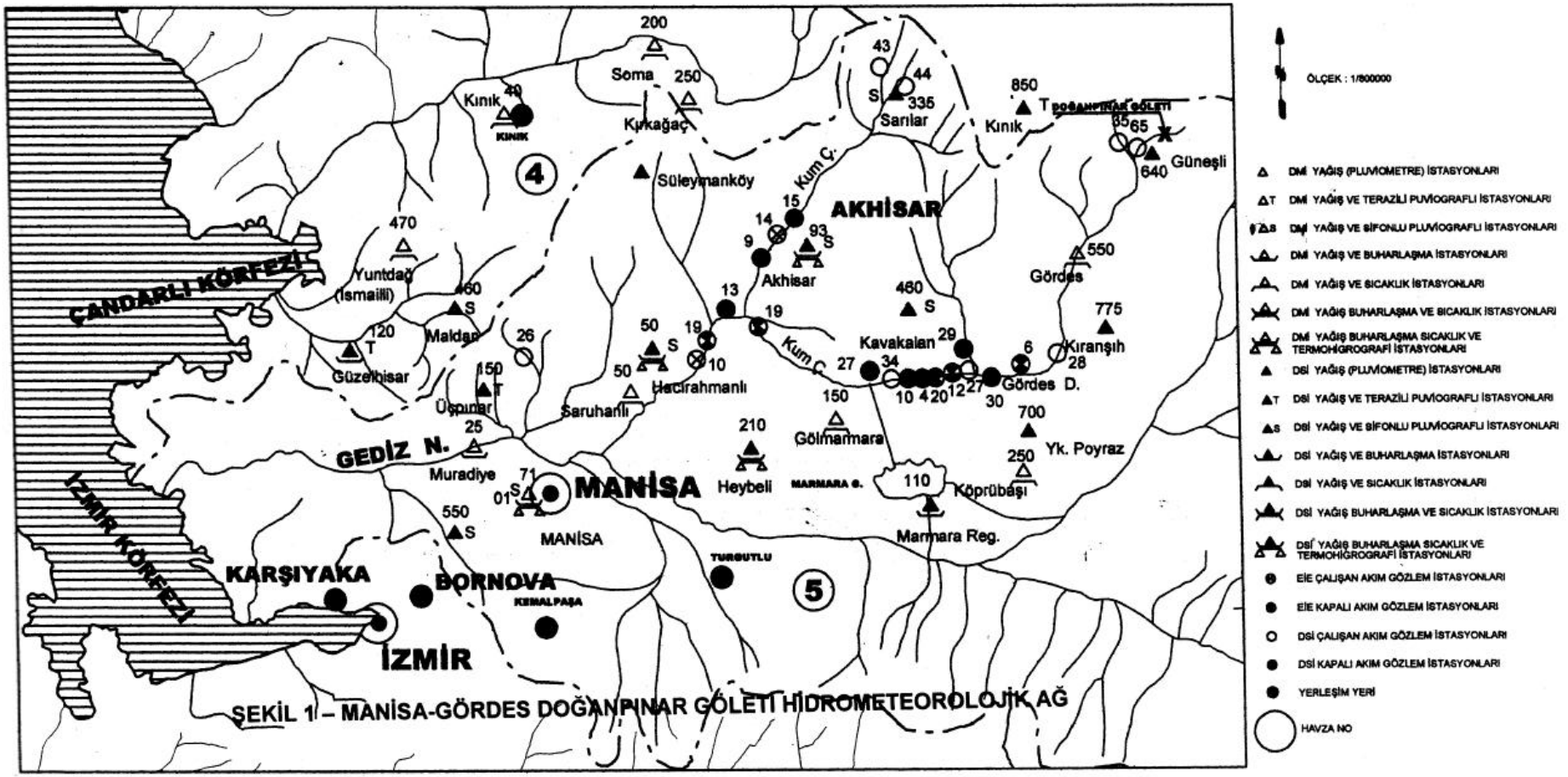
**Tablo 23: Regional Floods Frequency Analysis for Doğanpınar Pond**

| Sıra No | AGİ No | Yağış | N (Yıl) | En Büyük $Q_{MAX.}$ | UDF | $Q_T$ ($m^3/s$) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2 | 5 | 10 | 25 | 50 | 100 | 500 | 1000 |
| 1 | 5-35 | 88.0 | 17 | 40.5 | LN2 | 9.66 | 18.34 | 25.64 | 36.66 | 46.17 | 56.83 | 86.52 | 101.69 |
| 2 | 5-43 | 64.0 | 15 | 66.6 | LP3 | 12.03 | 24.61 | 34.39 | 47.75 | 58.14 | 68.74 | 93.76 | 104.65 |
| 3 | 509 (5-14) | 901.6 | 46 | 433.0 | LN3 | 114.25 | 199.83 | 257.83 | 332.40 | 388.80 | 445.90 | 583.02 | 644.56 |
| 4 | 520 | 1470.4 | 10 | 514.0 | LN3 | 251.05 | 378.32 | 451.15 | 533.99 | 590.52 | 643.46 | 757.17 | 803.29 |
| 5 | 5-34 | 1444.0 | 16 | 520.0 | LN2 | 126.68 | 236.11 | 326.95 | 462.61 | 578.89 | 708.25 | 1065.36 | 1246.36 |
| 6 | 5-15 | 512.3 | 28 | 360.0 | LP3 | 99.51 | 181.16 | 236.05 | 302.61 | 349.11 | 392.51 | 482.50 | 516.95 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

| Sıra No | AGİ No | Yağış | N (Yıl) | Ölçülen En Büyük $Q_{MAX.}$ ($m^3/s$ | | $Q_T / Q_2$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5-35 | 88.0 | 17 | 40.5 | | 1.00 | 1.90 | 2.65 | 3.80 | 4.78 | 5.88 | 8.96 | 10.53 |
| 2 | 5-43 | 64.0 | 15 | 66.6 | | 1.00 | 2.05 | 2.86 | 3.97 | 4.83 | 5.71 | 7.79 | 8.70 |
| 3 | 509 (5-14) | 901.6 | 46 | 433.0 | | 1.00 | 1.75 | 2.26 | 2.91 | 3.40 | 3.90 | 5.10 | 5.64 |
| 4 | 520 | 1470.4 | 10 | 514.0 | | 1.00 | 1.51 | 1.80 | 2.13 | 2.35 | 2.56 | 3.02 | 3.20 |
| 5 | 5-34 | 1444.0 | 16 | 520.0 | | 1.00 | 1.86 | 2.58 | 3.65 | 4.57 | 5.59 | 8.41 | 9.84 |
| 6 | 5-15 | 512.3 | 28 | 360.0 | | 1.00 | 1.82 | 2.37 | 3.04 | 3.51 | 3.94 | 4.85 | 5.19 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **ORTALAMA** | | | | | | **1.00** | **1.81** | **2.42** | **3.25** | **3.91** | **4.60** | **6.35** | **7.18** |

# 9.FIGURES


River discharge (cumecs)
40
30
20
10
Peak discharge
Rising limb
Falling limb
Peak rainfall
Lag time
Storm flow
Base flow
Rainfall (mm)
60
50
40
30
20
10




