ASSESSMENT OF IRRIGATION WATER QUALITY AND CONTAMINATION IN THE KÜÇÜK MENDERES RIVER BASIN İZMİR-TURKEY

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ABSTRACT

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In this study the chemistry and associated quality and contamination related issues of both ground and surface waters in the Küçük Menderes River Basin were investigated on the basis of hydrogeological and hydrochemical data using Geographic Information Systems (GIS) methods.

The point contamination sources in the basin are waste disposal sites and sewage systems of the municipalities, factories and mines. The waste disposal sites and sewage discharges of many municipalities, especially those of Ödemiş, have deteriorated the water quality along the Küçük Menderes river channel. Primary areas where industrial facilities have contaminated waters are located to the north of Tire, to the south of Torbalı, and northeast of Beydağ. The main

areas where mines have deteriorated the groundwater quality in local scale are the vicinities of Beydağ, Mescitli and Kaymakçı towns. The other point contamination source in the basin is the salt-water determined in some well waters of the Selçuk sub-basin. Nitrate and potassium concentrations in some locations (especially between Ödemiş and Tire and to the east of Torbalı around Develi town) exhibit the degrading effects of agricultural activities.

Contamination potential maps, prepared on the bases of hydrogeological parameters of DRASTIC indicate that the highest contamination potential including areas are located between Ödemiş and Tire along the Küçük Menderes river channel, to the west of Boğaziçi, south and east of Torbalı, and around Çırpı, Belevi, Selçuk and Develi.

Contamination risk maps for the irrigation water applications show that the groundwaters located along the Küçük Menderes river channel between Kiraz and Tire, along the Fertek stream channel to the north and south of Torbalı, to the north of Tire, and to the northwest of Selçuk carry high contamination risk for irrigation purposes, especially in terms of EC, NO_3, Cl and Na% parameters.

In the light of collected data and related analyses, water quality component of water management planing is presented.

Keywords: Küçük Menderes, groundwater, surface water, water quality, contamination, GIS, DRASTIC, risk.

ÖZ

KÜÇÜK MENDERES HAVZASININ SULAMA SUYU KALİTESİ VE KİRLİLİĞİ

İZMİR-TÜRKİYE

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Bu çalışmada Küçük Menderes Havzası yeraltı ve yüzey sularının kimyasal ve buna bağlı kalite ve kirlenme boyutları hidrojeolojik ve hidrokimyasal veriler ışığında ve Coğrafi Bilgi Sistemleri metodları kullanılarak çalışılmıştır.

Nokta kirlilik kaynakları belediyelerin atık sahaları ve kanalizasyonları, fabrikalar ve maden sahalarıdır. Birçok belediyenin, özellikle Ödemiş belediyesinin, atık sahaları ve kanalizasyonu Küçük Menderes nehri yatağı boyunca su kalitesini düşürmektedir. Endüstri sahalarının kirlettiği yerlerin başında Tire'nin kuzeyi, Torbalı'nın ve Beydağ kuzeydoğusu gelmektedir. Yeraltısuyu kalitesini bozan cevherleşmeler Beydağ, Mescitli ve Kaymakçı

civarındadır. Bazı alanlarda (özellikle Ödemiş-Tire arası ve Torbalı doğusu Develi civarı) yeraltısuyundaki nitrat ve potasyum konsantrasyonları tarım faaliyetlerinin olumsuz etkisini göstermektedir.

DRASTIC metodunun hidrojeolojik parametreleri bazında hazırlanan kirlenme potansiyeli haritalarına göre Küçük Menderes nehri yatağı boyunca Ödemiş-Tire arası, Boğaziçi batısı, Torbalı'nın güneyi ve doğusu, Çırpı, Belevi, Selçuk ve Develi taraflarındaki yeraltısuları yüksek kirlenme potansiyeli taşımaktadır.

Sulama suyu amaçlı kirlenme riski analizine göre yeraltısuları Kiraz ve Tire arasında uzanan Küçük Menderes nehri yatağı boyunca, Torbalı kuzey ve güneyinde uzanan Fertek deresi kanalı boyunca, Tire'nin kuzeyinde ve Selçuk ilçe merkezi kuzeybatısında özellikle EC, NO_3, Cl ve Na% parameterelerine göre yüksek kirlenme riski taşımaktadır.

Toplanan veriler ve yapılan çalışmalar ışığında su kullanım planlamasının kalite kısmı sunulmuştur.

Anahtar kelimeler: Küçük Menderes, yeraltısuyu, yüzey suyu, su kalitesi, kirlilik, CBS, DRASTIC, risk.

To my family…

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CHAPTER I

INTRODUCTION

The Küçük (K) Menderes River Basin (3500 km^2) extending in the east-west direction toward the Aegean coast line at western Turkey is a very productive agricultural area with industrial sites at west (Figure 1.1). A three dimensional view of the basin from South at 70° inclination can be seen in Figure 1.2. Almost all irrigation and industrial water needs in the area are supplied from groundwaters due to both unsuitable chemical content and especially low flow rate of surface waters during dry periods in the K. Menderes River and its tributaries which discharge to the Aegean sea after crossing the entire basin. Recent reconnaissance surveys on groundwaters of the basin by State Hydraulic Works (DSİ, Devlet Su İşleri) indicate that the quality of groundwaters has been deteriorated.

The water management plan of the basin for irrigation applications based on 1970 ies data has been decided to be revised by DSİ because of increasing irrigation water demand and possible contamination problems associated with the water sources in the area.

1.1. Purpose and Scope

Considering continuously increasing demand for irrigation water in the basin, it is imperative that types, dimensions and sources of the deterioration must be known prior to any water management planning activity. The purpose of

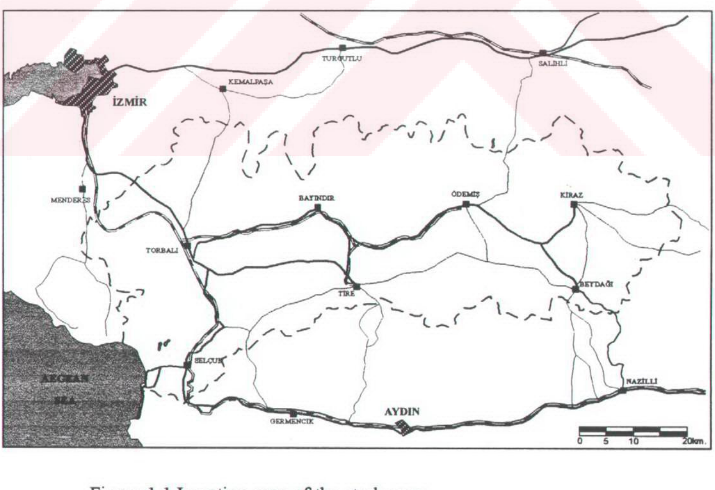


Figure 1.1 Location map of the study area.

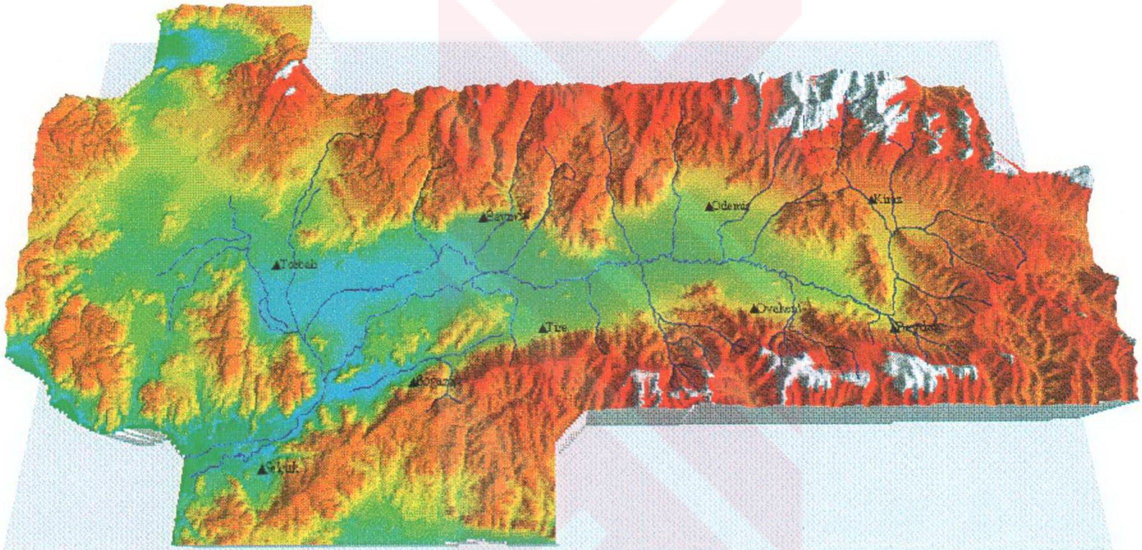


Figure 1.2. Three dimensional view of the basin.

this study is to investigate the chemistry and associated quality and contamination related issues of both ground and surface waters in the K. Menderes River Basin on the basis of hydrogeological and hydrochemical data.

In accordance with the purpose, following objectives are aimed for the investigation:

* Determination of the chemical content of ground and surface waters both in dry and wet seasons throughout the basin.

* Determination of the potential sources of contamination in the basin.

* Establishing the qualities of the waters in the basin according to the irrigation water limits of Water Contamination Control Regulations of Turkey.

* Determination of the areas where the waters have already been contaminated in the basin.

* Determination of the active sources of contamination.

* Determination of the contamination vulnerable areas in the basin using hydrogeological parameters.

* Establishing the contamination risk areas for irrigation water in the basin using both hydrogeological and hydrochemical data.

* Establishing water quality component of water management plan.

CHAPTER II

PREVIOUS STUDIES

2.1. Geology

Geological studies in the area have been performed by numerous workers (e.g. Asar, 1957; Akartuna, 1962; Graciansky, 1965; Arpat and Bingöl, 1969; Akkök et al., 1984; Konak, 1985; Satır and Friedrichsen, 1986) on different aspects. The generalized columnar section of the basin prepared by METU (1998) is shown in Figure 2.1a. On the basis of previous studies, the stratigraphic sequence in the basin may be summarized as follows:

Metamorphic rocks of the Menderes Group constitute the basement of the study area. These Paleozoic rocks are composed of five different lithological units. From oldest to youngest the units include:

Section 1; Marble interbedded with micaschist, garnet bearing schist and phyllite.

Section 2; Augen gneiss, granitic gneiss, migmatitic-syngenetic granite, micaschist and metagabbroic metamorphics.

Section 3; Micaschist, calcschist, and marble alternations.

Section 4; Meta-ultramafics.

Section 5; Marble-calcschist alternation.

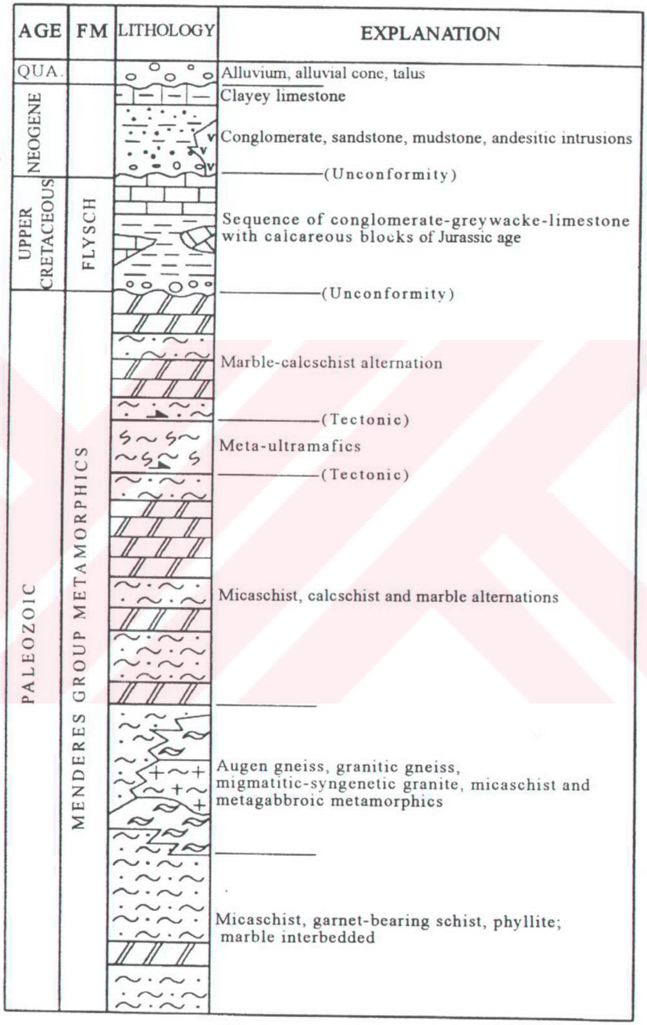


Figure 2.1a. Generalized columnar section of the Küçük Menderes Basin (METU, 1998).

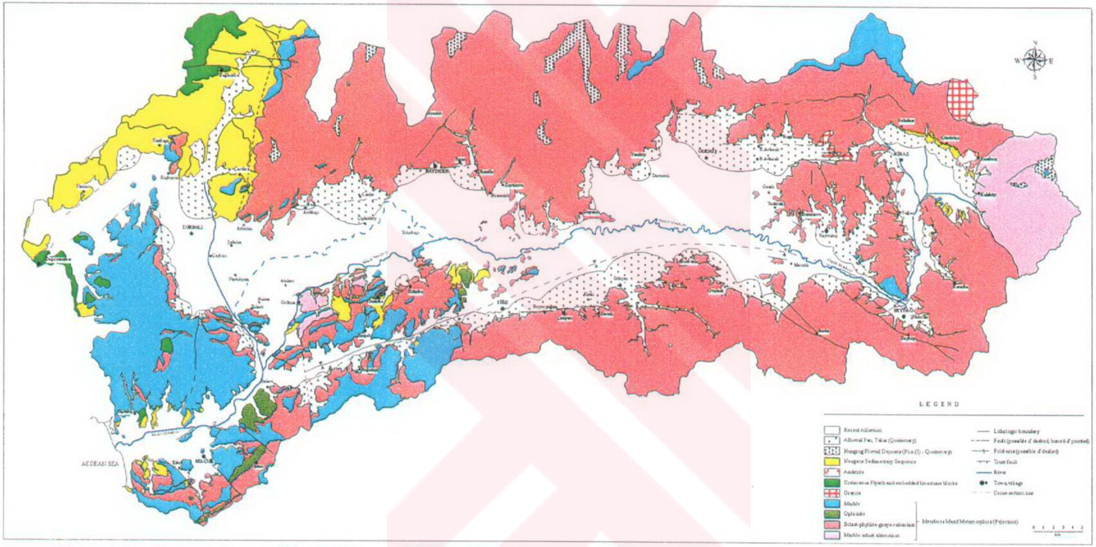


Figure 2.1b. Geological map of the study area. (METU, 1999)

The Menderes group is unconformably overlain by the Upper Cretaceous Bornova Flysh. The flysh sequence includes conglomerate-greywacke-limestone with calcareous blocks of Jurassic age. The Neogene units unconformably overly the Bornova Flysh in the sequence. Conglomerate, sandstone, mudstone and andesitic intrusions form the lower part of the Neogene. The upper part of it is composed of clayey limestone. Unconformably overlying Quaternary fill is composed mainly of alluvium, alluvial cone and talus deposits.

The geological map of the area, prepared by METU (1999) is shown in Figure 2.1b. E-W and WNW-ESE grabens and their related active normal faults are the most prominent neo-tectonic features of the region. The K. Menderes River Basin is dominated by E-W trending normal faults (METU, 1998).

2.2. Hydrogeology

The first published hydrogeological work in the basin was carried out by DSİ (1973) in which major hydrogeological elements (aquifer distribution, groundwater table contour map, hydraulic conductivity, groundwater budget etc.) were presented. Nippon (1996) studied the basin in terms of irrigation potential.

Climate

Typical Mediterranean climate is dominant in the region, hot and dry in summer and warm and rainy in winter. Rain is generally of convective type in the inland section of the basin and orographic at the coasts and at the highlands of inland (METU, 1998). Snow may be present only at the top of the mountains surrounding the basin at the east, north and south in winter. Annual average atmospheric input to the basin is 735.5 mm as estimated on the basis of data collected from 10 meteorological stations between the years of 1957 and 1997 (METU, 1998).

Springs

Fifteen springs having discharge rates ranging between 15 l/s and 50 l/s were reported in DSİ (1973). Geographic distribution of these springs are shown in Figure 2.2. The names of the springs, their discharge rates and the lithological units from which the springs emerge are listed in Table 2.1a.

Streams

The most important stream in the basin is the K. Menderes River which starts flowing from 220 m elevation in the east and reaches to the Aegean Sea at Selçuk after 114 km long flow path toward west (Figure 2.2). The major tributaries of the river are Fertek, Uladı, Ilıca (Ergenli), Değirmendere (Falaka), Aktaş, Rahmanlar, Pirinçci, Yuvalı, Ceriközkaya, Eğridere, Birgi, Cevlik and Keleş streams. The geographic distribution of these in the basin is shown in Figure 2.2. The annual mean and monthly flow rates of the streams are listed in Table 2.1b. In the summer period the streams usually dry out before reaching to the K. Menderes River. The K. Menderes River with low flow rate at the east of the basin itself also dries out toward west in summer.

Lakes and Swamps

Two lakes (Gebekirse and Çatak) and one swap (Eleman), covering about 1500 ha area are located at the western part of the basin where the K. Menderes River joins the Aegean Sea (Figure 2.2). The surface area of the Gebekirse Lake is about 75 ha and the deepest part of it is about 5 m. (METU, 1998). According to the information obtained from local people, the sea water moves about 4 km toward inland through the K. Menderes river channel and mixes with the Gebekirse Lake waters in winter. The Çatak Lake has a surface area of 74 ha and the deepest part of it is about 4 m. (METU, 1998). The Eleman Swamp is dry in summer but invaded by the waters of the K. Menderes River in winter. About 100 ha area at the western part of the swamp is covered by water even in summer.

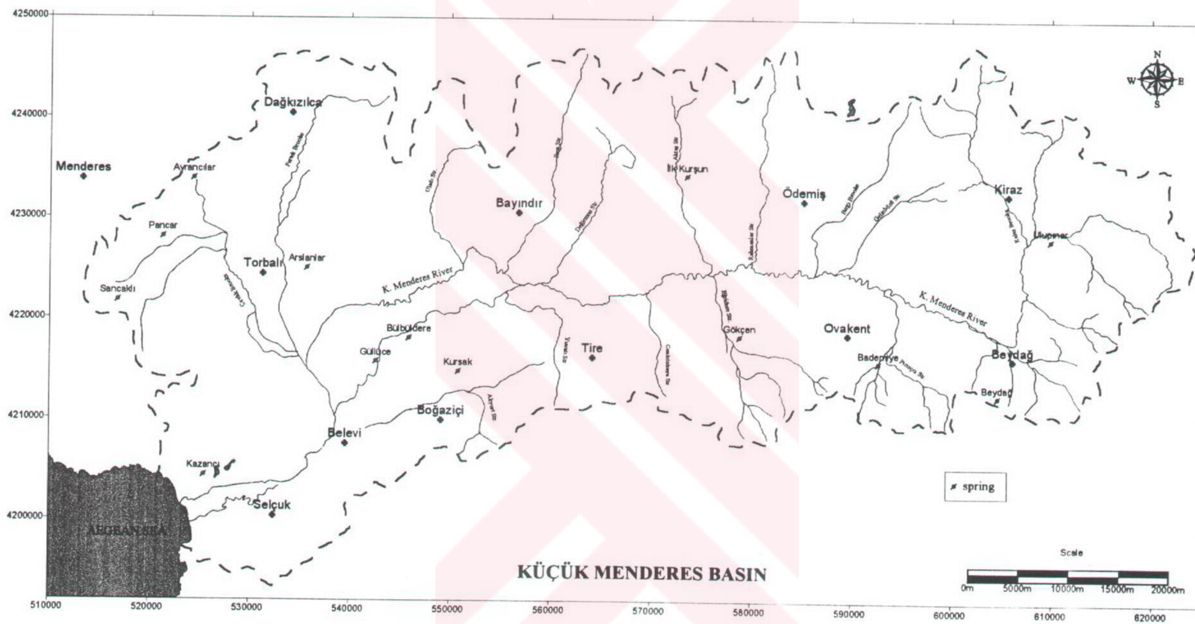


Figure 2.2. Location of the springs and the streams in the basin.

Table 2.1. (a) List of the springs and their average annual discharge rates (DSİ, 1973). (b) List of the streams and their average monthly discharge rates (METU, 1998).

(a)

Name	North	East	Unit	Discharge (l/s)
Ayrancılar	4233900	524350	Conglomerate	500
Oğlananası	4234300	522100	Conglomerate	300
Kısık	4236900	516750	Calcerous	50
Sancaklı	4221750	516800	Calcerous	15
Pancar	4228100	521300	Calcerous	50
Güllüce	4215750	542600	Calcerous	17
Bülbüldere	4218100	545900	Calcerous	15
Kazancı	4204400	525500	Calcerous	300
Arslanlar	4225000	535700	Conglomerate	180
Kursak	4214800	550800	Calcerous	200
Ilkkurşun	4234250	573600	Calcerous	60
Ulupınar	4228100	609900	Calcerous	50
Bademiye	4215750	592700	Calcerous	40
Gökçen	4218300	578850	Calcerous	25
Beydağ	4212450	604600	Calcerous	20

(b)

	Months												Annual Average
	10	11	12	1	2	3	4	5	6	7	8	9	(m3/s)
K. Menderes River-Beydağ Bridge													
Ave.	0.57	0.89	2.92	2.80	4.28	4.42	4.21	2.73	1.11	0.61	0.48	0.57	2.13
K. Menderes River-Subaşı Bridge													
Ave.	0.64	0.84	5.77	7.19	10.57	5.51	6.16	3.87	2.27	0.66	0.12	0.46	3.67
K. Menderes River-Rahmanlar Bridge													
Ave.	0.14	0.45	13.49	20.13	37.11	19.24	14.48	10.11	2.62	0.53	0.05	0.10	9.87
K. Menderes River-Çift Köprüler													
Ave.	2.39	3.11	19.82	49.14	36.75	36.85	27.32	18.40	7.25	2.16	0.69	2.40	17.19
K. Menderes River-Selçuk													
Av.	1.58	4.01	15.38	27.91	31.97	26.31	15.86	8.72	3.90	0.92	0.20	0.61	11.45
Rahmanlar Stream-Bebekler													
Ave.	0.03	0.16	0.80	1.12	0.86	1.03	0.72	0.36	0.16	0.10	0.06	0.06	0.45
Aktaş Stream-Bülbüller													
Ave.	0.19	0.44	1.03	0.91	0.86	0.84	0.75	0.49	0.26	0.04	0.00	0.00	0.48
Falaka Stream-Falaka													
Ave.	0.23	0.62	1.44	1.74	1.24	1.10	0.71	0.47	0.21	0.13	0.11	0.15	0.68

Water Bearing Units

Metamorphic rocks (shist and gneiss) and crystalline limestone (marble) of the Menderes Massive, Neogene sedimentary deposits (conglomerate and limestone) and Quaternary alluvium are the important hydrogeological units in the K. Menderes River Basin (METU, 1998). The main aquifer system in Kiraz, Ödemiş-Tire, Bayındır-Torbalı, and Selçuk sub-basins consists of alluvium. The alluvium is composed mainly of alluvial fan, gravel, sand, silt and clay and covers the largest area in the basin (Figure 2.1b). The alluvium with thickness reaching up to 300 m in the Ödemiş-Tire and Bayındır-Torbalı sub-basins, has the most important groundwater potential in the basin (METU, 1998). Besides the alluvium, marbles especially in the Torbalı, Tire and Selçuk sub-basins, and the Neogene deposits in the Torbalı sub-basin bear aquifer characteristics (METU, 1998). Gneiss, shist, phyllite, and calc-shist forming the lower parts of the metamorphic series and porous but non-fractured marbles forming the upper parts of the metamorphic series do not have any aquifer properties. Thus, they provide the impervious boundaries.

Hydraulic conductivity distribution of the units in the basin were estimated by Yılmaz (1999) on the basis of the pumping test data collected by DSİ and Bank of Provinces (İller Bankası) (Figure 2.3). Storativity of the units determined by METU (1999) are shown in Figure 2.4.

Groundwater

The groundwater table contour map of the wet season is shown in Figure 2.5 (METU, 1999). Groundwater movement in the area is from east to west in general. Recharge to the aquifers in the sub-basins are determined by DSİ (1973) as follows: Kiraz sub-basin, 16 hm^3/year; Ödemiş-Tire + Bayındır-Torbalı sub-basins, 158 hm^3/year (which is 151 hm^3/year according to Nippon, 1996) and Selçuk sub-basin: 8 hm^3/year. According to METU (1999) the recharge values are Kiraz sub-basin; 13 hm^3/year, Ödemiş-Tire sub-basin; 109 hm^3/year, Bayındır-Torbalı sub-basin; 207 hm^3/year and Selçuk sub-basin; 17 hm^3/year.

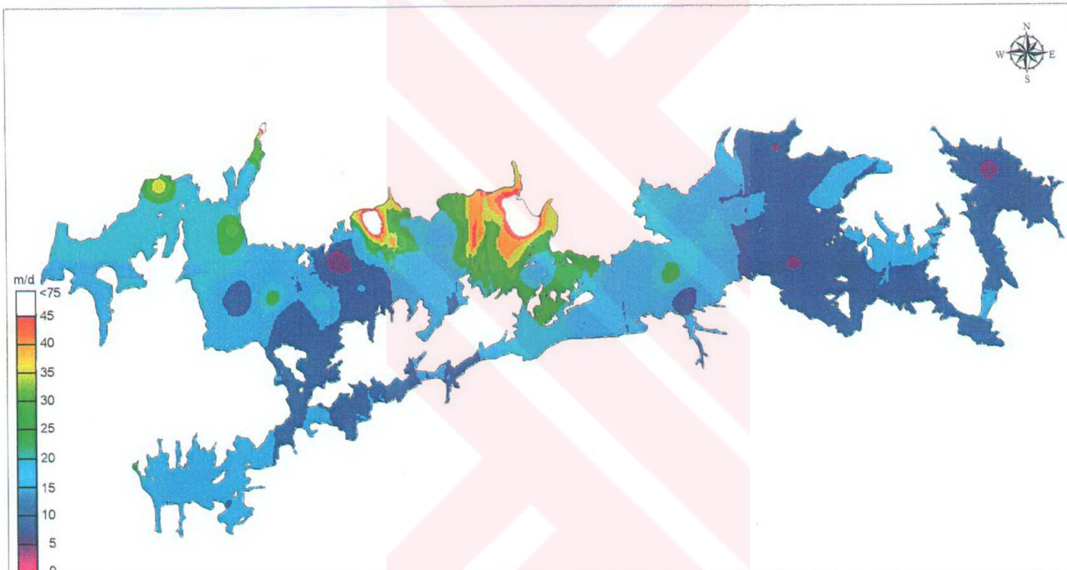


Figure 2.3. Hydraulic conductivity distribution in the basin. (Yılmaz, 1999).

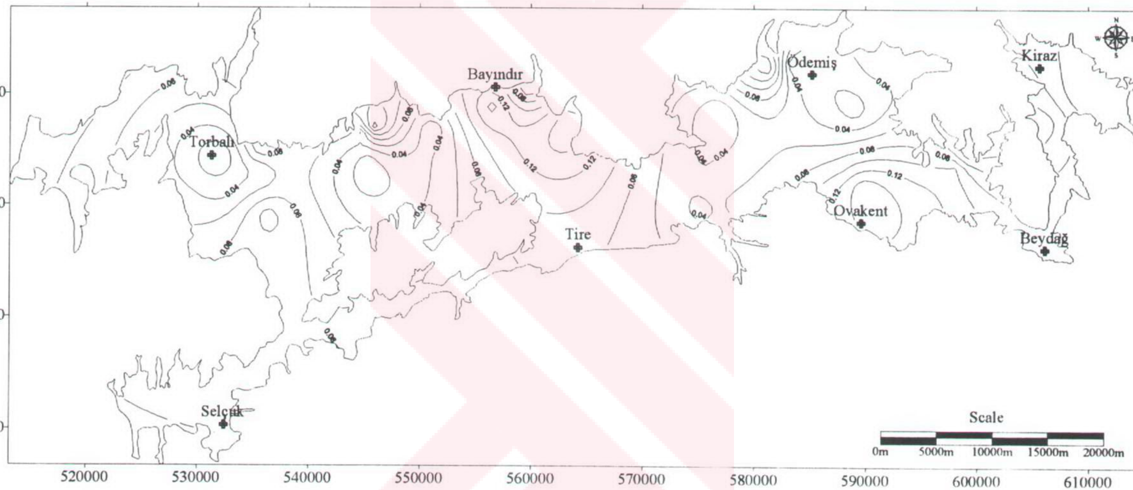


Figure 2.4. Storativity distribution in the basin. (METU, 1999)

Figure 2.5. Groundwater table contour map of the basin in wet season. (METU, 1999).

Discharge from Kiraz sub-basin to Ödemiş-Tire sub-basin is 252.580 m^3/6months, from Ödemiş-Tire sub-basin to Bayındır-Torbalı sub-basin is 5.828.320 m^3/6 months, from Bayındır-Torbalı sub-basin to Selçuk sub-basin is 49.086 m^3/6 months and from Selçuk sub-basin to Aegean Sea is 214.000 m^3/6 months as determined by METU (1999).

DSİ (1973) reported 15.5 x 10^6 m^3/year of total discharge for Kiraz sub-basin, 158 x 10^6 m^3/year for Ödemiş-Tire-Bayındır-Torbalı-Pancar sub-basins and 8 x 10^6 m^3/year for Selçuk sub-basin.

In the basin, there are more than 6000 registered wells opened by the DSİ, Bank of Provinces (İller Bankası), Rural Area Services (Köy Hizmetleri) and by public. The number of wells with the unregistered private ones is much greater than 6000.

2.3. Hydrochemistry

Water chemistry observation of the DSİ at the opening time in the water of a new well has been continued since 1930 ies in the region. In the study of DSİ (1973), major ion analyses of 47 water samples, collected at different times from different DSİ wells, and 3 surface water samples from the K. Menderes River were reported. At present, 361 major ion analyses of DSİ well waters collected during well openings are present in the records of the Geotechnique Services and Groundwater Department of the DSİ. The sampling locations and the chemical analyses of these compiled 361 well waters are listed in Table I.1 and Table I.2, respectively. The water quality of these samples, estimated using the inland water sources limits of the measured parameters, are also provided in Table I.3. Brief evaluation of these analyses is given in Appendix I. The DSİ initiated a monitoring program in 1995 covering 93 wells in the basin (Figure I.1). Chemical analyses of major ions have been regularly carried out in June and September since then. The sampling locations and the chemical analyses of these well waters between 1995 and 1997 are listed in Table I.4 and Table I.5, respectively. The qualities of these waters, estimated using the limits of inland water sources and irrigation water sources with respect to the measured parameters are given in Table I.6. Many major ion analyses of the registered private wells are also present in the files of DSİ İzmir District. In addition, chemical analyses of samples taken from the wells opened for drinking purposes by either Bank of Provinces or the Rural Area Services, are present in the records of these related institutions.

The DSİ monitors the chemistry of the streams in the basin, as well. This monitoring program initiated in 1985 with a single point on the K. Menderes River near Selçuk and expanded to 14 locations in 1995, covering all the major streams in the basin. Three of these sampling points are located at the K. Menderes River (Beydağ Dam axis, Etibank mining facilities, Selçuk), three are along the Fertek stream (upstream, north of Torbalı, south of Torbalı), and one point each on the Gelinbözü, Rahmanlar, Aktaş, Falaka (Değirmendere), Ergenli (Ilıca), Pirinçci, Eğridere and Akyurt streams. The monitoring locations are shown in Figure II.1. The chemical analyses of the collected surface waters and their annual average concentrations are given in Table II.1 and Table II.2, respectively. The water qualities of the annual average data, estimated using the inland water sources limits of the measured parameters are listed in Table II.3. Brief evaluation of these waters is given in Appendix II.

2.4. Contamination

Water Contamination

In the previous studies, water contaminations, caused by different sources in the basin are reported by Nippon (1996) and DSİ (1973). DSİ (1973) reported that in Menderes (Cumaovası) town, some well waters contain high SO_4 concentrations and some of the others have high NO_2 and NH_3. In the reports of Nippon (1995, 1996), some contamination indicators are stated in some wells of Menderes town with medium-high salinity, in Ödemiş and Avlucak with high B and in Halıköy and Beydağ with low pH and high salinity, reflecting the effects of Hg mining activity in the area. The K. Menderes river waters near Selçuk town contain high BOD, high EC, low dissolved O_2, and medium-high salinity hazard according to the report of Nippon (1996). In the same report it is also stated that the Gebekirse lake water is brackish.

CHAPTER III

HYDROCHEMISTRY AND WATER QUALITY

3.1. Methods

In order to determine the chemical composition and quality of the waters both during and prior to the irrigation period (in dry and wet seasons), the sample collection programs were carried out in July, 1998, in October, 1998 and in April, 1999. A total of 84 water samples were analyzed in the field during dry season. In July, 54 samples from wells and 13 samples from springs and in October, 6 samples from wells were collected for detailed chemical analyses. In the wet season sampling period, 46 samples from wells and 21 samples from streams were collected in April for chemical analyses. Geographic distributions of the sampling locations are shown in Figure 3.1. The explanation about the sampling locations is given in the tables 3.1, 3.2, and 3.3.

The samples were collected in two sets into new 1 lt plastic bottles, which were washed twice thoroughly with the water sampled. These two sets were filtered in the field if they are collected from surface waters. One set of sample at each location was acidified for long time preservation using HNO_3 until pH value of a sample becomes less than 3. This set of sample was used for the heavy metal analyses. Other than these two sets, a 5 lt water sample was collected from a given location for BOD analysis which is carried out in July period only. All the samples were kept refrigerated until they were transported to the laboratory.

Temperature, electrical conductivity (EC), total dissolved solids (TDS) and pH parameters of the waters were measured in the field. The amounts of Na, K, Ca, Mg, HCO_3, CO_3, SO_4, Cl, N-NO_2, N-NO_3, N-NH_3, o-PO_4, B, F, Pb, Zn,

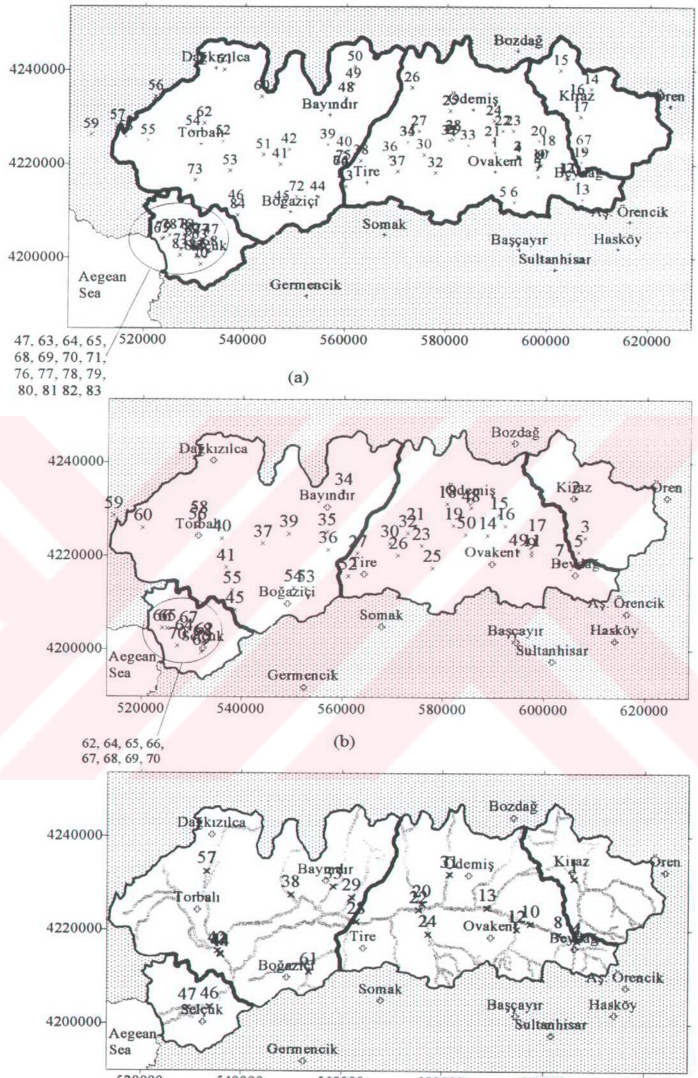


Figure 3.1. Geographic distribution of the (a) groundwater samples studied in 6-22/July/1998 and in 8-11/October/1998, (b) groundwater samples studied in 1-6/April/1999, and (c) surface water samples studied in 1-6/April/1999. For explanation see tables 3.1, 3.2 and 3.3.

Table 3.1. Location of the waters investigated in 6-22/July/1998 (no: 1-67, 74-81) and in 8-11/October/1998 (no: 68-73, 82-84). Distribution of the locations in the basin is shown in Figure 3.1a.

Sample No	Explanation	East	North	Well Depth (m)	T (°C)
1	Ovakent, Ovakent-Ödemiş road, KO1	589600	4222600	40	19.6
2	Ovakent, Mescitli, gaseous well, KM2	594100	4221700	38	18.2
3	Ovakent, Mescitli, gaseous well, KM3	594300	4221700	60	20
4	Ovakent,Mescitli, KM4	594200	4221400	30	18.5
5	Bademli, Kırık Stream spring, KAB 5	591200	4212000	-	16.5
6	Bademli, Kozluk Stream spring, KAB6	593500	4212000	-	18
7	Beydağ, Emirli, leakage from mine, ME7	598100	4217400	-	22
8	Beydağ, Emirli, mine area, KE8	598000	4219200	90	20
9	Beydağ, Emirli, mine area, KE9	598700	4219800	?	22
10	Beydağ, Emirli, mine area, KE10	598500	4220000	?	22
11	Beydağ, Halıköy, mine area, KB11	604100	4217000	28	19
12	Beydağ, Halıköy, mine area, KB12	603700	4217100	13	18
13	Beydağ, Tabaklar, spring, KABE13	606800	4212500	-	18
14	Kiraz, Suludere, K. Menderes spring,KAS14	608500	4236100	-	17.5
15	Kiraz, Çatak, K. Menderes spring, KAÇ15	602400	4240100	-	17
16	Kiraz, Ceritler, KCK16	605700	4233900	60	20.5
17	Kiraz, Arkacılar, KKK17	606500	4230200	12	19
18	Kaymakçı, Çaylı, KÇ18	600100	4222900	75	20
19	Beydağ, farm, KÇ19	606600	4220500	?	20
20	Kaymakçı, near cemetery , KKAY20	598300	4225000	90	23
21	Ödemiş, Türkönü, KTM21	589100	4224900	70	20
22	Kaymakçı, Türkönü, mine area, KTK22	591100	4227200	80	23
23	Kaymakçı, Kurucaova, mine area, KMT23	593200	4227200	10	23
24	Birgi, Yolüstü Cooperative well, KY24	589400	4229400	100	22
25	Ödemiş, Demirci DSİ 39074, KOD25	580750	4231445	135	18
26	Ödemiş, Veliler, Aktaş S., RAK26	573100	4236400	-	19
27	Ödemiş, İlkkurşun, KKA27	574600	4227100	80	21
28	Ödemiş, Karakova, HI28	581400	4226200	100	21
29	Ödemiş, Karakova, HI29	581300	4225300	?	21
30	Gökçen, DSİ 14355, KG30	575600	4222100	75	16
31	Ödemiş, Karakova, KHI31	580600	4225100	80	20.5
32	Gökçen, Kırtepe, KGG32	577900	4218200	25	17
33	Ödemiş, Balabanlı, KBM33	584300	4224100	100	21
34	Ödemiş, Doyranlı, KD34	572280	4224800	11	20
35	Ödemiş, Doyranlı, KD35	572320	4224800	18	18
36	Tire, Kozalan, KKO36	568800	4221600	22	20
37	Tire, Zincirlikuyu area, KZI37	570300	4218500	62	17
38	Tire, Kutsan Factory, KTM38	563000	4220800	10	19
39	Bayındır, Tokatbaşı, KB39	556400	4224200	100	21
40	Tire, Tekke Ovası, KT40	559700	4222600	26	19
41	Çırpı, Yeniçiftlik Village, KY41	547000	4220000	30	20
42	Çırpı, Esmatulumbası area, KÇI42	548800	4223200	60	20
43	Tire, Yuvalı, KS43	560000	4215300	93	16.5
44	Boğaziçi, Karagöl Farm, KS44A	554600	4213100	90	20
45	Boğaziçi, Kurşak, KS45	547500	4211000	61	19
46	Torbalı, Belevi, KS46A	538400	4211200	70	26
47	Selçuk, farm, KS47	533500	4203800	90	22

Table 3.1 continued.

Sample No	Explanation	East	North	Well Depth (m)	T (°C)
48	Bayındır, Ergenli thermal water, KER 48	560000	4234100	65	40.2
49	Bayındır, Ergenli Sarıyurt spring, KSA49	561400	4237100	-	21
50	Bayındır, Ergenli Ilıcadere spring, KSA50	561700	4240700	-	21
51	Çırpı, Yeniçiftlik Village, KÇ51	543700	4222000	60	22.5
52	Torbalı, Aslanlar DSİ well, KAR52	535700	4224900	100	23
53	Pamukyazı, Subaşı Road, KPA53	537100	4218600	80	23
54	Torbalı, Pancar Road, KTO54	529700	4226900	60	22.5
55	Pancarköy, Kıyasovası, KPK55	520700	4225000	?	23.5
56	Oğlananası, spring, KAO56	522200	4234400	-	21
57	Menderes, Develi,KD57	514600	4228200	10	22
58	Menderes, Tekeliköy, KT58	516200	4225900	10	20
59	Menderes, Şaşal spring, KT59	509400	4226300	-	
60	Torbalı, Dağtekeli spring, KAD60	543300	4234500	-	17
61	Torbalı, Dağkızılca, KFE61	535900	4240100	6	22
62	Torbalı, Makaralıkuyu area, KFE62	532000	4228800	100	19.5
63	Selçuk, Korudağ T., KSE63, (TDS4)	531200	4202700	40	21
64	Selçuk, near K. Menderes, KSE64, (TDS6)	529800	4203500	40-100?	22
65	Selçuk, Kazancı spring, KSE65	523600	4204000	-	20
66	Tire, old Karateke Village spring, KAT66	556900	4218300	-	20
67	Kiraz, Urumbo, KI70	607200	4223100	10	18
68	Selçuk, DSİ 20046, S71	533301	4201252	105	21
69	Selçuk, DSİ 21381, S72	531017	4200106	70	24
70	Selçuk, municipality İSK No1, S73	531408	4198641		22
71	Selçuk, Süleyman Farm., S74	527436	4201733		22
72	Tire, Kurşak DSİ 26886, K75	550300	4213100	93	20
73	Torbalı, Ahmetli near DSİ 33133, K76	530200	4216600	82	22
74	Tire, Karateke Village, spring, KAT67	559100	4218500	-	30
75	Tire, Karateke Village, spring, KAT68	559600	4219700	-	30
76	Selçuk, Çatak Lake	528200	4205000	-	32
77	Selçuk, near K. Menderes, TDS3	531600	4203900	60	21.5
78	Selçuk, Zeytinköy Road, artesian, TDS8	525100	4204800	38	23.5
79	Selçuk, before Kazancı spring, TDS9	523900	4204300	-	22
80	Selçuk, Çatak Lake Road, fountain, TDS11	529600	4204200	?	22.5
81	Selçuk, Çatak Lake Road, TDS12	528900	4204800	60	19.9
82	Selçuk, Efes Road, Carpet Shop, TDS13	530650	4200415	?	24
83	Selçuk, Efes Road, gas station , TDS14	527242	4200586	?	22
84	Selçuk, Belevi-İzmir roundabout gas station, TDS16	538700	4209200	30	21

Table 3.2. Locations of the groundwaters investigated in 1-6/April/1999. Distribution of the locations in the basin is shown in Figure 3.1b.

Sample No	Explanation	East	North	Well Depth (m)	T(°C)
2	Kiraz exit Petrol Ofisi	606041	4232369	22	18
3	Kiraz, Yenişehir	607956	4223969	12	17
5	Beydağ, farm	606705	4220935	9.5	18
7	Beydağ, K. Menderes River bank	602885	4218924	50	17.5
9	Emirli, drinking water	597400	4220300	70-80	18
11	Emirli, K. Menderes River bank	597400	4221047	35-40	17
14	Ovakent, K. Menderes River bank	588700	4224600	101	16
15	Ödemiş, Yolüstü	590920	4228925	105	18.5
16	Ödemiş, Türkönü	592221	4226591	52	18.5
17	Ödemiş, Kaymakçı	598405	4224261	85	19
18	Ödemiş, Demircili	580635	4231274	90	18
19	Ödemiş, Hacı İbrahim Farm	581944	4226598	130	19
21	Ödemiş, İlkkurşun	574423	4226486	67	20
23	Gökçen, Kahrat	575660	4222300	110	15
25	Gökçen, Kırtepe	577855	4217536	32	16.5
26	Inbetween Tire-Gökçen	570952	4220250	73	19
27	Tire Kutsan Paper Factory	562925	4220651	10	18
30	Inbetween Ödemiş-Bayındır	569289	4222773	11	17.5
32	Ödemiş, Doyranlı drinking water	572875	4224988	18	17
34	Ergenli, thermal water	560027	4233839	81	41.5
35	Bayındır, Tokatbaşı	556842	4225270	90	19
36	Tire, Turgutlu	557039	4221426	22	18
37	Çırpı, Hasköy	544088	4222722	60	19
39	Bayındır, Çıplakköy	549254	4224877	92	17.5
40	Şehitler	535988	4223776	84	22
41	Pamukyazı	536868	4217545	80	17.5
45	Belevi, Kayayurt Petrol gas station	538725	4208473	50	17.5
48	Ödemiş, Ovakent exit Tabaş gas station	585386	4230477	100-120	17
49	Mescitli, gaseous well	594778	4221119	25	15
50	Ödemiş, K. Menderes River bank	584417	4224756	80	15
52	Tire	561116	4215724	55	16
53	Boğaziçi, after the coal mine	552727	4213099	65	17.5
54	Boğaziçi, Kurşak DSİ No: 26886	550270	4213221		17.5
55	Torbalı, Tulum	538136	4212737	32	20
56	Torbalı, Petline Gas station	531066	4226320		18
58	Torbalı, back of dye factory	531452	4227781	80	17
59	Develi	514264	4228597	7.5	18
60	Pancarköy	520173	4226030	Artesian	19.5
62	Selçuk, Total gas station	532696	4201822	80	16
64	Selçuk, Mandıra	528683	4202589		19
65	Selçuk, Zeytinköy road, artesian	525257	4204572	Artesian	19
66	Selçuk, Kazancı spring	524161	4204619	Spring	19.5
67	Selçuk, East of Çatak Lake	529484	4204242		19
68	Selçuk, Municipality slaughterhouse	532319	4201551		18
69	Selçuk exit BP Gas station	532087	4199485		18.5
70	Selçuk, East of Kuşadası road roundabout	527277	4200776		19

Table 3.3. Locations of the surface waters investigated in 1-6/April/1999. Distribution of the locations in the basin is shown in Figure 3.1c.