ŞEKİL 1 – MANİSA-GÖRDES DOĞANPINAR GÖLETİ HİDROMETEOROLOJİK AĞ

**Figure 1:Hydrometeorological Network for Manisa – Gördes Doğanpınar Pond ( Small Dam )**

| DOĞANPINAR | | | |
|---|---|---|---|
| KOT (m) | ARA ALAN (km² ) | TOPLAM ALAN (Km² ) | % ALAN |
| 1450> | 0.09 | 0.09 | 0.143 |
| 1400-1450 | 0.43 | 0.52 | 0.862 |
| 1350-1400 | 0.90 | 1.42 | 2.370 |
| 1300-1350 | 1.20 | 2.62 | 4.376 |
| 1250-1300 | 3.52 | 6.15 | 10.258 |
| 1200-1250 | 5.24 | 11.38 | 18.998 |
| 1150-1200 | 8.55 | 19.93 | 33.261 |
| 1100-1150 | 11.61 | 31.54 | 52.635 |
| 1050-1100 | 8.27 | 39.81 | 66.438 |
| 1000-1050 | 6.01 | 45.83 | 76.474 |
| 950-1000 | 4.68 | 50.50 | 84.276 |
| 900-950 | 4.09 | 54.60 | 91.106 |
| 850-900 | 3.56 | 58.16 | 97.046 |
| <850 | 1.77 | 59.9 | 100.000 |

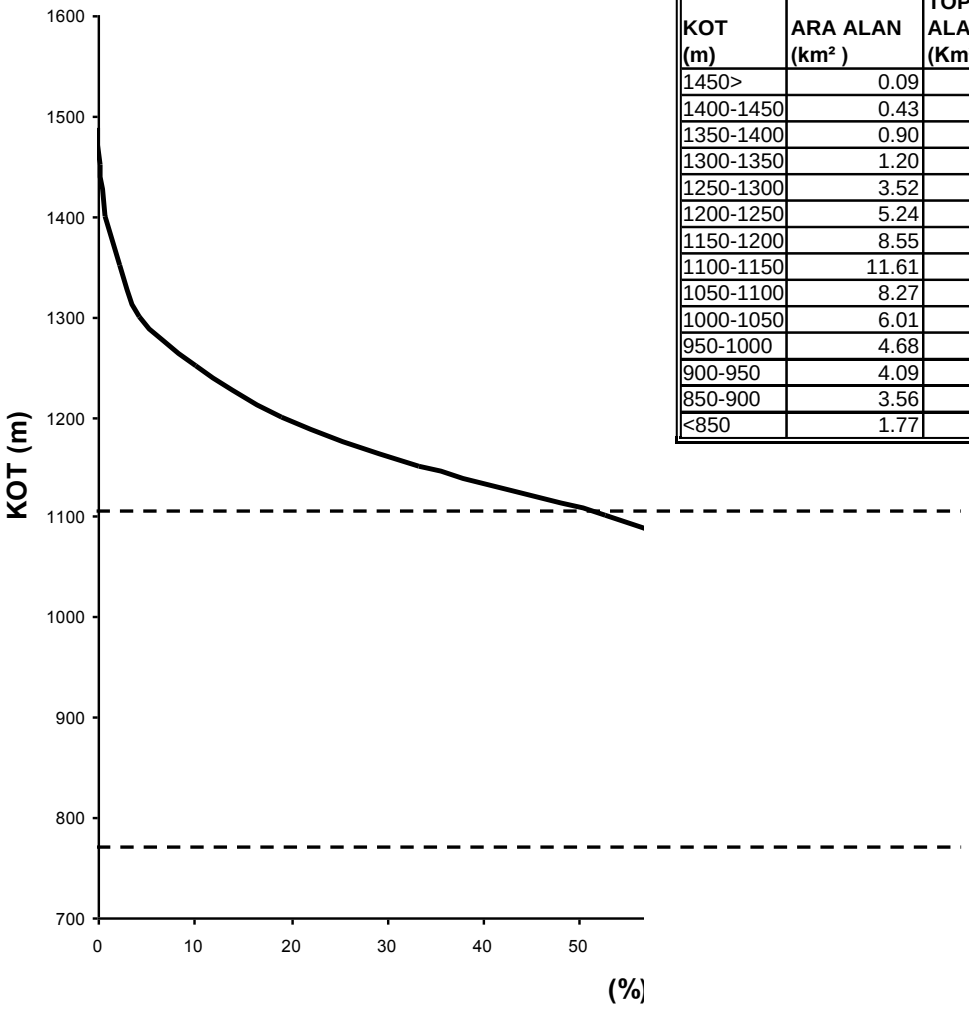
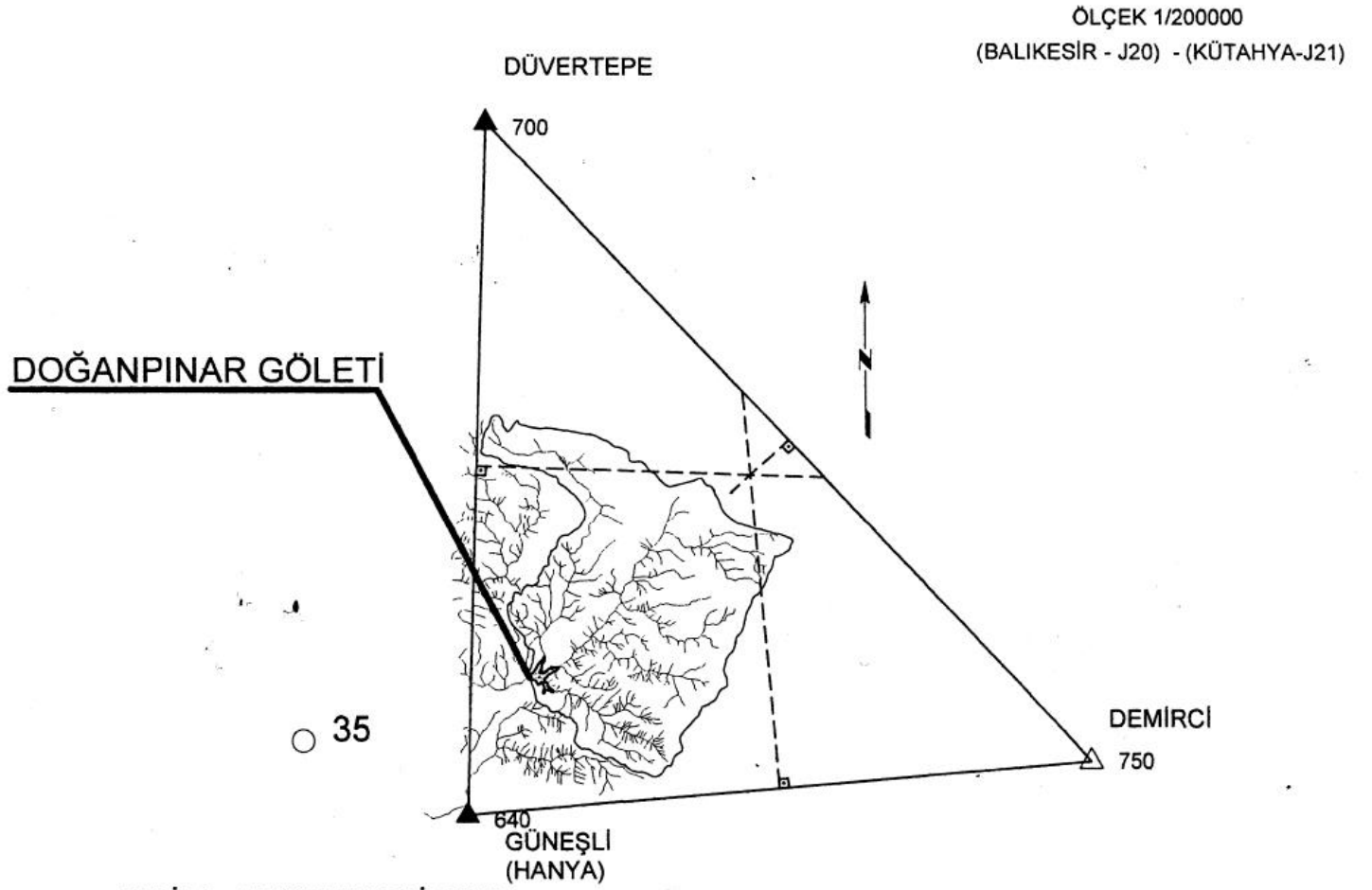



**Figure 2: Hypsometric Curve for Doğanpınar Pond**




**ŞEKİL 3 – THIESSEN POLİGONU**

**Figure 3: Thiessen Polygons**

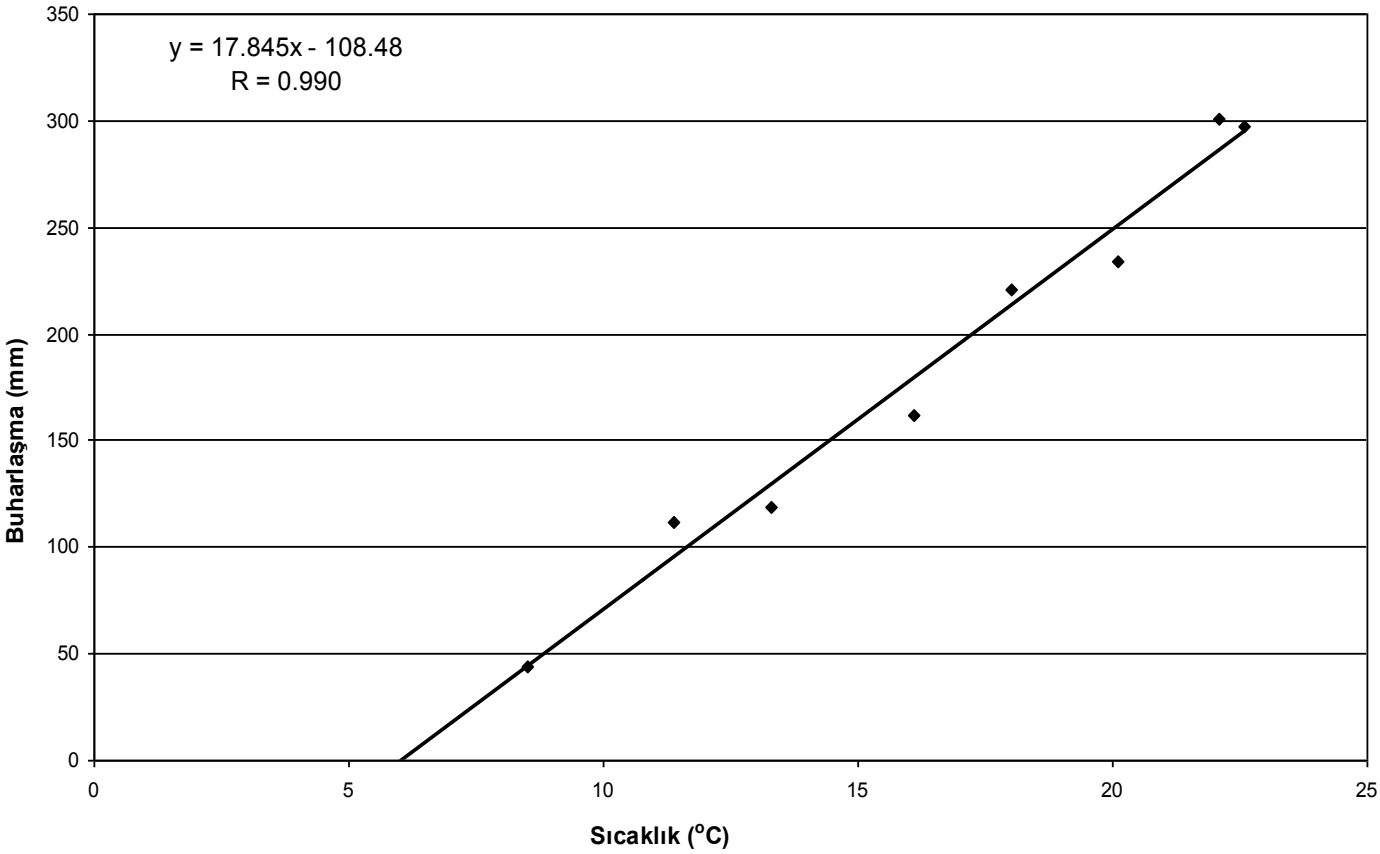



**Figure 4: Correlation between Monthly Evaporation