Sample No	Explanation	East	North	T (°C)
1	K.Menderes River, Kiraz centrum exit downstream	606031	4230990	12
4	K. Menderes River, upstream Beydağ Dam axe	606600	4217700	16.5
8	K. Menderes River, Beydağ centrum exit downstream	602952	4219091	16
10	K. Menderes River, before mixing with the Pirinçci Stream	597400	4221400	15.5
12	Pirinçci Stream	594712	4220291	12
13	K.Menderes River, Ödemiş dump site downstream	588900	4224800	14.5
20	Aktaş Stream	575974	4225684	16.5
22	K.Menderes River, after mixing with the Rahmanlar, Aktaş and Eğridere streams	575276	4224301	14
24	Eğridere Stream	577171	4219169	16
28	K. Menderes River, after Tire Kutsan Paper Factory, downstream	562897	4221934	16
29	Falaka (Değirmendere) Stream	561899	4226933	17.5
31	Rahmanlar Stream	581375	4231919	11
33	Ergenli (Ilıca) Stream	558214	4229336	11
38	Uladi Stream	549889	4227549	15.5
42	Fertek Stream, before mixing with the K.Menderes River northern branch, to the south of Torbalı	535314	4215533	16
43	K.Menderes River northern branch, before mixing with the Fertek Stream	535838	4215013	15
44	Fertek Stream, after mixing with the K.Menderes River northern branch.	535949	4214723	15.5
46	K.Menderes River southern branch before mixing with the northern branch	533858	4203589	14.5
47	K.Menderes River, toward sea, after northern and southern branches are mixed.	529329	4203356	14.5
57	Fertek Stream, to the north of Torbalı	533106	4232502	15
61	Akyurt Stream	553494	4211096	15

Cu, Fe, Cd, Ni, Cr, Sb, BOD, and organic matter of the waters were determined in the laboratories of the State Hydraulic Works (DSİ) of Turkey using titrimetric, spectrophotometric and AAS methods. Because no excessive heavy metal amounts, in general, were determined in the water samples of July, number of heavy metal measurements reduced to the selected number of water samples in April collection. Analytical precision for each ion in the measurements was established by submitting five duplicate samples to the laboratories. The results (± mg/l) are as follows: 0.16 for Na, 0.17 for K, 6.17 for Ca, 4.78 for Mg, for 6.22 HCO_3, 2.98 for SO_4, 3.96 for Cl, for 0.001 N-NO_2, 1.0 for N-NO_3, 0.003 for N-NH_3, 0.007 for o-PO_4, 0.11 for B, 0.17 for F and 0.15 for organic matter.

3.2. Groundwater

In this section, groundwater hydrochemistry and water quality of the sub-basins are evaluated in terms of seasonal, annual, and spatial characteristics using the data collected in this study. The spatial concentration distribution overlays, prepared for both dry and wet seasons using the collected data are presented in Figure III.1 and Figure III.2, respectively. Major ion concentration distribution in a given sampling location both for dry and wet periods are presented using Stiff diagrams in Figure 3.2. Temporal characteristics of groundwaters are discussed on the basis of both the collected and the compiled data. In order to evaluate spatial, seasonal, and temporal distributions of the irrigation water classes in the basin, the class distribution overlays were prepared using both the data collected during this work and the data compiled from DSİ monitoring program. These overlays are shown in the figures III.3-III.8. Quality classes of the waters, stated in the following sections were determined using the limits of both irrigation water and inland water sources reported in the Water Contamination Control Regulations of Turkey (WCCR, 1988 and 1991). In the evaluation of the spatial overlays or maps, it should be kept in mind that they were drawn through interpolation using the sampling points shown in Figure 3.1.

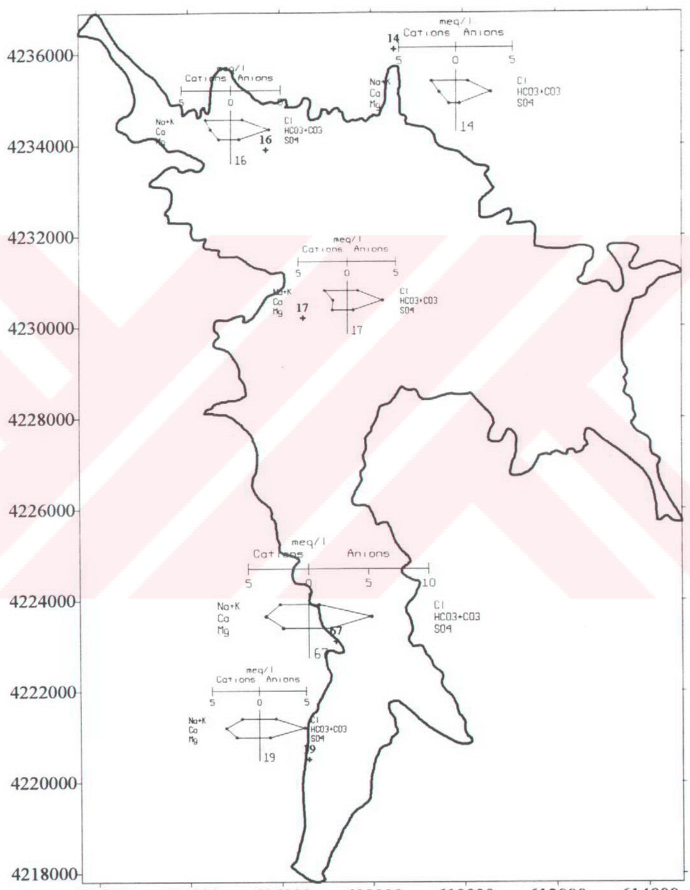


Figure 3.2a. Stiff diagram of the chemical analyses of dry season samples in the Kiraz Sub-basin.

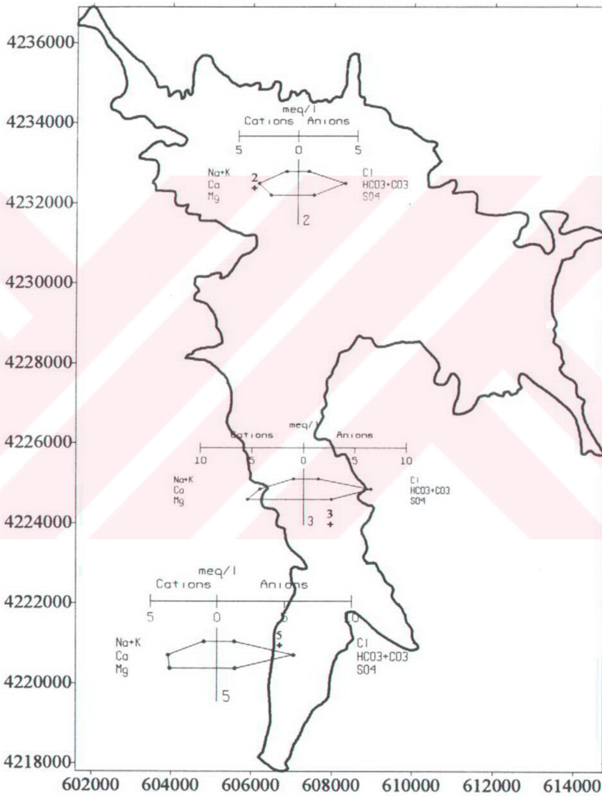


Figure 3.2b. Stiff diagram of the chemical analyses of wet season samples in the Kiraz Sub-basin.

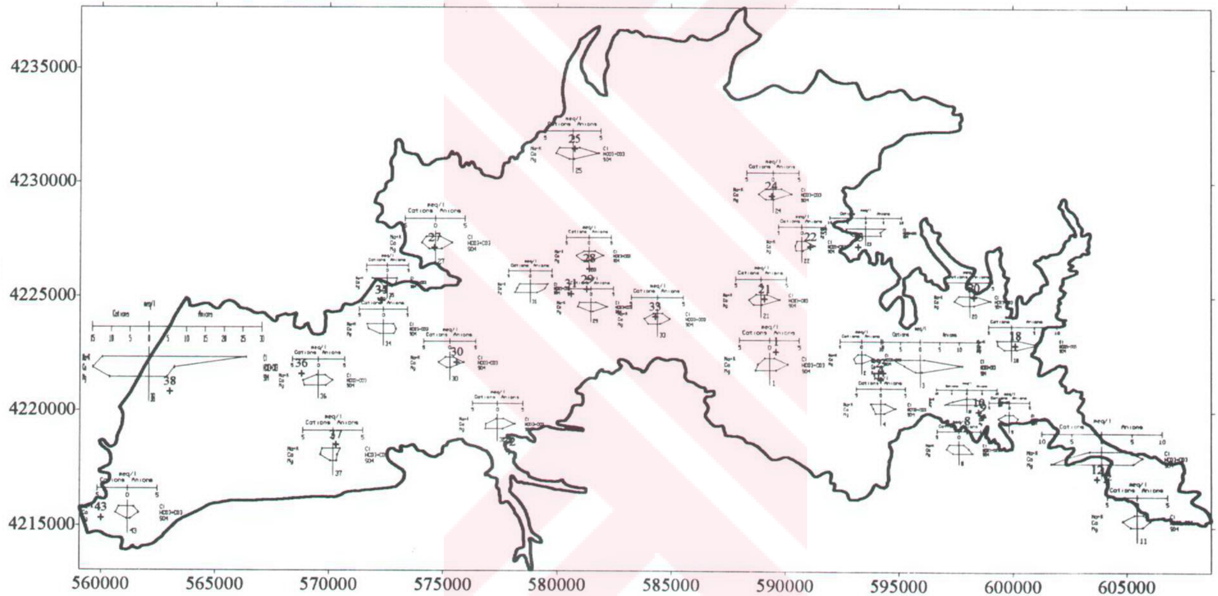


Figure 3.2c. Stiff diagram of the chemical analyses of dry season samples in the Ödemiş-Tire Sub-basin.

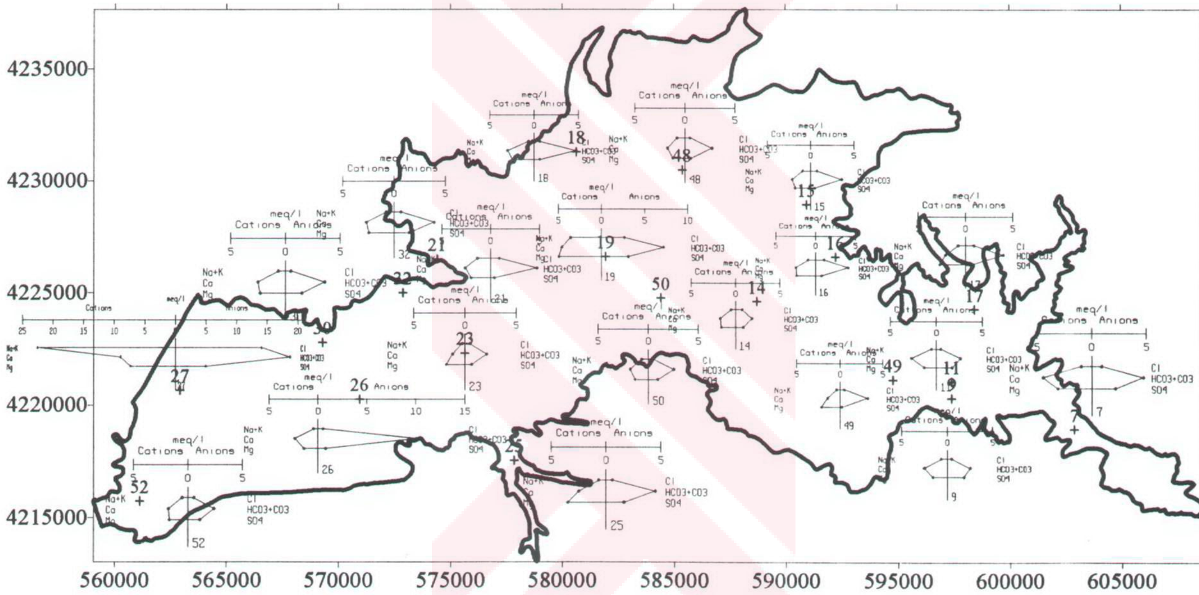


Figure 3.2d. Stiff diagram of the chemical analyses of wet season samples in the Ödemiş-Tire Sub-basin.

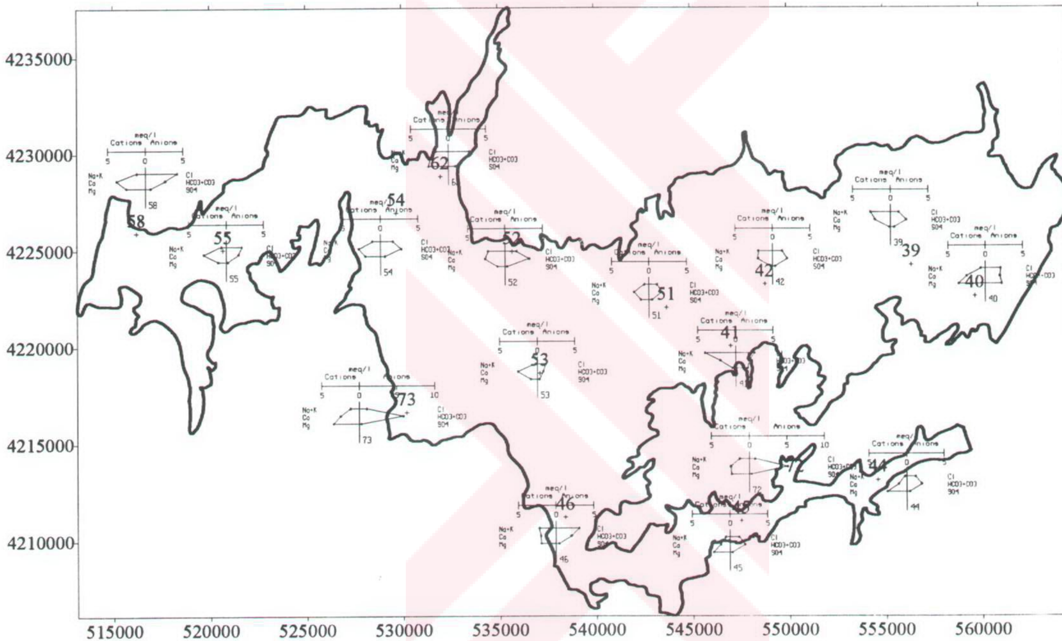


Figure 3.2e. Stiff diagram of the chemical analyses of dry season samples in the Bayındır-Torbalı Sub-basin.

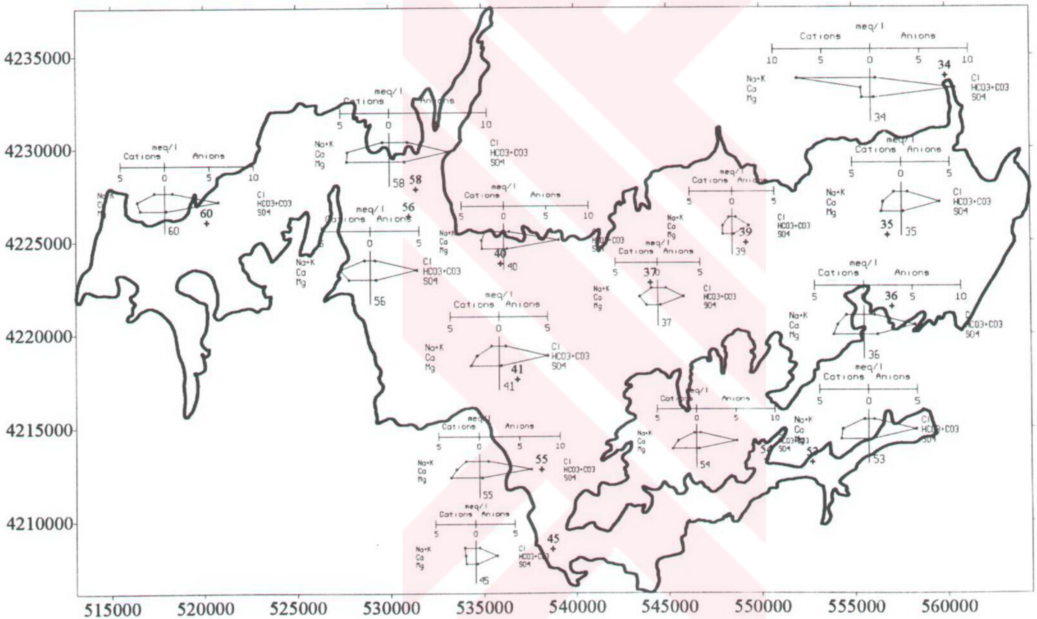


Figure 3.2f. Stiff diagram of the chemical analyses of wet season samples in the Bayındır-Torbalı Sub-basin.

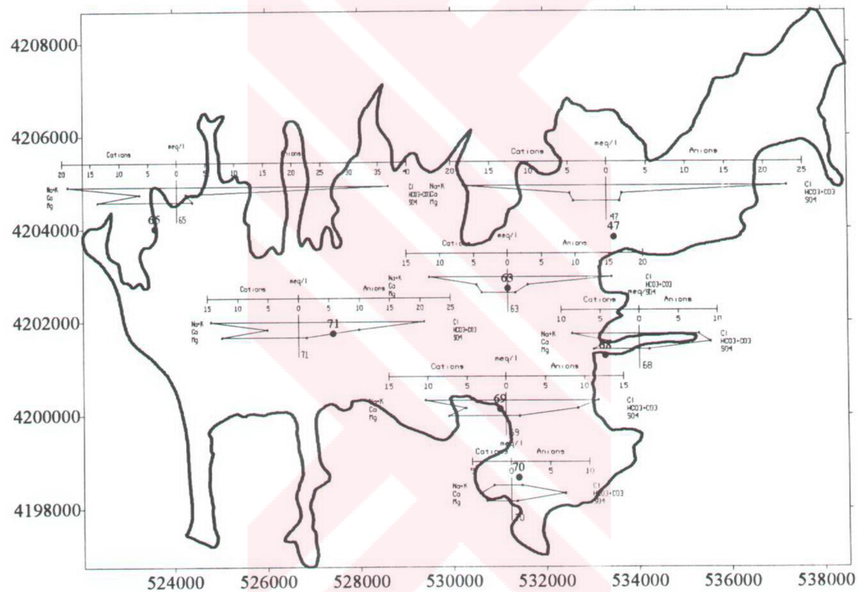


Figure 3.2g. Stiff diagram of the chemical analyses of dry season samples in the Selçuk Sub-basin.

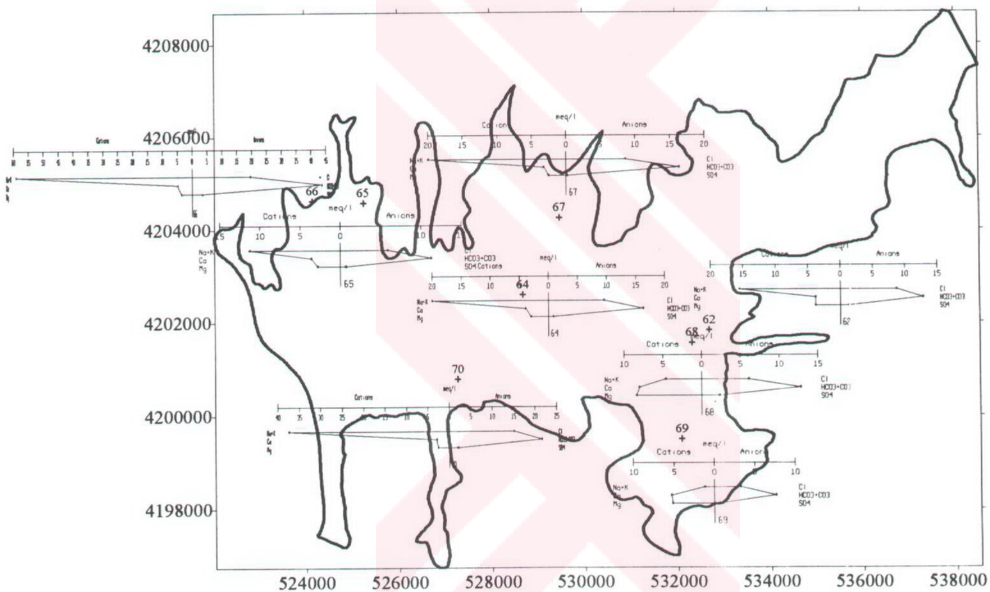


Figure 3.2h. Stiff diagram of the chemical analyses of wet season samples in the Selçuk Sub-basin.

3.2.1. Kiraz Sub-basin

Chemical analyses and the estimated water quality classes of the Kiraz sub-basin groundwater samples are listed in Table 3.4. The sub-basin average values and related water quality classes of the dry season data, wet season data and annual data for each parameter are also given in the table.

Hydrochemistry

Percent concentration distributions of the cations and anions in the sub-basin indicate, in general, that the sub-basin groundwaters are of Ca/Mg-HCO_3 type (Table 3.4, Table I.6 and Figure I.2). The seasonal chemical changes between irrigation period (July) and prior to irrigation period (April) can be stated as follows, on the basis of the observation data. Concentrations of Na (50-21mg/l), B (0.5-0.04mg/l), o-PO_4 (0.03-0 mg/l) and pH (7.42-6.69) decrease and amounts of EC (449-803 μS/cm), K (2-2.2 mg/l), Mg (17-45 mg/l), Ca (45-74 mg/l), HCO_3 (237-330 mg/l), Cl (40-43 mg/l), SO_4 (41-87 mg/l), F (0.1-0.3 mg/l), N-NO_2 (0.018-0.022 mg/l), N-NO_3 (2.22-4.8 mg/l), and organic matter (0-0.55 mg/l) increase (Table 3.4a). The spatial concentration changes in the sub-basin indicate that almost all the measured parameters exhibit an increasing trend from Kiraz to Beydağ (Figure III.1 and Figure III.2). The temporal changes that have occurred in the amounts of the measured parameters between 1995 and 1999 are shown in Figure 3.3. In the figure, overall trends of the parameters (by considering also the data scatters at a given observation period) suggest a slight increase in SO_4 and Ca+Mg contents in the Kiraz sub-basin groundwaters.

Water quality

The salinity in the sub-basin groundwaters are of either medium (C2) or high (C3) (Table 3.4b, Table I.3, and Table I.6). According to the SAR, Na %, and Cl **irrigation water** limits, the groundwaters are in very good (I) class in both dry and wet seasons. Salinity and sodium alkali hazard (SAR) classification of the sub-basin samples are shown in Figure 3.4. On the other hand, the groundwaters include EC and NO_3 contents indicating very good (I), good (II),

Table 3.4. (a) Chemical analyses and (b) quality classes of the waters investigated in the Kiraz sub-basin. For sample locations see Table 3.1, Table 3.2 and Figure 3.1. The classes were estimated using both the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. According to the WCCR (1988), I. High quality, II. Medium quality, III. Low quality, IV. Very low quality. According to the WCCR (1991), I. Very good, II. Good, III. usable, IV. Usable with caution, V. Harmful, C1/S1. Low, C2/S2. Medium, C3/S3. High, C4/S4. Very high. F: Fresh. B: Brackish. S: Saline. 0: Soft, 1: Medium hard, 2: Hard, 3: Very hard, 4. Extremely hard. Mix: Mixed.

(a)

Sample No	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	Ni mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat. mg/l	Sb mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
Kiraz Sub-basin—July, 98																											
14	0.39		29.0		38.5	0.0			270	0.3		187.75	1.56	7.2	48.30		0.00	0.017	0.00	0.04		8.30	0.00		16.0	130	
15	0.47		30.8		31.5	0.0			170	0.0		162.76	0.39	4.4	46.00		0.00	0.017	0.00	0.00		8.29	0.00		16.3	90	
16	0.63		41.2	<0.005	40.6	0.0	<0.005	<0.005	430	0.5	0.25	235.30	1.56	14.6	58.19	<0.05	0.00	0.021	1.59	0.05	0.015	6.63	0.00	0.09	39.1	210	0.076
17	0.51	40.0	29.4	<0.005	37.8	0.0	<0.005	0.005	320	0.0	0.04	222.50	1.56	18.6	52.67	<0.05	0.00	0.021	1.03	0.02	0.015	7.04	0.0	<0.01	29.1	160	0.051
19	0.46		70.2	<0.005	62.3	0.0	<0.005	0.011	760	0.0	0.05	293.83	0.78	29.2	41.63	<0.05	0.00	0.031	6.30	0.01	0.016	7.10	0.00	0.06	55.1	370	0.025
67	0.63		71.0	<0.005	31.15	0.0	<0.005	<0.005	742	0.0	0.03	320.04	6.00	25.6	51.00		0.00	0.002	4.42	0.05	<0.005	7.16	0.00		90.5	370	0.037
Average	0.52	40.00	45.27	0.00	40.31	0.00	0.00	0.00	448.67	0.13	0.09	237.03	1.98	16.60	49.63	<0.05	0.00	0.02	2.22	0.03	0.01	7.42	0.00	0.05	41.02	221.67	0.05
Std. Dev.	0.10	0	20.13	0.00	11.44	0.00	0.00	0.01	248.78	0.22	0.11	60.46	2.03	9.85	5.72		0.00	0.01	2.58	0.02	0.01	0.70	0.00	0.05	28.39	121.39	0.02
Kiraz Sub-basin—April, 99																											
2	0		65.6		32.2	0			648	0.4		242.62	1.95	27.3	20.93		0.01	0.031	5.2	0		6.41	0.85		65.6	324	
3	0		84.2		52.5	0			932	0.2		401.12	1.95	65.7	20.93		0.01	0.019	4.55	0		6.76	0.8		131.1	465	
5	0.11		73.3		45.7	0			830	0.3		346.26	2.73	43.05	20.93		0.005	0.017	4.815	0		6.9	0		64.55	415	
Average	0.04		74.37		43.47	0.00			803.33	0.30		330.00	2.21	45.35	20.93		0.01	0.02	4.86	0.00		6.69	0.55		87.08	401.33	
Std. Dev.	0.06		9.35		10.33	0.00			143.87	0.10		80.49	0.45	19.30	0.00		0.00	0.01	0.33	0.00		0.25	0.48		38.12	71.49	
Kiraz Sub-basin —98-99																											
Average	0.28		59.82		41.89	0			626	0.22		283.52	2.09	30.98	35.28		0	0.02	3.54	0.02		7.06	0.28		64.05	311.5	
Std. Dev.	0.08		14.74		10.89	0			196.32	0.16		70.47	1.24	14.58	2.86		0	0.01	1.45	0.01		0.48	0.24		33.26	96.44	

(b)

Sample No	TDS	Cl	N-NH_4	N-NO_2	N-NO_3	BOD	o-PO_4	SO_4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Type	*EC	*Cl	*NO_3	*Na %	*SO_4	*B
Kiraz Sub-basin —July, 98																									
14	I	II	I	III	I		II	I	I	I								C2S1	F1-NaHCO3	II	I	I	III	I	I
15	I	II	I	III	I		I	I	I	I								C1S1	F0-NaHCO3	I	I	I	III	I	I
16	I	II	I	III	I		II	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	II	III	I	II
17	I	II	I	III	I	IV	I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-MgHCO3	II	I	I	III	I	II
19	I	II	I	III	II		I	I	I	I	II	I	I	I	I	II	II	C3S1	F2-CaHCO3	III	I	III	II	I	I
67	I	II	I	III	III		II	I	I	I	I	I	I	I	I	II		·C2S1	F2-CaHCO3	II	I	III	II	I	II
Average	I	II	I	III	I	IV	II	I	I	I	II	I	I	I	I	I	II			II	I	II	II	I	II
Kiraz Sub-basin —April, 99																									
2	I	II	I	III	II		I	I	I	I								C2S1	F2-CaHCO3	II	I	III	I	I	I
3	I	II	I	III	I		I	I	I	I								C3S1	F3-MgHCO3	III	I	III	I	I	I
5	I	II	I	III	I		I	I	I	I								C3S1	F2-CaHCO3	III	I	III	I	I	I
Average	I	II	I	III	I		I	I	I	I										III	I	III	I	I	I
Kiraz Sub-basin —98-99																									
Average	I	II	I	III	I		I	I	I	I										II	I	III	II	I	I

and usable (III) irrigation water classes during observation periods (Table 3.4b). B concentrations indicate either very good or good quality of irrigation groundwaters in the sub-basin. Heavy metal concentrations of the samples in the sub-basin are lower than the limits of irrigation water. The seasonal changes suggest that the irrigation water quality in the wet period becomes degraded in NO_3 concentration to usable (III) class but it becomes better in B amount with very good (I) class (Table 3.4b). In terms of annual sub-basin average data, all the observed parameters, except NO_3 (which is in usable class), are either in very good or in good class (Table 3.4b). The spatial water quality class change in the sub-basin indicates that EC, Na% and NO_3 parameters exhibit an increasing class trend (decreasing quality) from east to west whereas B shows the increasing class trend toward southeast (Beydağ) (Figure III.3, Figure III.6, Figure III.7, and Figure III.8). The other parameters (Cl, SO_4) do not show any spatial class change. The temporal data indicate that the overall quality of the groundwaters has not changed since 1995 in the sub-basin for all parameters but B whose quality has decreased from very good to good class (figures III.3-III.8).

According to the **inland water sources** N-NH_4, SO_4, B, F, Zn, Cr, Fe, Cu limits, the groundwaters in the sub-basin are in high quality (I) class (Table 3.4b). While Cl, Pb, Cd, and Ni contents of the groundwaters indicate medium quality (II), N-NO_2 concentrations suggest low quality (III) class. In terms of the inland water sources o-PO_4 limits, the sub-basin includes high or medium quality groundwaters. One sample (no: 17 of July) taken after Kiraz waste disposal site indicate very low quality (IV) class according to the BOD classification limits. Annual sub-basin average data indicate that all the observed parameters, except N-NO_2 (which is in low quality (III) class), are either in high quality or medium quality class in terms of the inland water sources limits (Table 3.4b).

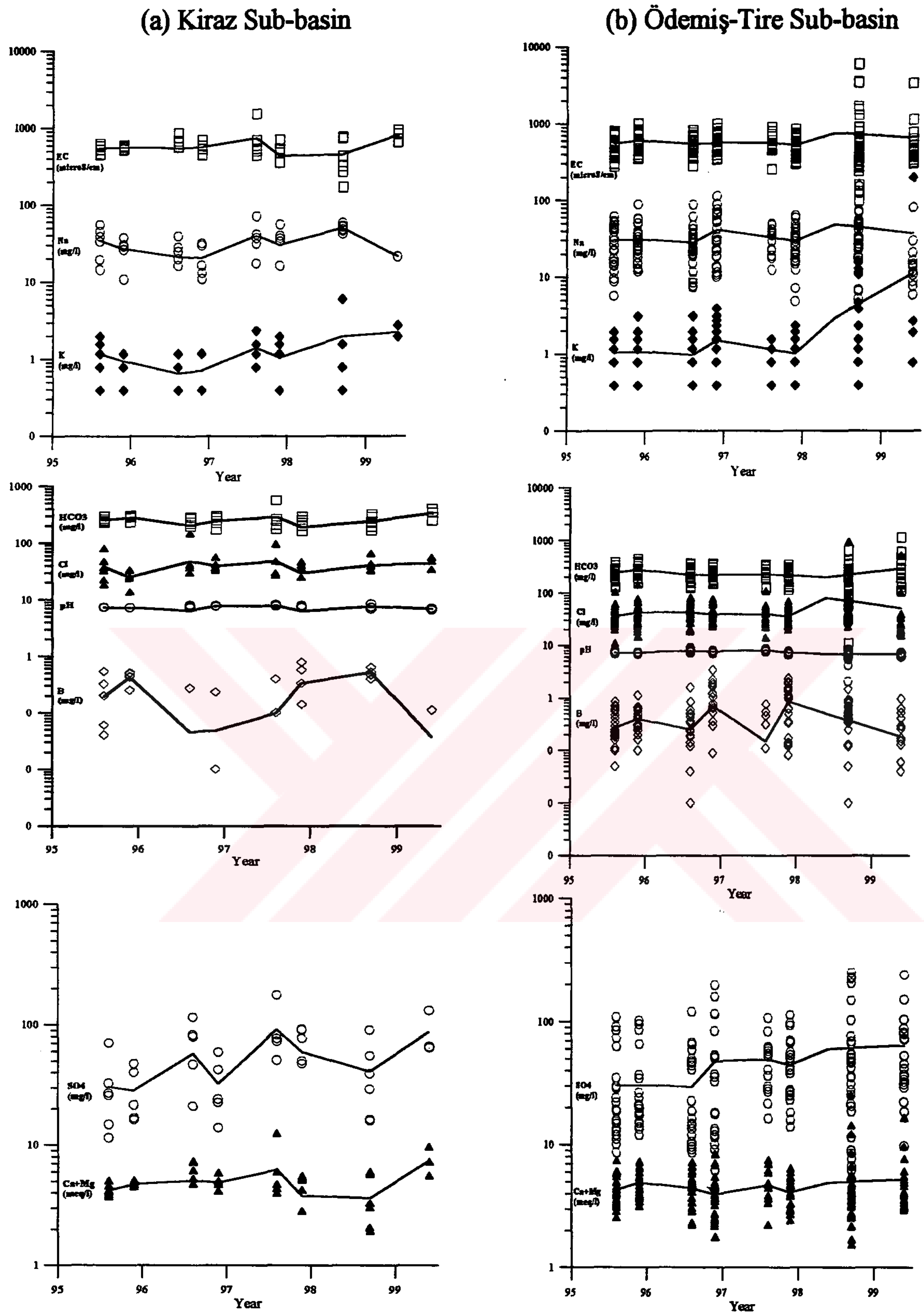
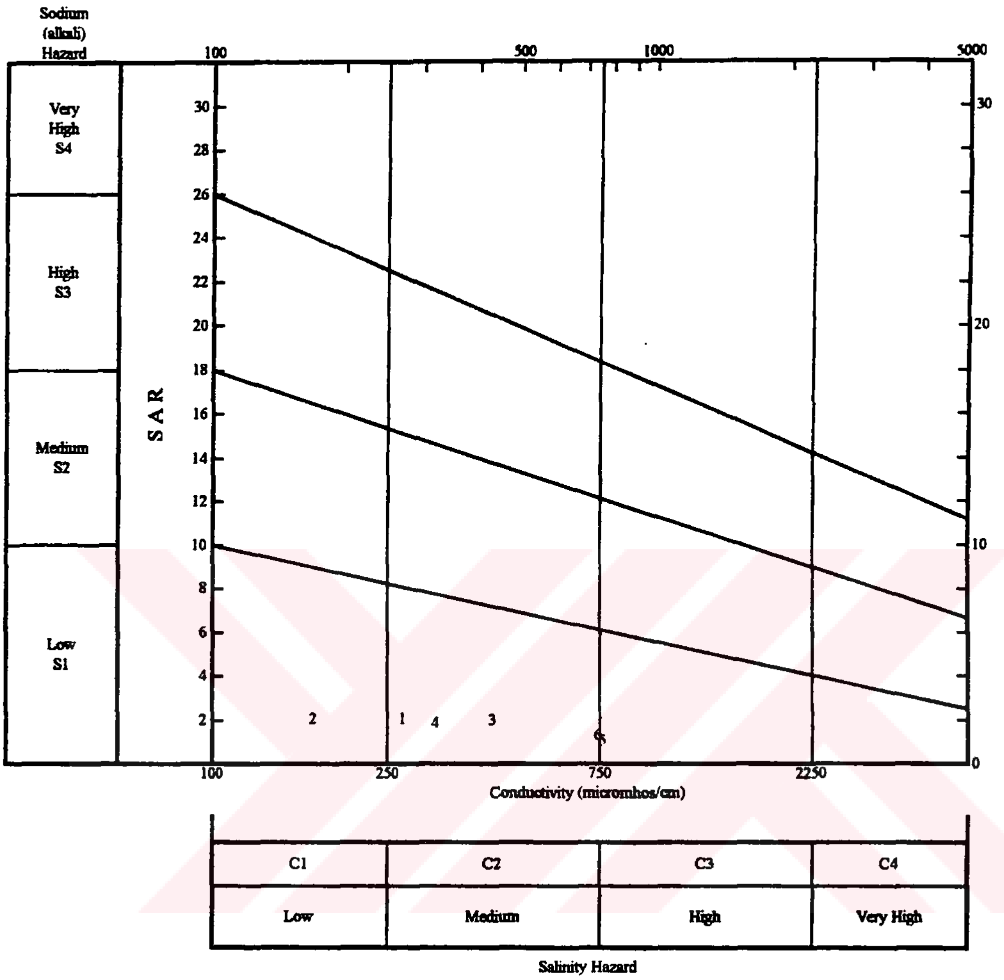
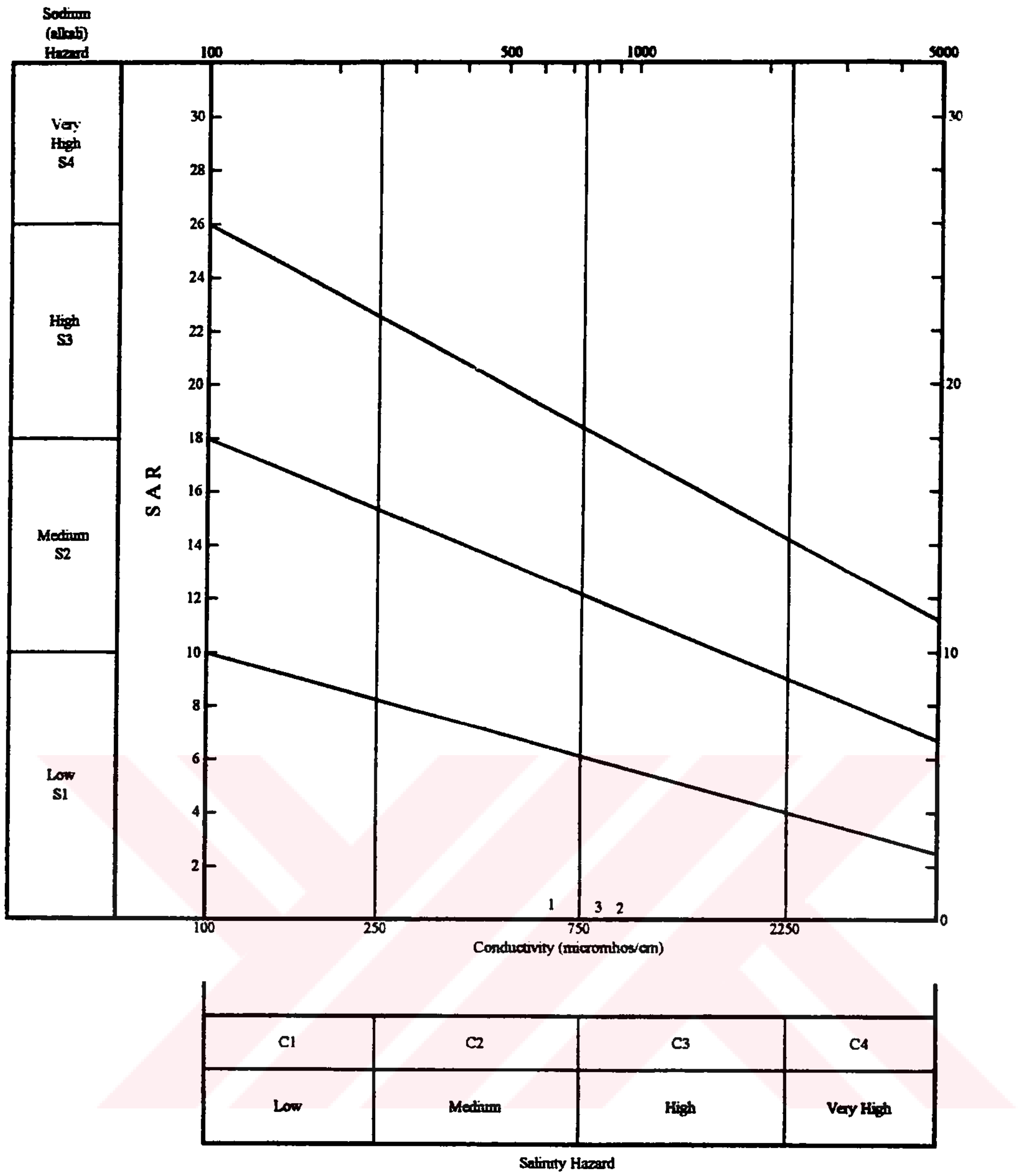


Figure 3.3. Ion concentrations distribution from 1995 to 1999 in (a) Kiraz and (b) Ödemiş-Tire sub-basins.



1	14
2	15
3	16
4	17
5	19
6	67

Figure 3.4a. Wicox diagram of the chemical analyses of dry season samples in the Kiraz Sub-basin.



1 2
2 3
3 5

Figure 3.4b. Wicox diagram of the chemical analyses of wet season samples in the Kiraz Sub-basin.

3.2.2 Ödemiş-Tire Sub-basin

Chemical analyses and the estimated water quality classes of the Ödemiş-Tire sub-basin groundwater samples are given in Table 3.5. The sub-basin average values and related water quality classes of the dry season data, wet season data and annual data for each parameter are also given in the table.

Hydrochemistry

Percent concentration distributions of the cations and anions in the sub-basin indicate that the majority of the sub-basin groundwaters are of Ca/Mg-HCO_3 type (Table 3.5, Table I.6 and Figure I.1). Some waters of dry season, however, are in mix type in the anion content. In addition, Na is the dominant cation instead of Ca or Mg in some samples (Table 3.5b). The groundwater sample (no: 38 of July) collected from a well near the Tire Kutsan Paper Factory (TKPF) is CaCl type. In the same location, groundwater type is Na-Mix in wet season (no: 27 of April). On the basis of the observation period, the seasonal chemical changes between irrigation period and prior to irrigation period can be stated as follows. Amounts of EC (763-650 μS/cm), Na (49-38mg/l), Ca (61-55 mg/l), Cl (79-50 mg/l), B (0.5-0.2 mg/l), N-NO_2 (0.022-0.018 mg/l), and o-PO_4 (0.19-0.01 mg/l) decrease and amounts of pH (6.78-6.92), K (3-12 mg/l), Mg (23-30 mg/l), HCO_3 (200-287 mg/l), SO_4 (61-64 mg/l), F (0.26-0.40 mg/l), N-NO_3 (2.4-3.6 mg/l), and organic matter (0.00-0.10 mg/l) increase (Table 3.5a). The spatial concentration changes in the sub-basin indicate that the measured parameters exhibit an increasing trend in the vicinity of mines to the east of Ödemiş, in the vicinity of the TKPF and to the northeast of Tire along the K. Menderes River (Figure III.1 and Figure III.2). The temporal changes that have occurred in the amounts of the measured parameters in the sub-basin between 1995 and 1999 are shown in Figure 3.3b. In the figure, overall trends of the parameters (by considering also the data scatters at a given observation period) suggest an increasing trend for SO_4 in the Ödemiş-Tire sub-basin groundwaters.

Table 3.5. (a) Chemical analyses and (b) quality classes of the waters investigated in the Ödemiş-Tire sub-basin. The classes were estimated using both the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. For explanation see caption of Table 3.4. For sample locations see Table 3.1, Table 3.2 and Figure 3.1.