and Temperature Values at Güneşli Station**

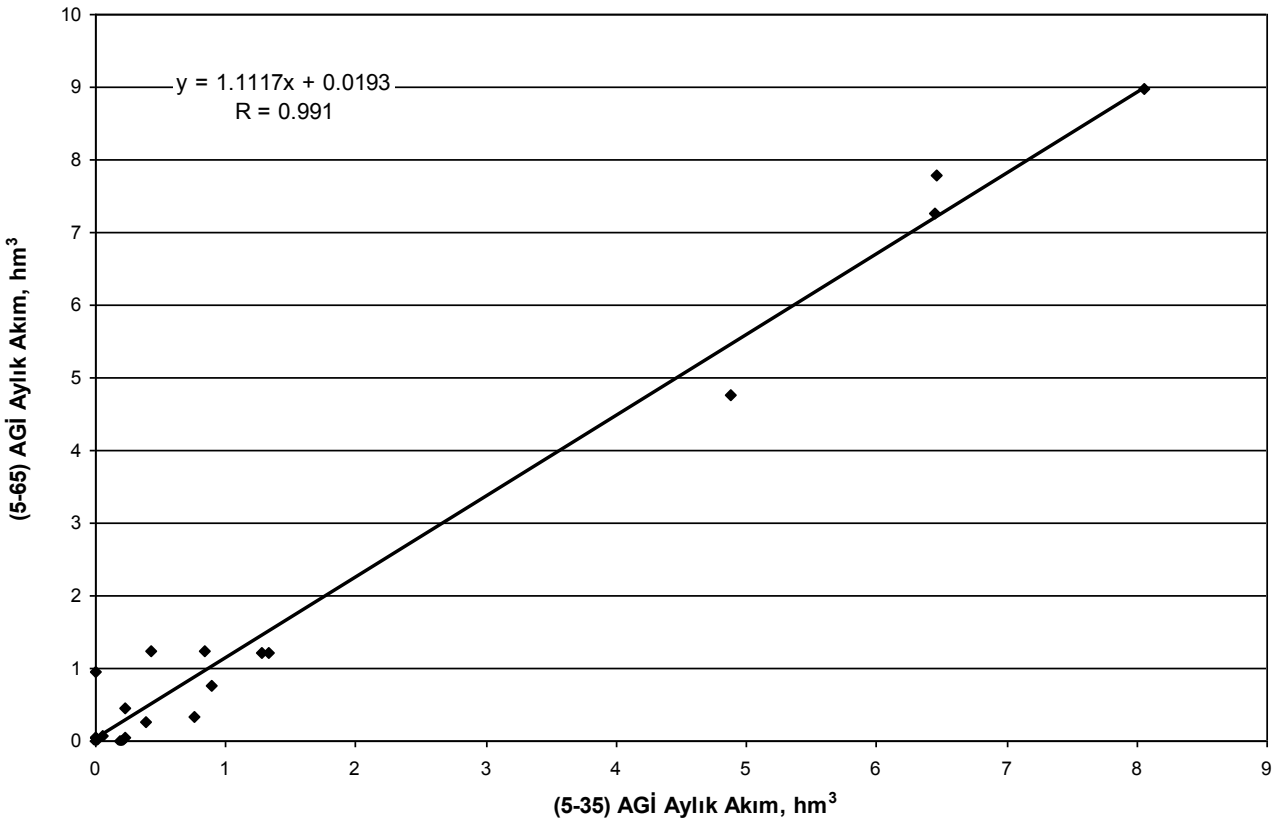



**Figure 5: Correlation between Montly Flows at SGS No : 5 – 65 and 5 – 35**

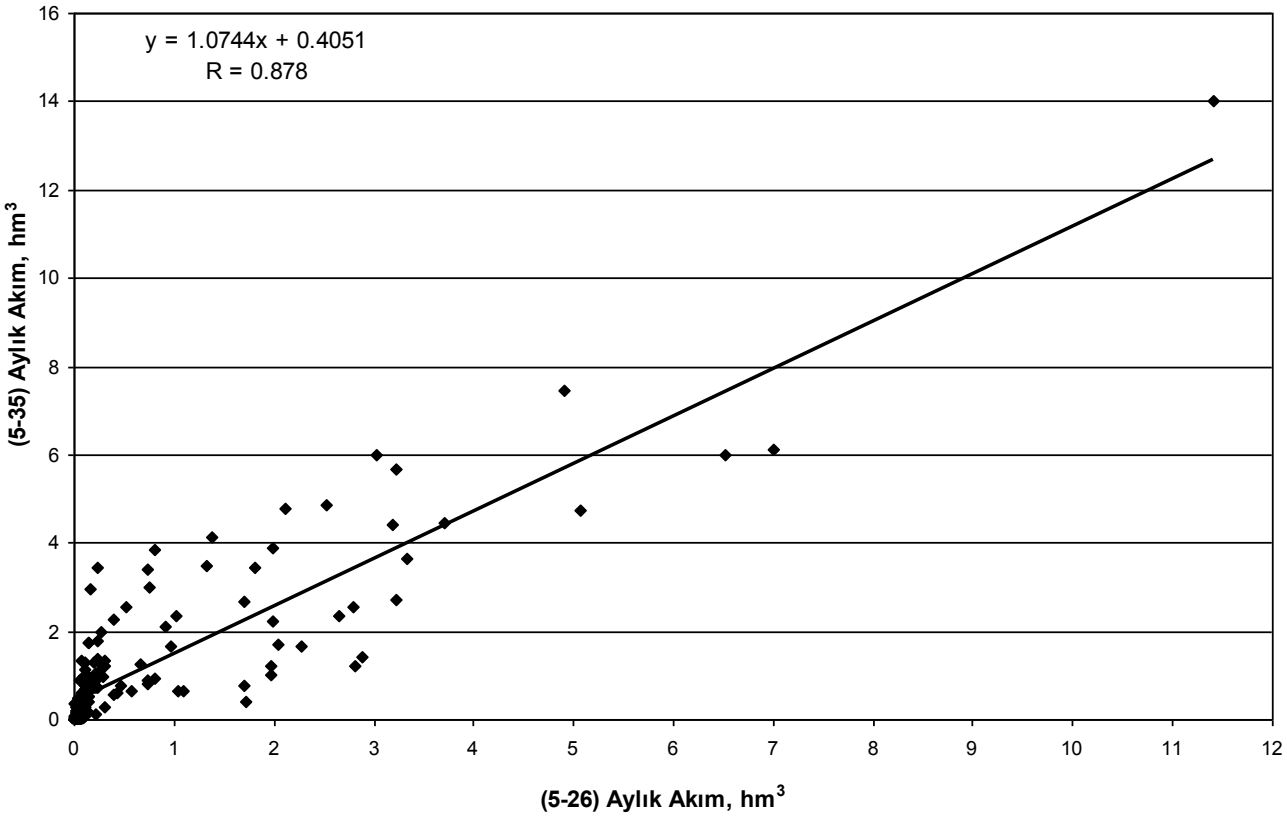



**Figure 6: Correlation between Montly Flows at SGS No : 5 – 35 and 5 – 26**

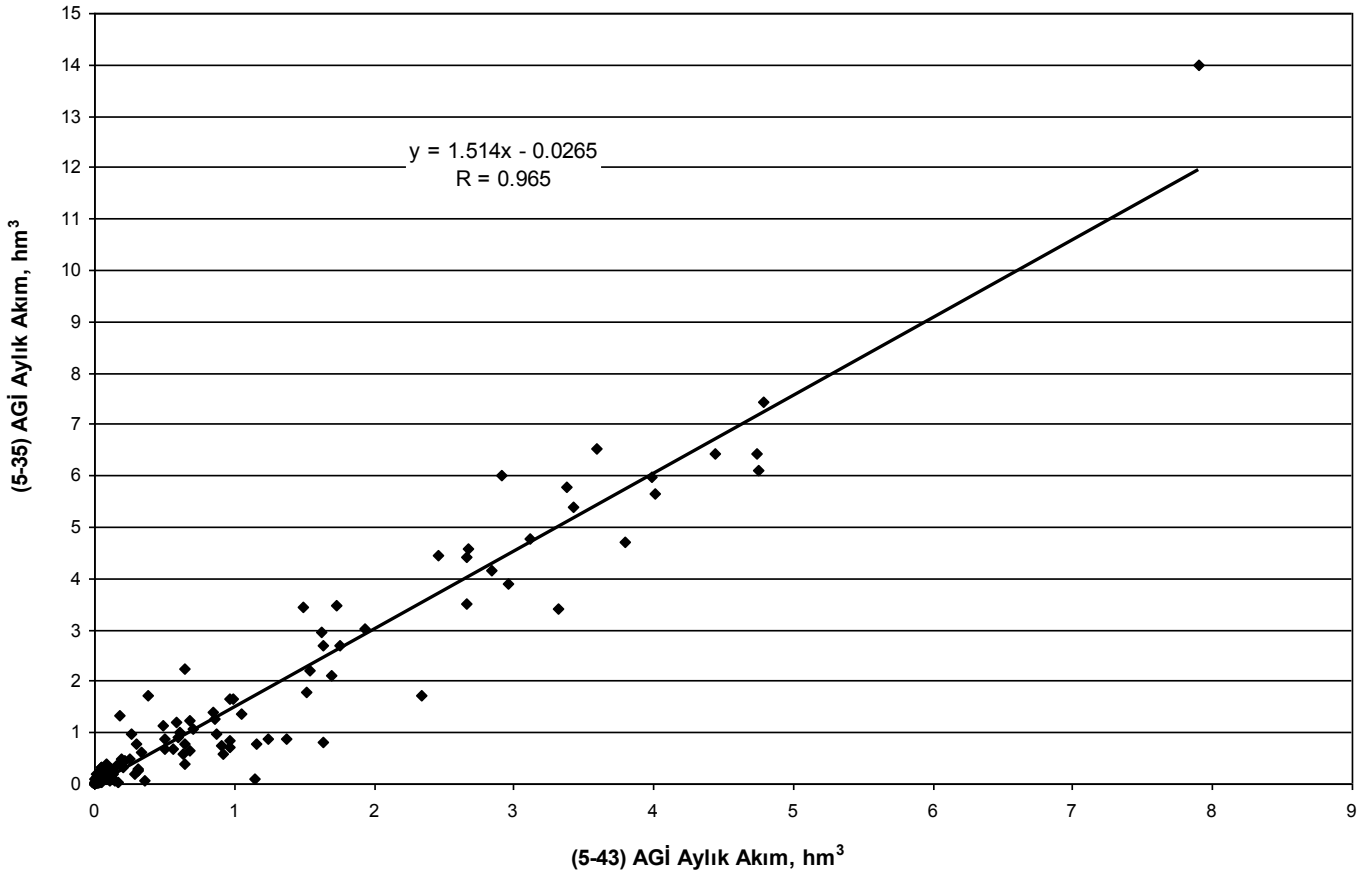



**Figure 7: Correlation between Montly Flows at SGS No : 5 – 35 and 5 - 43**

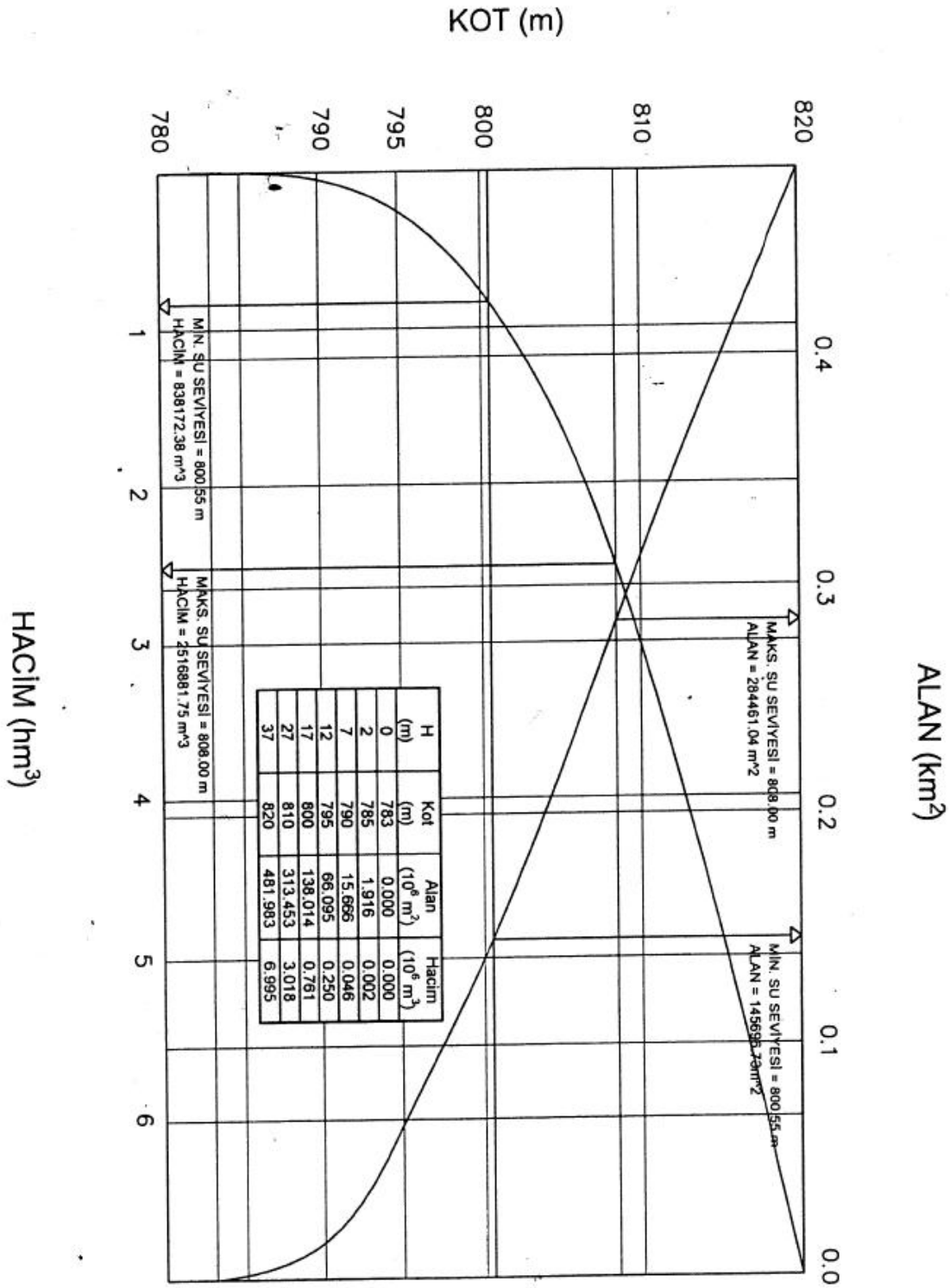