(a)

Sample No	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	Ni mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat. mg/l	Sb mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
Ödemiş-Tire—July, 98																											
1	0.51		39.0	<0.005	28.7	0.0	<0.005	0.009	450	0.0	0.05	190.19	0.39	28.4	17.71	<0.05	0.00	0.021	1.80	0.03	<0.005	7.07	0.00	<0.01	54.3	230	0.016
2	0.51	50.0	36.0	<0.005	32.2	0.0	<0.005	0.005	390	0.0	0.05	180.44	0.39	16.3	19.32	0.10	0.00	0.018	1.02	0.00	<0.005	5.83	0.00	<0.01	5.3	200	0.008
3	0.39		81.6	<0.005	34.3	0.0	<0.005	<0.005	890	0.0	0.08	656.54	4.68	15.2	153.64	<0.05	0.00	0.015	0.00	0.02	0.006	5.57	0.00	0.01	18.7	440	<0.005
4	0.45	40.0	30.8	<0.005	32.9	0.0	<0.005	0.012	290	0.2	0.05	184.71	1.56	12.9	47.61	<0.05	0.00	0.015	0.54	0.00	0.006	6.34	0.00	<0.01	36	150	0.020
5	0.25		25.0		32.2	0.0			130	0.0		95.10	0.78	3.4	26.91		0.00	0.013	0.00	0.00		7.54	0.00		11.5	70	
6	0.12		22.0		21.7	0.0			160	0.2		123.14	0.78	6.8	30.36		0.00	0.009	0.00	0.02		7.60	0.00		9.0	80	
7				<0.005			<0.005	0.027	5940		26.32					0.15					0.043	2.07		0.34		2980	1.640
8	0.46		57.2	<0.005	38.5	0.0	<0.005	0.018	470	0.3	0.03	134.72	1.56	16.6	49.22	<0.05	0.00	0.020	2.03	0.14	0.009	6.45	0.00	0.10	149.3	240	0.130
9	0.65		54.6	<0.005	36.4	0.0	<0.005	<0.005	420	0.4	0.11	135.33	0.78	8.6	23.00	<0.05	0.00	0.017	0.78	0.04	0.011	6.80	0.00	0.12	66.6	200	0.017
10	0.48		92.2	<0.005	67.2	0.0	<0.005	<0.005	1290	0.5	0.08	348.08	0.39	89.8	6.67	<0.05	0.00	0.025	6.32	0.03	0.015	6.79	0.00	0.05	224.6	640	0.015
11	0.66		48.6	<0.005	35.7	0.0	<0.005	0.009	280	0.1	0.06	131.06	0.39	13.6	11.27	0.05	0.00	0.019	3.67	0.00	0.010	6.36	0.00	0.32	42.4	140	0.047
12	0.93		113.4	0.005	145.6	0.0	<0.005	0.015	1690	0.0	0.05	412.09	0.78	102.9	45.08	0.21	0.00	0.081	1.14	0.00	0.016	4.17	0.00	0.14	250.2	840	0.194
13	1.47		21.0		30.1	0.0			100	0.3		126.79	1.56	7.7	45.08		0.00	0.018	0.00	0.00		7.76	0.00		35.5	40	
18	0.81		60.0	<0.005	53.9	0.0	<0.005	0.005	670	0.2	0.01	354.18	2.34	18.5	71.53	<0.05	0.00	0.035	4.09	0.02	0.017	7.04	0.00	0.11	55.0	330	<0.005
20	0.70		64.6	<0.005	51.8	0.0	0.005	0.006	610	0.2	0.02	276.15	1.56	17.6	51.98	<0.05	0.00	0.027	0.72	0.02	0.016	7.02	0.00	0.10	46.6	300	0.006
21	0.88		49.0	<0.005	41.3	0.0	<0.005	0.008	420	0.0	0.24	223.16	0.78	18.6	23.00	<0.05	0.00	0.019	1.19	0.02	0.009	7.55	0.00	0.05	7.7	200	0.029
22	0.51		29.2	<0.005	28.0	0.0	<0.005	0.007	240	0.6	0.10	169.47	0.78	15.1	23.92	<0.05	0.00	0.021	3.03	0.11	0.015	7.20	0.00	<0.01	8.6	110	0.076
23	0.70		97.2	<0.005	197.4	0.0	<0.005	0.008	1530	0.0	0.52	247.50	3.90	44.2	124.20	0.06	0.00	0.030	17.26	0.12	0.020	6.44	0.00	<0.01	206.5	760	0.030
24	0.35		54.0	<0.005	59.5	0.0	<0.005	0.012	330	0.0	0.10	223.11	0.78	15.8	32.20	<0.05	0.00	0.021	4.93	0.02	0.006	6.80	0.00	<0.01	6.7	160	0.127
25	0.38		60.6	<0.005	43.4	0.0	<0.005	0.007	440	0.3	0.09	283.46	1.56	7.8	54.51	<0.05	0.00	0.019	1.30	0.00	0.012	7.12	0.00	0.01	9.1	210	0.012
26	0.37		65.2		39.9	0.0			440	0.0		268.22	1.56	2.7	51.98		0.00	0.011	0.00	0.00		8.26	0.00		11.5	210	
27	0.13		44.8	<0.005	30.1	0.0	<0.005	0.005	340	0.3	0.06	172.51	0.78	12.3	33.81	<0.05	0.00	0.018	2.57	0.04	0.012	7.16	0.00	0.02	50.4	160	0.012
28	0.34	30.00	56.2	<0.005	49.0	0.0	0.007	0.006	590	0.0	0.02	204.21	0.78	18.0	25.07	<0.05	0.00	0.021	2.50	5.37	0.013	7.17	0.00	<0.01	31.2	290	0.008
29	0.40		59.0	<0.005	39.9	0.0	<0.005	0.012	460	0.0	0.14	223.72	15.60	1.6	49.22	<0.05	0.00	0.020	2.33	0.02	0.014	7.22	0.00	<0.01	21.6	220	0.040
30	0.39		43.6	0.006	25.9	0.0	<0.005	0.010	270	0.2	0.08	165.20	0.39	6.8	19.09	<0.05	0.00	0.021	1.09	0.00	0.011	7.40	0.00	0.21	6.2	130	0.007
31	0.38	0.96	60.8	<0.005	144.2	0.0	<0.005	0.007	900	0.4	0.05	210.31	1.56	43.7	56.12	0.14	0.00	0.030	3.58	0.03	0.012	6.93	0.00	<0.01	76.4	440	0.011
32	0.37		46.4	<0.005	42.0	44.97	<0.005	0.005	480	0.7	0.05	118.87	0.39	29.3	5.29	<0.05	0.00	0.019	2.79	0.02	0.016	7.08	0.00	0.08	48.0	230	0.011
33	0.58		50.2	<0.005	35.0	65.95	0.006	0.006	440	0.5	0.05	10.972	1.17	21.2	16.56	<0.05	0.00	0.021	2.13	0.07	0.010	7.02	0.00	0.11	25.5	210	0.030
34	0.05		61.6	<0.005	73.5	23.98	<0.005	0.006	790	0.6	0.09	109.72	12.87	9.1	70.84	<0.05	0.00	0.025	4.54	0.04	0.021	6.87	0.00	0.11	103.3	390	0.012
35	0.58	0.68	33.8	<0.005	80.5	47.97	<0.005	<0.005	640	0.4	0.08	30.480	15.99	11.6	73.60	<0.05	0.00	0.025	1.70	0.03	0.014	7.08	0.00	0.08	51.4	310	0.008
36	0.53	1.82	58.8	0.005	47.6	25.18	<0.005	0.007	550	0.4	0.08	114.60	0.39	32.4	6.90	<0.05	0.00	0.029	4.32	0.02	0.013	6.88	0.00	0.03	69.6	270	0.013
37	0.01		42.0	<0.005	42.0	21.58	<0.005	0.008	300	0.0	0.08	0.0	0.39	5.2	41.40	<0.05	0.00	0.019	1.09	0.02	0.015	7.14	0.00	<0.01	27.9	150	<0.005
38	0.43	1.12	297.2	0.005	916.3	0.0	<0.005	<0.005	3460	1.6	0.05	412.09	10.92	126.7	276.92	0.10	0.00	0.013	0.00	0.09	0.012	7.05	0.00	0.28	230.5	1730	<0.005
43	0.87		40.0	<0.005	35.8	17.98	<0.005	0.011	280	0.3	0.78	75.59	0.78	1.8	32.89	<0.05	0.00	0.015	0.00	0.00	0.015	6.94	0.00	0.03	21.6	130	0.885
74									400													7.10				200	
75									380													7.18				180	
Average	0.50	17.80	60.47	0.00	79.17	7.50	0.00	0.01	762.78	0.26	0.99	200.35	2.71	23.70	49.00	0.03	0.00	0.02	2.38	0.19	0.01	6.78	0.00	0.08	61.17	376.94	0.11
Std. Dev.	0.28	21.56	47.30	0.00	155.09	16.60	0.00	0.01	1072.67	0.32	4.79	130.69	4.37	28.95	51.60	0.06	0.00	0.01	3.15	0.93	0.01	1.06	0.00	0.10	70.21	538.61	0.33
Ödemiş-Tire Sub-basin—April, 99																											
7	0		89.4		32.9	0			776	0.5		288.34	1.95	37.5	20.93		0	0.019	8.55	0		6.7	0		104.3	388	
9	0		50.4	<0.005	16.8	0	<0.005	<0.005	469	0.6	<0.05	154.84	0.78	19.1	14.95	<0.005	0	0.019	1.43	0.03	<0.005	7.3	0		88.2	234	0.013
11	0		54		15.8	0			434	0.4		159.11	0.78	16	11.96		0	0.018	0.98	0.03		7.08	0		81.5	216	
14	0		34.6		26	0			381	0.2		111.56	0.78	19.4	10.81		0	0.018	0.3	0		6.51	0		41.8	190	
15	0		42.8		25.9	0			456	0.2		219.46	0.78	21.8	20.93		0	0.02	1.87	0.05		7.01	0		22.3	227	
16	0.04		49.4	<0.005	37.45	0	<0.005	<0.005	513	0.25	0.4	249.03	1.95	29.05	20.93	0.013	0.005	0.0175	7.905	0.01	<0.005	6.73	0.515		36.15	256	2.65
17	0.52		43.2		32.2	0			479	0.6		245.06	2.73	33.3	16.79		0	0.021	9.45	0.01		6.91	0		34	239	
18	0.29		60		24.5	0			525	0.4		292.61	1.95	29.6	13.8		0.01	0.018	4.05	0		7.03	0		30.9	262	

Table 3.5 continued.

Sample No	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	Ni mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat. mg/l	Sb mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
Ödemiş-Tire Sub-basin—April, 99 continued.																											
19	0		92	<0.005	95.2	0	<0.005	<0.005	1140	0.4	0.08	440.75	0.78	60.1	80.96	0.019	0	0.019	5.75	0	0.011	7.09	1.56		151.5	569	0.167
21	0.15		52		31.5	0			573	0.3		289.56	1.95	24.2	29.9		0	0.018	7.67	0		6.73	0		18.5	236	
23	0.26		24		17.5	0			302	0.1		129.85	1.95	22	5.98		0	0.019	0.96	0		7	0		32.4	150	
25	0.13		49.8		20.3	0			631	0.4		275.54	2.73	42.5	13.8		0.02	0.018	9.68	0		6.96	0		79.5	315	
26	0.17		47.2		18.6	0			383	0.4		613.27	1.95	17.5	8.97		0	0.02	4.39	0.02		7.04	0		37.3	191	
27	0.41		179.4	<0.005	497.4	0	<0.005	<0.005	3380	1.6	0.75	1143.0	199.7	89.2	400.2	0.027	0.03	0.018	0.11	0.05	0.011	7.03	0		239.5	169	<0.005
30	0.96		50.6	<0.005	18.2	0	<0.005	<0.005	522	0.4	0.13	220.68	1.95	28.1	13.8	<0.005	0	0.015	2.66	0	<0.005	7.11	0		72.9	260	0.027
32	0.63		54.2	<0.005	23.3	0	<0.005	<0.005	594	0.3	<0.05	239.27	1.95	29.7	16.79	<0.005	0	0.018	2.19	0	<0.005	6.99	0		71.7	296	0.036
48	0		34.4		18.2	0			319	0.2		166.42	0.78	14.4	16.79		0	0.017	2.32	0		7.19	0		29.1	158	
49	0.06		29	<0.005	17.5	0	<0.005	<0.005	340	0.2	0.05	197.51	1.95	25.8	7.82	<0.005	0	0.018	0.81	0	0.006	6.07	0		9.8	169	0.059
50	0		36.1	<0.005	14.7	0	<0.005	0.1	418	0.3	0.13	155.15	0.78	16.1	14.375	<0.005	0	0.0185	0.795	0	0.009	7.08	0		45.65	208	0.081
52	0		35.6		20.3	0			372	0.2		145.70	1.95	20.7	10.81		0	0.018	0.75	0		6.82	0		52.9	185	
Average	0.18		55.41	0.00	50.21	0.00	0.00	0.01	650.35	0.40	0.19	286.84	11.51	29.80	37.56	0.01	0.00	0.02	3.63	0.01	0.00	6.92	0.10		64.00	245.90	0.38
Std. Dev.	0.26		33.81	0.00	106.68	0.00	0.00	0.04	669.52	0.31	0.26	232.45	44.30	17.66	86.79	0.01	0.01	0.00	3.32	0.02	0.01	0.27	0.36		53.68	95.70	0.92
Ödemiş-Tire Sub-basin—98-99																											
Average	0.34		57.94	0.00	64.69	3.75	0.00	0.01	706.56	0.33	0.59	243.60	7.11	26.75	43.28	0.02	0.00	0.02	3.00	0.10	0.01	6.85	0.05		62.58	311.42	0.25
Std. Dev	0.27		40.55	0.00	130.89	8.30	0.00	0.02	871.10	0.32	2.52	181.57	24.33	23.31	69.19	0.03	0.00	0.01	3.23	0.47	0.01	0.66	0.18		61.95	317.15	0.62

(b)

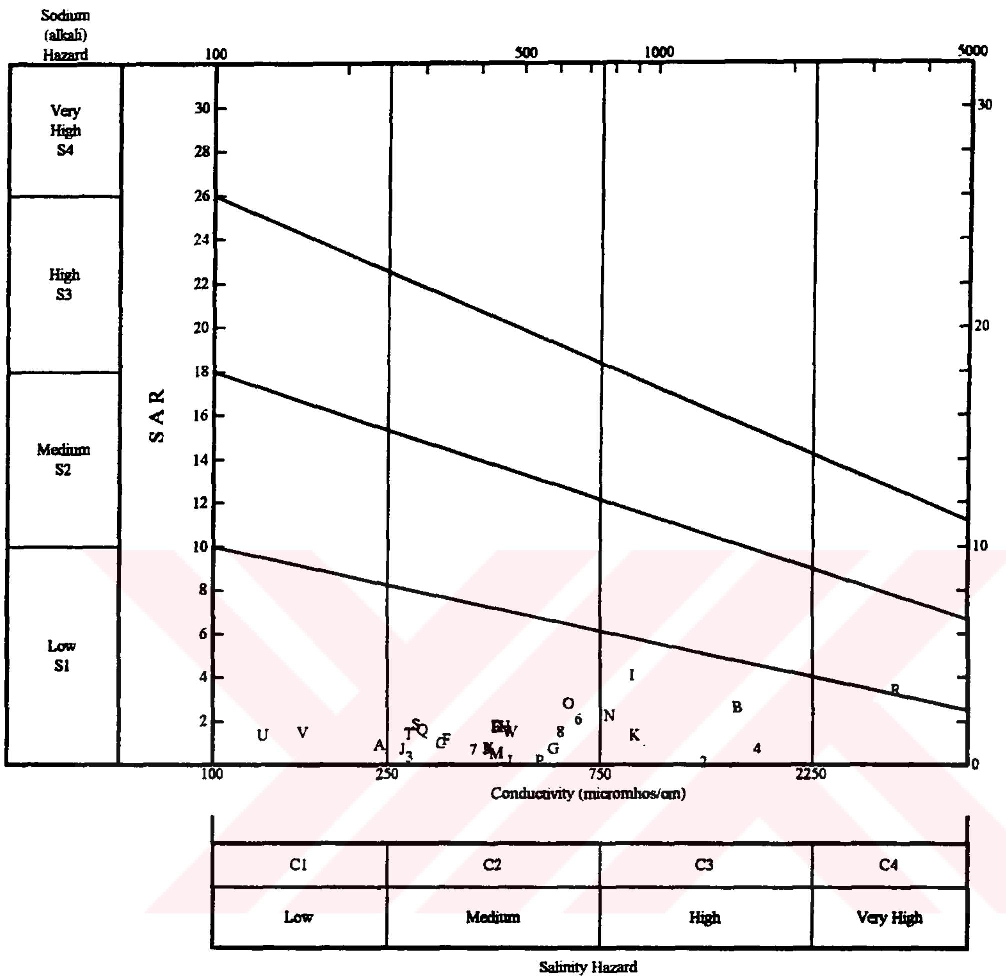
Sample No	TDS	Cl	N-NH_4	N-NO_2	N-NO_3	BOD	o-PO_4	SO_4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Type	*EC	*Cl	*NO_3	*Na%	*SO_4	*B
Ödemiş-Tire Sub-basin—July, 98																									
1	I	II	I	III	I		II	I	I	I	I	I	I	I	I	II	II	C2S1	F2-MgHCO3	II	I	II	I	I	II
2	I	II	I	III	I	IV	I	I	I	I	I	I	I	I	I	II	III	C2S1	F1-CaHCO3	II	I	I	II	I	II
3	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	II	C3S1	F2-NaHCO3	III	I	I	III	I	I
4	I	II	I	III	I	IV	I	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	I	III	I	I
5	I	II	I	III	I		I	I	I	I								C1S1	F0-CaHCO3	I	I	I	III	I	I
6	I	I	I	III	I		I	I	I	I								C1S1	F0-CaHCO3	I	I	I	III	I	I
7	III	I	I	I	I		I	I	I	I	III	III	I	IV	II	II	III	C4	F0-CaMix	V	I	I		I	I
8	I	II	I	III	I		II	I	I	I	I	I	I	I	I	II	II	C2S1	F2-CaMix	II	I	II	II	I	I
9	I	II	I	III	I		II	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaMix	II	I	I	II	I	II
10	II	II	I	III	II		II	III	I	I	II	I	I	I	I	II	II	C3S1	F3-MgMix	III	I	III	I	II	I
11	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaMix	II	I	III	I	I	II
12	II	II	I	IV	I		I	III	I	I	II	I	I	I	I	II	IV	C3S1	F3-MgMix	III	II	II	I	II	II
13	I	II	I	III	I		I	I	IV	I								C1S1	F0-NaHCO3	I	I	I	III	I	III
18	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F2-CaHCO3	II	I	III	III	I	II
20	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F2-CaHCO3	II	I	I	II	I	II
21	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	II	II	I	II
22	I	II	I	III	I		II	I	I	I	II	I	I	I	I	II	II	C1S1	F1-CaHCO3	I	I	III	II	I	II
23	II	II	I	III	III		II	III	I	I	II	I	I	II	I	II	III	C3S1	FB3-CaKMix	III	II	V	II	II	II
24	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	III	II	I	I
25	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	II	II	I	I
26	I	II	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	I	II	I	I
27	I	II	I	III	I		II	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	III	II	I	I
28	I	II	I	III	I	IV	IV	I	I	I	II	I	I	I	I	II	II	C2S1	F2-CaHCO3	II	I	III	II	I	I
29	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	III	II	I	I
30	I	II	I	III	I		I	I	I	I	II	I	I	I	I	III	II	C2S1	F1-CaHCO3	II	I	I	II	I	I

Table 3.5 continued.

Sample No	TDS	Cl	N-NH$_4$	N-NO$_2$	N-NO$_3$	BOD	o-PO$_4$	SO$_4$	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Type	*EC	*Cl	*NO$_3$	*Na%	*SO$_4$	*B
Ödemiş-Tire Sub-basin—July, 98 continued																									
31	I	II	I	III	I	I	II	I	I	I	II	I	I	I	I	II	III	C3S1	F2-MgMix	III	II	III	II	I	I
32	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F2-MgHCO3	II	I	III	I	I	I
33	I	II	I	III	I		II	I	I	I	I	I	I	I	I	II	II	C2S1	F2-CaHCO3	II	I	II	I	I	II
34	I	II	I	III	I		II	I	I	I	III	I	I	I	I	II	II	C3S1	F1-CaMix	III	I	III	III	I	I
35	I	II	I	III	I	I	II	I	I	I	II	I	I	I	I	II	II	C2S1	F1-NaMix	II	I	II	III	I	II
36	I	II	I	III	I	I	I	I	I	I	II	I	I	I	I	II	II	C2S1	F2-CaMix	II	I	III	I	I	II
37	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaMix	II	I	I	III	I	I
38	III	IV	I	III	I	I	II	III	I	III	II	I	I	I	I	II	III	C4S1	B4-CaCl	V	V	I	II	II	I
43	I	II	I	III	I		I	I	I	I	II	III	I	II	I	II	II	C2S1	F1-CaHCO3	II	I	I	II	I	II
74	I																			II					
75	I																			II					
Average	I	II	I	III	I	III	III	I	I	I	II	I	I	II	I	I	II			III	I	III	II	I	II
Ödemiş-Tire Sub-basin—April, 99																									
7	I	II	I	III	II		I	I	I	I								C3S1	F2-CaHCO3	III	I	IV	I	I	I
9	I	I	I	III	I		II	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	II	I	I	I
11	I	I	I	III	I		II	I	I	I								C2S1	F2-CaHCO3	II	I	I	I	I	I
14	I	II	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	I
15	I	II	I	III	I		II	I	I	I								C2S1	F1-CaHCO3	II	I	II	I	I	I
16	I	II	I	III	II		I	I	I	I	I	IV	I	II	I	II	II	C2S1	F2-CaHCO3	II	I	IV	I	I	I
17	I	II	I	III	II		I	I	I	I								C2S1	F2-MgHCO3	II	I	IV	I	I	II
18	I	I	I	III	I		I	I	I	I								C2S1	F2-CaHCO3	II	I	III	I	I	I
19	II	II	I	III	II		I	I	I	I	II	I	I	I	I	II	II	C3S1	F3-MgHCO3	III	I	III	II	I	I
21	I	II	I	III	II		I	I	I	I								C2S1	F2-CaHCO3	II	I	IV	II	I	I
23	I	I	I	III	I		I	I	I	I								C2S1	F1-MgHCO3	II	I	I	I	I	I
25	I	I	I	III	II		I	I	I	I								C2S1	F2-MgHCO3	II	I	IV	I	I	I
26	I	I	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	III	I	I	I
27	I	IV	I	III	I		II	III	I	III	II	I	I	II	I	II	II	C4S1	B4-NaMix	V	IV	I	III	II	I
30	I	I	I	III	I		I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	III	I	I	II
32	I	I	I	III	I		I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	II	I	I	II
48	I	I	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	III	I	I	I
49	I	I	I	III	I		I	I	I	I	I	I	I	I	I	II	I	C2S1	F1-MgHCO3	II	I	I	I	I	I
50	I	I	I	III	I		I	I	I	I	I	I	I	I	III	II	I	C2S1	F1-CaHCO3	II	I	I	I	I	I
52	I	I	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	I
Average	I	II	I	III	I		I	I	I	I	I	II	I	I	I	I	I			II	I	III	I	I	I
Ödemiş-Tire Sub-basin—98-99																									
Average	I	II	I	III	I		II	I	I	I	I	I	I	II	I	I	I			II	I	III	II	I	I

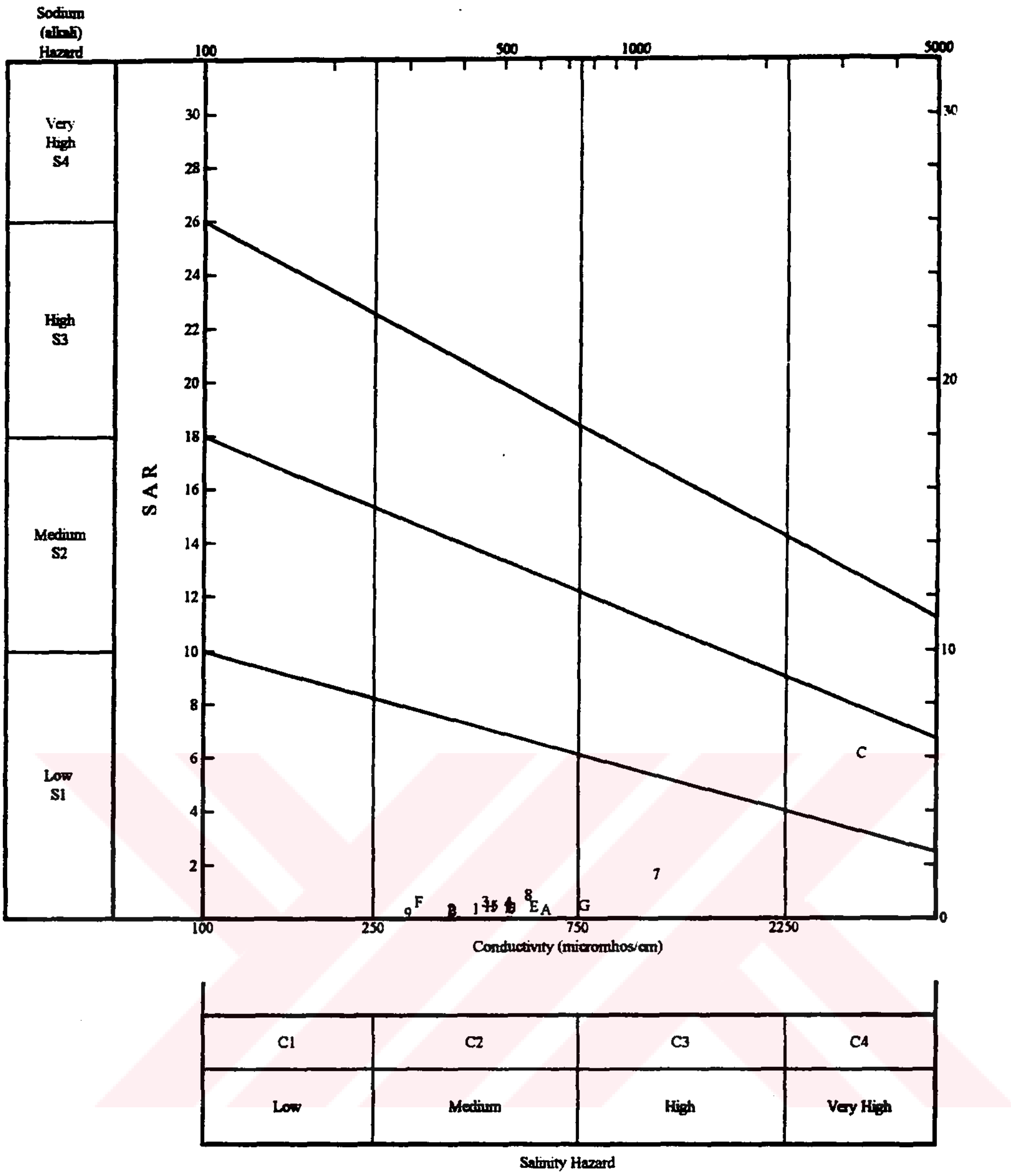
Water quality

According to the **irrigation water** salinity and EC limits, groundwaters in the Ödemiş-Tire sub-basin are in generally of medium (C2) quality and in good (II) classes, respectively (Table 3.4b and Table I.6). Salinity and sodium alkali hazard (SAR) classification of the sub-basin samples are shown in Figure 3.5. However, salinity class is high (C3) and EC class is usable (III) in the groundwaters that are affected by the mines (no: 3, 10, 12, 23 of July and no: 7 of April) and sewage system of Ödemiş Municipality (no: 31, 34 of July; 19 of April) in the sub-basin (Table 3.4b). The salinity and EC of the groundwater collected from a well near the TKPF are very high (C4) and harmful (V), respectively. According to the irrigation water NO_3 limits, some of the water samples are in usable (III) class, few samples of April are in usable with caution (IV) class and one sample of July (no: 23) is in harmful (V) class. Nitrate contents of the other water samples are either in very good (I) or good (II) classes. According to the SAR, Cl, SO_4, Na%, and B irrigation water limits, except the sample collected from north of the TKPF, the sub-basin groundwaters are either in very good (I) or good (II) classes (Table 3.4b and figures III.4-III.8). The samples from the TKPF area include Cl concentrations in usable with caution (IV) and in harmful (V) classes (Table 3.4b and Figure III.4). Among all the collected data, only one sample of July includes B in usable (III) class. The others are either in very good or good classes. Heavy metal concentrations of the samples in the sub-basin are lower than the limits of irrigation water. The seasonal changes suggest that the irrigation water quality in the wet period becomes better in EC and B amounts (Table 3.5b). In terms of annual sub-basin average data, all the observed parameters, except NO_3 (which is in usable (III) class), are either in very good (I) or in good (II) class. The spatial water quality class changes in the sub-basin indicate that EC, B and Na% parameters exhibit an increasing class trends (decreasing quality) along the eastern and western boundaries of the sub-basin whereas Cl shows the increasing class trend to the north of Tire only along the western boundary (Figure III.3, Figure III.4, Figure III.6, and Figure III.7). The DSİ observation wells (DSİ no: 13, 16, 17, 18, 23, 24, 26, 27, especially 28, 29, 30, 32) as a whole, indicate that B concentration



1	1	B	23	L	32	V	6
2	10	C	24	M	33	W	8
3	11	D	25	N	34	X	9
4	12	E	26	O	35		
5	13	F	27	P	36		
6	18	G	28	Q	37		
7	2	H	29	R	38		
8	20	I	3	S	4		
9	21	J	30	T	43		
A	22	K	31	U	5		

Figure 3.5a. Wicox diagram of the chemical analyses of dry season samples in the Ödemiş-Tire Sub-basin.



1	11
2	14
3	15
4	16
5	17
6	18
7	19
8	21
9	23
A	25
B	26
C	27
D	30
E	32
F	48
G	7
H	9

Figure 3.5b. Wicox diagram of the chemical analyses of wet season samples in the Ödemiş-Tire Sub-basin.

increases in the Ödemiş sub-basin from east to west. This increase is manifested on the distribution of B irrigation water quality from usable class (III) to harmful class (V) (Table I.6 and Figure III.6). While SO_4 does not show any spatial class change in the sub-basin, the class of NO_3 parameter becomes worse along the eastern boundary and along the K. Menderes river channel toward Tire (Figure III.5 and Figure III.8). The temporal irrigation water quality changes in the sub-basin since 1995 indicate that there is a local increase in EC, Cl and SO_4 concentrations (figures III.3-III.5).

According to the **inland water sources** N-NH_4, N-NO_3. SO_4, B, F, Zn, Cr, Fe, Cu limits, the groundwaters in the Ödemiş-Tire sub-basin are in high quality (I) class (Table 3.5b). While Cl, Pb, Cd, and Ni contents of the groundwaters indicate medium quality (II), N-NO_2 concentrations suggest low quality (III) class in general. The water sample (no: 28 of July) that was collected from a range near Ödemiş sewage discharge area is in very low quality class (IV) with respect to the o-PO_4 limits while the other samples are of either high (I) or medium (II) quality class groundwaters. SO_4, F and Ni concentrations of the well water collected from the TKPF vicinity indicate low quality (III) in terms of related inland water sources limits. The samples 10, 12, and 23 of July are of medium quality (II) in terms of SO_4 limits and 16 of April is of very low quality (IV) in terms of Zn limits. All these samples are located in the vicinity of mines in the sub-basin. Samples 30 and 34 of July are of low quality (III) in Cd and Pb limits, respectively. Sample 50 of April is in low quality (III) according to the Fe inland water sources limits. According to the BOD classification limits, the samples from Mescitli and Karakova (2, 4, and 28 of July) indicate very low quality (IV) but the samples (no: 31, 35, 36, and 38 of July) to the west of Karakova indicate high quality (I) class of waters. Annual sub-basin average data indicate that, all the observed parameters, except N-NO_2 (which is in low quality (III) class), are either in high quality or medium quality class in terms of inland water sources limits (Table 3.5b).

3.2.3. Bayındır-Torbalı Sub-basin

Chemical analyses and the estimated water quality classes of the Bayındır-Torbalı sub-basin groundwater samples are listed in Table 3.6. The sub-basin average values and related water quality classes of the dry season data, wet season data and annual data for each parameter are also given in the table.

Hydrochemistry

Percent concentration distributions of the cations and anions in the sub-basin indicate that the majority of the sub-basin groundwaters are of Ca/Mg-HCO_3 type (Table 3.6, Table I.6 and Figure I.1). Some waters of the dry season, however, are in mix type in anion content. In addition, Na is the dominant cation instead of Ca or Mg in some samples (Table 3.6). The groundwater sample collected from a well near Belevi is CaCl type. The Ergenli thermal water is NaCl type in July but Na-Mix type in April. The seasonal chemical changes between irrigation and prior to irrigation periods, on the basis of observation data, can be stated as follows. Amounts of pH (7.34-7.22), Na (33-31mg/l), K (1.9-1.5 mg/l), Cl (61-28 mg/l), B (0.56-0.26 mg/l), N-NO_2 (0.02-0.019 mg/l), N-NO_3 (3.0-2.2 mg/l), and o-PO4 (0.013-0.003 mg/l) decrease and amounts of EC (602-663 μS/cm), Ca (47-51 mg/l), Mg (17-30 mg/l), HCO_3 (86-311 mg/l), SO_4 (25-27 mg/l), F (0.24-0.44 mg/l), and organic matter (0.0-0.21 mg/l) increase (Table 3.6a). The spatial concentration changes in the sub-basin indicate that almost all the measured parameters exhibit an increasing trend to the north of Torbalı, Boğaziçi, Bayındır and along the southwestern and Tire boundary of the sub-basin (Figure III.1 and Figure III.2). The temporal changes that have occurred in the amounts of the measured parameters between 1995 and 1999 are shown in Figure 3.6a. In the figure, overall trends of the parameters (by considering also the data scatters at a given observation period) suggest no particular increasing or decreasing concentration trend in the sub-basin.

Table 3.6. (a) Chemical analyses and (b) quality classes of the waters investigated in the Bayındır-Torbalı sub-basin. The classes were estimated using both the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. For explanation see caption of Table 3.4. For sample locations see Table 3.1, Table 3.2 and Figure 3.1.

(a)

Sample No	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	Ni mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat mg/l	Sb mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
Bayındır-Torbalı—July, 98																											
39	0.53		41.6	<0.005	37.1	24.58	<0.005	0.005	430	0.3	0.29	75.59	9.75	2.0	54.97	<0.05	0.00	0.015	0.33	0.01	0.012	7.26	0.00	0.03	22.1	200	0.033
40	0.64	0.94	50.4	<0.005	71.4	35.97	<0.005	0.013	750	0.3	0.04	44.50	0.78	43.3	13.80	0.05	0.00	0.009	0.00	0.04	0.013	7.20	0.00	0.19	104.7	380	0.014
41	0.47		41.2	0.005	89.6	35.97	<0.005	0.008	760	0.5	0.45	39.01	11.70	5.5	86.94	<0.05	0.00	0.09	0.00	0.05	0.012	7.33	0.00	0.12	76.8	370	0.009
42	0.72		38.2	<0.005	45.5	25.18	<0.005	0.008	380	0.3	0.05	67.05	1.95	2.6	41.86	<0.05	0.00	0.011	0.00	0.01	<0.005	7.35	0.00	<0.01	16.3	190	0.008
44	1.24		21.6	<0.005	40.1	25.18	<0.005	0.008	610	0.3	1.08	69.49	0.39	31.5	5.52	<0.05	0.00	0.021	0.96	0.00	0.015	7.42	0.00	0.09	19.2	300	0.034
45	0.26		23.8	<0.005	42.2	23.98	<0.005	0.015	590	0.3	0.04	74.37	0.39	26.3	12.42	<0.05	0.00	0.019	0.96	0.00	0.013	7.27	0.00	0.12	14.4	290	0.011
46	0.40	1.03	40.0	<0.005	108.5	36.57	<0.005	0.014	820	0.3	0.04	49.98	0.78	23.7	50.60	<0.05	0.00	0.017	0.54	0.01	0.020	7.30	0.00	0.05	19.7	400	0.008
48	0.99		64.0	<0.005	73.0	127.12	<0.005	<0.005	840	1.2	0.09	22.55	3.90	3.0	127.19	0.07	0.00	0.015	0.00	0.00	0.007	6.85	0.00	0.08	14.0	410	<0.005
49	0.40		52.2		67.4	38.37			410	0.3		89.61	0.39	14.0	41.40		0.00	0.022	3.14	0.00		7.91	0.00		13.9	200	
50	0.58		44.0	<0.005	42.5	28.18	<0.005	<0.005	390	0.3	0.07	34.77	0.39	3.9	21.85	<0.05	0.00	0.019	0.00	0.03	0.010	8.02	0.00	0.19	14.4	190	0.019
51	0.50		40.2	<0.005	36.9	31.18	<0.005	0.005	400	0.3	0.07	39.01	3.90	13.1	12.42	<0.05	0.00	0.015	1.07	0.03	0.012	7.32	0.00	0.05	19.2	190	0.027
52	0.91		53.6		53.2	59.96			850	0.3		74.37	1.56	12.5	51.75		0.00	0.021	0.68	0.03		6.86	0.00		13.4	420	
53	1.18		52.0	<0.005	39.0	23.98	<0.005	0.009	480	0.0	0.07	0	0.78	10.5	4.83	<0.05	0.00	0.021	0.67	0.01	0.006	7.54	0.00	<0.01	13.9	240	0.019
54	0.40		58.0	<0.005	58.5	24.58	<0.005	0.013	640	0.0	0.44	118.87	0.39	24.7	24.38	<0.05	0.00	0.027	5.90	0.01	0.023	7.30	0.00	<0.01	27.9	320	0.016
55	0.51		60.0	<0.005	73.7	47.97	<0.005	0.014	640	0.0	0.01	1.82	0.39	12.6	15.18	<0.05	0.00	0.021	1.32	0.00	0.017	7.27	0.00	0.06	9.6	320	0.040
56	0.91		40.0		42.5	24.58			440	0.5		25.60	0.39	8.5	13.80		0.00	0.011	0.10	0.00		7.45	0.00		4.3	210	
57	0.4	0.25	101.8	0.005	97.1	0.0	<0.005	0.005	930	0.0	0.03	202.38	0.39	18.2	16.10	<0.05	0.00	0.029	18.46	0.01	0.021	7.06	0.00	0.18	59.6	460	0.010
58	0.23		76.8	<0.005	148.9	0.0	0.006	0.014	980	0.6	0.21	160.32	0.78	30.7	26.22	<0.05	0.00	0.030	17.86	0.00	0.023	7.15	0.00	0.11	34.1	480	0.102
59	0.31		30.4		33.7	17.98			150	0.0		54.86	0.39	5.8	17.71		0.00	0.019	0.45	0.00		7.01	0.00		1.4	70	
60	0.45		14.0		35.5	29.98			110	0.0		3.048	0.39	6.1	31.74		0.00	0.011	0.18	0.01		7.10	0.00		1.9	60	
61	0.21	1.25	42.2	<0.005	71.6	0.0	<0.005	<0.005	690	0.0	0.01	119.48	0.39	16.2	23.00	<0.05	0.00	0.023	3.47	0.02	0.025	7.25	0.00	0.07	24.5	340	<0.005
62	0.35	2.05	48.6	<0.005	99.3	52.76	<0.005	0.010	780	0.0	0.05	24.99	0.78	32.2	38.18	<0.05	0.00	0.023	5.08	0.02	0.017	7.48	0.00	0.12	44.2	380	0.006
66	0.49		60.0		81.5	24.58			580	0.0		54.86	11.31	2.2	31.97		0.00	0.025	7.35	0.04		7.12	0.34		20.7	280	
72	0.02	30	49.4		26.6	0.0			618	0.0		312.11	2.00	28.6	29.00		0.00	0.001	0.00	0.01		7.73	0.00		12.2	308	
73	0.80	30	50.0	<0.005	34.3	0.0	<0.005	<0.005	580	0.0	0.037	358.44	2.00	41.9	26.00		0.01	0.00	10.30	0.01	<0.005	7.48	0.00		13.3	280	0.008
84									790													7.73				390	
Average	0.56	9.36	47.76	0.00	61.98	29.55	0.00	0.01	601.5	0.23	0.17	84.68	2.25	16.78	32.75	0.01	0.00	0.02	3.15	0.01	0.01	7.34	0.01	0.09	24.63	295.31	0.02
Std. Dev	0.30	14.11	17.81	0.00	29.75	26.01	0.00	0.01	221.9	0.28	0.27	89.53	3.43	12.65	26.99	0.02	0.00	0.02	5.24	0.01	0.01	0.29	0.07	0.06	23.87	109.83	0.02
Bayındır-Torbalı—April, 99																											
34	1		19.6	<0.005	17.5	0	<0.005	<0.005	1043	1.5	<0.05	526.09	4.68	10.4	169.97	<0.005	0	0.019	0.52	0	<0.005	6.83	0		15.4	520	<0.005
35	0.49		37.4		22.4	0			408	0.4		240.80	0.78	24.6	16.79		0	0.018	0.03	0		7.39	0		9.8	203	
36	0.9		53.2	<0.005	38.9	0	<0.005	<0.005	760	0.6	<0.05	320.04	0.78	37.4	39.79	<0.005	0	0.018	0.7	0.03	<0.005	6.97	0		66.8	380	0.021
37	0.68		43.2		35	0			406	0.4		186.54	0.78	16.2	16.79		0	0.019	0.85	0		7.24	0		14.6	202	
39	0.25		22		15.8	0			216	0.3		121.92	0.78	13.2	7.82		0	0.017	1.47	0.01		7.42	0		10.8	108	
40	0		52.4		21.7	0			755	0.4		396.85	1.95	31.5	49.91		0.01	0.017	0.12	0		7	0		18.3	378	
41	0.22		45.2	<0.005	24.5	0	<0.005	<0.005	516	0.4	<0.05	304.80	0.78	34.7	16.79	<0.005	0	0.017	0.09	0	<0.005	7.44	0		9.9	257	0.027
45	0		25.2	<0.005	18.2	16.79	<0.005	<0.005	785	0.1	0.15	133.50	0.78	14.3	30.82	<0.005	0	0.023	0.13	0	0.006	7.27	3.2		11.5	392	0.014
53	0.4		52.8	<0.005	20.3	0	<0.005	<0.005	604	0.2	0.05	298.71	0.78	33.9	8.97	<0.005	0.01	0.02	1.31	0	0.011	7.05	0		17.3	301	0.013
54	0		47		16.8	0			534	0.4		310.90	0.78	37.1	5.98		0	0.018	0.34	0		7.48	0		13.3	266	
55	0		55.6	<0.005	40.6	0	<0.005	<0.005	806	0.2	0.13	393.20	1.95	42	36.8	<0.005	0	0.018	1.82	0	0.011	7.18	0		16.4	402	0.013
56	0		61.8	<0.005	18.2	0	<0.005	<0.005	579	0.8	<0.05	291.39	1.95	26.5	11.96	<0.005	0	0.02	1.95	0	0.012	7.33	0		29.1	289	0.115
58	0		85.8	<0.005	66.5	0	<0.005	<0.005	960	0.2	<0.05	371.86	1.95	52.8	14.95	<0.005	0	0.021	5.64	0	0.012	7.49	0		74.4	480	0.011
59	0		95.4	<0.005	37.8	0	<0.005	<0.005	920	0.4	<0.05	396.25	1.95	45.4	16.79	<0.005	0	0.018	12.85	0	0.012	7.11	0		86.5	460	0.011
60	0		61.8		30.1	0			650	0.3		366.98	1.95	33.6	25.99		0	0.021	5.18	0		7.1	0		6.3	324	
Average	0.26		50.56	<0.005	28.29	1.12	0.00	0.00	662.8	0.44	0.04	310.66	1.51	30.24	31.34	0.00	0.00	0.02	2.20	0.00	0.01	7.22	0.21		26.69	330.80	0.03
Std. Dev	0.35		21.10		13.70	4.34	0.00	0.00	228.61	0.34	0.06	107.84	1.05	12.54	40.43	0.00	0.00	0.00	3.42	0.01	0.01	0.21	0.83		26.26	114.36	0.03
Bayındır-Torbalı—98-99																											
Average	0.41		49.16	0.00	45.14	15.33	0.00	0.00	632.1	0.34	0.10	197.67	1.88	23.51	32.05	0.00	0.00	0.02	2.68	0.01	0.01	7.28	0.11		25.66	313.05	0.025
Std. Dev	0.33		19.45	0.00	21.73	15.17	0.00	0.00	225.3	0.31	0.16	98.69	2.24	12.60	33.71	0.01	0.00	0.01	4.33	0.01	0.01	0.25	0.45		25.06	112.10	0.025

Table 3.6 continued.