**Figure 8A: Elevation – Volume - Area Curves for Doğanpınar Pond Reservoir**

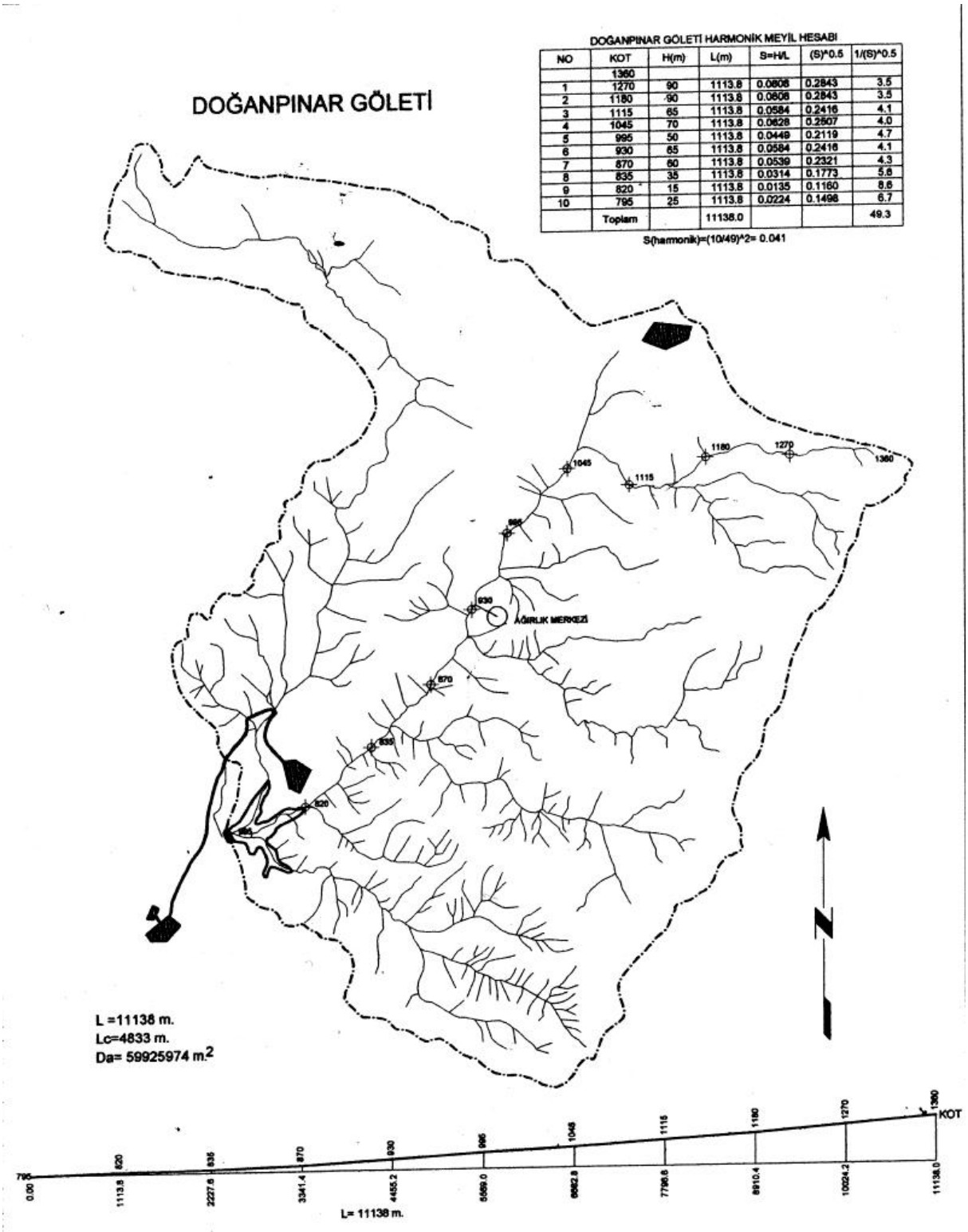
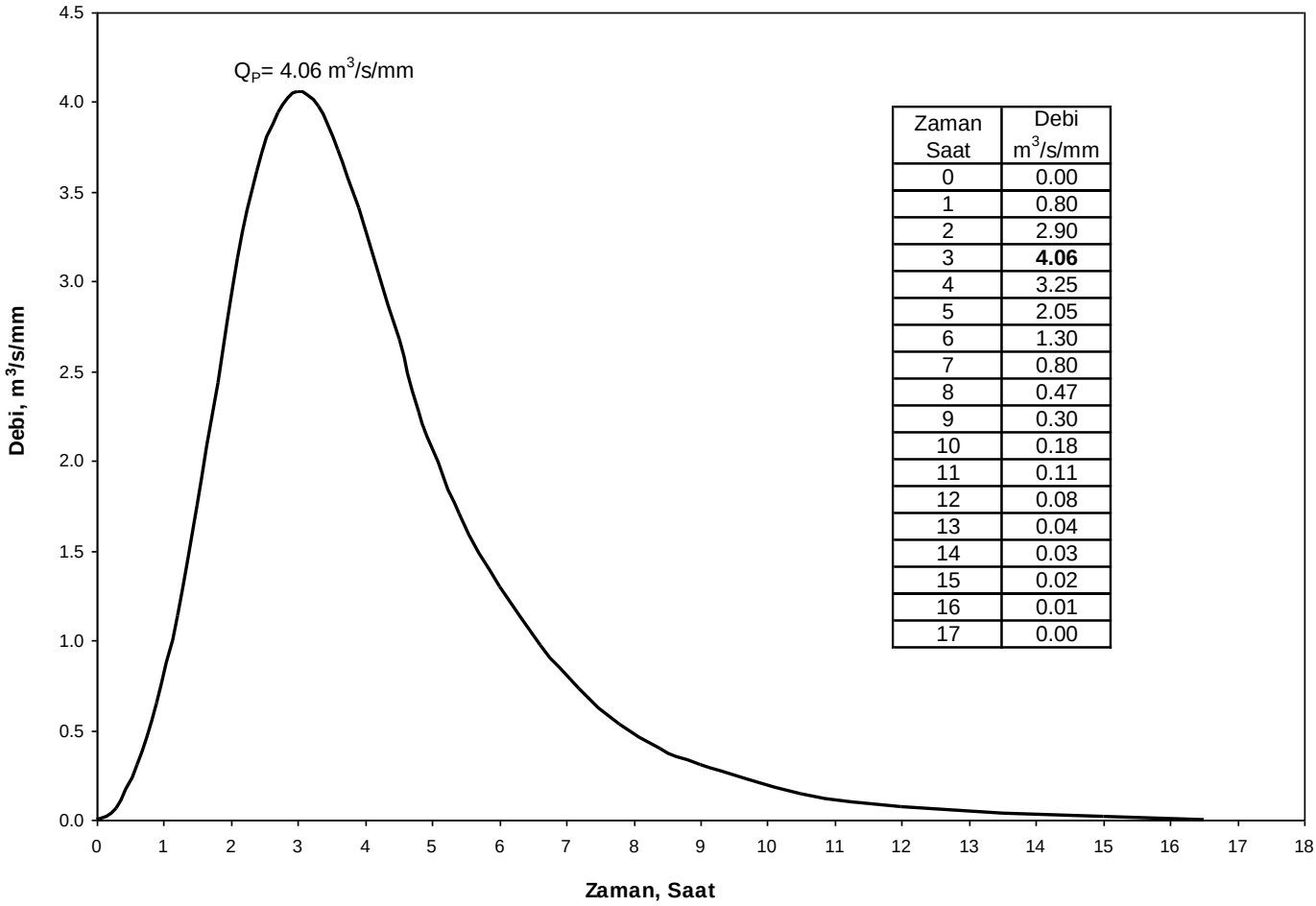
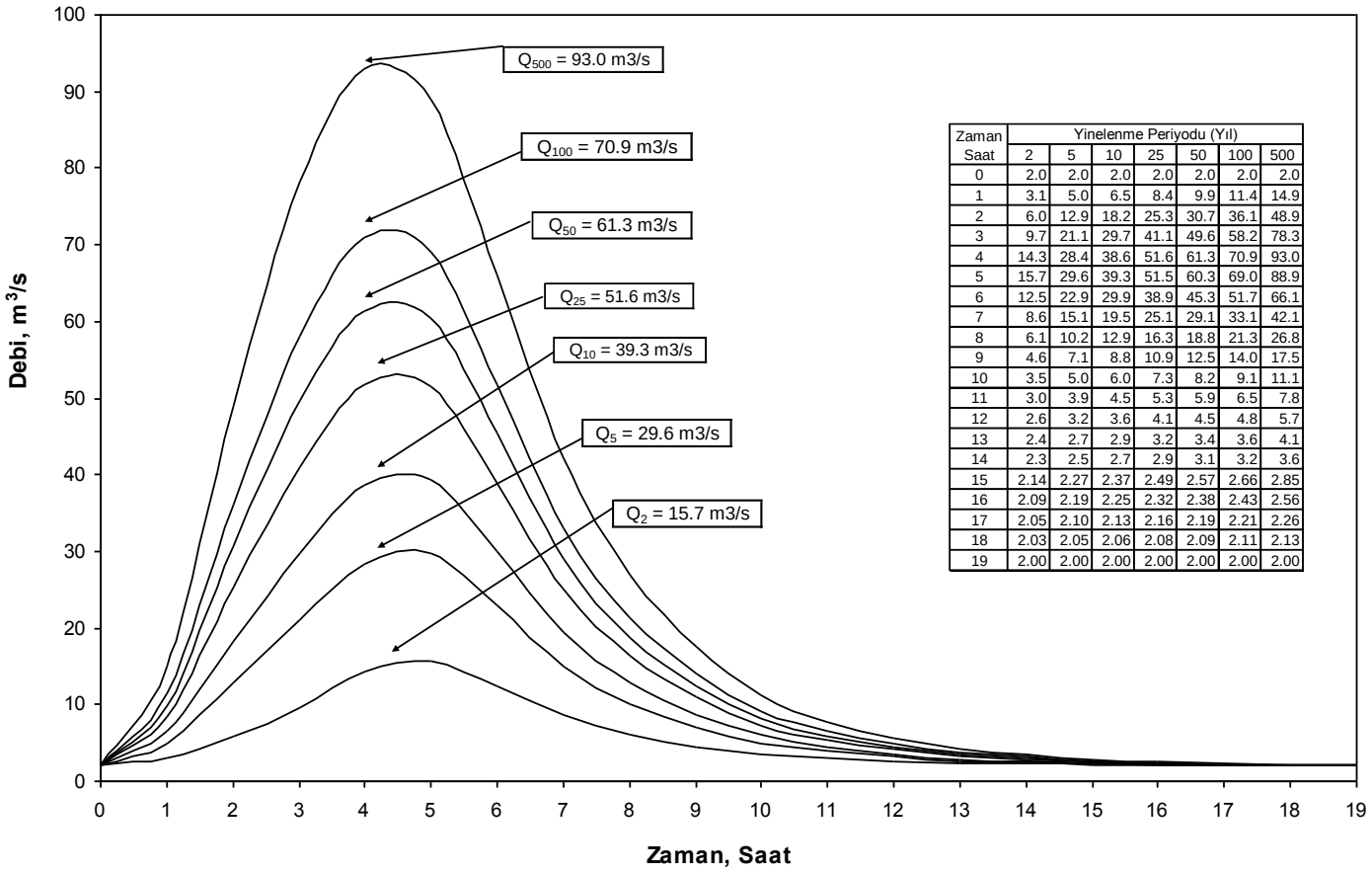



**Figure 9: Harmonic Slope Calculation of Doğanpınar Pond catchment**



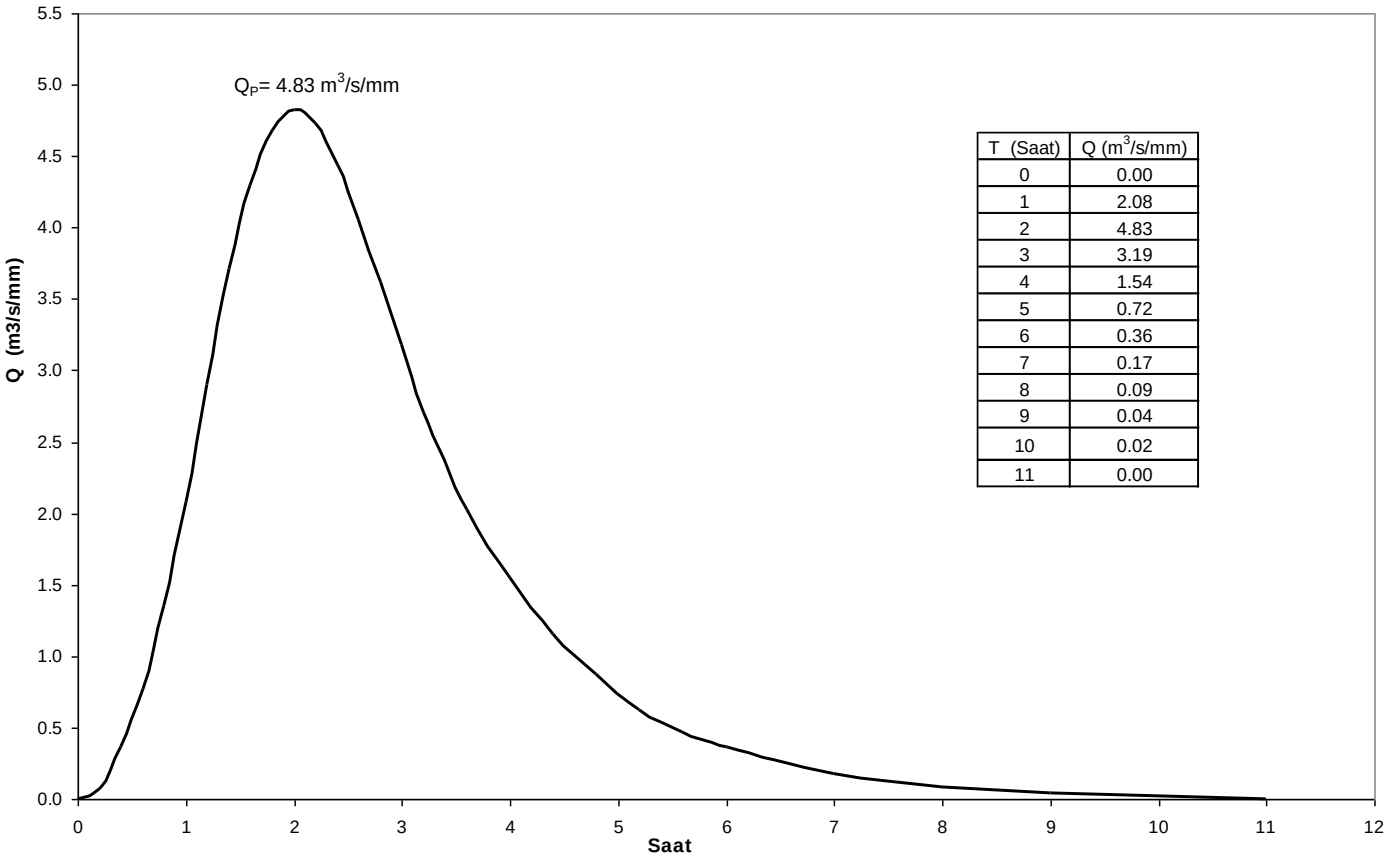

| Zaman Saat | Debi $m^3$/s/mm |
|---|---|
| 0 | 0.00 |
| 1 | 0.80 |
| 2 | 2.90 |
| 3 | **4.06** |
| 4 | 3.25 |
| 5 | 2.05 |
| 6 | 1.30 |
| 7 | 0.80 |
| 8 | 0.47 |
| 9 | 0.30 |
| 10 | 0.18 |
| 11 | 0.11 |
| 12 | 0.08 |
| 13 | 0.04 |
| 14 | 0.03 |
| 15 | 0.02 |
| 16 | 0.01 |
| 17 | 0.00 |

**Figure 10: 2 hr and 1 mm UH for Doğanpınar Pond Catchment ( DSİ Snythetic UH Method )**




| Zaman | Yinelenme Periyodu (Yıl) | | | | | | |
|---|---|---|---|---|---|---|---|
| Saat | 2 | 5 | 10 | 25 | 50 | 100 | 500 |
| 0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| 1 | 3.1 | 5.0 | 6.5 | 8.4 | 9.9 | 11.4 | 14.9 |
| 2 | 6.0 | 12.9 | 18.2 | 25.3 | 30.7 | 36.1 | 48.9 |
| 3 | 9.7 | 21.1 | 29.7 | 41.1 | 49.6 | 58.2 | 78.3 |
| 4 | 14.3 | 28.4 | 38.6 | 51.6 | 61.3 | 70.9 | 93.0 |
| 5 | 15.7 | 29.6 | 39.3 | 51.5 | 60.3 | 69.0 | 88.9 |
| 6 | 12.5 | 22.9 | 29.9 | 38.9 | 45.3 | 51.7 | 66.1 |
| 7 | 8.6 | 15.1 | 19.5 | 25.1 | 29.1 | 33.1 | 42.1 |
| 8 | 6.1 | 10.2 | 12.9 | 16.3 | 18.8 | 21.3 | 26.8 |
| 9 | 4.6 | 7.1 | 8.8 | 10.9 | 12.5 | 14.0 | 17.5 |
| 10 | 3.5 | 5.0 | 6.0 | 7.3 | 8.2 | 9.1 | 11.1 |
| 11 | 3.0 | 3.9 | 4.5 | 5.3 | 5.9 | 6.5 | 7.8 |
| 12 | 2.6 | 3.2 | 3.6 | 4.1 | 4.5 | 4.8 | 5.7 |
| 13 | 2.4 | 2.7 | 2.9 | 3.2 | 3.4 | 3.6 | 4.1 |
| 14 | 2.3 | 2.5 | 2.7 | 2.9 | 3.1 | 3.2 | 3.6 |
| 15 | 2.14 | 2.27 | 2.37 | 2.49 | 2.57 | 2.66 | 2.85 |
| 16 | 2.09 | 2.19 | 2.25 | 2.32 | 2.38 | 2.43 | 2.56 |
| 17 | 2.05 | 2.10 | 2.13 | 2.16 | 2.19 | 2.21 | 2.26 |
| 18 | 2.03 | 2.05 | 2.06 | 2.08 | 2.09 | 2.11 | 2.13 |
| 19 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |

**Figure 11: Flood Hydrographs of Different Recurrence Interval for Doğanpınar Pond Site**




| T (Saat) | Q ($m^3$/s/mm) |
|---|---|
| 0 | 0.00 |
| 1 | 2.08 |
| 2 | 4.83 |
| 3 | 3.19 |
| 4 | 1.54 |
| 5 | 0.72 |
| 6 | 0.36 |
| 7 | 0.17 |
| 8 | 0.09 |
| 9 | 0.04 |
| 10 | 0.02 |
| 11 | 0.00 |