(b)

Sample No	TDS	Cl	N-NH4	N-NO2	N-NO3	BOD	o-PO4	SO4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Type	*EC	*Cl	*NO3	*Na %	*SO4	*B
Bayındır-Torbalı—July, 98 continued.																									
39	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-NaHCO3	II	I	I	III	I	II
40	I	II	I	III	I	I	II	I	I	I	II	I	I	I	I	II	II	C3S1	F2-MgMix	III	I	I	I	I	II
41	I	II	I	IV	I		II	I	I	I	II	I	I	II	I	II	II	C3S1	F1-NaMix	III	I	I	III	I	I
42	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	I	III	I	II
44	I	II	I	III	I		I	I	IV	I	II	I	I	III	I	II	II	C2S1	F1-MgHCO3	II	I	I	I	I	III
45	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F1-MgHCO3	II	I	I	I	I	I
46	I	II	I	III	I	I	I	I	I	I	II	I	I	I	I	II	II	C3S1	F1-CaCl	III	I	I	II	I	I
48	I	II	I	III	I		I	I	I	II	I	I	I	I	I	II	III	C3S1	F1-NaCl	III	I	I	IV	I	II
49	I	II	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	III	II	I	I
50	I	II	I	III	I		II	I	I	I	I	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	I	II	I	II
51	I	II	I	III	I		II	I	I	I	II	I	I	I	I	II	II	C2S1	F1-CaHCO3	II	I	I	I	I	I
52	I	II	I	III	I		II	I	I	I								C3S1	F1-CaHCO3	III	I	I	II	I	II
53	I	II	I	III	I		I	I	IV	I	I	I	I	I	I	II	II	C2S1	F1-CaMix	II	I	I	I	I	III
54	I	II	I	III	II		I	I	I	I	III	I	I	II	I	II	II	C2S1	F2-CaHCO3	II	I	III	I	I	I
55	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	II	C2S1	F2-CaCl	II	I	II	I	I	II
56	I	II	I	III	I		I	I	I	I								C2S1	F1-CaMix	II	I	I	I	I	II
57	I	II	I	III	III	I	I	I	I	I	III	I	I	I	I	II	II	C3S1	F2-CaMix	III	I	V	I	I	I
58	I	II	I	III	III		I	I	I	I	III	I	I	I	I	II	II	C3S1	F2-CaMix	III	II	V	I	I	I
59	I	II	I	III	I		I	I	I	I								C1S1	F0-CaHCO3	I	I	I	II	I	I
60	I	II	I	III	I		I	I	I	I								C1S1	F0-NaMix	I	I	I	III	I	I
61	I	II	I	III	I	I	I	I	I	I	III	I	I	I	I	II	II	C2S1	F1-CaMix	II	I	III	II	I	I
62	I	II	I	III	II	I	I	I	I	I	II	I	I	I	I	II	II	C3S1	F2-MgMix	III	I	III	II	I	I
66	I	II	I	III	II		II	I	I	I								C2S1	F1-CaMix	II	I	IV	II	I	I
72	I	II	I	I	I	IV	I	I	I	I	I	I	I	I	I	I		C2S1	F2-CaHCO3	II	I	I	II	I	I
73	I	II	I	I	IV	IV	I	I	I	I	I	I	I	I	I	II		C2S1	F2-MgHCO3	II	I	IV	I	I	II
84	I																			III					
Average	I	II	I	III	I	III	I	I	I	I	II	I	I	I	I	II	I			II	I	III	II	I	II
Bayındır-Torbalı—April, 99																									
34	II	I	I	III	I		I	I	IV	II	I	I	I	I	I	II	I	C3S1	F0-NaHCO3	III	I	I	IV	I	II
35	I	I	I	III	I		I	I	I	I								C2S1	F1-MgHCO3	II	I	I	I	I	I
36	I	II	I	III	I		II	I	I	I	I	I	I	I	I	II	I	C3S1	F2-MgHCO3	III	I	I	II	I	II
37	I	II	I	III	I		I	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	II
39	I	I	I	III	I		I	I	I	I								C1S1	F1-CaHCO3	I	I	II	I	I	I
40	I	I	I	III	I		I	I	I	I								C3S1	F2-CaHCO3	III	I	I	II	I	I
41	I	I	I	III	I		I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-MgHCO3	II	I	I	I	I	I
45	I	I	I	III	I		I	I	I	I	I	I	I	I	I	II	I	C3S1	F1-CaHCO3	III	I	I	II	I	I
53	I	I	I	III	I		I	I	I	I	II	I	I	I	I	II	I	C2S1	F2-MgHCO3	II	I	II	I	I	I
54	I	I	I	III	I		I	I	I	I								C2S1	F2-MgHCO3	II	I	I	I	I	I
55	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	I	C3S1	F2-MgHCO3	III	I	II	II	I	I
56	I	I	I	III	I		I	I	I	I	II	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	II	I	I	I
58	I	II	I	III	II		I	I	I	I	II	I	I	I	I	II	I	C3S1	F3-MgHCO3	III	I	III	I	I	I
59	I	II	I	III	III		I	I	I	I	II	I	I	I	I	II	I	C3S1	F3-CaHCO3	III	I	V	I	I	I
60	I	II	I	III	II		I	I	I	I								C2S1	F2-CaHCO3	II	I	III	I	I	I
Average	I	II	I	III	I		I	I	I	I	I	I	I	I	I	II	I			II	I	II	I	I	I
Bayındır-Torbalı—98-99																									
Average	I	II	I	III	I		I	I	I	I	II	I	I	I	I	II	I			II	I	III	II	I	I

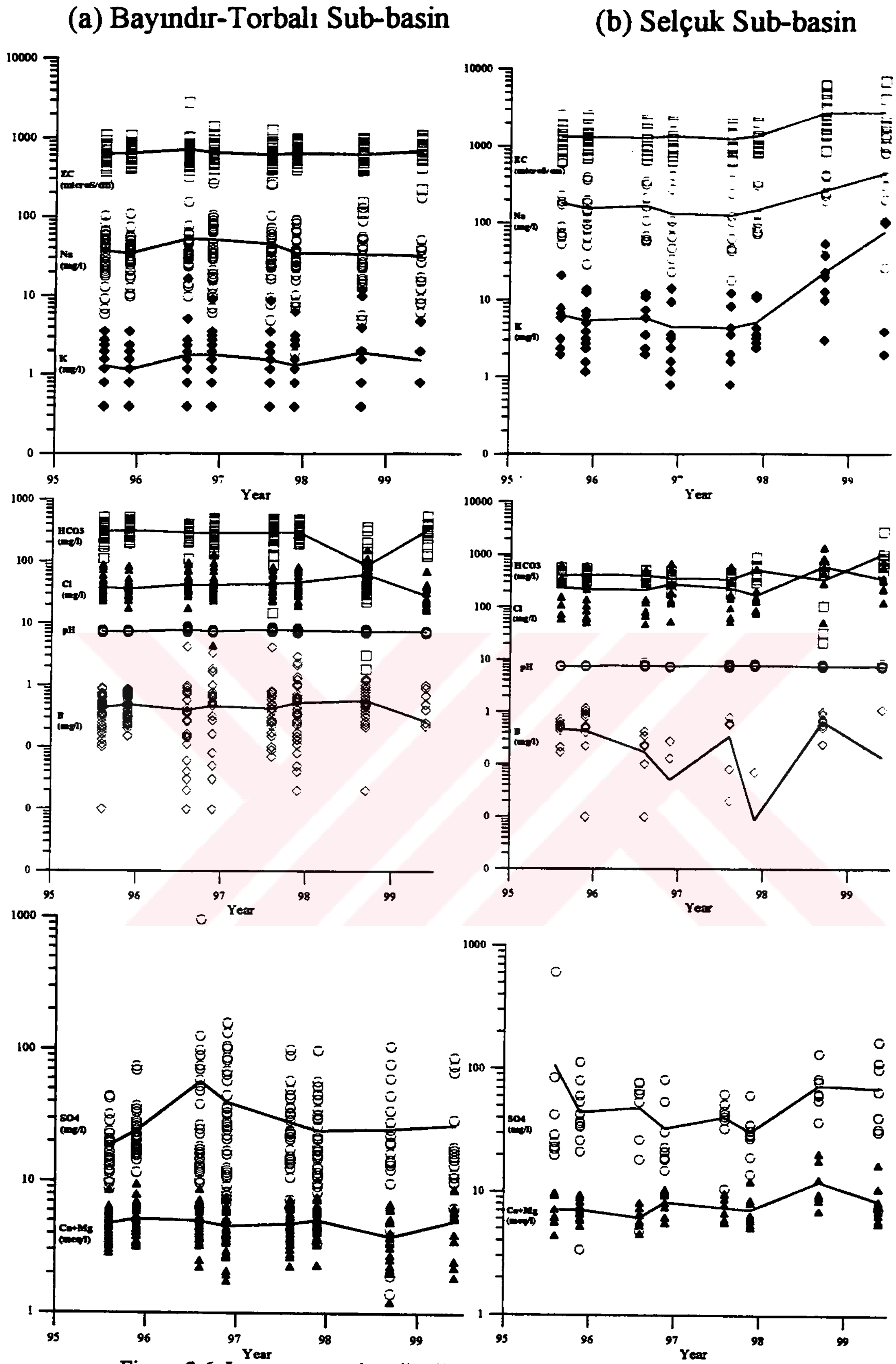
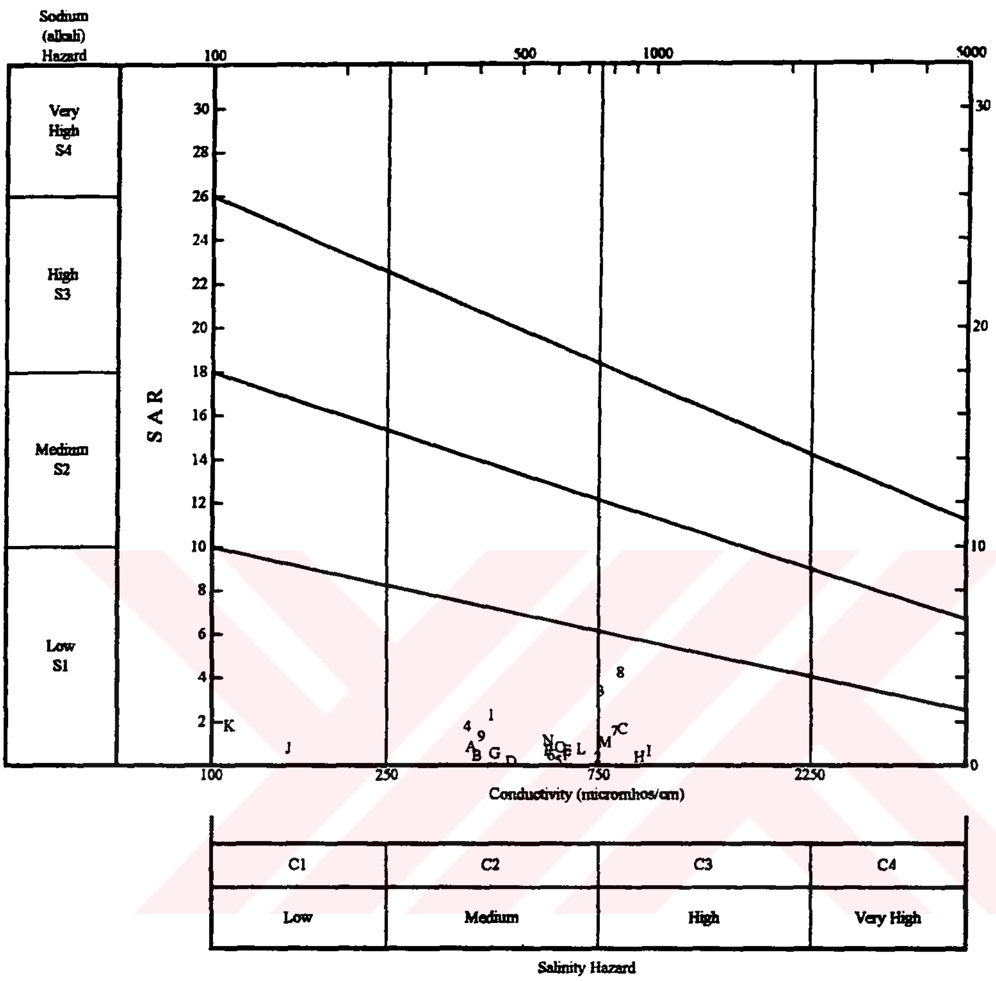


Figure 3.6. Ion concentration distributions from 1995 to 1999
in (a) Bayındır-Torbalı and (b) Selçuk sub-basins.

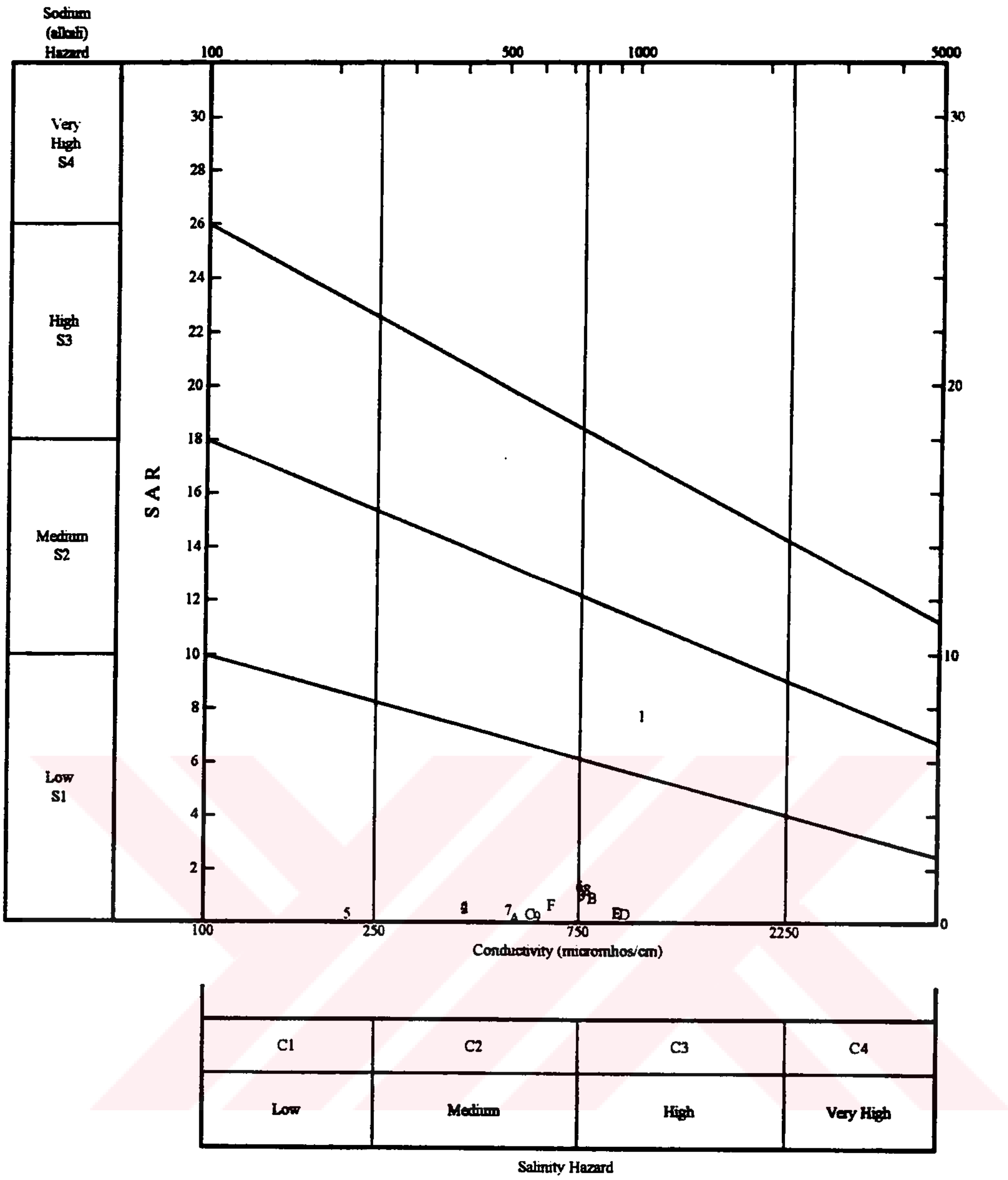
Water quality

The salinity in the Bayındır-Torbalı sub-basin groundwaters is of either medium (C2) or high (C3). According to the **irrigation water** SAR, Na%, Cl, B, and SO_4 limits, the sub-basin waters in general are either in very good (I) or in good (II) classes (Table 3.6b and Table I.6). Salinity and sodium alkali hazard (SAR) classification of the sub-basin samples are shown in Figure 3.7. The Ergenli thermal water is in usable with caution (IV) class with respect to the Na% limits (Table 3.6b). In terms of EC limits, groundwaters in the sub-basin are either in good (II) or in usable (III) classes. In terms of NO_3 limits, on the other hand, groundwaters in the sub-basin include all five types of classes. While samples 66 and 73 of July and the Ergenli thermal water of April are in usable with caution (IV) class, samples 57, 58 of July from far west of the basin (in Develi) are in harmful (V) class in terms of NO_3 limits. Heavy metal concentrations of the samples in the sub-basin are lower than the limits of irrigation water. The seasonal changes suggest that the irrigation water quality in the wet period become better in B amount (Table 3.6b). In terms of annual sub-basin average data, all the observed parameters, except NO_3 (which is in usable (III) class), are in very good (I) class (Table 3.6b). The spatial water quality class changes in the sub-basin indicate that EC, Cl, and B parameters exhibit an increasing class trend (decreasing quality) in the vicinity of Torbalı, along the southwestern boundary and middle section of the eastern boundary of the sub-basin whereas Na% shows the increasing class trend in the vicinity of Bayındır (Figure III.3, Figure III.4, Figure III.6, and Figure III.7). While SO_4 does not show any spatial class change in the sub-basin, the classes of NO_3 parameter become worse to the west of Torbalı along the western boundary (Figure III.5 and Figure III.8). Groundwaters in the east and south of the sub-basin are generally in very good quality with respect to NO_3 content (Figure III.8). The temporal changes in the water quality since 1995 occur in the west of the sub-basin for Cl and in the other areas for B from very good (I) class to good (II) class (figures III.4 and III.6).



1	39	B	51	L	61
2	40	C	52	M	62
3	41	D	53	N	66
4	42	E	54	O	72
5	44	F	55	P	73
6	45	G	56		
7	46	H	57		
8	48	I	58		
9	49	J	59		
A	50	K	60		

Figure 3.7a. Wicox diagram of the chemical analyses of dry season samples in the Bayındır-Torbalı Sub-basin.



1 34
2 35
3 36
4 37
5 39
6 40
7 41
8 45
9 53
A 54
B 55
C 56
D 58
E 59
F 60

Figure 3.7b. Wicox diagram of the chemical analyses of wet season samples in the Bayındır-Torbalı Sub-basin.

The Bayındır-Torbalı sub-basin waters in general are either in high quality (I) or in medium quality (II) classes with respect to all parameters but N-NO_3 in terms of the **inland water sources** limits (Table 3.6b). According to the N-NO_2 limits, the waters are in low quality (III). Some samples of dry season are in low quality (III) class with respect to either N-NO_3, or Pb, or Fe, or Ni limits. According to the BOD classification limits, while some samples (no: 72 and 73 of July) indicate very low quality (IV), the others (no: 39, 45, 57, 61, and 62 of July) indicate high quality (I) class of waters. The annual sub-basin average data indicate that, all the observed parameters, except N-NO_2 (which is in low quality (III) class), are either in high quality or medium quality class in terms of the inland water sources limits (Table 3.6b).

3.2.4. Selçuk Sub-basin

Chemical analyses and the estimated water quality classes of the Selçuk sub-basin groundwater samples are listed in Table 3.7. The sub-basin average values and related water quality classes of the dry season data, wet season data and annual data for each parameter are also given in the table.

Hydrochemistry

Percent concentration distributions of the cations and anions in the sub-basin indicate that the sub-basin groundwaters include Na-Cl, Mg-Cl and Ca/Mg-HCO_3 types in the dry season and Na/Ca/Mg-HCO_3 types in the wet season (Table 3.7, Table I.6 and Figure I.1). On the basis of observation period, the chemical changes between irrigation and prior to irrigation can be stated as follows. Concentrations of Ca (96-89 mg/l), Mg (88-48 mg/l), Cl (591-341 mg/l), SO_4 (73-69 mg/l), B (0.65-0.14 mg/l), and o-PO_4 (0.05-0.0 mg/l) decrease and amounts of pH (7.42-7.45), EC (2701-2726 μS/cm), Na (264-441mg/l), K (23-76 mg/l), HCO_3 (329-1029 mg/l), F (0.10-0.24 mg/l), N-NO_2 (0.01-0.03 mg/l), N-NO_3 (2.4-2.8 mg/l), and organic matter (0.10-0.22 mg/l) increase (Table 3.7a). The spatial concentration changes in the sub-basin, in general, indicate an

Table 3.7 continued.

Sample No	TDS	Cl	N-NH_4	N-NO_2	N-NO_3	BOD	o-PO_4	SO_4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Class	*EC	*Cl	*NO_3	*Na %	*SO_4	*B
Selçuk Sub-basin— July, 98 continued.																									
79	II																			IV					
80	II																			IV					
81	III																			V					
82	II																			IV					
83	III																			V					
Average	II	IV		II	I	III	II	I	I	I	I	I	I	I	I	I	I			IV	IV	II	III	I	II
Selçuk Sub-basin— April, 99																									
62	II	III	I	III	I		I	I	I	I								C3S1	B2-NaHCO3	III	III	III	III	I	I
64	II	III	I	III	I		I	I	I	I								C4S2	B2-NaHCO3	IV	III	I	IV	I	I
65	II	III	I	III	I		I	I	I	I								C3S1	FB2-NaHCO3	III	II	I	III	I	I
66	III	IV	I	III	I		I	I	I	I								C4S4	B3-NaHCO3	V	IV	I	V	I	I
67	II	III	I	IV	I		I	I	I	I								C3S2	B2-NaHCO3	III	III	I	IV	I	I
68	II	III	I	III	II		I	I	I	I								C3S1	FB4-MgHCO3	IV	II	IV	II	I	I
69	I	II	I	III	II		I	I	I	I								C3S1	F3-CaHCO3	III	I	IV	I	I	I
70	III	IV	I	III	I		I	I	IV	I								C4S4	B2-NaHCO3	V	IV	I	V	I	II
Average	II	III	I	III	I		I	I	I	I										IV	III	III	III	I	I
Selçuk Sub-basin—98-99																									
Average	II	IV	I	III	I		II	I	I	I										IV	IV	III	III	I	I

Table 3.7. (a) Chemical analyses and (b) quality classes of the waters investigated in the Selçuk sub-basin. The classes were estimated using both the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. For explanation see caption of Table 3.4. For sample locations see Table 3.1, Table 3.2 and Figure 3.1.

(a)

Sample No	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	Ni mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat. mg/l	Sb mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
Selçuk Sub-basin—July, 98																											
47	0.70	1.00	95.2	<0.005	815.4	47.97	<0.005	<0.005	2830	0.2	0.02	21.33	12.87	52.2	414.00	<0.05	0.00	0.021	0.98	0.00	0.021	7.27	0.00	0.05	79.2	1410	<0.005
63	0.56		92.6		545.2	35.97			2210	0.0		106.07	37.83	46.2	244.95		0.00	0.019	1.31	0.03		7.25	0.00		55.2	1100	
64									1460													7.24				720	
65	1.0	0.75	130.0		1304.6	31.78			6180	0.0		32.91	53.82	167.5	404.80		0.00	0.018	1.47	0.03		7.12	0.68		132.1	3040	
68	0.65		73.6	<0.005	270.2	0.0	<0.005	<0.005	1700	0.2	0.02	555.96	10.00	71.0	192.00		0.00	0.00	1.65	0.01	<0.005	7.28	0.00		61.2	850	<0.005
69	0.50		102.8	<0.005	416.9	0.0	<0.005	<0.005	2320	0.0	0.02	558.40	20.00	89.4	225.00		0.00	0.00	7.39	0.01	<0.005	7.27	0.00		83.0	1160	<0.005
70	0.24		76.8	<0.005	49.4	0.0	<0.005	<0.005	864	0.3	0.02	420.62	3.00	37.5	48.00		0.00	0.002	3.91	0.04	<0.005	7.19	0.00		37.0	433	<0.005
71	0.89	50	103.2	<0.005	732.9	0.0	<0.005	<0.005	3140	0.0	0.02	606.55	23.00	153.6	318.00		0.00	0.00	0.00	0.20	<0.005	7.61	0.00		63.0	1560	<0.005
76									3090													7.71				1540	
77									1910																	950	
78									1390													7.16				700	
79									2650													7.14				1320	
80									2230																	1100	
81									4020																	1940	
82									2280													8.19				1130	
83									4940													8.02				2460	
Average	0.65	17.25	96.31	0.00	590.66	16.53	<0.005	<0.005	2700	0.10	0.02	328.83	22.93	88.20	263.82	<0.05	0.00	0.01	2.39	0.05	<0.005	7.42	0.10	0.05	72.96	1338.3	<0.005
Std. Dev	0.25	28.36	18.87	0.00	409.95	21.18			1372	0.13	0.00	265.08	17.56	52.43	128.43		0.00	0.01	2.50	0.07	0.01	0.35	0.26	0	30.23	673.23	
Selçuk Sub-basin—April, 99																											
62	0		76.1		310.1	0			1801	0.2		783.04	99.84	46.35	299		0	0.019	4.135	0		7.51	0		65.35	900	
64	0		78.4		338.8	0			2500	0.3		993.66	99.84	36.5	400.2		0	0.017	0.42	0		7.3	0		40.3	1250	
65	0		72.0		208.3	0			1460	0.4		687.03	99.84	34.1	200.1		0	0.018	0.77	0		7.17	0		32.4	720	
66	0		95.8		695.1	0			6970	0		2670.7	99.84	42.4	1300.0		0	0.019	1.03	0		7.1	1.73		164.8	3480	
67	0		64.8		304.5	0			1830	0		996.10	99.84	31	400.2		0	0.068	0.12	0		8.46	0		7.3	910	
68	0		161.2		215.6	0			2100	0.3		779.08	3.9	101.9	103.96		0	0.023	7.15	0		7.12	0		111.9	1040	
69	0		106.4		116.9	0			1000	0.1		468.18	1.95	62.9	25.99		0	0.02	8.6	0		7.25	0		30.9	500	
70	1.09		58.4		535.2	227.86			4150	0.6		855.89	101.4	31.2	800.4		0	0.018	0.15	0		7.69	0		99.6	2070	
Average	0.14		89.14		340.56	28.48			2726.4	0.24		1029.21	75.81	48.29	441.23		0.00	0.03	2.80	0.00		7.45	0.22		69.07	1358.75	
Std. Dev	0.39		33.06		188.58	80.56			1953.8	0.21		684.72	44.99	24.08	419.93		0.00	0.02	3.41	0.00		0.46	0.61		52.63	976.60	
Selçuk Sub-basin—98-99																											
Average	0.39		92.73		465.61	22.51			2713.6	0.17		679.02	49.37	68.25	352.53		0	0.02	2.59	0.02		7.43	0.16		71.01	1348.53	
Std. Dev	0.32		25.96		299.27	50.87			1663.3	0.17		474.9	31.28	38.25	274.18		0	0.01	2.96	0.03		0.4	0.43		41.43	824.92	

(b)

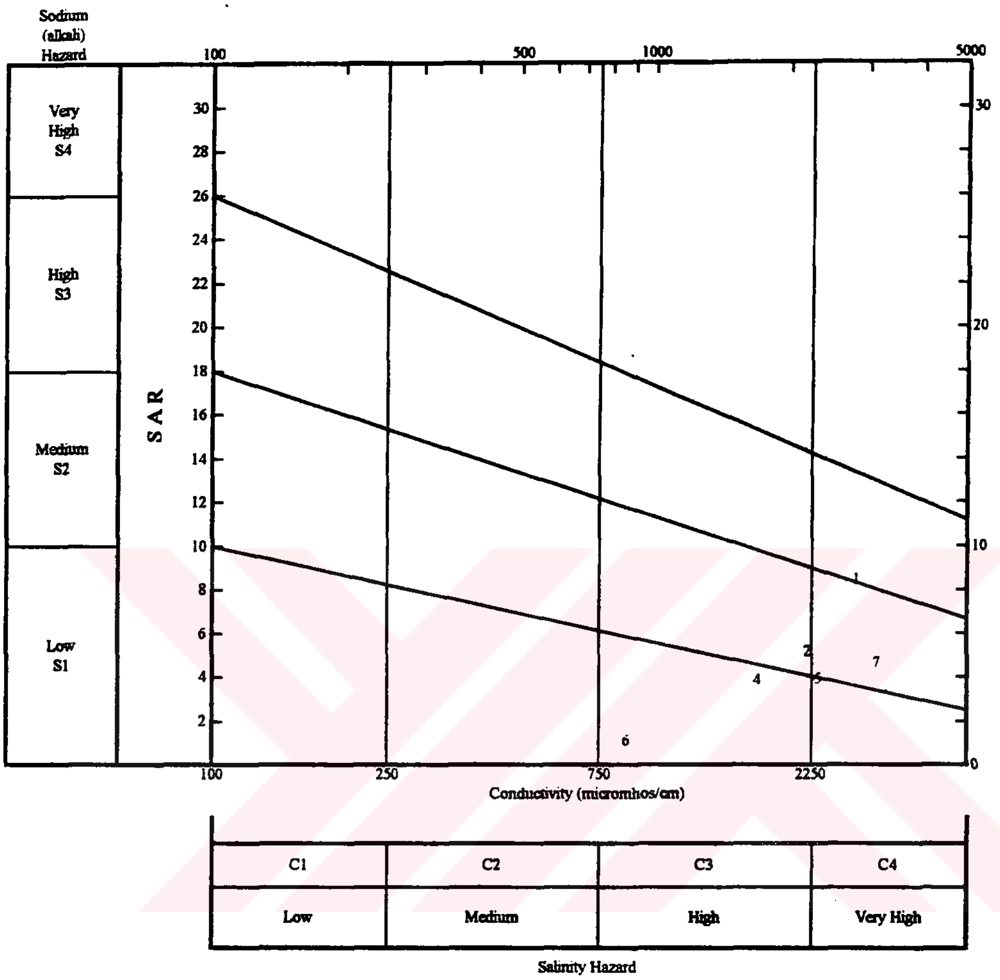
Sample No	TDS	Cl	N-NH_4	N-NO_2	N-NO_3	BOD	o-PO_4	SO_4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Type	*EC	*Cl	*NO_3	*Na %	*SO_4	*B
Selçuk Sub-basin— July, 98																									
47	II	IV	I	III	I	I	I	I	I	I	III	I	I	I	I	II	II	C4S1	B3-NaCl	IV	V	I	IV	I	II
63	II	IV	I	III	I		II	I	I	I								C3S1	B3-NaCl	IV	IV	II	III	I	II
64	II																			III					
65	III	IV	I	III	I	I	II	I	IV	I								C4S1	BS4-MgCl	V	V	II	III	I	II
68	II	III	I	I	II		I	I	I	I	I	I	I	I	I	II		C3S1	FB3-MgHCO3	III	III	II	III	I	II
69	II	IV	I	I	IV		I	I	I	I	I	I	I	I	I	II		C4S1	B3-MgCl	IV	III	IV	III	I	I
70	I	II	I	III	III		II	I	I	I	I	I	I	I	I	II		C3S1	F2-CaHCO3	III	I	III	II	I	I
71	III	IV	I	I	I	IV	III	I	I	I	I	I	I	I	I	II		C4S1	B4-MgCl	V	V	I	III	I	II
76	III																			IV					
77	II																			III					
78	II																			III					

increasing concentration trends from southeastern boundary to the northwestern or to the western boundary (Figure III.1 and Figure III.2). The temporal changes in the sub-basin between 1995 and 1999 are shown in Figure 3.6b. In the figure, overall trends of the parameters (by considering also the data scatters at a given observation period) suggest an increasing concentration trends for EC, HCO_3, K, SO_4, Ca+Mg in the sub-basin groundwaters.

Water quality

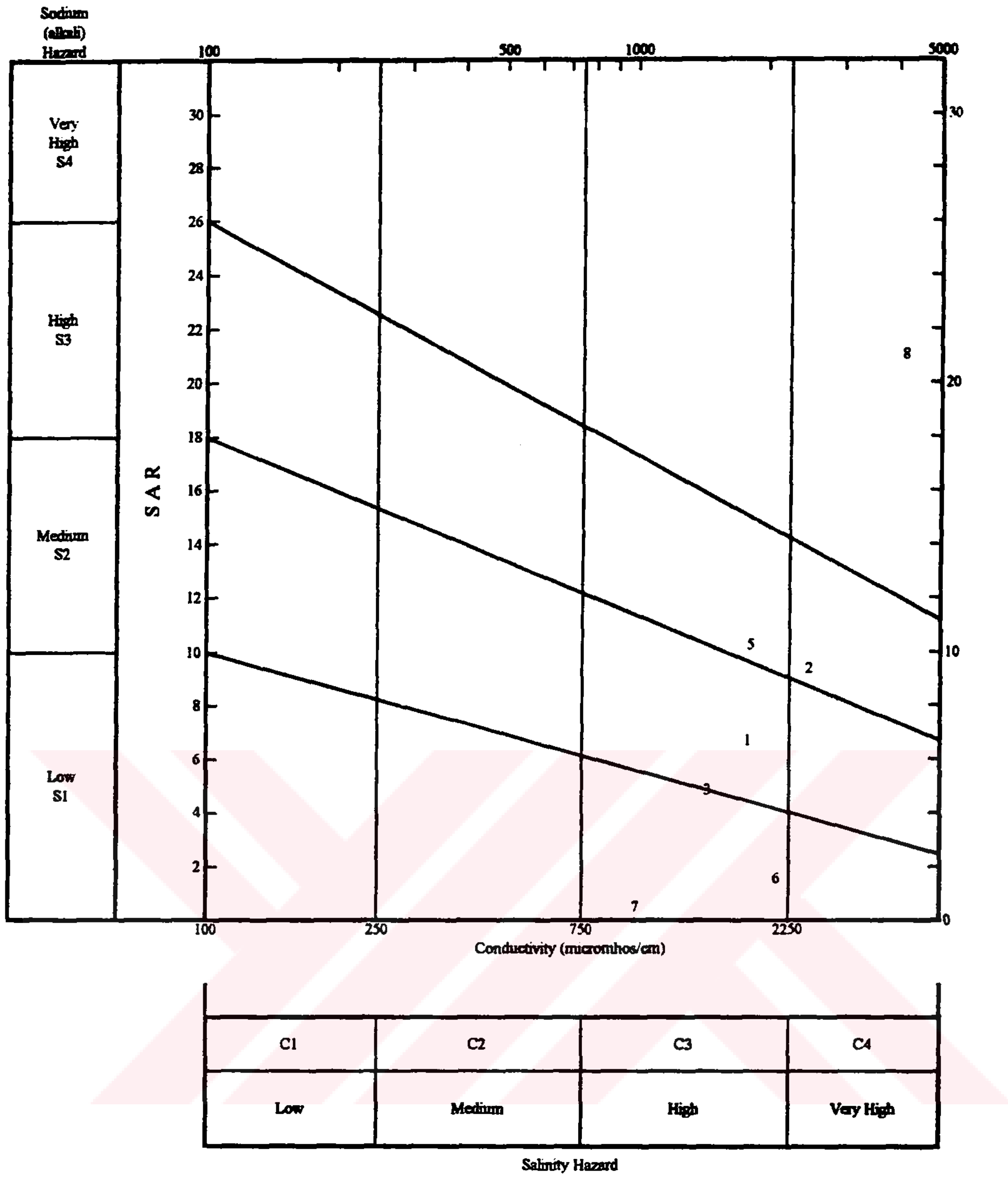
The sub-basin groundwaters include high (C3) and very high (C4) salinity (Table 3.7b and Table I.6). Although the SAR **irrigation water** class is very good (I) in the dry season samples, it ranges from very good (I) to usable with caution (IV) in the wet season samples. Salinity and sodium alkali hazard (SAR) classification of the sub-basin samples are shown in Figure 3.8. According to the NO_3, SO_4, and B irrigation water limits, the groundwaters are of either in very good (I) or in good (II) classes (Table 3.7b). However, in terms of EC, Cl, and Na% limits, the groundwaters are in usable (III), usable with caution (IV) and harmful (V) classes. Heavy metal concentrations of the samples in the sub-basin are lower than the limits of irrigation water. The seasonal changes suggest that the irrigation water quality in the wet period become better in B concentration (Table 3.7b). In terms of annual sub-basin average data, all the observed parameters, except EC (which is in usable with caution (IV) class) and NO_3 (which is in usable (III) class), are in very good (I) class (Table 3.7b). The spatial water quality class changes in the sub-basin indicate that EC, Cl, B, and Na% parameters exhibit an increasing class trends (decreasing quality) toward southwestern (shore line) boundary of the Selçuk sub-basin (Figure III.3, Figure III.4, Figure III.6, and Figure III.7). While SO_4 does not show any spatial class change in the sub-basin, the class of NO_3 parameter increases to the south of Selçuk centrum (Figure III.5 and Figure III.8). The temporal changes in the sub-basin since 1995 indicate that the quality of the groundwaters decreases with respect to Cl and B parameters (figures III.3 to III.8).

According to the Cl and N-NO_2 **inland water sources** limits, the groundwaters are of either in low quality (III) or in very low quality (IV) in the



1	47
2	63
3	65
4	68
5	69
6	70
7	71

Figure 3.8a. Wicox diagram of the chemical analyses of dry season samples in the Selçuk Sub-basin.



1	62
2	64
3	65
4	66
5	67
6	68
7	69
8	70

Figure 3.8b. Wicox diagram of the chemical analyses of wet season samples in the Selçuk Sub-basin.

Selçuk sub-basin (Table 3.7b). The limits of all the other parameters considered for the inland water sources classification are predominantly in high quality (I) class. Some parameters of few samples are in medium quality (II) class. According to the BOD classification limits, one sample (no: 71 of July) from a farm indicate very low quality (IV), the others (no: 47 and 65 of July) indicate high quality (I) class of waters. The annual sub-basin average data indicate that all the observed parameters, except N-NO_2 (which is in low (III) quality class) and Cl (which is in low (IV) quality class), are either in high quality or medium quality class in terms of inland water sources limits (Table 3.7b).

3.2.5. K. Menderes River Basin

Using quality classes listed in the tables 3.4, 3.5, 3.6, and 3.7 as numeric numbers and by assigning an equal weight to all classification parameters, both the irrigation water quality maps (Figure 3.9) and the inland water sources quality maps (Figure 3.10) were prepared for the basin. In the preparation of the irrigation water quality maps, EC, Cl, NO_3, SO_4, Na%, and B classes (I, II, III, IV, V (B does not have class V)) of each water sample were taken as an integer number and were summed up. As a result, the total-quality class of each water sample was determined. Thus, the minimum total quality number on the map can be equal to 6, indicating the areas with the highest water quality for irrigation in the basin. The maximum total quality number in the map can be 29, indicating the areas with the lowest water quality for irrigation in the basin. When the irrigation quality maps of the basin in dry season are evaluated in the light of this information, it can be seen that the first degree low quality irrigation waters are present in the vicinity of mining areas to the east of Ödemiş, in the vicinity of old waste disposal sites, industrial facilities, and factories to the north of Tire, around Ergenli, in the vicinity of Develi, and to the north of Selçuk (Figure 3.9a). The second degree low quality irrigation waters are located in the sewage discharge site of Ödemiş Municipality and in the vicinity of Fertek stream. The third degree low quality irrigation waters are observed in the vicinity of K. Menderes river channel around Beydağ and between İlkkurşun and Karateke, in the vicinity

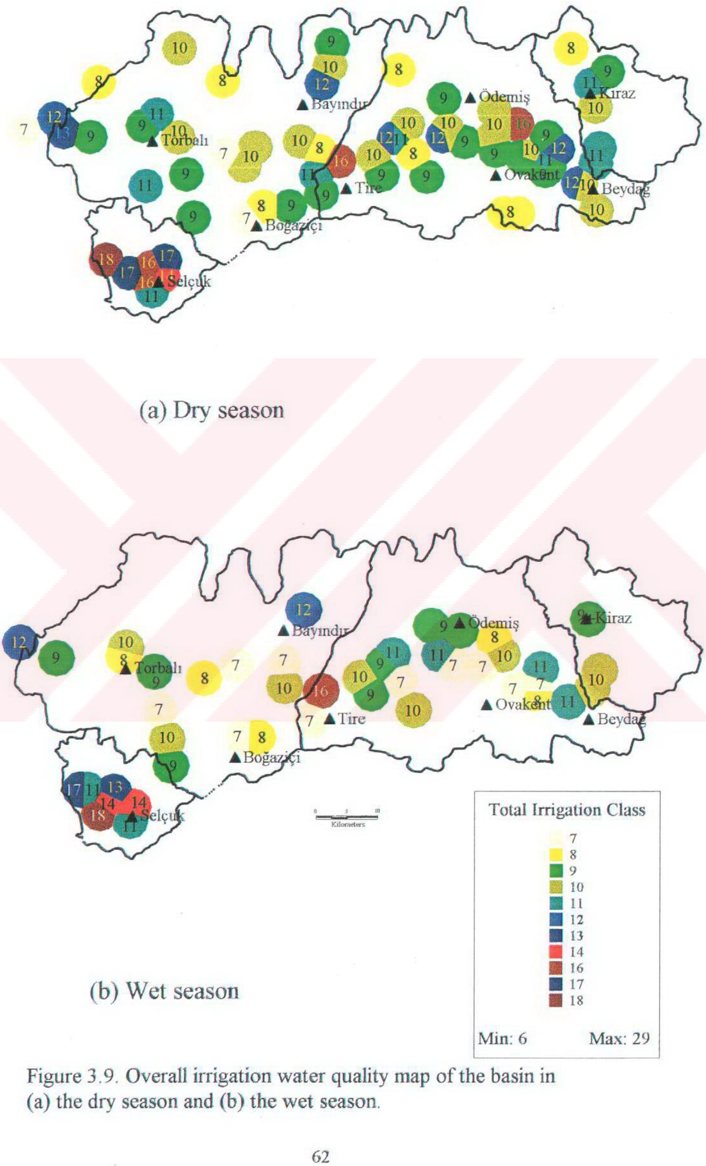


Figure 3.9. Overall irrigation water quality map of the basin in (a) the dry season and (b) the wet season.

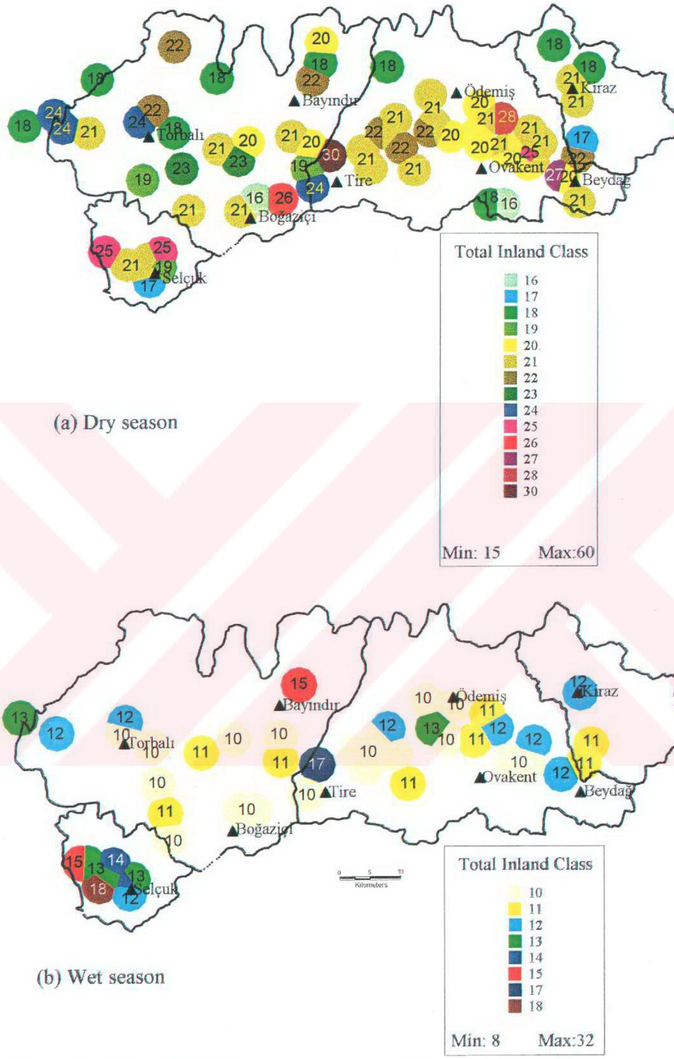


Figure 3.10. Overall inland water sources quality map of the basin in (a) the dry season and (b) the wet season.

of Fertek stream to the north of Torbalı, and at south of Selçuk. The wet season overall irrigation water quality is slightly better than that of dry season (Figure 3.9b). General overall irrigation water quality in the basin is around 10 in the range of 6 to 29.

In the preparation of the inland water sources quality maps for dry season (Figure 3.10a) TDS, Cl, $N\text{-}NH_4$, $N\text{-}NO_2$, $N\text{-}NO_3$, SO_4, B, F, Pb, Zn, Cr, Fe, Cu, Cd and Ni classes and for wet season (Figure 3.10b) TDS, Cl, $N\text{-}NH_4$, $N\text{-}NO_2$, $N\text{-}NO_3$, SO_4, B, and F classes (I, II, III, IV) of each water sample were taken as an integer number and were summed up. As a result, the total quality class of each water sample were estimated. Thus, the minimum total quality numbers can be equal to 15 and 8 for dry and wet seasons, respectively, indicating the highest water quality areas for the inland water sources in the basin (Figure 3.10). The maximum total quality number in the dry and wet season maps can be 60 and 32, respectively, indicating the lowest water quality areas for the inland water sources in the basin. When the inland water sources quality maps of the basin are evaluated, it can be seen that the lowest quality waters are present in the vicinity of mining areas around Ödemiş and to the north of Tire and Selçuk towns. General overall irrigation water quality in the basin is around 22 in the range of 15 to 60 in Figure 3.10a and is 11 in the range of 8 to 32 in Figure 3.10b.

3.3. Surface Water

The surface waters in the basin include the K. Menderes River and its nine major tributaries, namely Fertek, Pirinçci, Aktaş, Eğridere, Falaka, Rahmanlar, Ergenli, Uladı, and Akyurt streams. The K. Menderes River were sampled at 10 points, the Fertek stream was sampled at 3 and the others was sampled at 1 point during this study. The sampling locations of the waters, collected in April are given in Table 3.3 and Figure 3.1c. Chemical analyses and the estimated water quality classes of the surface water samples are given in Table 3.8.

Table 3.8. (a) Chemical analyses and (b) quality classes of the surface waters investigated in 1-6/April/1999. The classes were estimated using both the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. For explanation see caption of Table 3.4. For sample locations see Table 3.3 and Figure 3.1c.

(a) Chemical Analyses.

Sample No	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	CO_3 mg/l	Cr mg/l	Cu mg/l	EC µS/cm field	F mg/l	Fe mg/l	HCO_3 mg/l	K mg/l	Mg mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	Pb mg/l	pH field	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l field	Zn mg/l
K. Menderes River																								
1	0.41	20		18.9	0.0			204	0.2		71.94	0.78	7.502	5.98	0	0.019	5.61	0		6.5	1.24	13.6	101	
4	0.08	30		16.1	0.0			257	0.2		136.55	1.95	14.5	7.82	0	0.018	0.18	0		7.22	1.59	3.5	127	
8	0.14	37.2	<0.005	15.8	0.0	<0.005	<0.005	256	0.4	0.37	131.07	1.95	10.2	7.82	0	0.015	0.11	0	<0.005	7.51	0	31	127	0.01
10	0.43	32	<0.005	19.6	0.0	<0.005	<0.005	254	0.6	0.60	103.63	1.95	9.8	7.82	0	0.018	0.13	0	<0.005	7.43	0	36	126	0.011
13	1.15	21.8	<0.005	14.7	0.0	<0.005	<0.005	229	0.2	0.75	80.47	1.95	10.5	6.9	0	0.017	0.11	0	<0.005	7.34	0.91	32	114	<0.005
22	0.98	28	<0.005	27.3	0.0	<0.005	<0.005	266	0.1	0.62	123.75	1.95	16.2	9.89	0	0.019	0.08	0	<0.005	7.66	0.8	23.8	132	<0.005
28	0.2	52	<0.005	42	0.0	<0.005	<0.005	286	0.7	0.62	192.64	2.73	24.8	14.95	0	0.017	0.17	0.09	<0.005	7.67	0	42.8	142	<0.005
43	0	44.4	<0.005	25.9	0.0	<0.005	<0.005	533	0.2	0.13	257.86	2.73	27.2	25.99	0	0.018	0.13	0	0.008	7.7	2.25	39.5	266	0.165
46	0	47.6	<0.005	15.8	0.0	<0.005	<0.005	516	0.3	0.14	273.10	2.73	23.5	25.99	0	0.022	0.08	0.02	0.006	7.52	0	32.2	258	0.015
47	0	20	<0.005	24.5	0.0	<0.005	<0.005	546	0.2	0.12	137.16	2.73	15.1	30.82	0.01	0.021	0.49	0	0.007	7.5	2.85	34.8	273	0.015
Other streams																								
12	0.47	19.8		12.3	0.0			125	0.4		67.057	0.78	6.3	3.91	0	0.022	0.12	0		7.48	0	16.4	62	
20	0.56	44		35	0.0			328	0.4		223.73	0.78	26.7	8.97	0	0.017	0.19	0		8.22	0	16	164	
24	0.53	31.8		14.7	0.0			323	0		154.23	1.95	20.45	6.9	0	0.018	0.53	0		8.1	0	38.4	161	
29	0.53	46.8		16.1	0.0			338	0.1		192.64	3.9	12.6	10.81	0	0.037	0.09	0.23		7.6	9.2	13.6	169	
31	0.42	32.8		14.7	0.0			334	0.4		198.12	0.78	25.5	7.82	0	0.017	1.54	0		7.77	0.92	30.3	166	
33	0.53	33.6	<0.005	15.4	0.0	<0.005	<0.005	337	0.6	<0.05	178.01	0.78	19.8	8.97	0	0.019	0.05	0	<0.005	7.73	1.69	19.1	168	0.007
38	0.5	26.4		16.8	0.0			259	0.2		129.24	0.78	13.4	8.97	0	0.018	0.16	0		8.01	0.98	14.8	129	
42	0	42.6	<0.005	31.5	0.0	<0.005	<0.005	726	0.5	0.14	252.99	1.95	23.8	36.8	0	0.019	2.15	0	0.008	7.75	3.29	42.8	362	0.015
44	0	51.6	<0.005	29.4	0.0	<0.005	<0.005	631	0.3	0.14	282.86	2.73	30	30.82	0	0.025	0.94	0.02	0.006	7.72	0	40.8	315	0.081
57	0.47	44.8	<0.005	16.8	0.0	<0.005	<0.005	539	0.2	<0.05	243.84	1.95	27.8	12.88	0	0.017	0.09	0	0.012	8.5	1.15	36.5	269	0.013
61	0	71.2		27.3	0.0			658	0		375.52	4.68	41.1	11.96	0.02	0.13	0.05	0.29		7.8	2.52	44.5	328	

(b) Quality Classes.

Sample No	TDS	Cl	N-NH_4	N-NO_2	N-NO_3	o-PO_4	SO_4	B	F	Pb	Zn	Cr	Fe	Cu	Cd	Ni	Salinity-SAR	Class	*EC	*Cl	*NO_3	*Na %	*SO_4	*B
K. Menderes River																								
1	I	I	I	III	II	I	I	I	I								C1S1	F0-CaMix	I	I	III	I	I	I
4	I	I	I	III	I	I	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	I
8	I	I	I	III	I	I	I	I	I	I	I	I	II	I	II	I	C2S1	F1-CaHCO3	II	I	I	I	I	I
10	I	I	I	III	I	I	I	I	I	I	I	I	II	I	II	I	C2S1	F1-CaHCO3	II	I	I	I	I	I
13	I	I	I	III	I	I	I	IV	I	I	I	I	II	I	II	I	C1S1	F0-CaHCO3	I	I	I	I	I	III
22	I	II	I	III	I	I	I	I	I	I	I	I	II	I	II	II	C2S1	F1-CaHCO3	II	I	I	I	I	II
28	I	II	I	III	I	II	I	I	I	I	I	I	II	I	II	II	C2S1	F2-CaHCO3	II	I	I	I	I	I
43	I	II	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-MgHCO3	II	I	I	I	I	I
46	I	I	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	I	II	I	I
47	I	I	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F1-MgHCO3	II	I	I	II	I	I
Other streams																								
12	I	I	I	III	I	I	I	I	I								C1S1	F0-CaHCO3	I	I	I	I	I	I
31	I	I	I	III	I	I	I	I	I								C2S1	F1-MgHCO3	II	I	II	I	I	I
24	I	I	I	III	I	I	I	I	I								C2S1	F1-MgHCO3	II	I	I	I	I	II
20	I	II	I	III	I	I	I	I	I								C2S1	F2-MgHCO3	II	I	I	I	I	II
29	I	I	I	III	I	III	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	II
33	I	I	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F1-CaHCO3	II	I	I	I	I	II
38	I	I	I	III	I	I	I	I	I								C2S1	F1-CaHCO3	II	I	I	I	I	I
57	I	I	I	III	I	I	I	I	I	II	I	I	I	I	II	I	C2S1	F2-MgHCO3	II	I	I	I	I	I
42	I	II	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	II	II	I	I
44	I	II	I	III	I	I	I	I	I	I	I	I	I	I	II	I	C2S1	F2-CaHCO3	II	I	I	II	I	I
61	I	II	I	IV	I	III	I	I	I								C2S1	F2-CaHCO3	II	I	I	I	I	I

3.3.1. Streams

Hydrochemistry

The streams in the basin are either Mg-HCO_3 (Rahmanlar, Eğridere, Aktaş, and Fertek) or Ca-HCO_3 type (Pirinçci, Falaka, Ergenli, Uladı, Fertek and Akyurt) according to the percent cation and anion distributions (Table 3.8). Ion concentrations of the stream waters collected in April are compared with each other in Figure 3.11 where the streams are lined up from east to west in the direction of K. Menderes river flow. In general, the ranges of TDS, Ca, Mg, K, and Na amounts are 110-250 mg/l, 20-46 mg/l, 10-40 mg/l, 0.8-4 mg/l, and 4-20 mg/l, respectively (Table 3.8). However, Na concentration in the Fertek stream water reaches up to 37 mg/l after Torbalı town. The Fertek and Akyurt streams have higher cation concentrations than the other streams (Table 3.8, Figure 3.11). The range of HCO_3, SO_4, Cl, N-NO_3 in the streams are 70-250 mg/l, 15-30 mg/l, 12-20 mg/l, 0.05-2 mg/l. Similar to the cation amounts, The Fertek and Akyurt streams have higher anion concentrations than the other streams with the exception of N-NO_3 which is higher in the Rahmanlar and Fertek streams (Table 3.8, Figure 3.11). B and F concentrations are less than 0.5 mg/l. Relatively high organic matter changes between 1 mg/l and 3 mg/l in the Ergenli, Uladı, Fertek and Akyurt stream waters and reaches up to 9 mg/l in the waters of the Falaka stream. Those Cd, Cr, Cu, Fe, Ni, PO_4, Pb, and Zn concentrations in the streams are either very low or below the detection limits.

In order to determine the temporal trends of the ion concentrations in a given stream, DSİ monitoring data collected between 1995 and 1998 in March and April were used together with the data collected during this study. The concentration trends shown in Figure 3.12 between 1995 and 1999 indicate that in the Pirinçci stream Na and N-NO_3 concentrations have decreased whereas those of Mg and K have increased, in the Rahmanlar stream EC and Na concentrations have decreased but that of Mg has increased, in the Eğridere stream Na concentration has decreased but that of K has increased, in the Aktaş stream N-NO_3 and Fe concentrations have decreased but those of HCO_3, pH, Mg, and K have increased, in the Falaka stream N-NO_3 concentration has

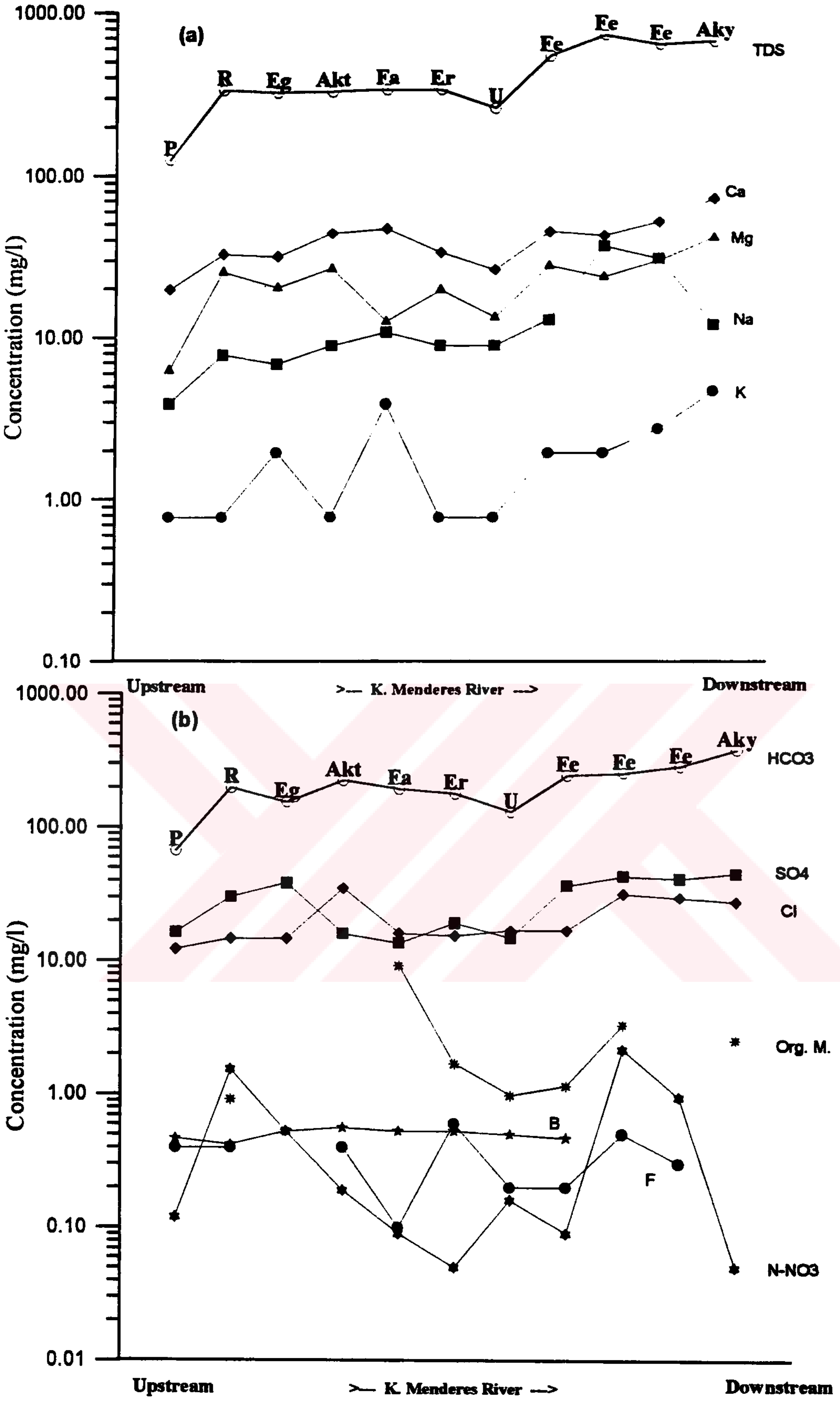


Figure 3.11. Ion concentration trends of the streams in April 1999. P: Pirinçci, R: Rahmanlar, Eg: Eğridere, Akt: Aktaş, Fa: Falaka, Er: Ergenli, U: Uladi, Fe: Fertek, Aky: Akyurt.

decreased but those of SO_4, o-PO_4, and K have increased, in the Ergenli stream N-NO_3 concentration has decreased but that of K has increased, in the Akyurt stream N-NO_3 concentration has decreased but those of K pH, o-PO_4, HCO_3, Ca, and Mg have increased, in the Fertek stream (North of Torbalı) Na, Cl concentrations have decreased but that of pH has increased and in the Fertek stream (South of Torbalı) Cl, N-NO_3 concentrations have decreased but that of pH has increased.

Water quality

All streams include fresh water and their hardness type change from soft (0) to hard (2). All stream waters are either in very good (I) or in good (II) quality classes with respect to all considered irrigation water limits (Table 3.8). Salinity and sodium alkali hazard (SAR) classification of the streams are shown in Figure 3.13. Temporal trends of the irrigation water classes in the streams are shown in Figure 3.14.

With respect to the inland water sources limits, except for those of N-NO_2 and o-PO_4, again all stream waters are either in high quality (I) or in medium good quality (II) classes (Table 3.8). Waters of Falaka and Akyurt streams are in low quality (III) class with respect to the o-PO_4 inland water sources limits but those of the others are in high quality (I) class. N-NO_3 concentrations in the Akyurt stream, at the bank of which an olive-oil mill is present, suggest very low quality (IV) class. The class of the other stream waters with respect to N-NO_2 inland water sources limits is in low quality (III) class.

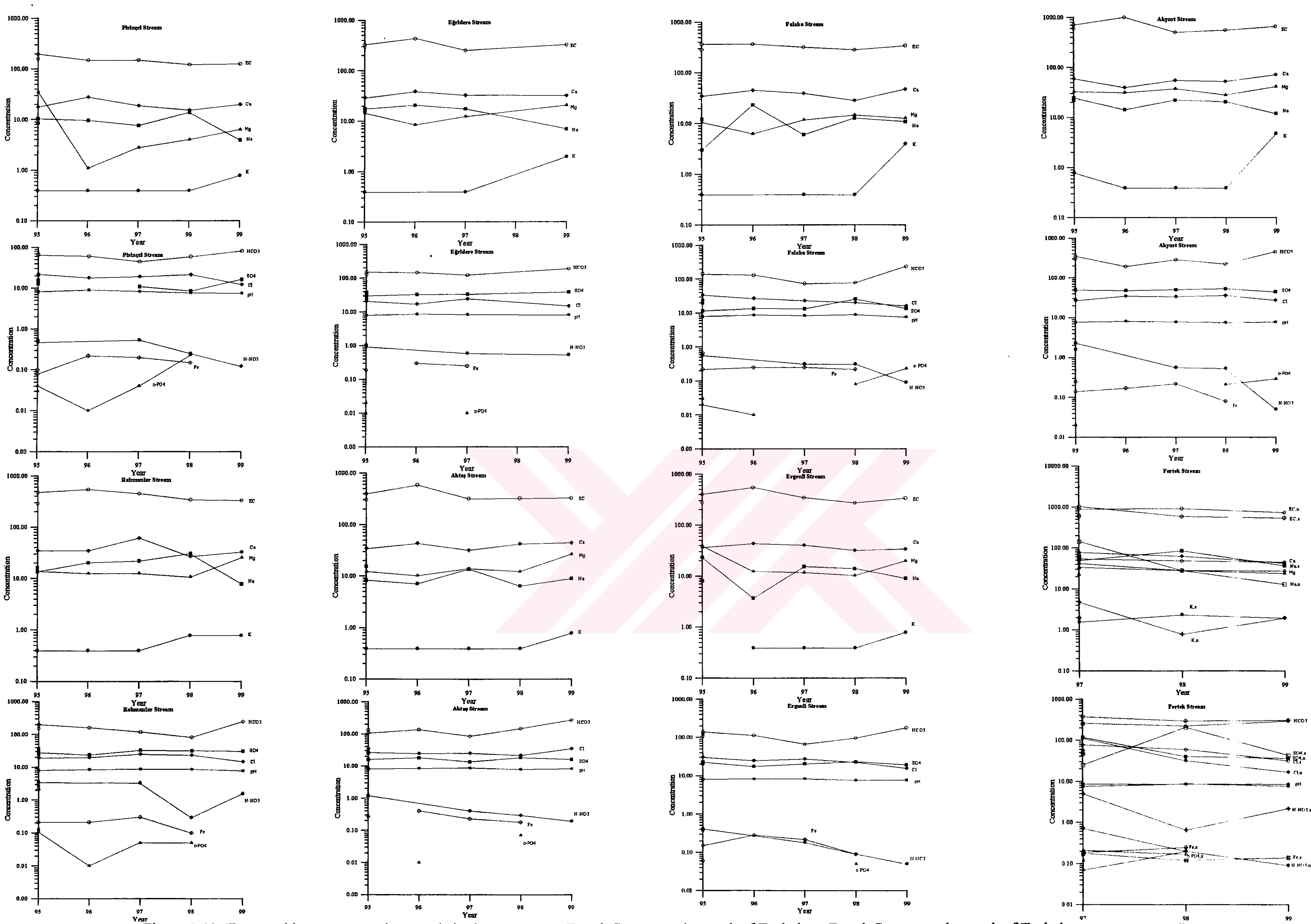
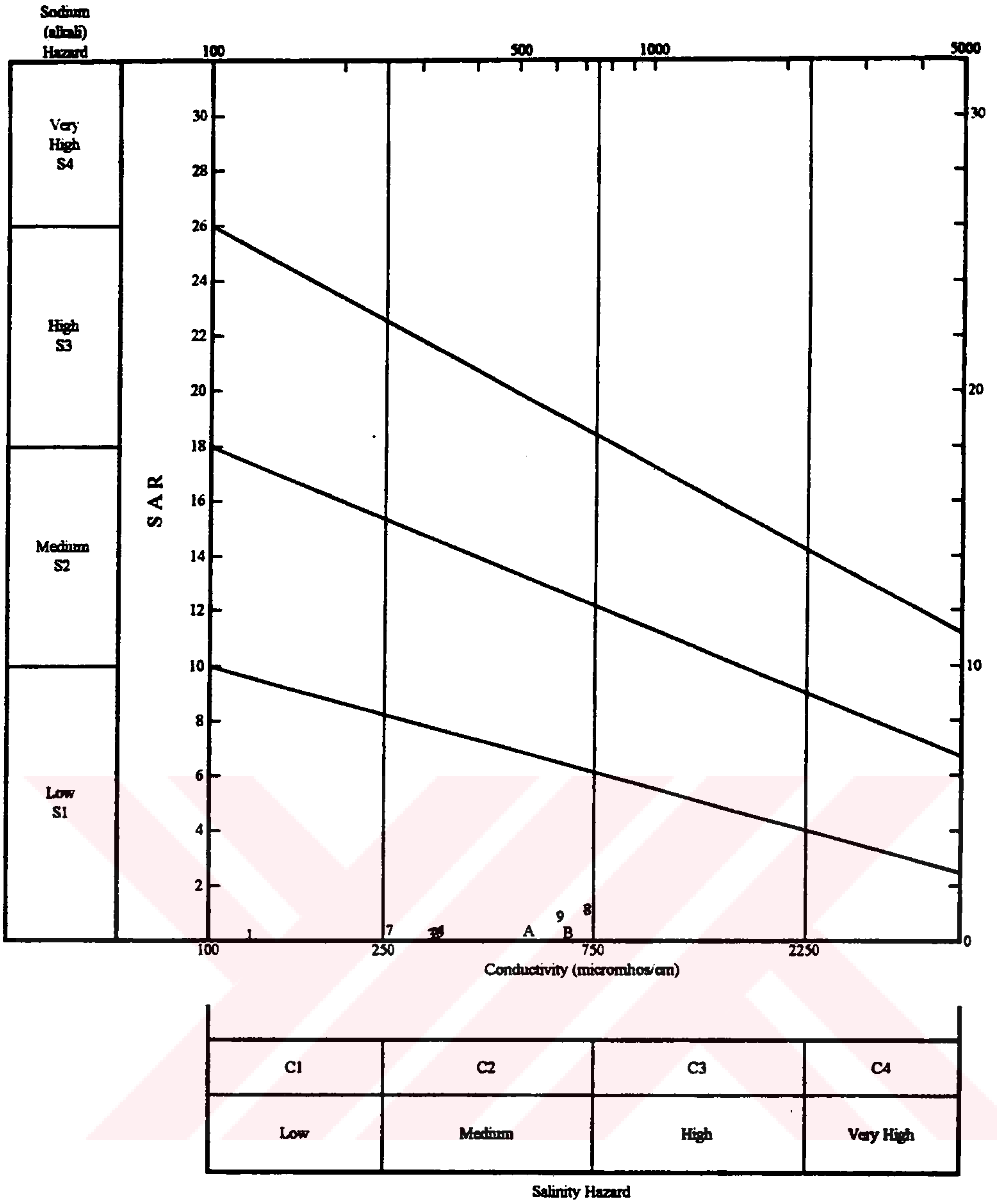


Figure 3.12. Temporal ion concentration trends in the streams. n: Fertek Stream to the north of Torbalı, s: Fertek Stream to the south of Torbalı.



1 12
2 20
3 24
4 29
5 31
6 33
7 38
8 42
9 44
A 57
B 61

Figure 3.13. Wicox diagram of the chemical analyses of samples taken from streams.

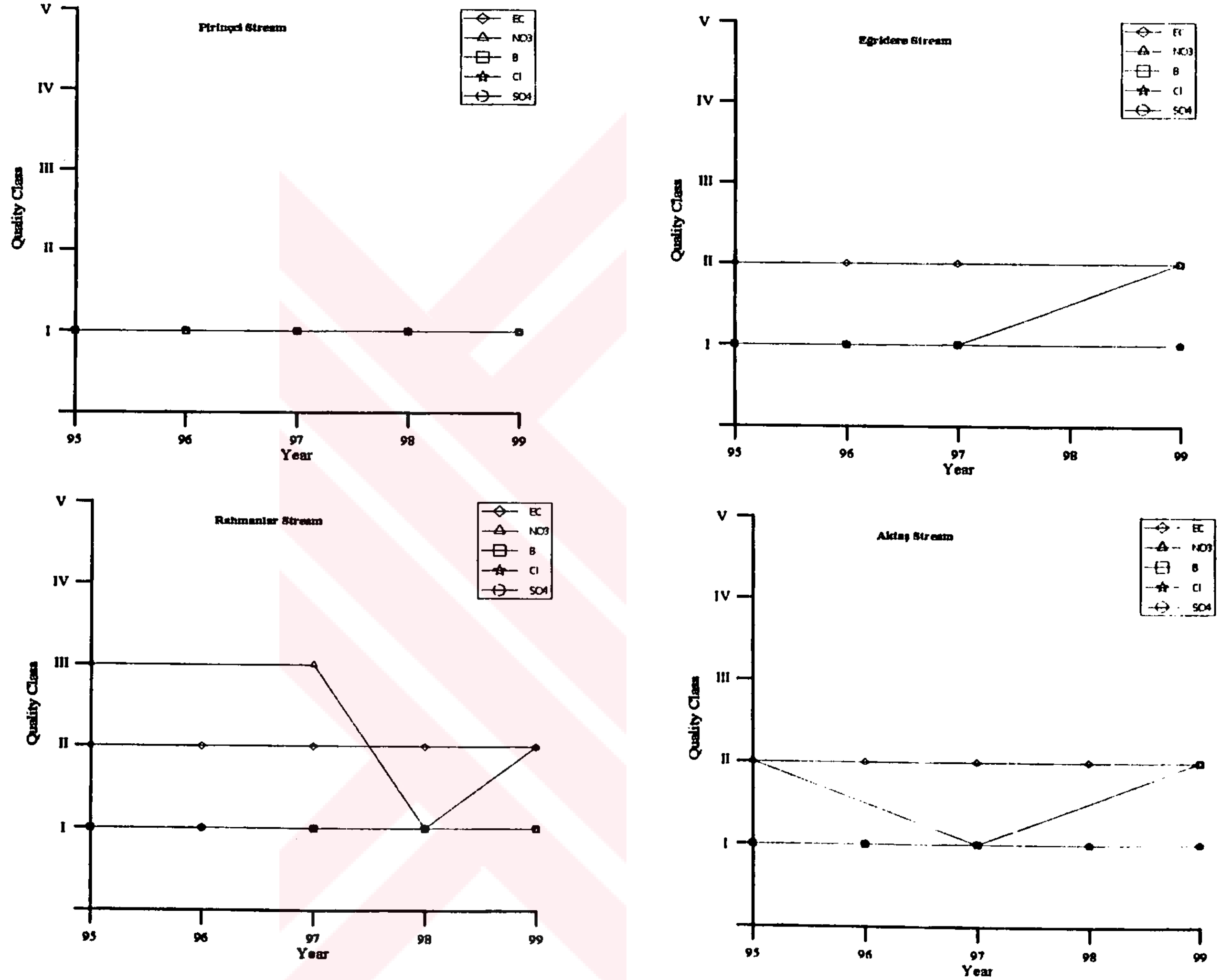


Figure 3.14. Temporal irrigation water quality trends in the streams.

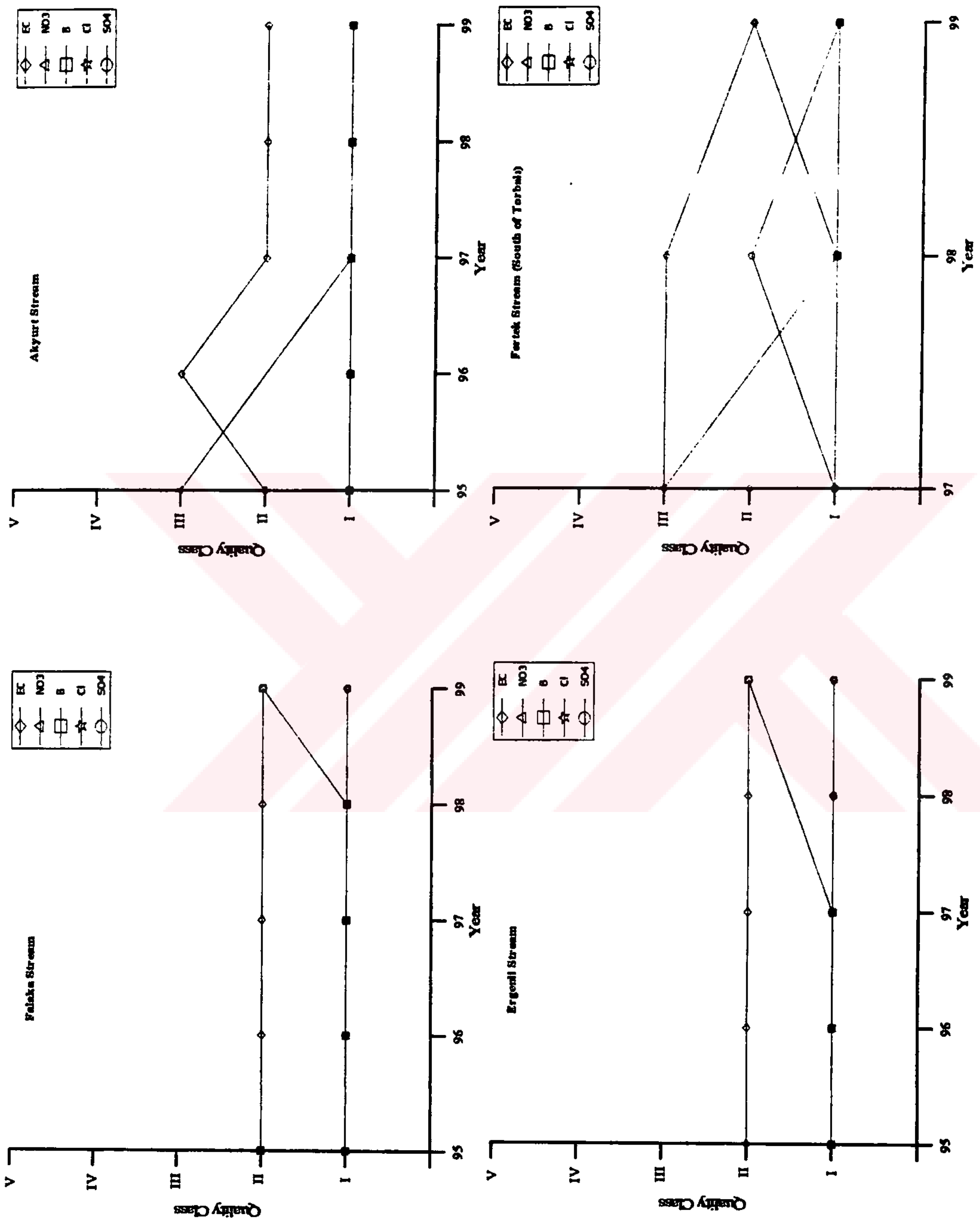


Figure 3.14 continued

3.3.2. K. Menderes River

Hydrochemistry

The K. Menderes river waters are Ca-HCO_3 type in the sampling locations, except at three points (Table 3.8). These are after Kiraz town in downstream direction (where Ca-Mix type), before mixing with the Fertek stream (where Mg-HCO_3 type) and before flowing into the Aegean Sea (where Mg-HCO_3 type). The ion concentrations measured in the river waters are shown in Figure 3.15 in the order of upstream to downstream together with the concentrations of the mixing stream waters. According to the samples collected in April, the upstream and downstream concentration range of the ions in the river is as follows: TDS, 100-273 mg/l; Na, 6-31 mg/l; Ca, 20-20 mg/l; Mg, 7.5-15 mg/l; K, 0.8-2.7 mg/l; HCO_3, 72-137 mg/l; SO_4, 13.6-35 mg/l; Cl, 19-25 mg/l; N-NO_3, 5.6-0.5 mg/l; F, 0.2-0.2 mg/l; and B, 0.4-0 mg/K (Table 3.8). In general, ion concentrations of the river exhibit increasing or decreasing trends depending on the concentrations of the streams mixing with it (Figure 3.15). When the ion concentrations in the river prior to the TKPF are compared with the concentrations after the TKPF, it is observed that almost all the concentrations are higher in the river water, collected after the TKPF. When the ion concentrations in the river prior to the Etibank mining facilities are compared with the concentrations after the facilities, it is observed that Cl, F, Fe, and Zn concentrations are higher in the river water collected after the facilities (Table 3.8). Increasing Mg and B concentrations are also observed in the river waters after the waste disposal area of Ödemiş Municipality.

In order to determine the temporal trends of the ion concentrations in the K. Menderes River, DSİ monitoring data collected between 1985 and 1998 in March and April were used together with the data collected during this study (Figure 3.16). The trends between 1985 and 1999 show that in the K. Menderes River (after the Etibank mining facilities) N-NO_3 and Na concentrations have decreased but those of Mg, o-PO_4 and K have increased and in the K. Menderes River (Selçuk) N-NO_3 concentration has decreased but that of K has increased.

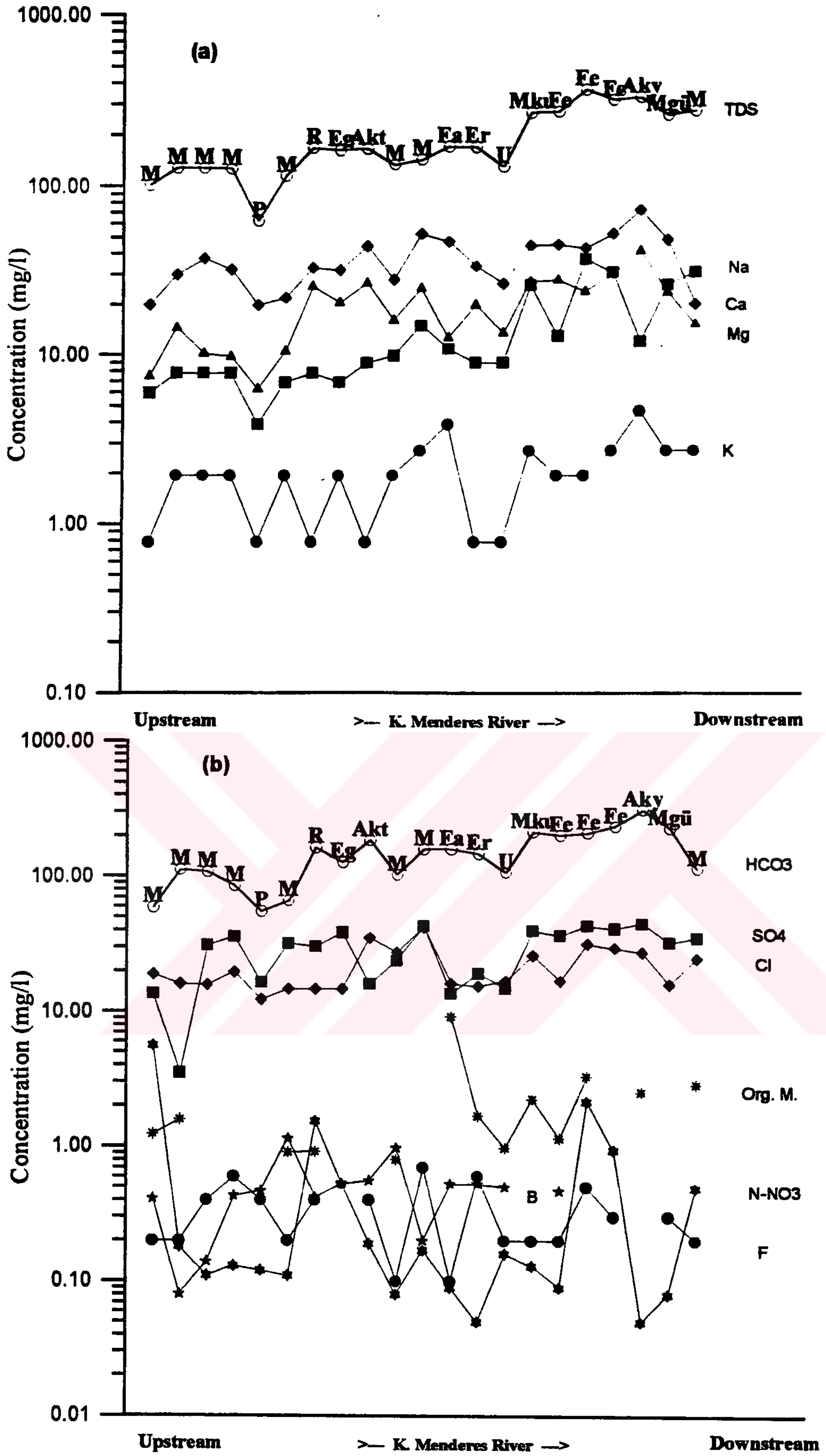


Figure 3.15. Ion concentration trends of both the streams and the K. Menderes River in April, 1999. M: K. Menderes River, MN: Northern branch of the K. Menderes River, MS: Southern branch of the K. Menderes River.

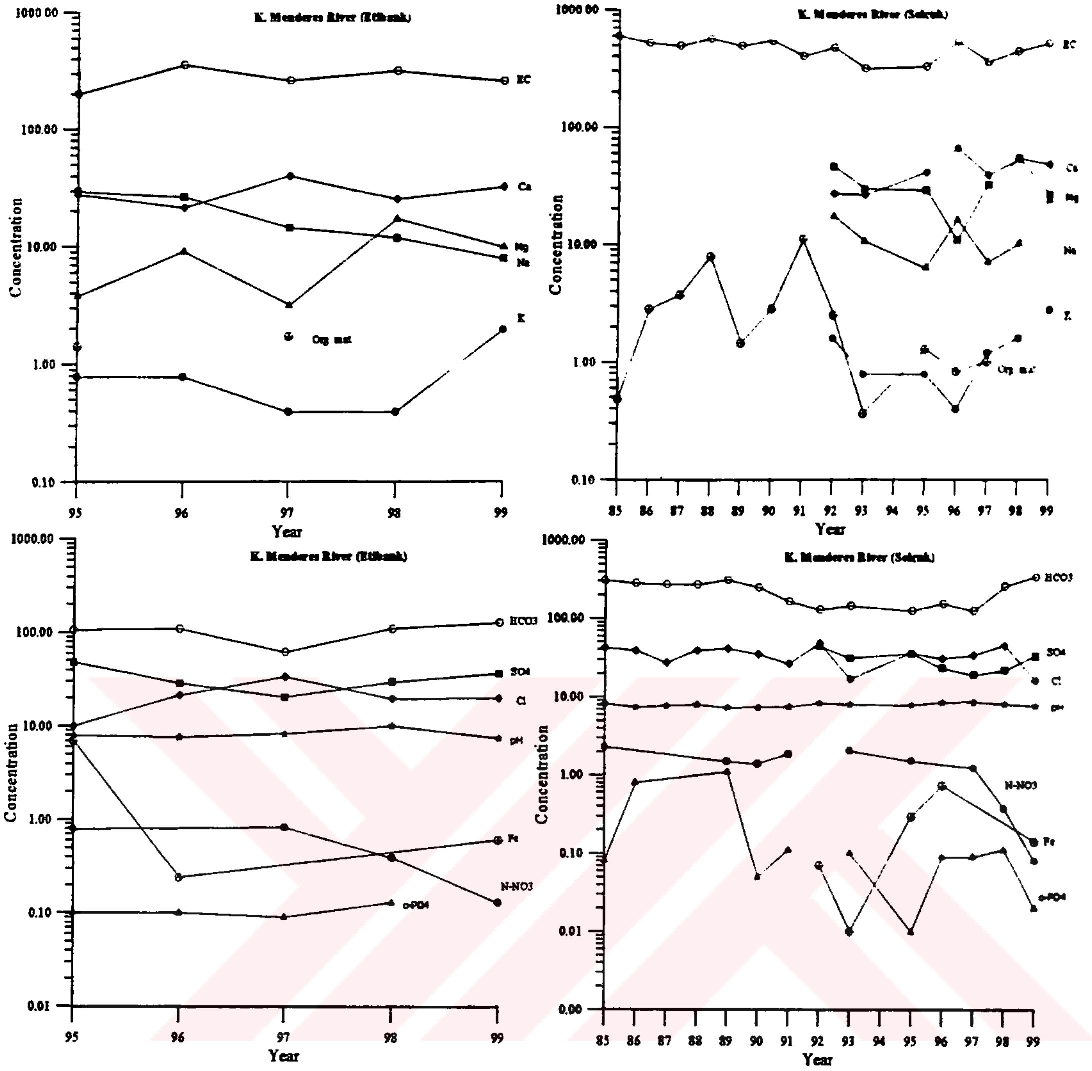
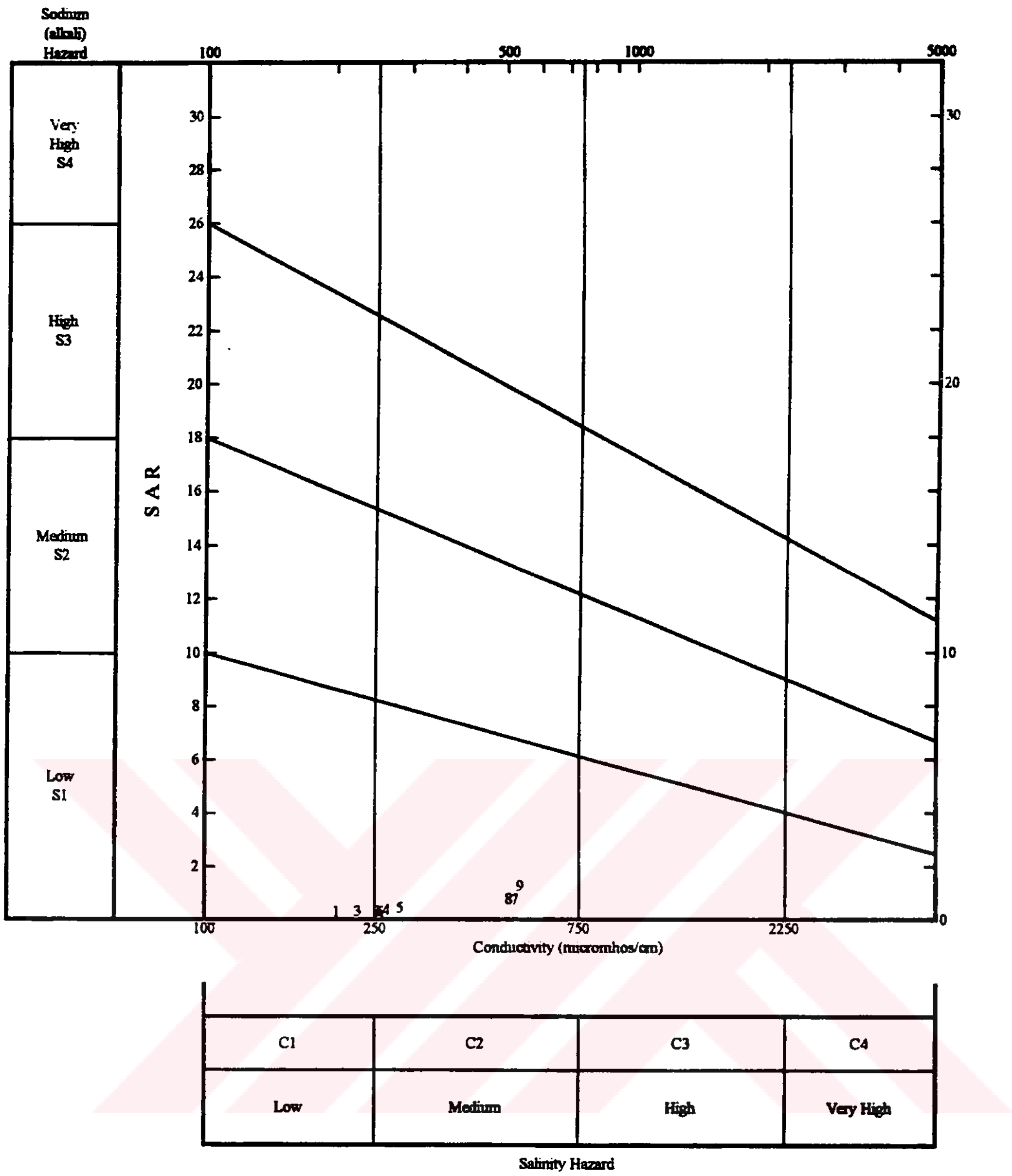


Figure 3.16. Temporal ion concentration trends in the K. Menderes River.

Water quality

The K. Menderes river waters include fresh water and their hardness type change from soft (0) to hard (2). Almost at all the sampling locations. river waters are either in very good (I) or in good (II) classes with respect to the all considered irrigation water limits (Table 3.8). Salinity and sodium alkali hazard (SAR) classification of the K. Menderes river samples are shown in Figure 3.17. Only at two points, the river waters are in usable (III) class. One of these points is located after the waste disposal site of Kiraz town where it is in usable class with respect to the NO_3 limits. The other point is located after the waste disposal site of Ödemiş town where it is in usable class with respect to the B limits. Temporal trends of the irrigation water classes in the streams are shown in Figure 3.18.

With respect to the all inland water sources limits, except to those of N-NO_2 and B, the river waters are either in high quality (I) or in medium quality (II) classes at the sampling locations (Table 3.8). Waters of the river are in very low quality (IV) class with respect to the B inland water sources limits at the sampling point located after the waste disposal site of Ödemiş Municipality. The class of the river stream waters with respect to the N-NO_2 inland water sources limits is in low quality (III).



1	1
2	10
3	13
4	22
5	28
6	4
7	43
8	46
9	47
A	8

Figure 3.17. Wicox diagram of the chemical analyses of samples taken from K. Menderes River.

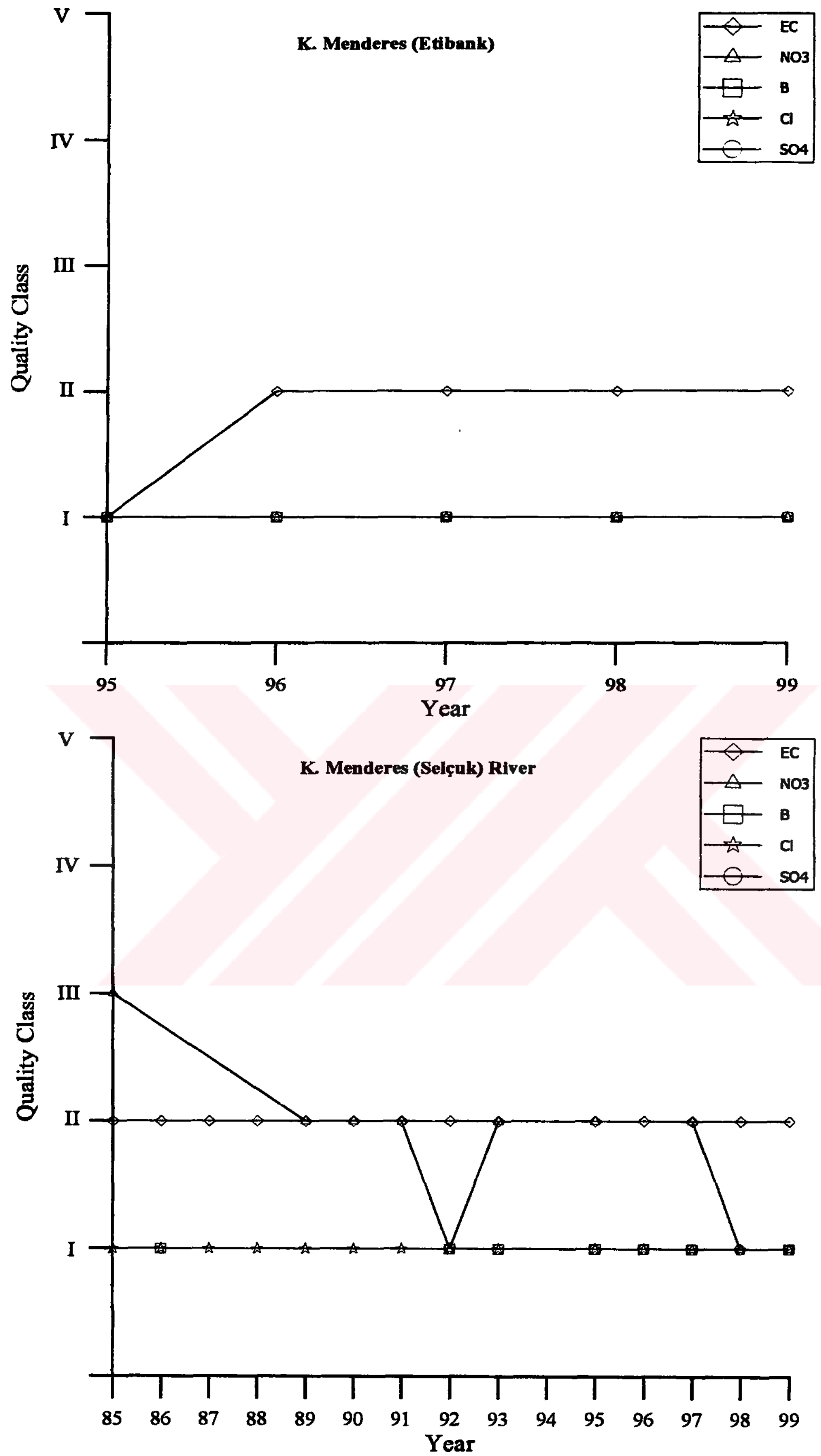


Figure 3.18. Temporal irrigation water quality trends in the K. Menderes River.

CHAPTER IV

CONTAMINATION

4.1. Contamination Sources

The major point contamination sources that could cause the contamination observed in the waters are as follows: waste disposal sites and sewage systems of the municipalities, factories and mines. The distributions of these sources in the basin were determined and are shown in Figure 4.1. All the municipalities in the basin discharge their sewage waters without any treatment either to the K. Menderes River or to its tributaries. The waste disposal sites of all but Torbalı, Oğlananası, Çaybaşı, and Tire municipalities are located either in the K. Menderes river channel or in the channels of its tributaries (Figure 4.1a). Disposed waste amounts of the municipalities and liquid phase discharge amounts of some industrial facilities in the basin are given in Table 4.1. The industrial facilities concentrate along the Fertek stream to the north and south of Torbalı, to the north of Tire and vicinity of Ödemiş town (Figure 4.1b). Mines that deteriorate the water quality in the basin are located between Ovakent and Beydağ, to the east of Ödemiş and to the north of Bayındır (Figure 4.1c). The other point contamination source in the basin is the salt-water determined in some well waters of the Selçuk sub-basin. The major non-point contamination sources in the basin are related to agricultural activities and cattle feeding operations. The amounts of chemical fertilizers and the other agro-chemicals used in agricultural activities are listed in Table 4.2. Metamorphic units are thought to be responsible of relatively high boron concentrations observed in the

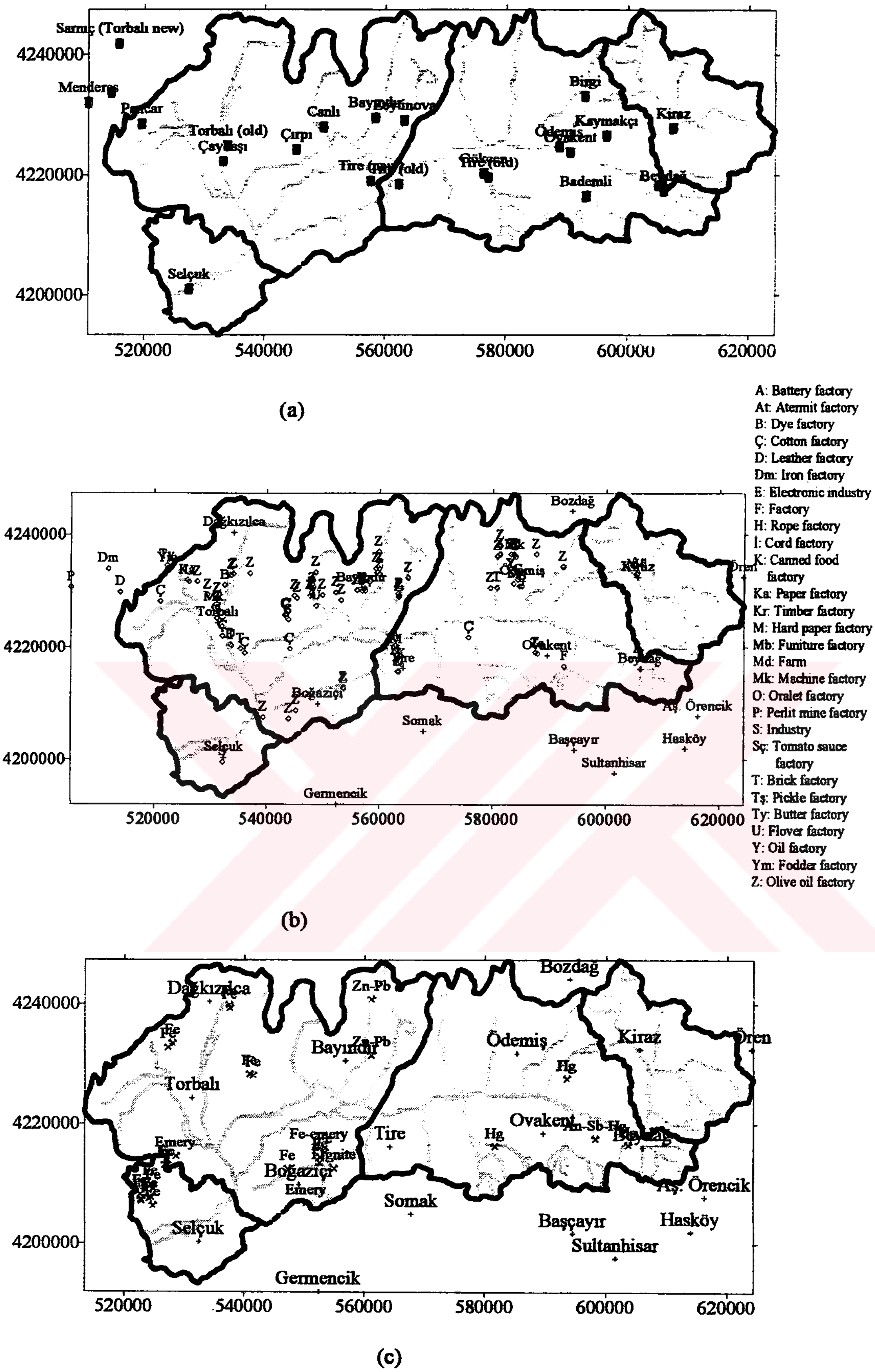


Figure 4.1. Geographic distribution of (a) the waste disposal sites of the municipalities, (b) industrial facilities, and (c) mines and mineralizations in the basin.