**Figure 12: 2.5 hr and 1 mm UH for Doğanpınar Pond catchment ( mockus UH Method**

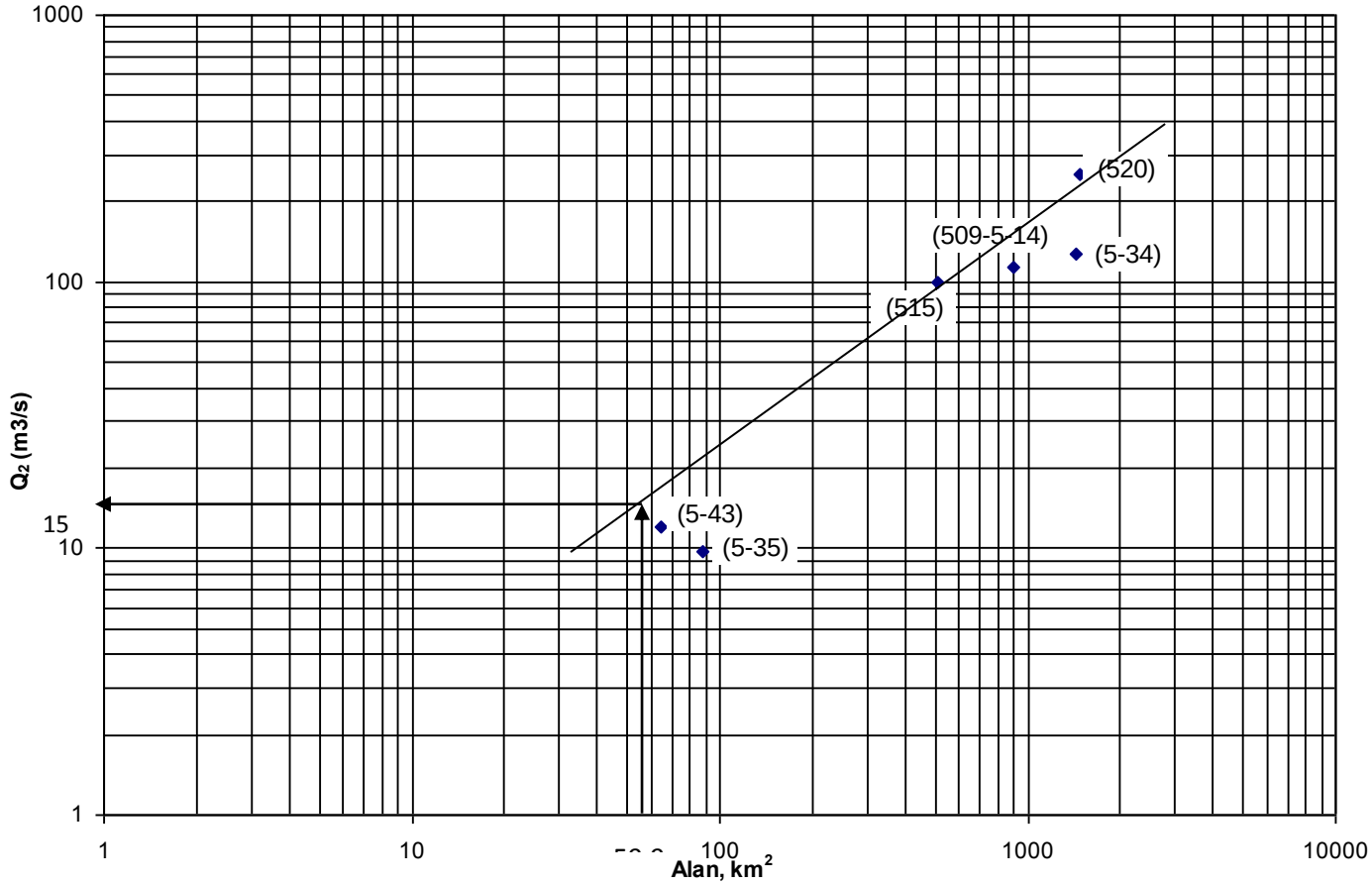
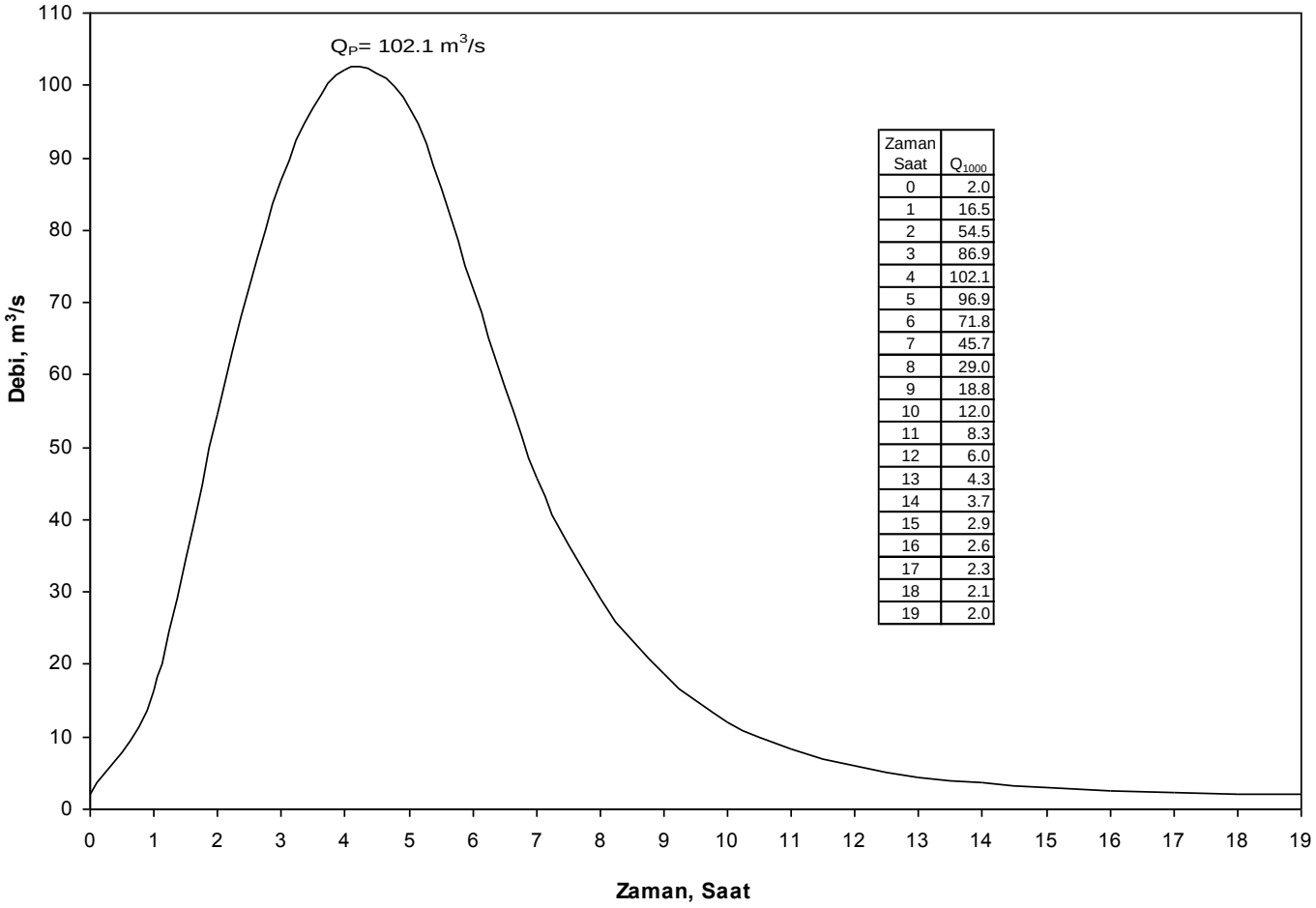



**Figure 13: Area – Q2 Curve Obtained from Regional Floods Frequency Analysis for Doğanpınar pond**




| Zaman Saat | $Q_{1000}$ |
|---|---|
| 0 | 2.0 |
| 1 | 16.5 |
| 2 | 54.5 |
| 3 | 86.9 |
| 4 | 102.1 |
| 5 | 96.9 |
| 6 | 71.8 |
| 7 | 45.7 |
| 8 | 29.0 |
| 9 | 18.8 |
| 10 | 12.0 |
| 11 | 8.3 |
| 12 | 6.0 |
| 13 | 4.3 |
| 14 | 3.7 |
| 15 | 2.9 |
| 16 | 2.6 |
| 17 | 2.3 |
| 18 | 2.1 |
| 19 | 2.0 |

**Figure 14: 1000 yr Flood Hydrograph for Doğanpınar Site**

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