Figure 4.2a. A scene from Ödemiş sewage discharged to surface water, near Karakova.

Figure 4.2b. A scene from Ödemiş dumpsite on K. Menderes river bank.

Table 4.1. (a) Amounts of waste disposed by the municipalities and (b) amounts of discharged water by the industrial facilities in the basin. Distribution of the locations is shown in Figure 4.1.

(a)

Municipality	Quantity ton/day
Bademli	2.5
Bayındır	20
Beydağ	15
Birgi	0.5
Canlı	1
Çaybaşı	5
Çırpı	3
Gökçen	3
Kaymakçı	1.5
Kiraz	5
Menderes	10
Oğlananası	2
Ovakent	2.5
Pancar	2
Tire	25
Torbalı	30
Zeytinova	0.5

(b) (IOFW, 1998)

City	Name	Quantity of waste water (m3/day)
Tire	Mithatbey canned food	10
	Tariş olive oil	20
	Tire Kutsan Paper	2500
Ödemiş	Öztusan tomato sauce	100
	Tariş Olive oil	20
	Selçuk food	225
	Denkon pickle	160
Torbalı	Sepiciler leather	1000
	Günkol AŞ	9
	Philsa tobacco	7873
	Tukaş canned food	60
	Ürün paper	50
	Ente Ind.	6
	Opel Car	85

Table 4.2 (a) Chemical fertilisers and (b) the agri-chemicals used in the basin (Nippon, 1996).

(a)

(ton)

Chemical Fertilisers		1992	1993	1994	Average
Ammonium Sulphate		8,076	9,166	6,380	7,874
Ammonium Nitrate		9,492	10,732	11,285	10,503
Ure		6,711	9,051	6,191	7,318
DiAmmonium Phosphate		1,088	1,432	1,320	1.280
Potassium Sulphate (50%K)		485	1,022	573	693
Triple Super Phosphate		433	540	652	542
Compound 15-15-15		10,018	10,908	11,828	10,918
Compound 20-20-0		5,612	3,981	3,697	4,430
Ammonium Nitrate		1,330	75	63	489
Potassium Nitrate		0	18	1	6
Calcium Ammonium Nitrate		49	856	249	385
Compound 25-5-10		0	594	186	260
Compound 25-5-0		374	23	22	140
Compound 26-13-0		0	0	0	0
Compound 15-45-0		22	0	1	8
Compound 11-52-0		0	0	5	2
Total		45,682	50,391	44,447	44.847
Conversion	N21% fertiliser	50,734	56,977	47,885	51,865
	P17%	19,466	19,708	19,965	19,713
	K50%	3,416	4,426	4,159	4,000
Total		73,772	81,111	71,979	75,621
Kg/ha					
	N21% fertiliser	301	338	284	307
	P17%	115	117	118	117
	K50%	20	26	25	24

(b)

Agricultural Chemicals	1993		1994		Average		Kg.lt/ha
	Amount of brand	Quantity sold	Amount of brand	Quantity sold	Amount of brand	Quantity sold	
Insektisit	100	477,113	107	420,571	104	448,842	1.2
Fungisit	63	425,502	93	487,493	78	456,498	1.2
Herbisit	31	120,913	35	324,050	33	222,482	0.6
Akarisit	19	41,861	15	53,214	17	47,538	0.1
Nematosit	6	4,400	8	12,410	7	8,405	0.0
Fumigant	5	67,152	15	101,057	10	84,105	0.2
Plant growth regulators	11	22,706	17	30,828	14	26,767	0.1
Others	7	194,069	13	191,124	10	192,597	0.5
Total	242	1,353,716	303	1,620,747	273	1,487,232	3.9

Ergenli thermal water, in the springs of Beydağ area and along the faults zones in the basin.

When the locations of these contamination sources are compared with both the quality data and the related water quality maps, it is observed that these sources have deteriorated the quality of both surface and ground waters in the basin. Primary areas where industrial facilities have contaminated waters of the basin are to the north of Tire town (by TKPF), south of Torbalı town (by industrial facilities located along the Fertek stream channel), and northeast of Beydağ. The waste disposal sites and sewage discharges of many municipalities in the basin, especially those of Ödemiş and Tire, have deteriorated the water quality along the K. Menderes river channel. The main areas where mines have degraded the water quality in local scale are in the vicinity of Beydağ, Mescitli, and Kaymakçı towns. The source of contamination that was detected in local area in Mescitli town, where gas poisonings have caused deaths, is thought to be an unknown mineralization in the area due to very high sulfate concentrations and very low pH values in the groundwater. Nitrate and potassium concentrations in some locations indicate the degrading effects of the agricultural activities. The degrading effects of agricultural activities are manifested especially between Ödemiş and Tire and to the east of Torbalı around Develi town.

The Salt Water Problem in the Selçuk Sub-basin

High concentrations of ions, especially that of Cl, in the groundwaters of the Selçuk sub-basin indicate a salt water problem. This problem could be caused by two possible mechanisms:

- The observed salt water is a sea water intrusion that has been caused by an excessive pumping.

- The observed salt water is not related to an excessive pumping. The salt water is a remnant of the old sea water intrusion (took place during post-Glacial rise of sea-level; Erinç, 1978) that has been refreshed by the encroaching fresh water from the basin at present. The salinity is also contributed by the reactions that have taken place in the aquifer between salt minerals and encroaching fresh water.

One of the most important tools, that could be used to investigate which one of these mechanisms is operative in the sub-basin, is chloride ion. Because chloride ion does not react with the minerals normally present in these type of environments. Thus, its mass increases or decreases only as a result of mixing. If sea water intrusion is operative at present, chloride concentration of the effected well waters would increase as a function of increasing time. However, the time here could be tens of years depending on the amount of groundwater being discharged from the aquifer by pumping. In addition, during this time chloride concentration would exhibit increasing and decreasing trends because of seasonal effects, especially during wet period. Because the aquifer in the sub-basin would be fed by fresh water coming from the basin and water discharge by pumping would be at minimum during wet period. In other words, chloride concentration prior to the pumping period in the well water, that has been affected by sea water, could be less than the concentration after pumping period of the previous year. This situation is proven in the other parts of the world where the sea water intrusion problem exists (Melloul and Goldenberg, 1997). The increasing-decreasing chloride trends become a continuously increasing trend after a certain mixing ratio of seawater. However, this point forward it is too late to clean up the aquifer contaminated by seawater.

If the second mechanism is operative in the sub-basin, a decreasing chloride trend would be observed as a function of increasing time in the well water whose salinity is already high. If this mechanism, indeed has been operative in the sub-basin for hundreds of years, chloride concentration of the well water in the begining of each pumping period should be less than the concentration measured in the begining of previous year's pumping period. However, because of changing seasonal fresh water feeding amounts, chloride concentrations could exhibit changing trends.

In the light of this information, chloride concentrations collected both by the DSİ and by the author from the same well waters of the Selçuk sub-basin were evaluated together. Chloride concentrations determined in waters (Table I.5, DSİ no: 61, 62, 63, 64, 65, 66) of the Selçuk sub-basin in June (prior to the pumping period) were plotted against time to observe the trends (Figure 4.3a). The Kazancı spring water (DSİ no: 66), located at the northwest of the sub-basin, exhibits an increasing chloride trend from 1995 to 1998 prior to the pumping period. Therefore, it could be concluded that this spring water (emanating from a calcareous unit) has been contaminated by sea water and there is a sea water intrusion in this area. However, it is not possible to reach a similar or an opposite conclusion for the well waters that are coming also from calcareous units along the southern boundary of the sub-basin. Chloride concentrations of the wells (64, 63, 62, 61), that are located from shore line to inland along a more or less straight line, are decreasing at a given time (Figure 4.3a). However chloride contents of these well waters between 1995 and 1998 are similar.

Weather they were collected prior to or after pumping period, chloride concentrations of all well waters (DSİ no: 61, 62, 63, 64, 65, 66, 94, 95, 96, 97, 98, 99) measured between 1992 and 1998 were used to draw the best fit trend of chloride concentration in each well as a function of time (Figure 4.3b). Note that, there is only after pumping period data for the wells of the DSİ (no: 94, 95, 96, 97, 98, and 99). The aim here is to determine the overall chloride trend in the considered time period. According to these best fit lines, waters of 61, 62, 64, 66, 94, 97, and 98 exhibit increasing chloride concentration trends but those of 63, 65, 95, and 99 show decreasing chloride concentration trends. The wells 97 and 99 are located very close to each other and their depths and located units are the same in the sub-basin. But while waters of well 97 show an increasing chloride trend, those of 99 show a decreasing one. Similar contradiction exists between waters of well 95 and well 96. These controversial trends cannot be assigned to the chloride input of the groundwaters moving from the Bayındır-Torbalı sub-basin to the Selçuk sub-basin; because these wells are fed by the groundwaters that are coming from the calcareous units located at the south of the Selçuk sub-basin.

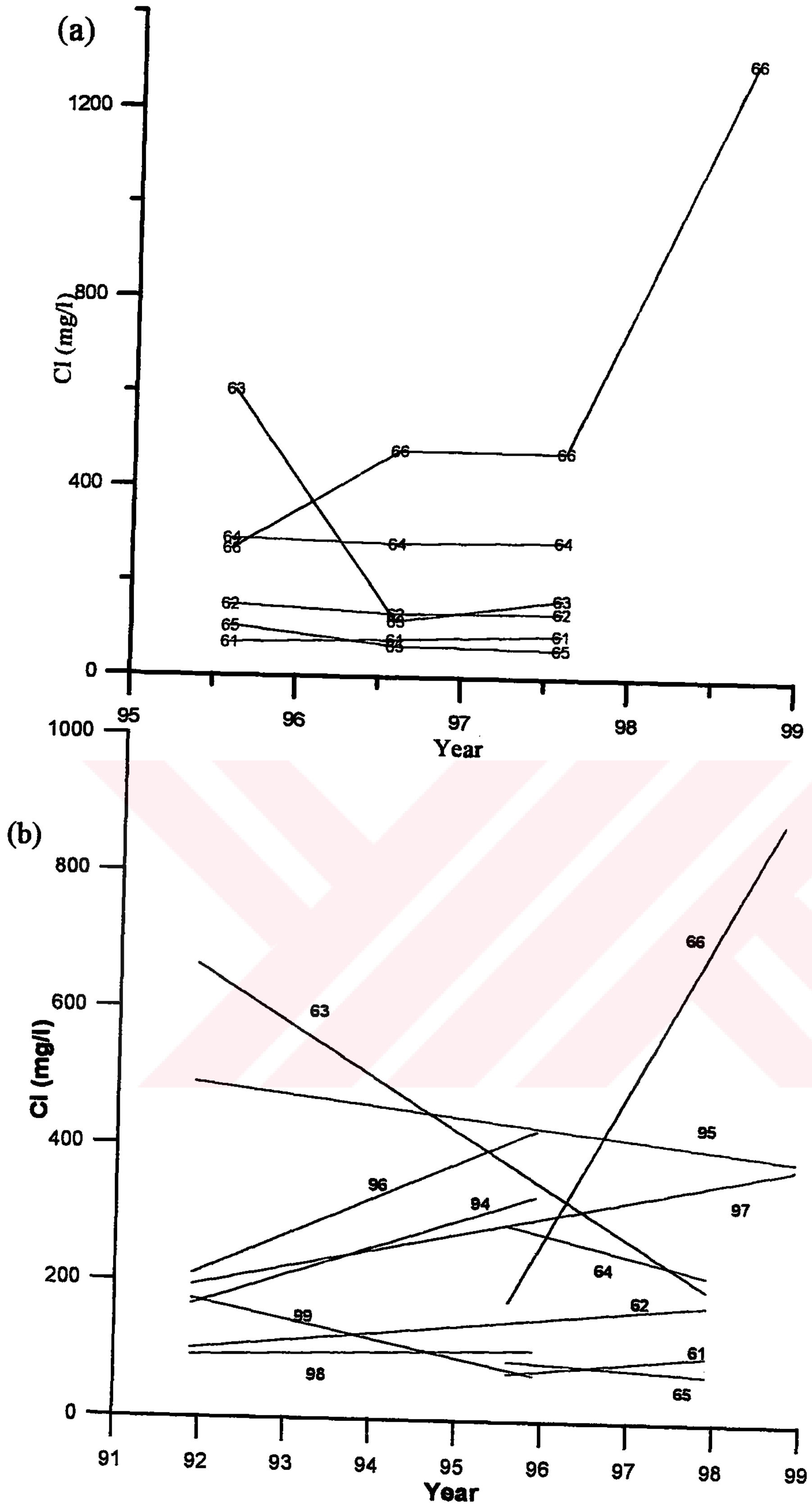


Figure 4.3. (a) Chloride concentration trends of the Selçuk sub-basin well waters in June from 1995 to 1998. (b) Chloride concentration best fit trends of the Selçuk sub-basin well waters from 1991 to 1999. For the explantion of the sample numbers see Table I.4.

According to these evaluations, it is not possible to tell for sure, which one of the mechanisms is operative in the sub-basin, except for the area of the Kazancı spring (no: 66). However, it may be said that probably sea water intrusion is operative in the sub-basin because overall trend of the lines in Figure 4.3b suggests an increasing chloride concentration. In addition, some well waters of the Selçuk Irrigation Cooperative are reported to be degrading in quality. Further investigation is needed before any conclusive statement.

4.2. Contamination Vulnerability

4.2.1. Methods

The model DRASTIC, that is developed by EPA (Environmental Protection Agency) and NWWA (National Water Well Association) by Aller et al. (1987) for the evaluation of groundwater pollution potential using hydrogeologic settings, is adapted in this study using computer environment. The acronym of DRASTIC stands for:

D: Depth to water

R: net Recharge

A: Aquifer media

S: Soil media

T: Topography-slope percentage

I: Impact of the vadose zone media

C: hydraulic Conductivity of the aquifer

The overlays that are classified into different zones using predetermined ranges (Table 4.3) were prepared for D, R, A, S, T, I, and C, separately. These

Table 4.3. (a) Range related and (b) unit related rates and the weights of the DRASTIC parameters. (Aller et al., 1987).

(a)

Depth to water table (weight=5)		Net Recharge (weight=4)		Topographic slope (weight=1)		Hydraulic Conductivity (weight=3)	
Interval (m)	Rate	Interval (cm)	Rate	Interval (%)	Rate	Interval (cm/day)	Rate
0-1.52	10	0-5.08	1	0-2	10	0-4.07	1
1.52-4.57	9	5.08-10.16	3	2-6	9	4.07-12.21	2
4.57-9.14	7	10.16-17.78	6	6-12	5	12.21-28.49	4
9.14-15.24	5	17.78-25.4	8	12-18	3	28.48-40.7	6
15.24-22.86	3	25.4 >	9	18 >	1	40.7-81.4	8
22.86-30.48	2					81.4 >	10
30.48 >	1						

(b)

Aquifer media (weight=3)		Soil media (weight=2)		Vadose zone media (weight =5)	
Unit	Rate	Unit	Rate	Unit	Rate
Weathered Metamorphic/Volkanic	3-5	Thin or absent/ River fload bank	10	Confining layer	1
Bedded sandstone, limestone and shale sequences	5-9	Thin	9	Silt/clay	2-6
Massive sandstone	4-9	Coarse alluvial with good drainage	8	Shale	2-5
Massive limestone	4-9	Weathered, moderate deep Brown soil lacking lime, moderate alluvial with good drainage	7	Limestone	2-7
Sand and pebble	4-9	Brown soil lacking lime, moderate deep	6	Sandstone	4-8
		Moderate colluvial moderate deep	5	Beddedlimestone, sandstone, shale	4-8
		Deep moderate/thin colluvial	4	Sand and pebble with significant silt and clay	4-8
		Moderate alluvial with insufficient drainage	3	Metamorphic/Volkanic	2-8
		Thin alluvial with insufficient drainage	2	Sand and pebble	6-9
		Hidromorphic	1	Karst limestone	8-10

overlays were superimposed on top of each other and the coincided areas of each overlay's polygons were drawn as another layer.

The pollution potential was graded for the polygons formed on the last layer using following equation:

$$DI = D_W D_R + R_W R_R + A_W A_R + S_W S_R + T_W T_R + I_W I_R + C_W C_R.$$

The result gives the Drastic Index (DI) of that polygon. The subscripts W and R stand for weight and rate, respectively, for each layer. The weights used for the DRASTIC calculations are given in Table 4.3.

Some assumptions associated with DRASTIC includes: (a) the contaminant is introduced from surface to ground, flushed into the groundwater by precipitation, at the same mobility of water. In other words, contaminant should penetrate soil and vadose zone and (b) Evaluation in 100 acres or larger areas are large enough for the purpose. Overlays or layers were prepared for the basin using 500 m by 500 m cell dimensions in griding and each cell was valued by the mean value. This grid was used as a mesh of common divider for all layers.

4.2.2. Depth to Water

The depth to water overlay was established by subtracting the groundwater levels given in Figure 2.5 from the topographic elevations at corresponding locations. The groundwater levels in the entire basin were numerically determined using the measured groundwater levels of METU (1999) in April through TIN (Triangulated Irregular Network) method. The depth to water value in each cell of the overlay was rated using the ranges given in Table 4.3a. Finally, these cell rates were used to draw the depth to water classification map for the entire basin (Figure 4.4a).

According to this map, the most vulnerable aquifer areas are located at the western part of the basin around Develi, South of Torbalı, West of Boğaziçi, and Selçuk sub-basin. In addition, some areas between Kiraz and Beydağ and to the north of Kiraz have a relatively high contamination potential with respect to the depth to water rating.

4.2.3. Recharge

The recharge overlay was established using the measured groundwater level differences between October, 1998 and April, 1999 of METU (1999) through TIN method. Once the differences in the basin were determined, they were multiplied by the storage coefficients in related locations. The grid of storage coefficient was established using the storage coefficient values of METU (1999) through natural neighbourhood (NN) method. Recharge value in each cell of the overlay was rated using the ranges given in Table 4.3a. These cell rates were used to draw the recharge classification map for the entire basin (Figure 4.4b). According to this map, the majority of the basin has high contamination vulnerability.

4.2.4. Aquifer Media

The aquifer units that were determined previously (Yılmaz, 1999) using 293 well logs were rated on the basis of the limits given in Table 4.3b. These rates were then overlayed on a map to classify the aquifer media in the basin (Figure 4.4c). According to this map, the most vulnerable areas are located at the east and in the middle parts of the basin with respect to the aquifer media rating.

4.2.5. Soil Media

The soil media map of the basin were adapted and digitized from Topraksu (1974). In the preparation of the map (Figure 4.4d), the soil types were rated using the limits given in Table 4.3b. According to this map, the K. Menderes river channel, to the east of Selçuk, and vicinity of Ödemiş, Tire,

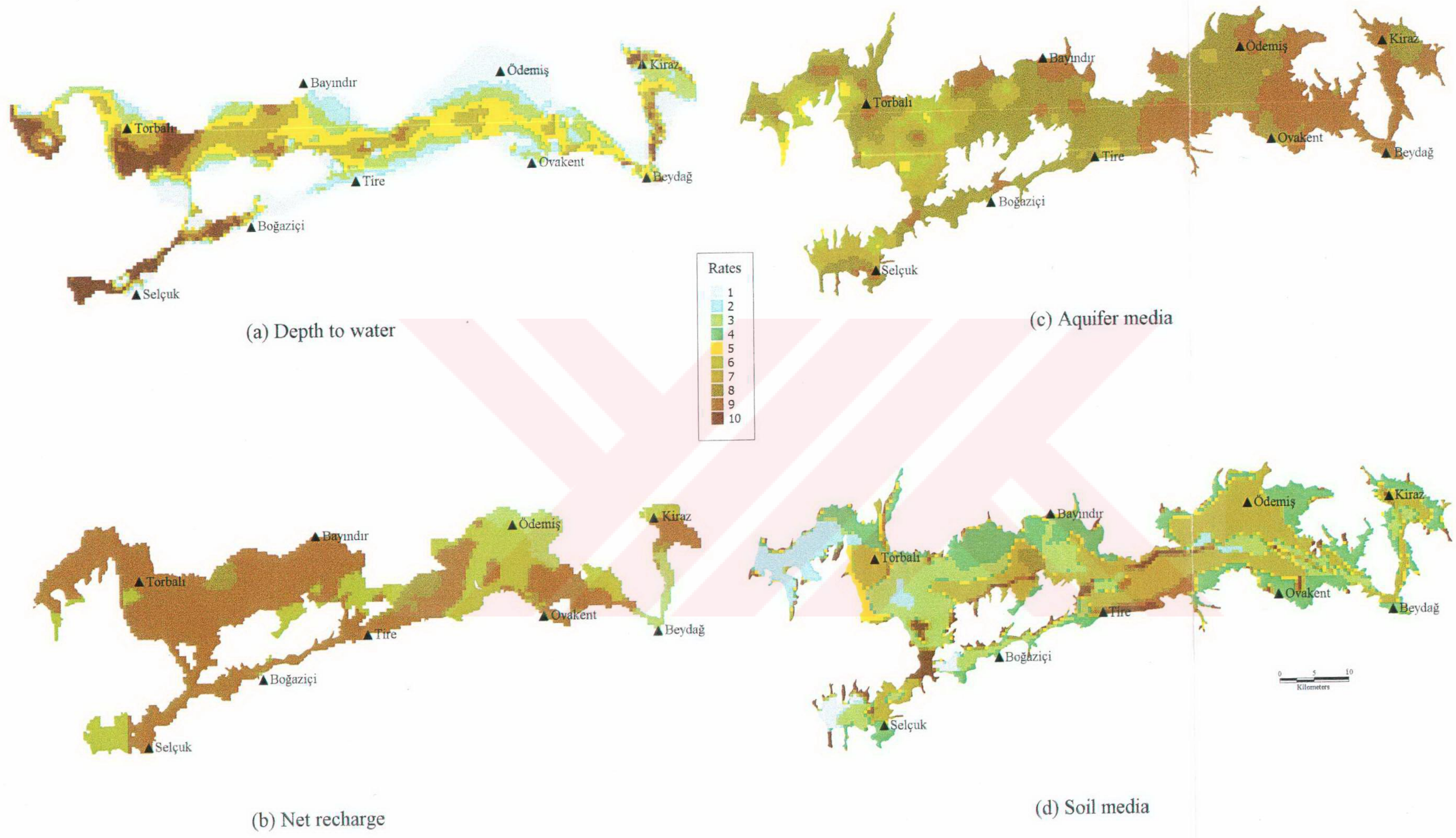


Figure 4.4. Wet season contamination potential distribution in the basin with respect to (a) the depth to water, (b) the net recharge, (c) the aquifer media and (d) the soil media rating.

Belevi and Torbalı towns are the most vulnerable areas with respect to soil media rating.

4.2.6. Topography-slope Percentage

The slopes that were determined from the topographic maps of the basin were rated using the percent intervals given in Table 4.3a. These rates, then were used to draw the topography-slope percentage map of the basin (Figure 4.5a). The map shows that almost whole basin carries a high contamination potential with respect to topographic slope rating.

4.2.7. Impact of the Vadose Zone Media

90 of 416 wells were chosen on the basis of both their lithological characteristics and their distribution in the basin to characterise the vadose zone media in April, 1999. The logs of these wells were evaluated and the vadose zone lower boundary has been determined one by one. In order to assign a rate to each well, the following formula has been used:

$$R = \frac{D}{\sum_{i=1}^{n} \frac{di}{ri}}$$

where R is the mean rate, D is the total thickness of n units, r_i is the rate obtained from Table 4.3b and d_i is the thickness of ith unit. Once the mean rates were calculated for each well, a grid map was prepared using the TIN method. The cell rates were then used to draw the classification map of the vadose zone media (Figure 4.5b).

According to this map, the highest contamination potential including areas in the basin are located to the west of Beydağ and Kiraz, between Ödemiş and Bayındır, vicinity of Ödemiş and Bayındır, along the banks of Fertek stream channel and to the south of Selçuk.

4.2.8. Hydraulic Conductivity of the Aquifer

The hydraulic conductivity classification map was prepared using the conductivity overlay of METU (1999) on the basis of the rates given in Table 4.3a. The hydraulic conductivity classification map of the basin (Figure 4.5c) indicates that the highest contamination vulnerability exists around Bayındır town and to the north of Çırpı.

4.2.9. DRASTIC

The rates of each layer stated above was multiplied by its related weight (given in Table 4.3) and then the results were summed up to obtain the general DRASTIC index of each cell in the basin. These indices were then used to draw the DRASTIC index map of the basin for wet season (Figure 4.5d). According to this map, the highest contamination potential including areas are located between Ödemiş and Tire along the K. Menderes river channel and to the north of it, to the west of Boğaziçi, south and east of Torbalı, and vicinity of Çırpı, Belevi, Selçuk and Develi.

In the light of these maps and the previously stated contamination sources (sewage, disposal sites, factories, mines, agricultural activities), it could be concluded that the groundwaters have a high risk of contamination along the flow channels of the K. Menderes River and the Fertek Stream. The risk analyses will be presented in the following section.

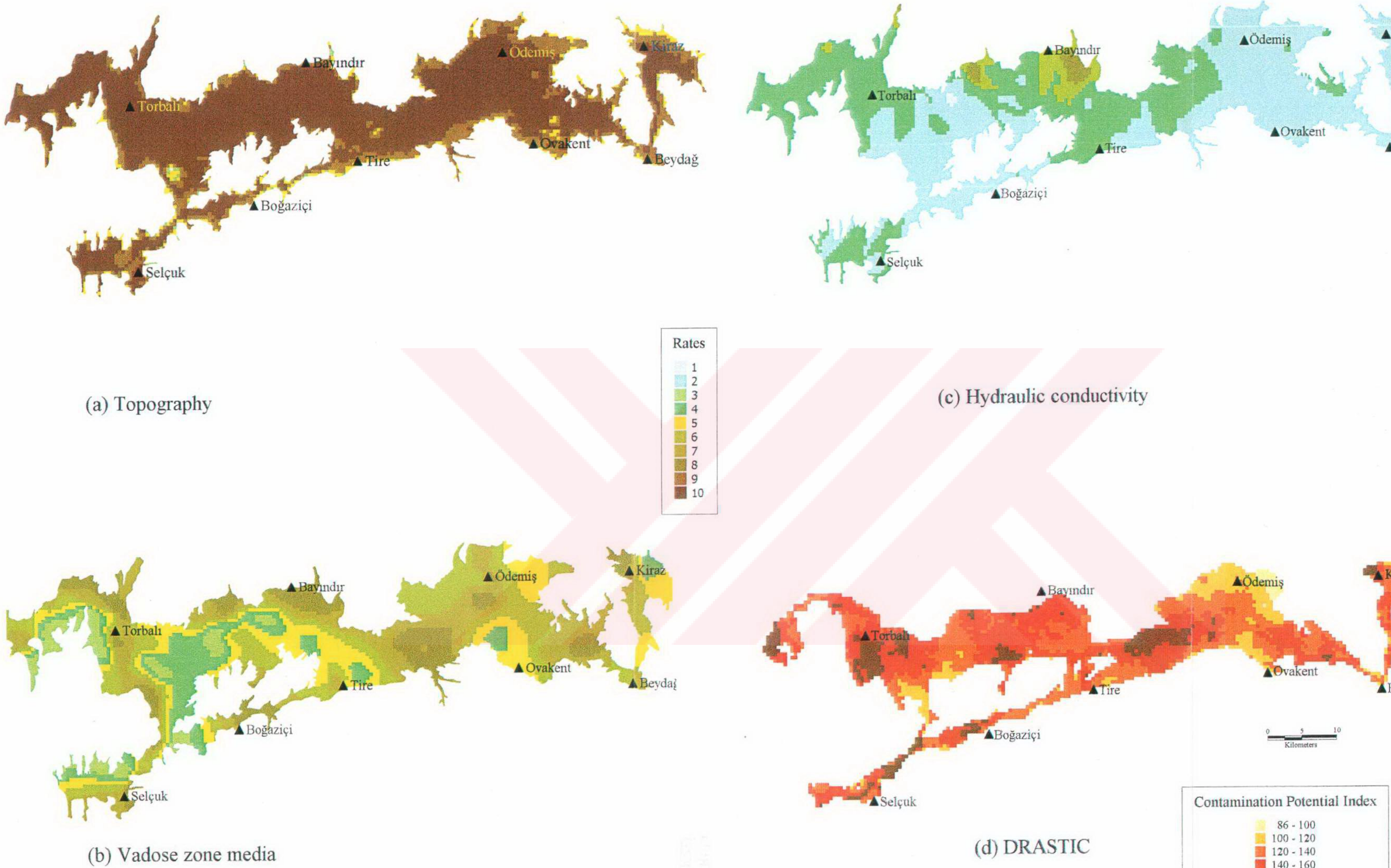


Figure 4.5. The wet season contamination potential distribution in the basin with respect to (a) the topography, (b) the vadose zone media, (c) the hydraulic conductivity ratings and (d) the DRASTIC index.

4.3. Contamination Risk

The contamination vulnerability map of the basin, prepared using hydrogeological parameters only, does not necessarily provide an information about the contamination risk in a given area Aller et al., (1987). Therefore, in order to establish contamination risk maps for the irrigation water in the basin, water quality data presented earlier were combined with the vulnerability data in such a way that DRASTIC index of a given location is multiplied by the related irrigation water parameter class (taken as an integer number) at the same location and divided by both the maximum DRASTIC index and the maximum class number.

$$R = \frac{DI \times IC}{DI_{max} \times IC_{max}} \times 100$$

Where R is the risk index, DI is DRASTIC index, IC is irrigation class at that location as an integer number, DI_{max} and IC_{max} are the maximum DRASTIC index and maximum irrigation class numbers in whole basin respectively.

Once the risk indices in the basin for each irrigation water parameter were determined, an overlay was prepared using those indices. In the overlays, the risk indices were categorised under 5 groups, representing 0-20 (I), 21-40 (II), 41-60 (III), 61-80 (IV) and 81-100 (V) percent contamination risks owned by a given location. The results are presented below. It should be kept in mind that the risk maps presented below do not based on systematic risk analyses. In other words, the maps do not present risks that established through considering all the risk parameters (e.g. source discharge rates and intervals, retardation) numerically but rather based on only hydrogeological vulnerability and present contamination data.

4.3.1. Irrigation Water EC Risk

The EC contamination risk overlay given in Figure 4.6a suggests that the groundwaters located to the north of Tire and to the northwest of Selçuk carry the highest contamination risk (V and IV) for irrigation purposes in the basin. The secondary EC contamination risk (III) bearing groundwaters are located along the K. Menderes river channel from south of Kiraz to the west of Beydağ, to the west of Ödemiş (Karakova vicinity), south of Bayındır, and west of Boğaziçi and along the Fertek stream channel to the south and north of Torbalı. The remaining groundwaters in the basin have relatively low EC contamination risk (II) for irrigation.

4.3.2. Irrigation Water Cl Risk

The Cl contamination risk overlay given in Figure 4.6b indicates that the groundwaters located to north of Tire and to the northwest of Selçuk carry relatively high contamination risk (IV and III) for irrigation purposes in the basin. Majority of the remaining groundwaters in the basin have low Cl contamination risk (I) for irrigation.

4.3.3. Irrigation Water NO_3 Risk

The NO_3 contamination risk overlay given in Figure 4.6c exhibits that relatively high contamination risk (IV) for irrigation purposes in the basin is in the groundwaters that are located along the K. Menderes river channel between Beydağ and Ödemiş and to the west of Ödemiş (Karakova vicinity). The secondary NO_3 contamination risk (III) bearing groundwaters are located along the K. Menderes river channel from Kiraz to Tire, to the north of Torbalı and in the vicinity of Develi. Majority of the remaining groundwaters in the basin have relatively low NO_3 contamination risk (II) for irrigation.

4.3.4. Irrigation Water B Risk

The B contamination risk overlay given in Figure 4.6d suggests that in general groundwaters in the basin have low (II-I) contamination risk for irrigation purposes. Some groundwaters in local areas have relatively high contamination risk (III) for irrigation in the basin. These areas are located along the northern boundary of the alluvium between Ödemiş and Tire and to the northwest of Selçuk.

4.3.5. Irrigation Water SO_4 Risk

The SO_4 contamination risk overlay given in Figure 4.6e shows that groundwaters in the basin have very low (I) contamination risk for irrigation purposes. Relatively high (II) SO_4 contamination risk bearing groundwaters are located to the north of Tire.

4.3.6. Irrigation Water Na% Risk

The Na% contamination risk overlay given in Figure 4.6f indicates that the groundwaters located to the northwest of Selçuk carry relatively high contamination risk (IV and V) for irrigation purposes in the basin. The groundwaters located to the north of Tire bear medium (III) contamination risk. Majority of the remaining groundwaters in the basin has low Na% contamination risk (I) for irrigation.

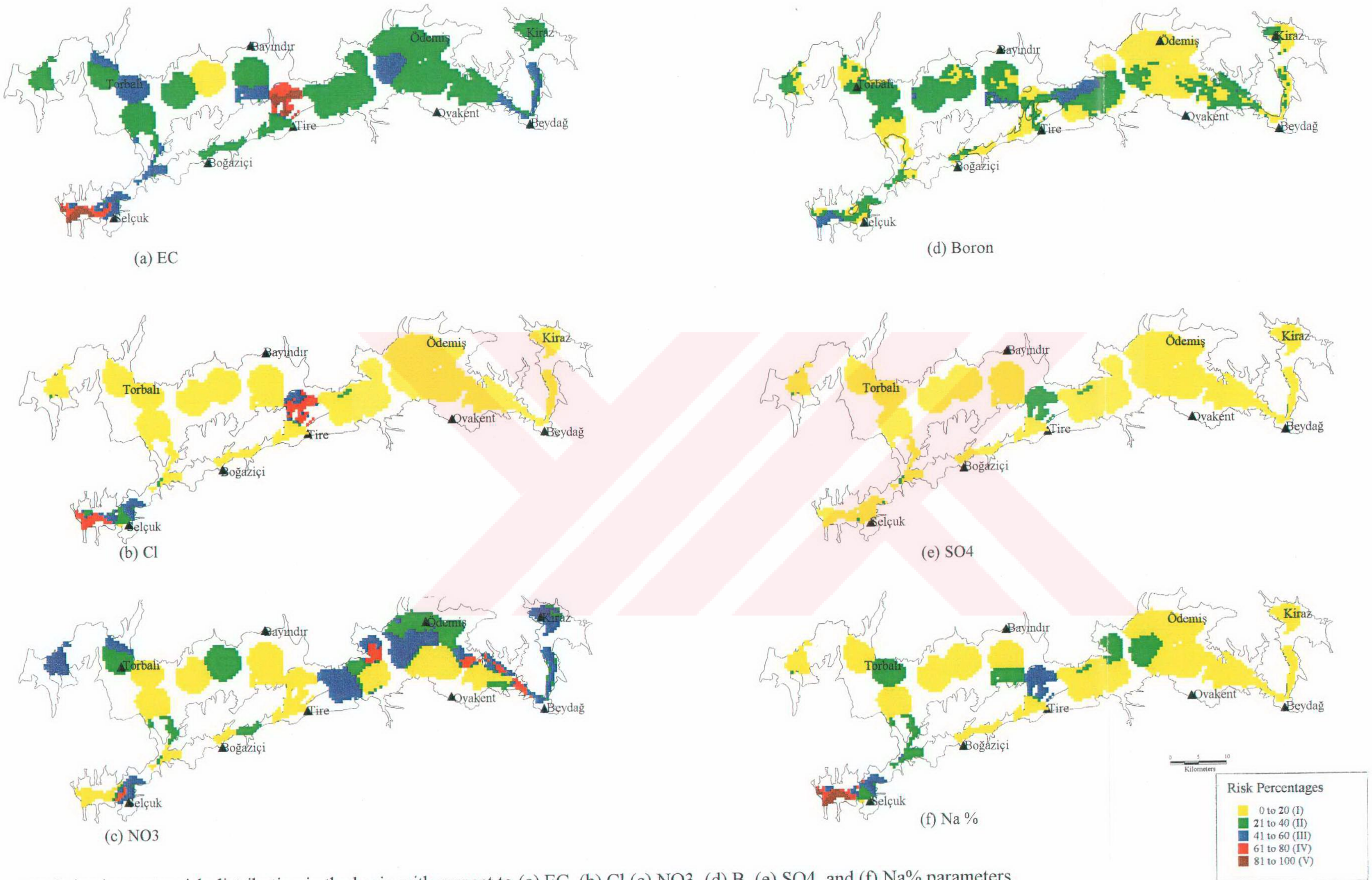


Figure 4.6. Irrigation water risk distribution in the basin with respect to (a) EC, (b) Cl (c) NO3, (d) B, (e) SO4, and (f) Na% parameters.

4.3.7. Irrigation Water Overall Risk

Previous overlays show that groundwaters located along the K. Menderes river channel between Kiraz and Tire, along the Fertek stream channel to the north and south of Torbalı, to the north of Tire (TKPF vicinity), and to the northwest of Selçuk carry high contamination risk for irrigation purposes, especially in terms of EC, NO_3, Cl and Na% parameters. Note that these areas coincide to the contamination sources determined in the basin.

4.4. Water Management Concerns

According to the risk maps, well openings should be limited or stopped in the following areas: between Doyranlı and Demircili, along K. Menderes channel to the South of Kurucaova, North of Tire and East of Selçuk. Because groundwater in these locations bear greater than 60% contamination risk.

According to the potential contamination maps, the most vulnerable groundwaters are located Northwest of Kiraz, East of Mescitli, along K. Menderes River channel to the South of Doyranlı and Demircili, from Çıplakköy to the K. Menderes River channel, Arslanlar, Şehitler, South of Torbalı, North of Değirmendere, North of Boğaziçi, around Belevi and between Selçuk and Belevi. Therefore, these areas are not suitable for solid waste disposal.

Surface waters in general can be utilized for irrigation purposes after removing the dump sites located along the channels.

CHAPTER V

CONCLUSIONS

Hydrochemistry

The annual average values and the associated standard deviations of the measured parameters in the basin groundwaters are as follows: Na, 35 (± 3) mg/l; K, 2.1 (±1.2) mg/l; Ca, 60 (±15) mg/l; Mg, 31 (±15) mg/l; HCO_3, 283 (±71) mg/l; CO_3, 0.00 (±0.00) mg/l; SO_4, 64 (±33) mg/l; Cl, 42 (±11) mg/l; N-NO_2, 0.02 (±0.01) mg/l; N-NO_3, 3.5 (±1.5) mg/l; N-NH_3, 0.00 (±0.00) mg/l; o-PO_4, 0.01 (±0.01) mg/l; B, 0.28 (±0.08) mg/l; F, 0.22 (±0.16) mg/l; Pb, 0.01 (±0.01) mg/l; Zn, 0.05 (±0.02) mg/l; Cu, 0.00 (±0.01) mg/l; Fe, 0.09 (±0.11) mg/l; Cd, 0.00 (±0.00) mg/l; Ni, 0.00 (±0.00) mg/l; Cr, 0.00 (±0.00) mg/l; Sb, 0.05 (±0.05) mg/l; BOD, 40 (±0.0) mg/l; EC, 626 (±196) µS/cm, pH, 7.06 (±0.48); and organic matter, 0.28 (±0.24) mg/l.

The spatial concentration changes between July 1998 and April 1999 in the groundwaters indicate that the measured parameters exhibit: an increasing trend from Kiraz to Beydağ in the Kiraz sub-basin; an increasing trend in the vicinity of mines to the east of Ödemiş, in the vicinity of TKPF and to the northeast of Tire along the K. Menderes River in the Ödemiş-Tire sub-basin; an increasing trend to the north of Torbalı, Boğaziçi, Bayındır and along the southwestern and Tire boundary of the Bayındır-Torbalı sub-basin; and in general, indicate an increasing concentration trend from southeastern boundary to the northwestern or to the western boundary of the Selçuk sub-basin.

The temporal trends of the parameters between 1995 and 1999 suggest: a slight increase in SO_4 and Ca+Mg contents in the Kiraz sub-basin groundwaters; an increase in SO_4 content in the Ödemiş-Tire sub-basin groundwaters; no particular increasing or decreasing concentration trends in the Bayındır-Torbalı sub-basin; an increasing concentration trends for EC, HCO_3, SO_4, Ca+Mg in the Selçuk sub-basin groundwaters.

Water quality

First degree low quality irrigation waters are present in the vicinity of mining areas to the east of Ödemiş, in the vicinity of old waste disposal sites, industrial facilities, and factories to the north of Tire, around Ergenli, in the vicinity of Develi, and north of Selçuk. The second degree low quality irrigation waters are located in the sewage discharge site of Ödemiş Municipality and in the vicinity of the Fertek stream. The third degree low quality irrigation waters are observed in the vicinity of the K. Menderes River channel around Beydağ and between İlkkurşun and Karateke, in the vicinity of Fertek stream to the north of Torbalı, and at the south of Selçuk. The wet season overall irrigation water quality is similar to that of dry season. General overall irrigation water quality in the basin is around 10 in the range of 6 to 29.

All streams include fresh water and their hardness type change from soft (0) to hard (2). The streams are either in very good (I) or in good (II) quality classes with respect to the considered irrigation water limits. The K. Menderes River waters include fresh water and their hardness type change from soft (0) to hard (2). Almost at all sampling locations, the river waters are either in very good (I) or in good (II) classes with respect to all considered irrigation water limits. Only at two points, the river waters are in usable (III) class. One of these points is located after the waste disposal site of Kiraz town where it is in usable class with respect to NO_3 limits. The other point is located after the waste disposal site of Ödemiş town where it is in usable class with respect to B limits.

Contamination sources

The point contamination sources that could cause the contaminations observed in the waters are as follows: waste disposal sites and sewage systems of the municipalities, factories and mines. Primary areas where industrial facilities have contaminated waters of the basin are north of Tire town (by the TKPF), south of Torbalı town (by the industrial facilities located along the Fertek stream channel), and northeast of Beydağ. The waste disposal sites and sewage discharges of many municipalities in the basin, especially those of Ödemiş, have deteriorated the water quality along the K. Menderes river channel. The main areas where mines have deteriorated the groundwater quality in local scale are Beydağ, Mescitli, and Kaymakçı towns. The other point contamination source in the basin is the salt-water determined in some well waters at the Selçuk sub-basin. Nitrate and potassium concentrations in some locations (especially between Ödemiş and Tire and to the east of Torbalı around Develi town) indicate the degrading effects of agricultural activities.

Contamination vulnerability

According to the depth to water parameter, the most vulnerable aquifer areas are located at the western part of the basin around Develi, south of Torbalı, west of Boğaziçi, and Selçuk Sub-basin. In addition, some areas between Kiraz and Beydağ and to the north of Kiraz have a relatively high contamination potential. The majority of the basin has high contamination vulnerability with respect to the recharge and the topographic slope parameters. The aquifer media parameter indicates that the most vulnerable areas are located at the east and in the middle parts of the basin. According to the soil media, the K. Menderes river channel, east of Selçuk and vicinity of Ödemiş, Tire, Belevi and Torbalı towns are the most vulnerable areas. The impact of vadose zone parameter suggests that the highest contamination potential including areas in the basin are located to the west of Beydağ and Kiraz, between Ödemiş and Bayındır, vicinity of Ödemiş and Bayındır, along the banks of Fertek stream channel and to the south of Selçuk. According to the hydraulic conductivity distribution, the highest contamination vulnerability exists around Bayındır town and to the north of Çırpı.

Considering all the hydrogeological parameters outlined above, the highest contamination potential including areas are located between Ödemiş and Tire along the K. Menderes river channel, to the west of Boğaziçi, south and east of Torbalı, and vicinity of Çırpı, Belevi, Selçuk and Develi.

Contamination risks

Contamination risk analyses with respect to irrigation water quality show that groundwaters located along the K. Menderes river channel between Kiraz and Tire, along the Fertek stream channel to the north and south of Torbalı, to the north of Tire (TKPF vicinity), and to the northwest of Selçuk carry high contamination risk for irrigation purposes, especially in terms of EC, NO_3, Cl and Na% parameters.

CHAPTER VI

RECOMMENDATIONS

* The monitoring program that has already been carried out by the DSİ both for groundwaters and surface waters, should be expanded to the new sampling locations. The new locations should be chosen in accordance with the contamination sources stated in this study.

* Further investigation should be carried out in the Selçuk sub-basin to find the salt-water distribution in three dimensions and its mechanism. The discharge rates should be kept at minimum in the sub-basin until the results of such investigation are obtained.

* Detailed local scale investigations should be carried out in the contaminated areas.

* The water management plan of the basin should be revised in the light of the results presented in this study.

* Industrial facilities should be controlled regularly to make sure that the discharged waters are treated in accordance with the regulations.

* Sewage water treatment facilities and the state of art waste disposal sites should be immediately established for the municipalities.

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APPENDIX I

Previous Groundwater Data

The sampling locations and chemical analyses of the 361 well waters compiled from DSİ files are listed in Table I.1. and Table I.2, respectively. The water quality of these samples, estimated using the inland water sources limits of the measured parameters, are also provided in Table I.3. The sampling locations and chemical analyses of the DSİ monitoring well waters between 1995 and 1997 are listed in Table I.4. and Table I.5, respectively. Geographic distribution of the monitoring well locations is shown in Figure I.1. The qualities of these samples, estimated using both the inland water sources limits and irrigation water limits of the measured parameters, are given in Table I.6. The monitoring data are evaluated in the text together with the data collected in this study. Irregularly collected data by DSİ are briefly evaluated in the following paragraphs.

Percent concentration distributions of the cations and anions in total of 361 well waters are shown in Figure I.2. The percent distributions indicate that the well waters are Ca-HCO_3 type in Kiraz and Beydağ and are Ca/Na-HCO_3/Cl types in Selçuk. Tire and Bayındır waters are Ca/Mg/mix types in cation content. In terms of anion content, the waters of Tire are HCO_3/mix type but those of Bayındır include also SO_4 type similar to those of Torbalı and Ödemiş. Cation contents of Torbalı and Ödemiş well waters indicate Ca/Mix/Mg/Na types. The ranges of EC, pH, B, Fe, NO_2, and organic matter values in the basin are shown in Figure I.3. EC values of some well waters in Bayındır, Menderes, Ödemiş, Tire and especially in Selçuk and Torbalı are higher than the basin average range of 200-700 μS/cm. In general, pH changes between 6.9 and 8.0. However, in some well waters of Bayındır, Ödemiş, and Torbalı, pH range is between 6.2 and 6.8. B concentrations in some waters of Bayındır, Ödemiş, Tire, and Selçuk are higher than the basin range of 0.1-1 mg/l. Fe and NO_2 concentrations range from 0.02 to 1 mg/l and from 0.01 to 0.3 mg/l, respectively. Organic matter amounts are higher in some well waters of Bayındır, Ödemiş, Torbalı and especially those of Selçuk (Figure I.3).

The estimated inland water sources quality classes of the waters are listed in Table I.3. According to the salinity classification, salinity of the basin waters, in general, is in medium (C2) class. However, some waters in the basin include high (C3) salinity. According to the Cl and Fe inland water sources limits, in general, water classes are either in high quality (I) class or in medium quality (II) class. However, some waters in the Selçuk sub-basin are in very low quality (IV) class with respect to the Cl limits. SO_4 concentrations suggest high quality (I) class with the exception of one well water in Ödemiş and four well waters in Torbalı. These exceptional waters are in low quality (III) class with respect to SO_4 limits. According to the B limits, some well waters of Bayındır, Ödemiş, Selçuk, and Tire are in very low quality (IV) class. Bayındır, Ödemiş, and Torbalı waters are in low quality (III) class in terms of N-NO_2 limits (Table I.3).

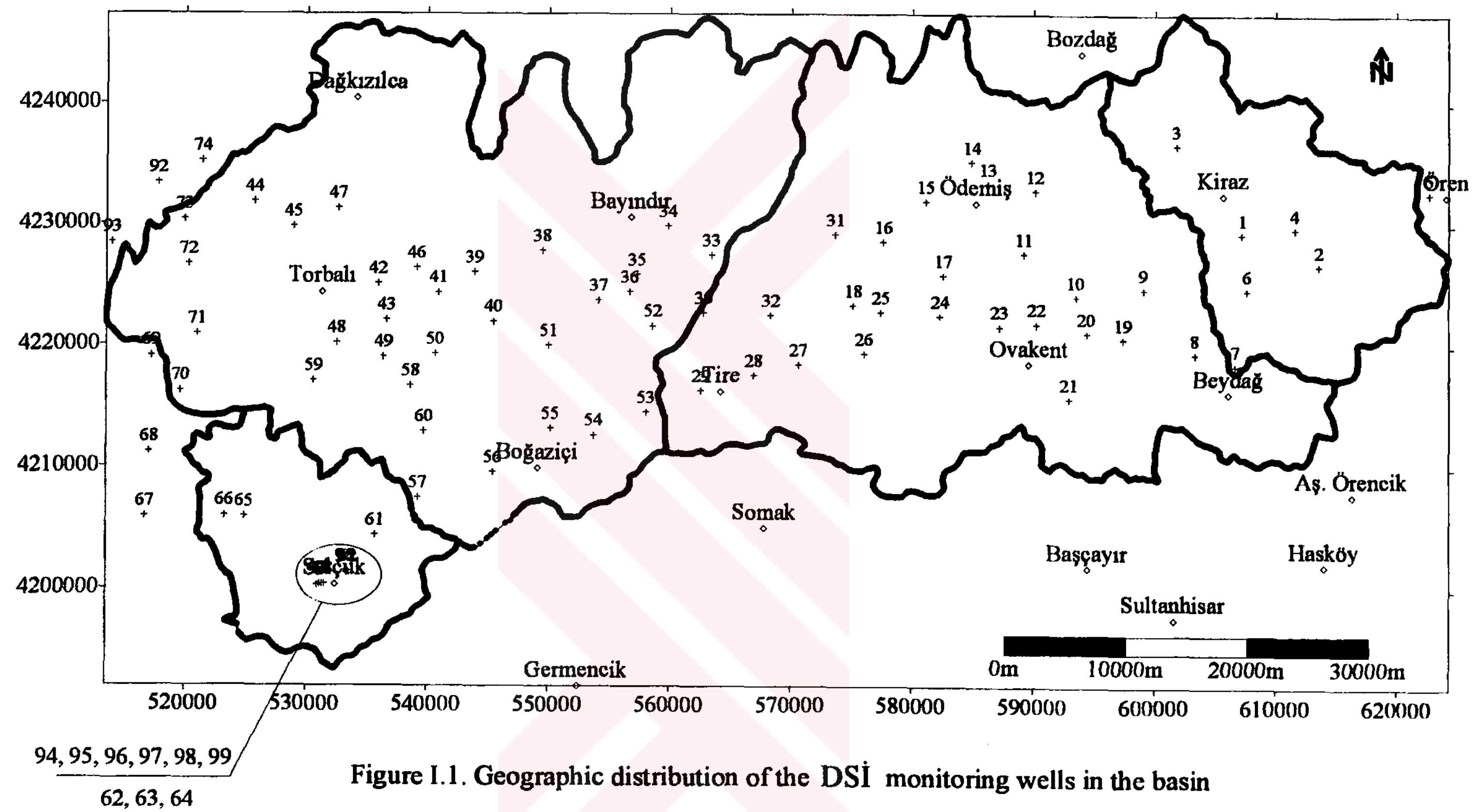


Figure I.1. Geographic distribution of the DSİ monitoring wells in the basin

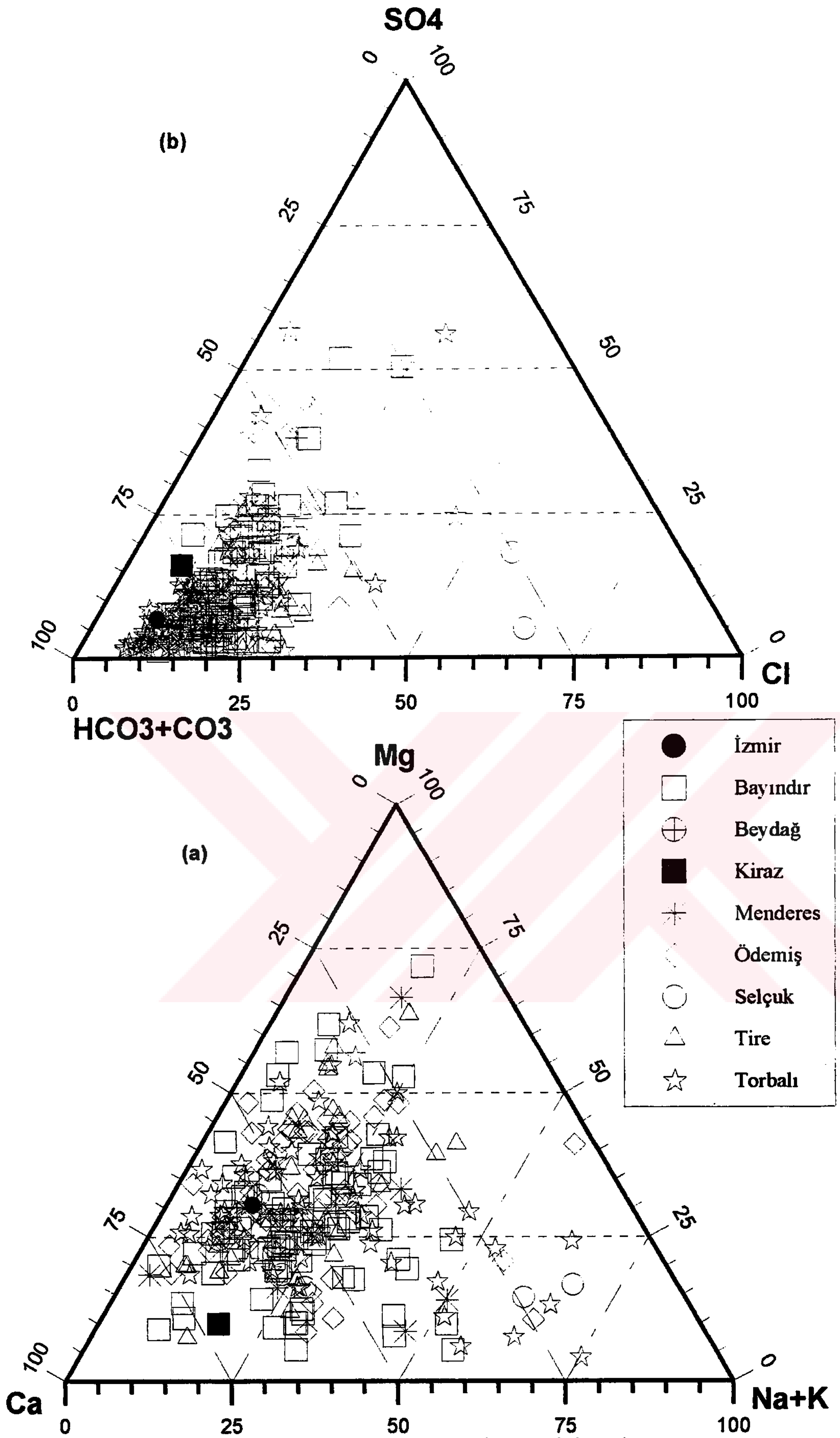


Figure I.2. Percent distributions of (a) cations and (b) anions in the irregularly collected DSİ well waters.

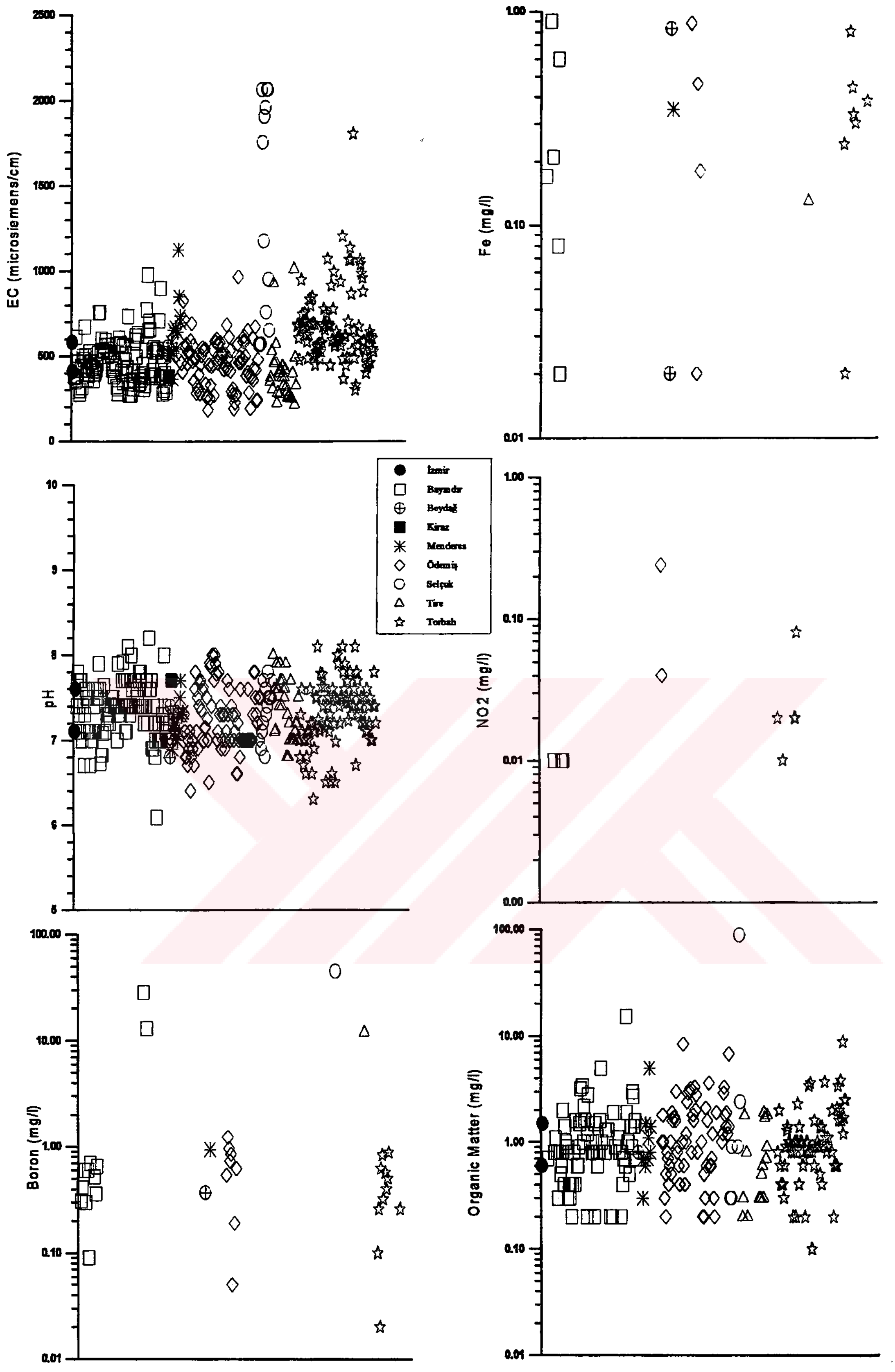


Figure I.3. Concentration range of EC, pH, B, Fe, NO2 and organic matter in the irregularly collected DSİ well waters.

Table I.1. Locations of the DSİ wells with available chemical analyses.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
İzmir	21036	L18-D2	519000	4232850	17.07.1976	150
İzmir	29	L18-D1	509025	4222175	18.11.1960	191
Bayındır	49003	L19-D1	550200	4226900	_	138
Bayındır	49081	L19-D1	550575	4226450	_	147
Bayındır	49080	L19-D1	550225	4226550	25.03.1995	161
Bayındır	49082	L19-D1	550550	4226125	19.06.1995	144
Bayındır	49488	L19-D2	559875	4228900	13.04.1995	140
Bayındır	48515	L19-D1	546200	4221545	_	78
Bayındır	48201	L19-D2	560800	4229050	13.06.1994	118
Bayındır	48032-A	L19-D1	548875	4227850	17.02.1995	74
Bayındır	48033	L19-D1	549250	4226720	31.01.1995	128
Bayındır	48032-B	L19-D1	549125	4227500	16.03.1995	101
Bayındır	48031	L19-D1	548800	4227400	_	113
Bayındır	48030	L19-D1	549325	4227275	15.12.1994	132
Bayındır	47818	L19-D1	546400	4227400	23.08.1994	99
Bayındır	47820	L19-D1	546300	4227050	20.09.1994	110
Bayındır	47819	L19-D1	545950	4227450	_	80
Bayındır	47822	L19-D1	546480	4227755	29.07.1994	98
Bayındır	47823	L19-D1	546100	4226600	26.09.1994	110
Bayındır	46636	L19-D2	563050	4227387	23.10.1993	96
Bayındır	46637	L19-D2	562400	4227175	15.11.1993	100
Bayındır	46638	L19-D2	562150	4226825	16.12.1993	108
Bayındır	46639	L19-D2	562400	4226425	_	100
Bayındır	46198	L18-C2	542850	4224075	12.04.1994	136
Bayındır	46199	L18-C2	543050	4224000	_	140
Bayındır	46195	L18-C2	542325	4223675	_	131
Bayındır	46196	L18-C2	543025	4223450	11.05.1994	126
Bayındır	46197	L18-C2	542500	4224200	25.04.1994	122
Bayındır	44185	L19-D1	547500	4227500	19.03.1993	120
Bayındır	43396	L19-D1	551025	4226000	_	125
Bayındır	43397	L19-D1	551250	4226400	27.05.1992	120
Bayındır	44186	L19-D1	547750	4227550	_	81
Bayındır	39395	L19-D1	550175	4227275	24.01.1990	100
Bayındır	39394	L19-D1	549950	4227475	_	108
Bayındır	39397	L19-D1	550475	4226875	17.02.1990	115
Bayındır	39396	L19-D1	550425	4227075	25.01.1990	108
Bayındır	39398	L19-D1	549800	4227575	19.02.1990	102
Bayındır	43331	L18-C2	543675	4225950	21.04.1992	101
Bayındır	43332	L19-D1	543900	4226050	_	100
Bayındır	43333	L19-D1	544075	4226150	10.03.1992	107
Bayındır	43334	L19-D1	544250	4226200	23.03.1992	100
Bayındır	39483	L19-D2	563425	4227350	31.07.1990	88
Bayındır	39484	L12-D2	563425	4227625	20.08.1990	90
Bayındır	39482	L19-D2	563325	4227100	15.10.1990	91
Bayındır	39481	L19-D2	563100	4226750	21.06.1990	97
Bayındır	39480	L19-D2	562980	4226500	_	94
Bayındır	27363-A	L19-D2	560175	4229475	21.11.1980	68

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Bayındır	27360	L19-D2	559750	4228500	_	107
Bayındır	27361	L19-D2	559925	4228850	29.08.1980	105
Bayındır	27362	L19-D2	560050	4229150	25.09.1980	110
Bayındır	28426	L19-D2	557825	4228825	22.08.1981	96
Bayındır	28425	L19-D2	558025	4228975	_	77
Bayındır	27363-B	L19-D2	560175	4229500	_	65
Bayındır	30306	L19-D2	560800	4229050	28.06.1983	96
Bayındır	30305	L19-C2	561750	4227210	22.04.1983	101
Bayındır	30304	L19-D2	561625	4227425	23.04.1983	100
Bayındır	30303	L19-D2	561400	4227350	18.05.1983	95
Bayındır	24863	L19-D1	546725	4221450	27.07.1978	71
Bayındır	24862	L19-D1	546125	4222325	23.08.1978	78
Bayındır	30666	L19-D1	551200	4226200	10.01.1984	65
Bayındır	30665	L19-D1	551075	4226350	26.02.1984	67
Bayındır	30664	L19-D1	553050	4226150	25.07.1983	100
Bayındır	30663	L19-D1	551150	4226750	12.03.1984	70
Bayındır	30662	L19-D1	551075	4226525	_	62
Bayındır	30661	L19-D1	551050	4226250	19.04.1984	63
Bayındır	30660	L19-D1	551100	4226875	18.05.1984	66
Bayındır	30659	L19-D1	551025	4226000	_	64
Bayındır	24866	L19-D1	546150	4221300	25.07.1978	74
Bayındır	30668-B	L19-D1	551250	4226400	13.06.1984	64
Bayındır	30667	L19-D1	551200	4226025	_	98
Bayındır	24869	L19-D1	545675	4222500	16.06.1978	86
Bayındır	24868	L19-D1	545450	4221925	27.05.1978	87
Bayındır	24867	L19-D1	545450	4221275	_	76
Bayındır	24865	L19-D1	545900	4221575	20.06.1978	81
Bayındır	24864	L19-D1	546200	4221550	29.06.1978	74
Bayındır	24879	L19-D1	544600	4224200	_	84
Bayındır	24878	L19-D1	544575	4224500	18.10.1978	92
Bayındır	24877	L19-D1	545425	4224050	27.09.1978	98
Bayındır	24876	L19-D1	544600	4224675	_	104
Bayındır	24875	L19-D1	544700	4225000	21.08.1978	100
Bayındır	24859	L19-D1	544225	4220175	14.06.1978	90
Bayındır	28402	L19-D2	558550	4229300	_	105
Bayındır	28403	L19-D2	559450	4229825	20.12.1980	104
Bayındır	21913	L19-D1	546700	4227500	17.02.1978	75
Bayındır	21914	L19-D1	546900	4227500	_	72
Bayındır	21915	L19-D1	547150	4227500	_	124
Bayındır	21916	L19-D1	547505	4227500	24.03.1978	76
Bayındır	21917	L19-D1	547750	4227545	17.02.1978	80
Bayındır	21918	L19-D1	546875	4227650	26.04.1978	75
Bayındır	24961	L19-D1	544875	4226500	12.09.1978	95
Bayındır	24962	L19-D1	544575	4226375	13.09.1975	82
Bayındır	24960	L19-D1	545125	4226625	12.08.1978	92
Bayındır	24959	L19-D1	545175	4226125	_	107
Bayındır	19148	L19-D1	545590	4226610	_	87
Bayındır	19147	L19-D1	546140	4226590	18.03.1975	105

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Bayındır	19146	L19-D1	546475	4227750	13.05.1975	84
Bayındır	19145	L19-D1	545790	4226975	_	60
Bayındır	19144	L19-D1	546360	4227090	22.04.1975	84
Bayındır	19142	L19-D1	546040	4227475	12.02.1975	8
Bayındır	19141	L19-D1	546410	4227400	30.04.1975	72
Bayındır	14490-A	L18-C2	543350	4225875	_	99
Bayındır	14490-B	L18-C2	543350	4225900	13.06.1970	44
Bayındır	14482	L18-C2	541140	4222400	13.07.1970	124
Bayındır	14491	L18-C2	543625	4225925	_	112
Bayındır	14493	L19-D1	544075	4226250	27.09.1970	106
Bayındır	988				27.08.1970	131
Bayındır	991	L19-D2	556850	4229875	29.09.1960	100
Bayındır	3963	L19-D1	543900	4226000	_	86
Bayındır	1001	L19-D1	548975	4227600	_	100
Bayındır	1002	L19-D2	563850	4227075	12.09.1960	94
Bayındır	1003	L19-D1	547875	4227275	24.09.1960	75
Bayındır	1004	L19-D2	561050	4228290	28.09.1960	88
Bayındır	7263	L19-D2	556975	422200	_	111
Bayındır	7262	L19-D1	548500	4224800	_	104
Beydağ	48720	L20-D3	606700	4218720	17.08.1995	35
Beydağ	48721	L20-D3	606575	4218475	_	37
Kiraz	47976	L20-D2	607975	4232525	25.07.1994	128
Menderes	23	L18-A3	512775	4234850	13.07.1959	330
Menderes	31	L18-D2	512000	4226300	_	201
Menderes	37149	L18-D3	517750	4218600	10.04.1988	150
Menderes	36407	L18-D3	517125	4218875	_	156
Menderes	48231	L18-D2	519525	4233525	_	108
Menderes	48232	L18-D2	519825	4233650	_	188
Menderes	48234	L18-A3	519025	4233700	26.09.1995	210
Menderes	43339	L18-D2	519750	4230750	22.02.1992	220
Menderes	41953	L18-D3	516700	4219300	20.01.1992	167
Menderes	41954	L18-D3	517150	4219125	_	118
Menderes	41955	L18-D3	517300	4219050	10.03.1992	225
Menderes	41956	L18-D3	516525	4219075	22.05.1992	112
Menderes	42691-B	L18-D3	517800	4216800	26.10.1993	153
Menderes	25	L18-D2	514975	4222925	18.09.1960	302
Ödemiş	33297-B	L20-D1	529750	4289105	_	107
Ödemiş	21919	L19-C2	577050	4228375	25.02.1997	106
Ödemiş	49129-B	L20-D4	592950	4215850	25.01.1995	101
Ödemiş	14911	L19-C2	587250	4221600	29.11.1994	117
Ödemiş	49129-A	L20-D4	592000	4215500	13.12.1994	96
Ödemiş	47981	L19-C2	586700	4222875	28.11.1994	116
Ödemiş	47980	L19-C2	587200	4222300	22.11.1994	123
Ödemiş	48216	L20-D1	589025	4228155	_	134
Ödemiş	47979	L19-C2	587275	4222600	_	138
Ödemiş	47978	L19-C2	587025	4222950	15.11.1994	121
Ödemiş	47977	L19-C2	587350	4223025	20.10.1994	141
Ödemiş	47982	L19-C2	586775	4222600	_	114

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Ödemiş	46234	L20-D2	599025	4224675	19.05.1993	93
Ödemiş	45750	L20-D1	589400	4233200	_	138
Ödemiş	45751	L20-D1	589600	4233125	31.03.1993	146
Ödemiş	44183	L20-D1	588200	4228700	27.01.1993	150
Ödemiş	44189	L19-C2	576850	4228850	14.04.1996	103
Ödemiş	44184	L20-D1	589050	4228150	_	138
Ödemiş	43351	L20-D1	590225	4232050	14.07.1992	158
Ödemiş	43352	L20-D1	590800	4231720	28.06.1992	89
Ödemiş	43353	L20-D1	591125	4231500	30.07.1992	140
Ödemiş	42409	L20-D1	589025	4229050	31.07.1991	170
Ödemiş	41971-B	L20-D4	593015	4217475	_	30
Ödemiş	39107	L20-D1	589075	4227650	21.04.1989	130
Ödemiş	39076-D	L19-C2	580475	4230700	24.08.1989	84
Ödemiş	39074	L19-C2	580750	4231445	25.06.1989	135
Ödemiş	39073	L19-C2	580870	4231800	27.05.1989	130
Ödemiş	39076-B	L19-C2	580950	4231775	_	152
Ödemiş	39075	L19-C2	580675	4231330	26.07.1989	118
Ödemiş	40947	L20-D1	591000	4231955	27.03.1990	95
Ödemiş	40948	L20-D1	590350	4231630	_	132
Ödemiş	35611	L20-D1	590675	4232750	12.03.1987	145
Ödemiş	36341	L20-D1	590700	4232600	15.05.1987	125
Ödemiş	32459	L19-C2	586075	4232475	28.08.1984	99
Ödemiş	32513	L20-D1	590350	4232475	30.06.1985	150
Ödemiş	32514	L20-D1	590125	4232825	_	150
Ödemiş	32515	L20-D1	589925	4232775	_	150
Ödemiş	32516	L20-D1	589200	4233000	27.07.1985	130
Ödemiş	32517	L20-D1	589300	4232450	_	150
Ödemiş	34214	L20-A4	589600	4242750	10.07.1986	52
Ödemiş	25527	L19-C2	583375	4232700	24.05.1975	105
Ödemiş	25526	L20-D1	589125	4227650	15.05.1979	104
Ödemiş	27329	L20-D1	590200	4229625	25.11.1980	117
Ödemiş	27328	L20-D1	589500	4227625	20.08.1980	67
Ödemiş	27327	L20-D1	590525	4230000	25.09.1980	120
Ödemiş	27326	L20-D1	589025	4229055	_	126
Ödemiş	27325	L20-D1	589075	4227655	14.07.1980	129
Ödemiş	27324	L20-D1	589055	4228150	31.07.1980	120
Ödemiş	27323	L20-D1	589425	4229525	19.09.1980	115
Ödemiş	27322	L20-D1	588825	4229475	_	111
Ödemiş	27321	L20-D1	588950	4228600	19.08.1980	126
Ödemiş	27320	L20-D1	589750	4229075	11.11.1980	112
Ödemiş	27319	L20-D1	589350	4229225	_	125
Ödemiş	27318	L20-D1	588200	4228700	31.07.1980	116
Ödemiş	27465	L20-D2	598975	4224780	15.07.1980	85
Ödemiş	21920	L19-C2	576900	4228625	_	104
Ödemiş	21922	L19-C1	576500	4228400	_	102
Ödemiş	21923	L19-C2	577625	4228600	21.06.1978	106
Ödemiş	21924	L19-C2	577600	4228850	11.07.1978	107
Ödemiş	21921	L19-C2	576875	4228850	25.05.1978	91

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Ödemiş	20321	L20-D1	591000	4231950	21.02.1976	83
Ödemiş	20322	L20-D1	592200	4232025	25.03.1976	103
Ödemiş	20323	L20-D1	590775	4231700	10.02.1976	81
Ödemiş	18643	L20-D1	590690	4232750	_	122
Ödemiş	18644	L20-D1	590825	4232875	21.08.1976	127
Ödemiş	20324	L20-D1	590350	4231625	28.01.1976	114
Ödemiş	20325	L20-D1	591150	4231475	_	119
Ödemiş	15792	L20-D2	598975	4224775	_	99
Ödemiş	984	L19-C2	584400	4231000	15.07.1959	131
Ödemiş	10571	L19-C2	588875	4231800	_	100
Ödemiş	10572	L19-C2	587755	4231445	10.09.1968	105
Ödemiş	10573	L19-C2	580680	4231330	_	102
Ödemiş	10574	L19-C2	580525	4231200	11.10.1968	82
Ödemiş	7889-B	L19-C2	579740	4229490	_	71
Ödemiş	7889-C	L19-C2	579735	4229485	_	25
Ödemiş	13426-A	L20-D1	589175	4221645	28.09.1969	140
Ödemiş	13426-B	L20-D1	589175	4221650	_	42
Ödemiş	1006	L20-D1	588575	4232000	_	76
Ödemiş	12219	L20-D1	589400	4232450	14.04.1969	119
Ödemiş	12218	L20-D1	589275	4233100	16.05.1969	122
Ödemiş	12217	L20-D1	589875	4232725	24.04.1968	128
Ödemiş	12216	L20-D1	590550	4232550	_	122
Ödemiş	12215	L20-D1	590075	4232025	_	135
Ödemiş	10065	L20-D2	606895	4227250	_	87
Ödemiş	12	L19-C2	577100	4227925	_	156
Ödemiş	14	L19-C2	585800	4231975	30.08.1960	151
Ödemiş	15	L19-C2	584400	4228500	28.05.1960	168
Ödemiş	17	L20-D1	587750	4221500	_	169
Ödemiş	18	L20-D1	590000	4229900	_	157
Ödemiş	19	L20-D1	592500	4225200	_	76
Ödemiş	20	L20-D2	599125	4221575	_	80
Ödemiş	21	L20-D1	594450	4220575	_	68
Ödemiş	22	L20-D1	609250	4230250	_	125
Selçuk	45691	L18-C4	524585	4206750	_	62
Selçuk	45692	L18-C4	524475	4206875	16.09.1993	68
Selçuk	41660	L18-C4	524625	4206600	_	38
Selçuk	22330	M18-D1	532625	4203650	_	82
Selçuk	24855	M18-B1	530875	4200300	17.04.1979	60
Selçuk	24854	M18-B1	531500	4200380	27.03.1979	156
Selçuk	24853	M18-B1	531325	4200375	16.02.1979	111
Selçuk	21381	M18-B1	531050	4200350	12.10.1976	7
Selçuk	20045	M18-B2	533375	4201300	28.12.1978	60
Selçuk	20046	M18-B2	533325	4201450	29.01.1976	105
Selçuk	20047	M18-B2	533225	4201450	27.02.1976	86
Selçuk	18495	M18-B2	533250	4201300	17.08.1973	79
Selçuk	1000	M18-B1	532275	4200225	18.07.1960	50
Tire	50241	L19-C2	577900	4221575	28.09.1995	185
Tire	41886-A	L19-D2	558400	4222200	_	69

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Tire	41886-B	L19-D2	558300	4222200	_	142
Tire	40932	L18-C2	543675	4220375	29.04.1990	92
Tire	34215	L19-D3	563125	4216750	23.06.1986	86
Tire	30301	L19-C4	575875	4219800	29.12.1982	102
Tire	28552	L19-C4	575800	4220075	_	100
Tire	26886	L19-D4	550250	4213100	19.07.1979	55
Tire	30204	L19-C1	575400	4222900	29.10.1982	100
Tire	30203	L19-C1	575500	4222725	19.10.1982	100
Tire	30202	L19-C2	575475	4222550	22.10.1982	100
Tire	30201	L19-C1	575560	4222475	20.09.1982	100
Tire	24858	L18-C2	543600	4220300	26.06.1978	84
Tire	24857	L19-D1	543900	4220400	11.07.1978	80
Tire	24856	L19-D1	544200	4220475	22.05.1978	98
Tire	30300-B	L19-C1	575675	4220300	10.12.1982	100
Tire	30299	L19-C2	577400	4220425	_	103
Tire	30298	L19-C4	575600	4220100	_	105
Tire	30297	L19-C3	577300	4219950	80.10.1983	105
Tire	30296-B	L19-C2	577200	4220175	10.10.1983	105
Tire	30296-A	L19-C3	577250	4220125	11.12.1982	100
Tire	14356	L19-C1	575490	4222425	_	100
Tire	14355	L19-C1	575600	4222100	11.04.1970	110
Tire	14354	L19-C1	575600	4222300	21.04.1970	100
Tire	14353	L19-C1	575660	4222300	27.03.1970	110
Tire	14352	L19-C1	575775	4221540	12.03.1970	110
Tire	14351	L19-C1	575815	4221715	11.02.1970	100
Tire	982				24.06.1960	137
Tire	983				25.06.1960	137
Tire	10066-A	L19-C1	575985	4221525	12.05.1968	182
Tire	7264	L19-C4	571800	4218800	22.02.1966	64
Tire	11	L19-C1	576225	4220300	_	143
Torbalı	50242-A	L18-C2	539600	4226410	21.11.1995	147
Torbalı	50242-B	L18-C2	539700	4226450	29.11.1995	60
Torbalı	49671	L18-C2	536875	4222375	11.07.1995	110
Torbalı	49670	L18-C2	536375	4221950	22.06.1995	129
Torbalı	48535	L18-C2	536625	4222130	_	123
Torbalı	46652	L18-C3	536100	4216175	14.12.1994	86
Torbalı	46651	L18-C3	535850	4215250	29.12.1994	72
Torbalı	46652-B	L18-C3	536095	4215010	24.03.1995	60
Torbalı	46650	L18-C3	536025	4215025	31.01.1995	76
Torbalı	46649	L18-C3	536160	4215000	20.02.1995	93
Torbalı	46648-B	L18-C3	535975	4215100	16.03.1995	53
Torbalı	46048	L18-C1	532000	4220275	_	118
Torbalı	46049	L18-C1	532700	4220025	22.06.1993	150
Torbalı	46050	L18-C4	532875	4219650	12.07.1993	130
Torbalı	46051	L18-C1	532375	4220450	29.07.1993	138
Torbalı	45749	L18-C2	535925	4225375	_	90
Torbalı	45748	L18-C2	535950	4225075	11.06.1993	83
Torbalı	45746	L18-C2	535575	4225575	27.04.1993	106

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Torbalı	45745-B	L18-C2	535750	4225700	10.08.1993	110
Torbalı	45747	L18-C2	535500	4225125	18.05.1993	94
Torbalı	49683	L18-C2	540975	4220250	17.07.1995	113
Torbalı	45745-A	L18-C2	535700	4225700	11.03.1993	102
Torbalı	43018	L18-C4	530375	4217075	22.09.1991	100
Torbalı	42436	L18-C3	537800	4218175	_	90
Torbalı	42492	L18-C1	532325	4219975	11.06.1991	120
Torbalı	42435	L18-C1	532575	4220400	23.05.1991	100
Torbalı	36742	L18-C1	525275	4231075	27.07.1987	60
Torbalı	36741	L18-C1	524650	4231425	14.07.1987	60
Torbalı	33270	L18-C2	535850	4222875	_	100
Torbalı	40923	L18-C3	536400	4219425	_	88
Torbalı	34493	L18-C2	534950	4225350	_	175
Torbalı	39488	L18-D2	521775	4224000	_	100
Torbalı	39489-A	L18-C1	522080	4224750	24.10.1991	38
Torbalı	39486	L18-C1	522050	4224300	_	44
Torbalı	39487	L18-C1	521950	4224200	11.09.1991	100
Torbalı	39485	L18-C1	522200	4224475	_	100
Torbalı	39495	L18-C1	521150	4224375	_	113
Torbalı	39494	L18-D2	521325	4224125	_	100
Torbalı	39493	L18-D2	521425	4223975	_	93
Torbalı	39492	L18-D2	521600	4223850	15.09.1991	100
Torbalı	39491	L18-C1	521925	4225075	15.06.1991	100
Torbalı	39490	L18-C1	521975	4224850	_	100
Torbalı	35493	L18-C2	535950	4225700	23.10.1986	75
Torbalı	39489-B	L18-C1	522075	4224750	26.10.1992	43
Torbalı	35250	L18-C2	536200	4219975	24.10.1986	85
Torbalı	33271	L18-C2	535950	4222450	_	105
Torbalı	29866	L18-C1	527800	4227175	13.08.1982	60
Torbalı	29865	L18-C1	527650	4227200	19.07.1982	65
Torbalı	29863	L18-C1	527700	4226625	10.06.1982	41
Torbalı	29864	L18-C1	527700	4226950	30.06.1982	70
Torbalı	31482	L18-D2	521250	4228100	_	224
Torbalı	26777	L18-C1	527750	4226300	17.06.1979	54
Torbalı	30311	L18-C2	536100	4220675	17.10.1983	97
Torbalı	30310	L18-C2	536175	4220125	18.10.1983	90
Torbalı	30309	L18-C2	536225	4219875	16.12.1983	85
Torbalı	30307	L18-C3	536100	4220675	28.09.1983	100
Torbalı	26802	L18-C3	540875	4219500	16.06.1979	121
Torbalı	33133	L18-C4	530500	4217100	27.11.1986	82
Torbalı	33274	L18-C2	536625	4222130	12.03.1988	107
Torbalı	33273	L18-C2	536380	4221950	23.06.1987	106
Torbalı	33275	L18-C2	536850	4222375	_	104
Torbalı	28554	L18-C3	541100	4219175	18.06.1981	90
Torbalı	27414	L18-C1	530875	4226375	_	120
Torbalı	27416	L18-C1	530525	4227025	15.05.1980	100
Torbalı	27415	L18-C1	530725	4226700	11.05.1980	100
Torbalı	26907	L18-C2	585700	4225075	_	70

Table I.1 continued.

CITY	WELL No	SHEET	EAST	NORTH	OPENING DATE	DEPTH (m)
Torbalı	26887	L18-B4	522300	4234875	_	93
Torbalı	28858	L18-C2	540975	4220850	20.08.1982	116
Torbalı	28857	L18-C2	540975	4220245	30.07.1982	104
Torbalı	28856	L18-C3	541300	4219875	_	102
Torbalı	28854	L18-C3	541100	4219175	31.05.1982	104
Torbalı	28853	L18-C3	540675	4219250	12.05.1982	107
Torbalı	30206	L18-C1	530800	4224375	27.08.1982	80
Torbalı	27422	L18-C1	530300	4227375	11.07.1980	68
Torbalı	27421	L18-C1	530375	4227225	29.05.1980	95
Torbalı	27420	L18-C1	530475	4226300	14.09.1980	110
Torbalı	27419	L18-C1	530625	4226550	30.05.1980	100
Torbalı	27418	L18-C1	530250	4226325	_	105
Torbalı	27417	L18-C1	530850	4226050	10.05.1980	102
Torbalı	22331	L18-C2	533125	4219975	21.07.1977	62
Torbalı	993	L18-C1	531250	4223100	16.10.1959	205
Torbalı	994	L18-C3	535350	4219500	10.02.1960	114
Torbalı	1005	L19-D4	544075	4219700	_	100
Torbalı	10063-B	L18-C1	532205	4226990	22.03.1968	54
Torbalı	10063-C	L18-C1	532210	4226990	28.03.1968	25
Torbalı	10064-A	L18-C1	529450	4221475	20.04.1968	84
Torbalı	7260	L18-C3	540750	4216675	14.02.1966	154
Torbalı	7261	L18-C3	538875	4219625	11.12.1966	123
Torbalı	28	L18-D2	519850	4233250	21.11.1960	200
Torbalı	26	L18-D2	520825	4227475	_	111
Torbalı	27	L18-C1	526975	4229000	16.12.1959	160
Torbalı	30	L18-A3	518150	4236550	25.11.1960	241

Table I.2. Chemical analyses of the DSİ well waters.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
İzmir	21036	7.10	581	18.85	1.17		74.15	24.31	335.55	0.00	21.27	21.61					0.6	28.5
İzmir	00029	7.60	410	11.04	9.78	6.50			346.54	0.00	15.95	40.83					1.5	32.5
Bayındır	49003	7.30	337	18.39	0.78	2.68			143.37	0.00	27.65	17.77						
Bayındır	49081	7.40	385	34.26	1.17	2.48			187.30	0.00	25.53	10.09	0.31				0.0	
Bayındır	49080	7.70	377	21.38	0.78	3.00			164.73	0.00	27.65	22.58	0.41				0.0	
Bayındır	49082	7.80	350	27.82	1.56	2.36			164.73	0.00	25.53	9.13				0.17	0.0	
Bayındır	49488	7.30	611	1441.31	2.35	3.60			261.12	0.00	31.91	56.20	0.60				0.0	
Bayındır	48515	7.10	422	39.54	1.56	2.76			202.55	0.00	27.65	20.17	0.30				0.0	
Bayındır	48201	7.70	468	8.05	0.39		53.91	20.42	230.62	0.00	21.98	15.85					0.7	21.8
Bayındır	48032-A	7.70	299	15.17	0.39	2.46			140.93	0.00	21.98	9.61	0.60			0.90	0.0	
Bayındır	48033	7.00	277	9.89	0.78		30.46	10.70	127.51	0.00	20.21	9.13	0.09				0.0	12.0
Bayındır	48032-B	7.40	299	20.46	0.78	2.22			126.29	0.00	29.07	11.53	0.70			0.21	0.0	
Bayındır	48031	6.70	442	18.39	0.78	3.73			185.47	0.00	35.45	24.50					0.0	
Bayındır	48030	7.30	314	20.92	0.78	2.62			188.52	0.00	9.22	9.61					0.0	
Bayındır	47818	7.60	499	3.68	0.39		56.31	25.77	231.84	0.00	29.07	23.06					0.0	24.6
Bayındır	47820	7.50	479	20.92	0.78		56.31	13.49	190.35	0.00	39.00	30.26	0.52			0.08	0.8	19.6
Bayındır	47819	7.10	670	34.03	1.17		85.77	11.67	289.19	0.00	53.89	23.54	0.36			0.60	0.8	28.1
Bayındır	47822	7.50	501	21.38	0.078		60.72	13.86	208.04	0.00	41.83	25.46	0.65	0.01		0.02	1.1	20.9
Bayındır	47823	7.10	440	24.83	0.78		45.89	14.47	190.35	0.00	32.97	25.46					0.0	17.4
Bayındır	46636	7.10	422	28.28	0.78		51.50	5.23	162.90	0.00	28.36	37.46					0.8	15.0
Bayındır	46637	6.70	361	3.22	0.39		56.11	9.00	163.51	0.00	31.91	5.28					0.3	17.7
Bayındır	46638	7.00	391	8.97	0.78		50.30	13.98	197.67	0.00	21.63	10.57					0.0	18.3
Bayındır	46639	7.00	527	16.32	0.39		67.53	14.71	223.30	0.00	52.47	7.69					0.8	22.9
Bayındır	46198	7.60	467	28.51	0.78		60.52	5.35	206.21	0.00	24.82	30.74					0.5	17.3
Bayındır	46199	7.40	464	26.44	0.78		50.90	11.91	220.86	0.00	33.68	5.76					0.6	17.6
Bayındır	46195	7.60	431	29.43	0.78		52.91	5.35	198.89	0.00	28.36	15.37					0.8	15.4
Bayındır	46196	7.10	438	9.43	0.39		72.14	4.86	194.62	0.00	24.82	25.46		0.01			2.0	20.0
Bayındır	46197	7.50	355	26.44	0.78		46.09	2.43	165.95	0.00	24.46	12.49		0.01			0.4	12.5
Bayındır	44185	7.60	430	8.05	0.39		60.12	11.67	183.03	0.00	30.14	22.58		0.01			1.4	19.8

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Bayındır	43396	7.50	398	26.90	0.78		27.05	18.96	175.10	0.00	30.84	17.29					1.0	14.5
Bayındır	43397	7.90	415	28.05	1.17		37.88	14.59	209.26	12.00	21.27	14.89					0.9	15.5
Bayındır	44186	7.60	449	11.04	0.39		51.30	18.11	158.63	0.00	23.04	61.96					0.8	20.2
Bayındır	39395	6.72	518	38.39	0.78		50.90	20.18	286.75	0.00	37.58	6.24					0.3	21.0
Bayındır	39394	6.82	754	40.00	1.96		69.74	29.42	367.28	0.00	54.24	6.72					0.4	29.5
Bayındır	39397	6.82	755	43.68	1.56		76.95	21.88	292.85	0.00	46.80	70.13					0.3	28.2
Bayındır	39396	7.08	500	38.62	0.78		44.09	18.84	262.34	0.00	35.10	7.69					0.4	18.8
Bayındır	39398	7.64	600	7.36	0.39		50.10	39.02	252.58	0.00	30.49	49.95					0.2	28.5
Bayındır	43331	7.10	536	27.82	0.78		63.53	13.13	214.76	0.00	28.36	55.72					0.4	21.3
Bayındır	43332	7.10	536	27.82	0.78		63.53	13.13	214.76	0.00	28.36	55.72					0.4	21.3
Bayındır	43333	7.30	531	20.46	0.39		59.12	18.84	253.19	0.00	32.26	16.33			0.01		0.8	22.5
Bayındır	43334	7.20	560	11.96	0.39		74.15	17.75	262.34	0.00	43.25	8.17					0.4	25.8
Bayındır	39483	7.30	591	13.56	2.35		76.15	18.84	216.59	0.00	30.49	76.37					1.6	26.7
Bayındır	39484	7.30	526	15.40	0.78		73.75	12.28	242.82	0.00	42.90	9.13					0.0	23.4
Bayındır	39482	7.20	565	41.38	7.82		60.12	13.37	279.43	0.00	41.83	16.33					0.6	20.5
Bayındır	39481	7.41	501	18.16	3.13		44.49	24.43	262.95	0.00	19.14	12.01					0.6	21.1
Bayındır	39480	7.50	542	22.76	4.30		57.31	18.72	272.71	0.00	21.63	20.17					0.9	22.0
Bayındır	27363-A	7.50	524	35.87	1.17		54.11	19.45	216.59	0.00	49.63	45.15					1.5	
Bayındır	27360	7.50	521	29.43	0.78		24.05	34.04	237.94	0.00	24.82	33.62					3.2	20.0
Bayındır	27361	7.40	521	5.52	0.78		40.08	36.47	237.94	0.00	24.82	31.70					1.6	25.0
Bayındır	27362	7.40	422	20.69	3.13		40.08	17.02	186.08	0.00	31.91	20.65					3.4	17.0
Bayındır	28426	7.40	429	26.67	1.56		34.07	18.23	207.43	0.00	21.27	19.21					1.0	16.0
Bayındır	28425	7.40	380	18.85	1.56		40.08	13.37	192.18	0.00	21.27	10.09					2.2	15.5
Bayındır	27363-B	7.00	457	6.90	0.78		42.08	27.96	192.18	0.00	24.82	41.79					1.6	2.2
Bayındır	30306	7.90	440	25.29	1.56		28.06	23.10	122.02	0.00	39.00	54.76					0.0	16.5
Bayındır	30305	7.40	322	22.99	0.78		40.08	4.86	128.12	0.00	35.45	15.37					0.2	12.0
Bayındır	30304	7.30	280	14.71	0.78		34.07	8.51	137.27	0.00	21.27	10.09					1.2	12.0
Bayındır	30303	7.30	310	15.17	0.78		38.08	8.51	134.22	0.00	21.27	23.06					2.8	13.0
Bayındır	24863	7.40	605	47.13	1.56		48.10	19.45	207.43	0.00	24.82	95.58					0.0	

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Bayındır	24862	7.70	566	7.36	0.39	3.90			128.12	0.00	14.18	83.10					0.0	
Bayındır	30666	7.40	411	26.21	0.78		38.08	13.37	219.64	0.00	17.73	2.88					0.8	15.0
Bayındır	30665	7.70	558	70.81	1.17		44.09	3.65	244.04	0.00	14.18	58.12					1.0	12.5
Bayındır	30664	7.10	346	28.74	4.69		38.08	8.51	198.28	79.41	21.27	5.76	13.00				0.8	
Bayındır	30663	7.10	479	31.27	1.56		56.11	7.29	204.38	0.00	35.45	21.61					0.2	28.0
Bayındır	30662	7.70	561	59.32	1.17		34.07	17.02	250.14	8.00	31.91	14.89					1.5	15.5
Bayındır	30661	8.10	513	48.74	0.78		40.08	12.16	253.19	0.00	21.27	18.73					1.0	15.0
Bayındır	30660	7.40	400	16.09	0.78		42.08	14.59	198.28	0.00	24.82	3.36					0.8	16.5
Bayındır	30659	7.30	435	44.14	0.78		40.08	6.08	213.54	0.00	28.36	6.72					0.6	12.5
Bayındır	24866	7.70	732	62.08	4.30		56.11	18.23	207.43	0.00	78.00	72.53					0.0	21.5
Bayındır	30668-B	8.00	271	11.50	0.78		20.04	6.08	103.72	12.00	17.73	10.57					0.8	12.5
Bayındır	30667	7.60	338	39.54	1.17		36.07	3.65	192.18	0.00	14.18	14.41					1.6	10.5
Bayındır	24869		272	13.79	1.17	2.40			88.46	0.00	17.73	51.87					5.0	12.0
Bayındır	24868		272	17.47	1.17	2.20			76.26	0.00	24.82	48.03					1.0	11.0
Bayındır	24867	7.70	360	7.36	0.39		20.04	21.88	103.72	0.00	21.27	39.87					0.0	14.0
Bayındır	24865	7.40	309	11.50	0.78		6.01	25.53	116.53	0.00	21.27	20.17					0.0	12.0
Bayındır	24864	7.60	412	16.55	0.78		20.04	24.31	57.96	0.00	31.91	90.78					0.0	
Bayındır	24879	7.50	593	41.84	1.17		44.09	27.96	271.49	0.00	46.09	28.82					0.8	25.0
Bayındır	24878	7.40	620	45.98	3.52	4.70			237.94	0.00	28.36	100.39					1.3	23.5
Bayındır	24877	7.80	496	34.49	3.91	3.60			192.18	0.00	21.27	69.65					0.0	18.0
Bayındır	24876	7.40	631	43.22	0.78	4.60			244.04	0.00	35.45	72.05					0.0	
Bayındır	24875	7.80	620	33.11	1.17		54.11	27.96	240.99	0.00	39.00	68.21					1.3	25.0
Bayındır	24859	7.40	335	5.98	0.39		18.04	23.10	85.41	0.00	17.73	56.20					0.0	14.0
Bayındır	28402	7.40	340	19.77	1.17		30.06	15.80	170.83	0.00	28.36	4.32					0.2	14.0
Bayındır	28403	7.40	380	19.31	0.39	3.00			183.03	0.00	24.82	7.20					0.0	
Bayındır	21913	7.20	362	9.66	1.17		56.11	4.86	170.83	0.00	24.82	7.20					0.2	16.0
Bayındır	21914	7.40	396	13.79	1.96	3.50			146.42	0.00	35.45	36.02					0.0	17.5
Bayındır	21915	7.60	452	9.66	1.17		58.12	17.02	216.59	0.00	31.91	14.41					1.9	21.5
Bayındır	21916	7.70	306	11.50	2.74	3.40			155.58	0.00	21.27	39.39					0.0	17.0

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Bayındır	21917	7.20	329	11.96	1.17		50.10	10.94	155.58	0.00	31.91	24.02					0.9	17.0
Bayındır	21918		535	10.58	1.17	4.90			256.24	8.00	17.73	13.93					0.0	24.5
Bayındır	24961	8.20	772	28.97	1.56	4.30			170.83	2.00	49.63	62.44					0.0	
Bayındır	24962	7.60	978	27.59	0.39	6.00			271.49	0.00	42.54	74.93					0.0	30.0
Bayındır	24960	7.60	650	31.73	0.78		54.11	36.47	259.29	0.00	46.09	74.45					1.1	28.5
Bayındır	24959	7.70	705	45.98	0.78		52.10	35.25	298.95	0.00	42.54	68.21					0.8	26.0
Bayındır	19148	6.90	655	25.29	0.00		90.18	18.23	259.29	0.00	42.54	79.25					0.0	30.0
Bayındır	19147	6.90	388	18.39	2.74		48.10	12.16	88.46	0.00	21.27	106.63					0.2	17.0
Bayındır	19146	7.20	378	9.20	2.74		50.10	17.02	207.43	0.00	24.82	12.97					0.8	19.5
Bayındır	19145	6.80	538	26.21	2.35		64.13	17.02	207.43	0.00	35.45	67.24					0.4	23.0
Bayındır	19144	7.00	418	18.39	1.96		48.10	14.59	189.13	0.00	21.27	36.02					0.7	18.0
Bayındır	19142	6.09	550	27.59	1.56		64.13	17.02	219.64	0.00	31.55	64.36					0.0	
Bayındır	19141	7.40	391	10.81	2.74		50.10	13.37	195.23	0.00	24.82	11.53					0.6	18.0
Bayındır	14490-A	7.00	526	6.90	1.96	5.20			169.61	0.00	39.71	6.72					15.2	20.0
Bayındır	14490-B	7.00	526	6.90	1.96	5.20			163.51	0.00	39.71	6.72					1.9	21.5
Bayındır	14482	7.00	540	131.05	3.91		84.17	13.37	395.34	0.00	39.71	13.45					1.0	10.5
Bayındır	14491	7.00	527	40.92	7.04		104.21	20.67	294.07	0.00	49.63	22.58					1.0	18.0
Bayındır	14493	7.00	709	17.24	1.96		112.22	12.16	257.46	0.00	49.63	61.96					0.5	24.0
Bayındır	00988	7.30	375	22.3	9.78	3.42			175.71	0.00	22.34	42.27					0.0	31.1
Bayındır	00991	7.20	900	56.79	20.33	6.22			230.62	0.00	80.12	152.26					1.4	31.0
Bayındır	03963	8.00	464	17.70	2.74	5.40			2101.18	0.80	39.71	92.22					0.9	27.0
Bayındır	01001	7.40	280	10.81	9.78		34.07	9.72	140.32	0.00	15.60	21.13					3.0	12.5
Bayındır	01002	7.10	500	24.83	9.78		48.10	25.53	174.49	0.00	39.00	46.59					2.7	22.5
Bayındır	01003	7.20	300	9.89	9.78		28.06	15.80	139.10	0.00	15.60	5.28					1.4	18.0
Bayındır	01004	7.20	400	19.77	9.78		37.07	18.84	173.27	0.00	19.50	21.61					1.6	17.0
Bayındır	07263	7.00	323	20.00		2.60			198.28	0.00	29.78	9.13					0.7	16.5
Bayındır	07262	7.20	288	14.94	3.91	2.40			137.27	0.00	28.36						0.0	12.0
Beydağ	48720	6.80	518	12.19	0.39	4.70			213.54	0.00	29.78	43.23	0.37			0.02	0.0	
Beydağ	48721	7.40	556	41.84	1.56	3.76			220.25	0.00	29.07	57.16				0.83	0.8	18.8

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Kiraz	47976	7.70	381	15.86	0.78		56.71	4.74	179.98	0.00	11.34	30.26					0.0	16.9
Menderes	00023	7.50	640	94.72	9.78	2.69			245.26	0.00	70.91	37.46					0.7	13.4
Menderes	00031	7.30	850	85.07	9.78		56.11	13.37	280.65	0.00	43.96	101.83					5.0	19.5
Menderes	37149	7.33	734	57.02	1.56		48.90	30.15	333.72	0.00	47.15	30.74					0.8	24.6
Menderes	36407	7.33	698	40.69	1.56		62.73	26.50	374.60	0.00	26.24	11.53					1.4	26.6
Menderes	48231	6.90	503	18.85	1.56	4.42			272.10	0.00	23.40	7.69				0.35	0.0	
Menderes	48232	7.30	505	8.97	0.39	4.85			261.12	0.00	23.40	14.89	0.94				0.0	
Menderes	48234	7.20	580	34.26	1.17	4.57			311.15	0.00	26.94	11.05					0.0	
Menderes	43339	7.10	368	20.69	0.78		38.08	11.67	181.20	0.00	18.79	18.25					0.3	14.3
Menderes	41953	7.02	653	25.98	1.17		21.44	53.85	312.37	0.00	26.24	38.43					0.7	27.5
Menderes	41954	7.20	518	15.63	0.78		52.71	23.58	248.92	0.00	30.84	15.37					0.0	22.9
Menderes	41955	7.00	668	36.33	0.78		81.16	13.25	329.45	0.00	31.55	21.61			0.01		0.6	25.7
Menderes	41956	7.30	663	70.81	2.35		60.12	7.05	307.49	0.00	36.52	32.18					1.5	17.9
Menderes	42691-B	7.10	544	4.14	0.39		85.37	12.28	158.02	0.00	27.65	100.39					0.0	26.3
Menderes	00025	7.70	1125	190.83	16.03	3.00			302.61	0.00	104.23	195.97					1.1	15.0
Ödemiş	33297-B	7.30	460	23.45	3.91		26.05	27.96	172.05	0.00	24.82	57.64					0.0	18.0
Ödemiş	21919	7.10	409	17.47	1.17	3.40			189.13	0.00	21.27	23.54					0.0	17.0
Ödemiş	49129-B	6.80	825	28.97	0.78	7.22			401.45	0.00	51.41	22.58	0.54			0.88	0.0	
Ödemiş	14911	6.80	715	17.70	0.78	6.41			313.59	0.00	43.25	40.35	1.23				0.0	
Ödemiş	49129-A	6.70	600	7.59	0.39	5.76			287.97	0.00	19.50	39.87	0.96				0.0	
Ödemiş	47981	7.00	554	19.77	0.39	4.75			220.86	0.00	63.11	10.57	0.73				0.0	
Ödemiş	47980	6.90	569	22.07	0.39	4.79			230.62	0.00	36.52	45.63	0.85				0.0	
Ödemiş	48216	7.10	456	4.60	0.78		63.93	38.78	215.98	0.00	30.84	9.13	0.05			0.02	0.0	21.9
Ödemiş	47979	6.40	524	12.42	0.39		58.12	22.97	209.87	0.00	45.38	29.78				0.46	0.0	23.9
Ödemiş	47978	6.80	529	15.17	0.39	4.67			263.56	0.00	31.20	6.72	0.19				0.0	0.0
Ödemiş	47977	7.00	522	14.25	0.39		49.50	26.74	201.94	0.00	44.32	35.54				0.18	0.0	23.3
Ödemiş	47982	6.90	592	2.76	0.39		76.55	24.92	209.87	0.00	49.63	55.72	0.62				0.0	2.9
Ödemiş	46234	6.70	692	10.35	0.39		70.14	36.47	234.28	0.00	57.79	71.57		0.24			1.0	
Ödemiş	45750	7.60	470	14.94	0.39		54.11	17.02	196.45	0.00	28.36	35.54					1.8	20.5

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Ödemiş	45751	7.80	561	26.90	0.78		45.49	26.74	206.21	0.00	34.74	62.44		0.04			1.0	22.3
Ödemiş	44183	7.10	354	9.66	0.78		40.28	13.74	167.17	0.00	14.89	22.09					0.3	15.7
Ödemiş	44189	7.50	482	4.14	0.39		70.54	13.86	164.73	0.00	60.98	20.65					0.2	23.3
Ödemiş	44184	6.90	492	12.65	0.78		51.30	23.70	200.72	0.00	23.40	54.28					0.5	22.3
Ödemiş	43351	7.40	282	4.37	0.39		45.69	6.93	150.69	0.00	12.05	11.53					0.8	14.2
Ödemiş	43352	7.68	320	14.71	0.78		28.06	15.07	145.20	0.00	18.08	19.69					0.7	13.2
Ödemiş	43353	7.70	304	6.44	0.39		41.68	9.36	124.46	0.00	25.17	18.73					0.4	14.3
Ödemiş	42409	7.35	390	17.47	0.78		42.69	13.74	196.45	0.00	17.02	16.33					0.6	16.3
Ödemiş	41971-B	7.59	280	9.43	0.78		33.07	10.45	104.33	0.00	17.37	37.95					1.0	12.6
Ödemiş	39107	7.62	454	24.83	0.78		50.30	12.28	215.37	0.00	28.01	14.41					0.5	17.6
Ödemiş	39076-D	6.99	502	15.63	0.78		62.52	10.70	241.60	0.00	22.34	5.28					1.9	20.0
Ödemiş	39074	7.15	550	15.63	0.78		48.90	29.17	283.09	0.00	26.59	7.20					1.6	24.2
Ödemiş	39073	7.15	535	14.48	0.78		48.90	29.17	281.87	0.00	24.11	9.13					1.7	24.2
Ödemiş	39076-B	7.50	541	27.59	0.39		60.32	15.56	272.10	0.00	23.40	18.25			0.04		1.7	21.5
Ödemiş	39075	7.25	542	14.25	0.78		61.92	22.25	281.87	0.00	25.17	11.05					1.6	24.6
Ödemiş	40947	7.00	339	11.04	0.39		28.66	17.87	136.66	0.00	14.89	35.06					3.0	14.5
Ödemiş	40948	6.50	260	8.74	0.39		31.86	7.78	115.92	0.00	15.95	12.97					0.8	11.5
Ödemiş	35611	7.91	259	14.02	0.78		24.25	10.45	126.29	0.00	13.12	12.49					0.9	10.4
Ödemiş	36341	7.87	183	12.42	0.78		16.03	6.81	93.35	0.00	11.34	3.36					0.6	6.8
Ödemiş	32459	7.40	450	18.85	0.78		50.10	15.80	213.54	0.00	28.36	16.33					0.4	19.0
Ödemiş	32513	8.00	250	11.04	1.56		30.06	7.29	79.31	0.00	21.27	34.58					0.0	10.5
Ödemiş	32514	8.00	330	39.08	6.26		16.03	8.51	122.02	0.00	17.73	41.31					0.0	7.5
Ödemiş	32515	7.70	440	29.43	4.69		46.09	9.72	212.31	0.00	21.27	19.21					1.0	15.5
Ödemiş	32516	8.00	542	193.12	3.13		64.13	17.02	195.23	0.00	35.45	63.40					8.4	230.0
Ödemiş	32517	7.90	450	34.49	3.91		50.10	6.08	180.59	0.00	28.36	40.35					0.6	15.0
Ödemiş	34214	7.78	268	7.36	0.78		28.06	12.16	141.54	0.00	10.64	6.72					0.4	12.0
Ödemiş	25527	7.00	586	34.95	3.91		32.06	36.47	262.34	0.00	63.82	5.76					1.0	23.0
Ödemiş	25526	7.10	583	22.99	3.91		42.08	31.61	262.34	0.00	42.54	14.41					1.2	23.5
Ödemiş	27329	7.80	600	40.46	3.52		44.09	25.53	222.69	0.00	49.63	52.84					2.4	21.5

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Ödemiş	27328	7.30	463	33.34	1.96		56.11	4.86	225.74	0.00	21.27	19.21					2.9	16.0
Ödemiş	27327	7.40	574	19.77	1.56		50.10	31.61	222.69	0.00	28.36	74.45					0.0	25.5
Ödemiş	27326	6.90	491	19.77	1.17		40.08	29.17	131.17	0.00	28.36	112.39					3.0	22.0
Ödemiş	27325	7.30	580	31.27	1.17		36.07	32.82	259.29	0.00	42.54	21.13					3.2	22.5
Ödemiş	27324	7.00	500	25.75	2.74		40.08	26.74	234.89	0.00	31.91	30.74					0.8	21.0
Ödemiş	27323	7.30	517	14.71	0.78		40.08	32.82	213.54	0.00	21.27	60.52					0.0	23.5
Ödemiş	27322	6.90	461	18.85	2.74		20.04	36.47	128.12	0.00	21.27	105.19					1.8	20.0
Ödemiş	27321	7.00	515	36.79	2.35		40.08	19.45	213.54	0.00	28.36	46.11					1.6	18.0
Ödemiş	27320	7.10	422	10.58	1.56		36.07	24.31	158.63	0.00	35.45	33.62					3.3	19.0
Ödemiş	27319	7.70	514	26.21	1.17		38.08	26.74	189.13	0.00	35.45	56.20					2.0	20.5
Ödemiş	27318	7.30	437	29.89	1.96		50.10	7.29	192.18	0.00	24.82	28.82					2.8	15.5
Ödemiş	27465	7.60	681	40.92	2.74		60.12	29.17	91.52	0.00	53.18	204.14					0.8	27.0
Ödemiş	21920	7.00	428	15.17	1.17	3.40			195.23	0.00	17.73	18.73					0.0	17.0
Ödemiş	21922	7.00	486	27.59	4.69	4.00			155.58	0.00	49.63	65.80					0.0	20.0
Ödemiş	21923	7.40	611	28.97	2.74		56.11	36.47	274.55	0.00	28.36	87.90					0.0	29.0
Ödemiş	21924	7.30	532	31.73	3.91		60.12	23.10	189.13	0.00	28.36	119.12					0.0	24.5
Ödemiş	21921	7.30	413	20.69	2.74	4.00			140.32	0.00	39.00	75.41					1.0	20.0
Ödemiş	20321	7.00	291	17.93	6.65		36.07	6.08	106.77	0.00	7.09	62.44					0.2	
Ödemiş	20322	7.10	272	8.74	5.47		24.05	12.16	88.46	0.00	7.09	51.39					0.2	11.0
Ödemiş	20323	7.30	308	13.79	6.65	2.30			112.87	0.00	7.09	48.99					0.5	
Ödemiş	18643	6.60	190	23.68	2.35		1.20	9.72	70.16	0.00	7.09	54.76					0.3	7.0
Ödemiş	18644	6.60	225	6.44	2.74		24.05	7.29	76.26	0.00	14.18	24.02					2.1	9.0
Ödemiş	20324	7.20	272	10.81	3.91		26.05	8.51	109.82	0.00	7.09	27.38					0.6	10.0
Ödemiş	20325	7.00	275	10.81	4.69		20.04	15.80	115.92	0.00	10.64	33.14					1.6	11.5
Ödemiş	15792	6.80	570	16.32	4.69	4.90			207.43	0.00	46.09	49.47					0.0	24.5
Ödemiş	00984	7.60	965	45.29	9.78	7.64			223.91	0.00	85.09	170.03					3.6	38.0
Ödemiş	10571	7.00	462	12.87	2.35		72.14	17.26	236.72	0.00	29.78	35.06					0.6	21.1
Ödemiş	10572	7.00	493	13.79	3.13		88.18	24.56	200.72	18.60	29.78	36.50					0.6	23.8
Ödemiş	10573	7.00	463	15.63	2.35		84.17	22.00	261.73	0.00	39.71	36.50					0.7	23.5

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Ödemiş	10574	7.00	469	18.39	3.13		92.18	22.00	272.71	0.00	39.71	36.50					1.2	24.1
Ödemiş	07889-B	7.00	485	13.79	3.91		80.16	20.67	232.45	0.00	39.71	11.05					0.3	19.5
Ödemiş	07889-C	7.00	585	13.10	3.91		88.18	18.23	204.38	0.00	39.71	6.24					0.2	18.5
Ödemiş	13426-A	7.00	614	52.88	3.91	3.80			339.83	0.00	39.71	20.17					0.0	19.0
Ödemiş	13426-B	7.00	587	27.59	2.35	3.80			281.26	0.00	49.63	51.39					0.0	24.6
Ödemiş	01006	7.60	500	22.30	9.78		39.08	18.23	174.49	0.00	31.91	35.06					1.9	17.0
Ödemiş	12219	7.00	385	16.55	4.30	3.40			129.95	16.00	39.71	52.35					0.0	20.0
Ödemiş	12218	7.00	648	22.53	160.32	4.00			209.26	0.00	49.63	49.95					0.0	22.0
Ödemiş	12217	7.00	405	13.79	2.74	3.20			161.07	0.00	39.71	42.75					0.0	17.5
Ödemiş	12216	7.00	286	7.82	3.13	2.20			91.51	0.00	19.85	29.78					0.0	9.2
Ödemiş	12215	7.00	385	12.87	2.74	2.60			142.15	0.00	39.71	25.46					0.0	15.5
Ödemiş	10065	7.30	192	9.20	2.35		24.05	9.72	102.50	0.00	14.18	21.61					1.0	10.0
Ödemiş	00012	7.80	375	28.28	9.78	4.00			187.30	0.00	19.85	25.94					1.2	15.0
Ödemiş	00014	7.80	605	71.04	10.95	3.76			226.35	0.00	50.70	95.58					2.9	19.0
Ödemiş	00015	7.50	360	9.89	9.78		53.11	12.76	220.86	0.00	12.05	16.81					3.3	18.5
Ödemiş	00017	7.30	425	26.44	9.78	3.72			197.06	0.00	21.98	48.99					1.8	19.0
Ödemiş	00018	7.20	670	38.85	60.61	3.76			246.48	0.00	53.18	70.13					1.4	19.0
Ödemiş	00019	7.20	420	31.73	14.08	2.64			131.17	0.00	32.62	62.92					1.9	13.0
Ödemiş	00020	7.50	240	17.70	9.78	1.96			120.80	0.00	14.89	15.85					1.2	10.0
Ödemiş	00021	7.00	240	17.24	9.78	1.88			130.56	0.00	8.51	12.97					6.8	9.0
Ödemiş	00022	7.50	480	26.44	9.78	4.26			238.55	0.00	17.02	48.99					1.4	21.0
Selçuk	45691	6.90	566	36.33	0.78		64.13	11.31	256.24	0.00	35.45	25.46					0.3	2.1
Selçuk	45692	7.10	566	16.55	0.39		67.74	19.33	267.22	0.00	31.91	20.17					0.3	24.8
Selçuk	41660	7.20	570	17.01	0.78		64.33	22.97	298.34	0.00	26.94	10.09					0.9	25.5
Selçuk	22330	7.70	2063	289.69	16.42		60.12	38.90	350.81	0.00	443.16	46.59					0.0	310.0
Selçuk	24855	6.80	1756	193.12	14.86	8.80			359.96	0.00	340.35	99.91					0.0	
Selçuk	24854	7.60	1174	142.54	6.26	6.70			488.08	0.00	81.54	132.57					0.0	33.5
Selçuk	24853	7.30	1906	229.91	28.94	9.10			359.96	0.00	407.71	117.20					0.0	45.5
Selçuk	21381	7.40	1958	229.91	10.95	9.00			332.50	0.00	393.53	131.13	45.00				0.0	

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Selçuk	20045	7.80	757	38.17	3.91		88.18	17.02	324.57	0.00	74.45	6.72					0.0	29.0
Selçuk	20046	7.50	2064	303.48	14.47		106.21	38.90	338.61	0.00	443.16	193.09					0.9	
Selçuk	20047	7.50	2064	303.48	14.47		106.21	38.90	338.61	0.00	443.16	193.09					88.0	
Selçuk	18495	7.50	948	39.08	3.52	7.00			341.66	0.00	92.18	28.34					0.0	
Selçuk	01000	7.70	650	11.96	9.78		92.18	21.27	329.45	0.00	35.81	89.34					2.4	32.0
Tire	50241	7.50	350	7.82	0.39	3.40			201.33	0.00	14.18	2.40				0.13	0.0	
Tire	41886-A	8.00	377	12.65	0.39		60.12	3.53	175.10	0.00	21.63	17.77					0.2	16.4
Tire	41886-B	7.60	528	17.24	0.39		68.74	13.74	219.64	0.00	53.18	10.57					0.3	22.8
Tire	40932	7.10	305	21.61	0.39		22.04	12.76	135.44	0.00	18.79	16.81					0.0	10.7
Tire	34215	7.12	926	25.29	3.91		64.13	63.21	250.14	0.00	95.72	120.08					1.8	41.0
Tire	30301	7.90	459	18.85	1.17		56.11	17.02	244.04	0.00	28.36	12.01					0.0	21.0
Tire	28552	7.60	471	41.84	1.56		20.04	24.31	183.03	0.00	53.18	17.29					0.8	15.0
Tire	26886	7.60	570	22.99	3.91		18.04	42.55	262.34	0.00	24.82	24.02					0.2	22.0
Tire	30204	7.40	225	16.55	0.78		32.06	6.08	109.82	0.00	24.82	16.33					0.0	10.5
Tire	30203	7.90	287	12.42	0.78		22.04	17.02	146.42	0.00	17.73	7.69					0.0	12.5
Tire	30202	7.70	399	33.11	1.17		20.04	19.45	183.03	0.00	35.45	3.36					0.0	13.0
Tire	30201	7.40	279	11.04	1.17		22.04	17.38	131.17	0.00	14.18	19.21					0.0	
Tire	24858	7.70	404	24.37	1.56		36.07	12.16	146.42	0.00	17.73	48.03					0.0	14.0
Tire	24857	7.60	421	27.13	1.17		40.08	10.94	167.78	0.00	21.27	36.50					0.0	
Tire	24856	7.50	378	22.53	1.17	2.90			158.63	0.00	24.82	29.30					0.0	
Tire	30300-B	7.60	442	15.17	0.78		42.08	27.96	207.43	0.00	21.27	47.07					0.0	21.5
Tire	30299	7.90	329	9.66	0.78		24.05	24.31	183.03	0.00	14.18	11.53					0.0	16.0
Tire	30298	6.80	376	12.87	1.17		36.07	17.02	143.37	0.00	17.73	45.15					0.0	
Tire	30297	7.30	421	11.73	4.30		40.08	24.31	219.64	0.00	21.27	20.17					0.0	20.0
Tire	30296-B	6.80	320	17.93	1.17		30.06	10.94	103.72	0.00	24.82	38.91					0.0	
Tire	30296-A	7.20	291	20.69	0.78		40.08	4.86	131.17	0.00	31.91	12.97	12.00				0.0	
Tire	14356	7.00	257	12.65	0.39		52.10	13.49	100.06	0.00	39.71	23.54					0.3	10.8
Tire	14355	7.70	263	6.90	2.35		64.13	10.82	117.14	0.00	29.78	9.13					0.3	12.2
Tire	14354	7.00	270	8.28	2.35		72.14	12.16	118.36	0.00	29.78	14.89					0.3	11.9

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Tire	14353	7.00	253	13.56	3.91		52.10	33.43	99.45	0.00	29.78	23.06					0.5	
Tire	14352	7.00	250	10.35	3.91		64.13	13.98	101.28	0.00	29.78	27.86					0.6	
Tire	14351	7.00	250	12.65	3.91		64.13	10.94	115.92	0.00	19.85	16.33					0.3	
Tire	00982	7.10	400	32.19	9.78	3.17			150.08	0.00	28.01	50.91					1.9	16.0
Tire	00983	7.20	1010	63.00	9.78	7.40			243.43	0.00	93.24	169.07					1.7	
Tire	10066-A	7.20	216	6.90	3.13		20.04	23.10	118.97	0.00	20.56	32.66					0.7	14.5
Tire	07264	7.00	490	14.94	0.00	3.60			198.28	0.00	49.63	24.02					0.9	26.0
Tire	00011	7.50	330	13.79	9.78	3.22			161.68	0.00	18.08	31.70					1.8	16.0
Torbalı	50242-A	7.00	674	77.25	2.74	3.64			339.83	0.00	37.58	21.13	0.10			0.24	0.0	
Torbalı	50242-B	6.80	682	44.60	1.56	5.18			348.98	0.00	37.23	18.73	0.26			0.02	0.0	
Torbalı	49671	7.30	603	28.05	0.78	5.03			311.76	0.00	29.07	16.33	0.02				0.0	
Torbalı	49670	7.60	476	16.78	0.78	4.15			253.80	0.00	20.56	7.69	0.62				0.0	
Torbalı	48535	7.10	653	47.13	1.56	4.64			359.96	0.00	20.92	11.53	0.83				0.0	
Torbalı	46652	6.70	946	98.86	3.52	5.16			455.13	0.00	65.94	11.05	0.32			0.80	0.0	
Torbalı	46651	7.00	743	115.41	3.13	4.90			399.01	0.00	109.90	17.29					0.0	
Torbalı	46652-B	7.00	672	45.75	1.56	5.02			378.87	0.00	14.54	20.65	0.57			0.44	0.0	
Torbalı	46650	6.60	742	63.46	2.35	5.01			390.46	0.00	41.13	12.97	0.40			0.33	0.0	
Torbalı	46649	6.80	750	27.82	0.78	6.49			427.07	0.00	16.31	12.49	0.50				0.0	
Torbalı	46648-B	7.10	701	19.77	0.78	6.48			378.87	0.00	26.24	19.69	0.88			0.30	0.0	
Torbalı	46048	7.00	622	6.21	0.39		87.78	19.69	297.73	0.00	21.27	38.43					0.8	30.0
Torbalı	46049	7.10	584	19.54	0.78		72.75	17.99	243.43	0.00	47.15	31.70						25.6
Torbalı	46050	7.60	485	2.30	0.39		59.72	21.76	200.72	0.00	41.13	20.65		0.02	0.02		2.0	23.8
Torbalı	46051	7.20	625	18.62	0.78		63.13	27.59	328.23	0.00	16.31	25.94					0.6	27.1
Torbalı	45749	6.60	831	39.31	0.78		96.19	22.97	451.47	0.00	28.36	10.57					0.4	33.4
Torbalı	45748	7.20	795	32.88	0.78		86.57	28.93	442.32	0.00	25.53	8.65					0.4	33.5
Torbalı	45746	6.30	682	8.97	0.39		94.19	21.27	369.11	0.00	22.34	8.17					0.4	33.2
Torbalı	45745-B	6.90	845	47.59	1.56		91.98	22.00	456.35	0.00	31.91	6.24					0.3	32.0
Torbalı	45747	7.10	690	29.20	0.78		79.36	20.67	344.10	0.00	29.43	23.06		0.01			0.6	28.3
Torbalı	49683	7.50	501	39.31	1.17	3.52			236.11	0.00	38.64	14.41	0.26			0.38	0.0	0.3

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Torbalı	45745-A	7.50	686	33.34	0.78		81.96	16.17	366.06	0.00	22.34	12.49					0.9	27.1
Torbalı	43018	8.10	449	12.87	0.39		53.51	17.26	248.31	0.00	14.18	9.13					1.3	20.4
Torbalı	42436	7.24	521	11.06	0.78		68.54	17.50	251.97	0.00	23.75	28.82					1.4	242.0
Torbalı	42492	7.15	555	32.88	1.17		56.51	17.50	266.00	0.00	22.69	34.58					1.0	21.3
Torbalı	42435	7.11	565	36.79	1.17		32.67	39.63	296.51	0.00	24.11	13.45			0.01		1.0	24.5
Torbalı	36742	7.78	542	23.45	1.56		47.70	26.50	289.19	0.00	18.44	17.29					0.9	22.8
Torbalı	36741	7.63	570	28.05	1.56		48.10	26.99	289.19	0.00	23.40	23.06					0.8	23.1
Torbalı	33270	7.77	484	12.19	0.39		59.72	17.75	254.41	0.00	24.82	4.80					0.0	22.2
Torbalı	40923	7.40	523	5.52	0.39		70.14	18.23	237.94	0.00	19.85	37.95					0.2	25.0
Torbalı	34493	7.62	576	45.98	4.69		40.08	21.88	307.49	0.00	24.82	8.65					0.8	19.0
Torbalı	39488	7.14	672	28.74	1.17		52.50	35.74	301.39	0.00	48.93	24.98					1.0	27.8
Torbalı	39489-A	6.50	775	39.08	0.78		93.39	17.75	77.48	0.00	76.93	211.34					0.2	30.6
Torbalı	39486	7.20	655	9.66	0.39		55.71	42.18	323.96	0.00	42.54	8.17		0.02			1.0	31.2
Torbalı	39487	7.40	687	14.25	0.39		76.95	30.27	328.84	0.00	44.67	14.89		0.02			1.0	31.6
Torbalı	39485	7.50	750	20.46	0.39		40.08	57.62	316.03	0.00	36.87	68.21		0.08			2.3	33.7
Torbalı	39495	7.10	1071	83.69	2.35		92.18	31.61	320.91	0.00	150.32	67.24					0.4	36.0
Torbalı	39494	7.30	675	60.24	1.56		56.11	17.14	307.49	0.00	48.93	21.61					1.4	21.5
Torbalı	39493	6.50	689	43.22	0.78		79.16	13.74	297.73	0.00	58.50	21.61					1.0	25.4
Torbalı	39492	6.60	676	14.25	0.39		83.97	24.56	300.17	0.00	52.82	20.65					1.0	31.0
Torbalı	39491	7.60	444	47.59	1.56		26.45	13.86	195.23	0.00	40.77	10.57					0.8	12.3
Torbalı	39490	7.50	913	110.59	3.13		44.29	25.77	319.69	0.00	79.41	83.58					0.6	21.6
Torbalı	35493	7.19	592	36.79	1.56		70.14	12.16	302.61	0.00	28.36	18.25					0.7	22.5
Torbalı	39489-B	6.50	775	39.08	0.78	4.66			77.48	0.00	76.93	211.34					0.2	30.6
Torbalı	35250	6.98	994	61.62	3.13		60.12	51.06	553.97	0.00	24.82	13.45					0.0	36.0
Torbalı	33271	7.47	556	15.63	0.78		56.11	26.26	300.17	0.00	18.08	11.05					1.0	24.8
Torbalı	29866	8.00	580	19.77	1.17		48.10	37.68	231.84	0.00	28.36	85.98					1.0	2.8
Torbalı	29865	7.90	640	29.43	1.56		72.14	24.31	271.49	0.00	42.54	61.00					0.8	28.0
Torbalı	29863	7.40	600	20.23	1.56		60.12	31.61	305.05	0.00	28.36	34.58					3.4	23.0
Torbalı	29864	7.20	585	25.75	2.74		50.10	31.61	244.04	0.00	31.91	66.76					0.8	25.5

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Torbalı	31482	7.50	604	45.98	1.17		50.10	19.45	253.19	0.00	67.36	3.84					3.6	20.5
Torbalı	26777	7.50	597	21.15	0.78		34.07	41.33	280.65	0.00	39.00	16.33					0.1	25.5
Torbalı	30311	8.10	936	98.86	14.08		70.14	20.67	305.05	0.00	24.82	199.81					0.8	26.0
Torbalı	30310	7.80	560	27.59	4.69		58.12	27.96	305.05	0.00	21.27	44.19					0.0	26.0
Torbalı	30309	7.60	1203	208.76	1.17		50.10	6.08	289.80	0.00	17.73	329.50					0.6	15.0
Torbalı	30307	7.90	482	23.91	1.17		38.08	23.10	256.24	0.00	17.73	8.17					1.6	19.0
Torbalı	26802	7.50	366	23.91	1.96		22.04	19.45	176.93	0.00	28.36	4.32					0.9	13.5
Torbalı	33133	7.44	614	26.21	1.56		48.10	32.82	292.85	0.00	28.36	32.66					0.0	25.5
Torbalı	33274	7.69	618	37.02	1.17		46.89	27.96	306.88	0.00	31.20	17.77					1.0	23.2
Torbalı	33273	7.23	444	10.58	0.78		44.89	22.61	244.65	0.00	15.24	6.72					0.9	20.5
Torbalı	33275	7.44	488	5.98	0.78		60.52	19.21	245.26	0.00	25.88	6.24					0.9	23.0
Torbalı	28554	7.80	701	59.32	3.52		46.09	26.74	338.61	0.00	28.36	39.39					0.5	22.5
Torbalı	27414	7.50	1065	42.30	5.08		100.20	38.90	558.24	0.00	31.91	5.76					1.4	41.0
Torbalı	27416	7.30	1135	148.06	5.08		88.18	8.51	649.76	0.00	28.36	10.57					0.4	25.5
Torbalı	27415	7.40	1065	45.52	6.65		104.21	38.90	573.49	0.00	35.45	7.20					1.4	42.0
Torbalı	26907	7.40	864	85.53	7.43		42.08	30.39	399.62	0.00	56.72	17.29					0.0	23.0
Torbalı	26887	7.60	531	21.61	1.17	4.80					35.45	229.11					0.0	
Torbalı	28858	8.10	1807	266.70	9.38		44.09	54.70	579.59	20.00	141.81	194.05					3.7	33.5
Torbalı	28857	6.70	650	45.52	2.74		60.12	30.39	140.32	0.00	120.54	88.86					1.1	27.5
Torbalı	28856	7.80	486	32.65	1.96		40.08	17.02	176.93	0.00	28.36	8.17					0.8	17.0
Torbalı	28854	7.70	300	14.71	1.17		48.10	9.72	158.63	0.00	28.36	22.58					0.9	16.0
Torbalı	28853	7.30	326	21.15	0.78		28.06	13.37	134.22	0.00	31.91	16.33					1.1	12.5
Torbalı	30206	7.40	600	9.20	0.78		76.15	26.74	292.85	0.00	31.91	34.58					0.0	30.0
Torbalı	27422	7.40	556	12.42	2.35	5.00			286.75	0.00	24.82	9.61					0.0	
Torbalı	27421	7.50	672	23.91	3.13	5.60			326.40	0.00	28.36	27.38					0.0	
Torbalı	27420	7.20	1063	170.59	1.56		68.14	10.94	558.24	0.00	46.09	62.92					0.8	21.5
Torbalı	27419	7.30	1038	160.94	0.39		44.09	17.02	549.09	0.00	49.63	10.09					2.0	18.0
Torbalı	27418	7.50	984	72.19	3.52	3.80			518.59	0.00	39.00	30.26					0.2	35.0
Torbalı	27417	7.20	956	114.04	3.52		74.15	13.37	549.09	0.00	24.82	7.20					0.6	24.0

Table I.2 continued.

City	Well No	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	HCO_3 mg/l	CO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l	NO_2 mg/l	NH_4 mg/l	Fe mg/l	Organic M.(mg/l)	Hard. FD
Torbalı	22214	7.20	876	27.13	6.65	7.00			231.84	12.00	17.73	165.71					0.0	35.0
Torbalı	22331	7.10	584	8.74	2.74		64.13	26.74	286.75	0.00	24.82	21.61					0.6	27.0
Torbalı	00993	7.60	530	13.79	9.78	5.80			361.18	0.00	14.18	3.84					0.6	29.0
Torbalı	00994	7.10	505	16.32	9.78		70.14	22.49	305.05	0.00	17.02	12.97					2.1	27.0
Torbalı	01005	7.40	400	20.46	9.78		46.09	14.59	214.76	0.00	18.44	11.05					3.4	22.5
Torbalı	10063-B	7.20	432	16.09	1.56		38.08	38.90	295.90	0.00	27.65	9.61					1.6	25.5
Torbalı	10063-C	7.50	453	11.50	1.56		60.12	34.04	284.31	0.00	34.39	18.25					2.0	29.0
Torbalı	10064-A	7.00	608	16.09	1.96		104.21	29.17	331.28	0.00	39.71	7.69					3.8	29.5
Torbalı	07260	7.00	640	55.41	0.00	4.40			338.61	0.00	89.34	53.32					1.6	29.5
Torbalı	07261	7.00	460	225.31	0.00	4.00			3294.54	0.00	39.71	96.06					8.8	265.0
Torbalı	00028	7.40	615	13.33	9.78	6.80			372.16	0.00	23.04	30.26					1.2	34.0
Torbalı	00026	7.80	600	12.87	9.78	6.50			240.38	0.00	14.18	20.17					1.7	32.5
Torbalı	00027	7.40	540	12.87	9.78		124.25	19.33	351.42	0.00	19.14	22.09					2.5	31.0
Torbalı	00030	7.20	525	11.50	9.78		98.20	12.16	327.01	0.00	19.85						2.5	29.5

Table I.3. Quality classes of the DSİ well waters with respect to the limits of inland water sources (WCCR, 1988). For explanation see caption of Table 3.4.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
İzmir	21036	I	I					C2S1
İzmir	00029	I	I					C2
Bayındır	49081	II	I	I				C2
Bayındır	49080	II	I	I				C2
Bayındır	49082	II	I			I		C2
Bayındır	49488	II	I	I				C2
Bayındır	48515	II	I	I				C2
Bayındır	48201	I	I					C2S1
Bayındır	48032-A	I	I	I		II		C2
Bayındır	48033	I	I	I				C2S1
Bayındır	48032-B	II	I	I		I		C2
Bayındır	48031	II	I					C2
Bayındır	48030	I	I					C2
Bayındır	47818	II	I					C2S1
Bayındır	47820	II	I	I		I		C2S1
Bayındır	47819	II	I	I		II		C2S1
Bayındır	47822	II	I	I	III	I		C2S1
Bayındır	47823	II	I					C2S1
Bayındır	46636	II	I					C2S1
Bayındır	46637	II	I					C2S1
Bayındır	46638	I	I					C2S1
Bayındır	46639	II	I					C2S1
Bayındır	46198	I	I					C2S1
Bayındır	46199	II	I					C2S1
Bayındır	46195	II	I					C2S1
Bayındır	46196	I	I		III			C2S1
Bayındır	46197	I	I		III			C2S1
Bayındır	44185	II	I		III			C2S1
Bayındır	43396	II	I					C2S1
Bayındır	43397	I	I					C2S1
Bayındır	44186	I	I					C2S1
Bayındır	39395	II	I					C2S1
Bayındır	39394	II	I					C3S1
Bayındır	39397	II	I					C3S1
Bayındır	39396	II	I					C2S1
Bayındır	39398	II	I					C2S1
Bayındır	43331	II	I					C2S1
Bayındır	43332	II	I					C2S1
Bayındır	43333	II	I				I	C2S1
Bayındır	43334	II	I					C2S1
Bayındır	39483	II	I					C2S1
Bayındır	39484	II	I					C2S1
Bayındır	39482	II	I					C2S1
Bayındır	39481	I	I					C2S1
Bayındır	39480	I	I					C2S1
Bayındır	27363-A	II	I					C2S1
Bayındır	27360	I	I					C2S1
Bayındır	27361	I	I					C2S1
Bayındır	27362	II	I					C2S1
Bayındır	28426	I	I					C2S1
Bayındır	28425	I	I					C2S1
Bayındır	27363-B	I	I					C2S1

Table I.3 continued.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
Bayındır	30306	II	I					C2S1
Bayındır	30305	II	I					C2S1
Bayındır	30304	I	I					C2S1
Bayındır	30303	I	I					C2S1
Bayındır	24863	I	I					C2S1
Bayındır	24862	I	I					C2
Bayındır	30674	I	I	IV				C2S1
Bayındır	30666	I	I					C2S1
Bayındır	30665	I	I					C2S1
Bayındır	30664	I	I	IV				C2S1
Bayındır	30663	II	I					C2S1
Bayındır	30662	II	I					C2S1
Bayındır	30661	I	I					C2S1
Bayındır	30660	I	I					C2S1
Bayındır	30659	II	I					C2S1
Bayındır	24866	II	I					C2S1
Bayındır	30668-B	I	I					C2S1
Bayındır	30667	I	I					C2S1
Bayındır	24869	I	I					C2
Bayındır	24868	I	I					C2
Bayındır	24867	I	I					C2S1
Bayındır	24865	I	I					C2S1
Bayındır	24864	II	I					C2S1
Bayındır	24879	II	I					C2S1
Bayındır	24878	II	I					C2
Bayındır	24877	I	I					C2
Bayındır	24876	II	I					C2
Bayındır	24875	II	I					C2S1
Bayındır	24859	I	I					C2S1
Bayındır	28402	II	I					C2S1
Bayındır	28403	I	I					C2
Bayındır	21913	I	I					C2S1
Bayındır	21914	II	I					C2
Bayındır	21915	II	I					C2S1
Bayındır	21916	I	I					C2
Bayındır	21917	II	I					C2S1
Bayındır	21918	I	I					C2
Bayındır	24961	II	I					C3
Bayındır	24962	II	I					C3
Bayındır	24960	II	I					C2S1
Bayındır	24959	II	I					C2S1
Bayındır	19148	II	I					C2S1
Bayındır	19147	I	I					C2S1
Bayındır	19146	I	I					C2S1
Bayındır	19145	II	I					C2S1
Bayındır	19144	I	I					C2S1
Bayındır	19142	II	I					C1S1
Bayındır	19141	I	I					C2S1
Bayındır	14490-A	II	I					C2
Bayındır	14490-B	II	I					C2
Bayındır	14482	II	I					C2S1
Bayındır	14491	II	I					C2S1
Bayındır	14493	II	I					C2S1
Bayındır	00988	I	I					C2

Table I.3 continued.

City	Well No	Cl	SO$_4$	B	N-NO$_2$	Fe	N-NH$_4$	Salinity-SAR
Bayındır	00991	II	I					C3
Bayındır	03963	II	I					C2
Bayındır	01001	I	I					C2S1
Bayındır	01002	II	I					C2S1
Bayındır	01003	I	I					C2S1
Bayındır	01004	I	I					C2S1
Bayındır	07263	II	I					C2
Bayındır	07262	II						C2
Beydağ	48720	II	I	I		I		C2
Beydağ	48721	II	I			II		C2
Kiraz	47976	I	I					C2S1
Menderes	00023	II	I					C2
Menderes	00031	II	I					C3S1
Menderes	37149	II	I					C2S1
Menderes	36407	II	I					C2S1
Menderes	48231	I	I			II		C2
Menderes	48232	I	I	I				C2
Menderes	48234	II	I					C2
Menderes	43339	I	I					C2S1
Menderes	41953	II	I					C2S1
Menderes	41954	II	I					C2S1
Menderes	41955	II	I				I	C2S1
Menderes	41956	II	I					C2S1
Menderes	42691-B	II	I					C2S1
Menderes	00025	II	I					C3
Ödemiş	33297-B	I	I					C2S1
Ödemiş	21919	I	I					C2
Ödemiş	49129-B	II	I	I		II		C3
Ödemiş	14911	II	I	IV				C2
Ödemiş	49129-A	I	I	I				C1
Ödemiş	47981	II	I	I				C2
Ödemiş	47980	II	I	I				C2
Ödemiş	48216	II	I	I		I		C2S1
Ödemiş	47979	II	I			II		C2S1
Ödemiş	47978	II	I	I				C2
Ödemiş	47977	II	I			I		C2S1
Ödemiş	47982	II	I	I				C2S1
Ödemiş	46234	II	I		IV			C2S1
Ödemiş	45750	II	I					C2S1
Ödemiş	45751	II	I		III			C2S1
Ödemiş	44183	I	I					C2S1
Ödemiş	44189	II	I					C2S1
Ödemiş	44184	I	I					C2S1
Ödemiş	43351	I	I					C2S1
Ödemiş	43352	I	I					C2S1
Ödemiş	43353	II	I					C2S1
Ödemiş	42409	I	I					C2S1
Ödemiş	41971-B	I	I					C2S1
Ödemiş	39107	II	I					C2S1
Ödemiş	39076-D	I	I					C2S1
Ödemiş	39074	II	I					C2S1
Ödemiş	39073	I	I					C2S1
Ödemiş	39076-B	I	I				I	C2S1
Ödemiş	39075-B	II	I					C2S1

Table I.3 continued.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
Ödemiş	40947	I	I					C2S1
Ödemiş	40948	I	I					C2S1
Ödemiş	35611	I	I					C2S1
Ödemiş	36341	I	I					C1S1
Ödemiş	32459	II	I					C2S1
Ödemiş	32513	I	I					C2S1
Ödemiş	32514	I	I					C2S1
Ödemiş	32515	I	I					C2S1
Ödemiş	32516	II	I					C2S1
Ödemiş	32517	II	I					C2S1
Ödemiş	34214	I	I					C2S1
Ödemiş	25527	II	I					C2S1
Ödemiş	25526	II	I					C2S1
Ödemiş	27329	II	I					C2S1
Ödemiş	27328	I	I					C2S1
Ödemiş	27327	II	I					C2S1
Ödemiş	27326	II	I					C2S1
Ödemiş	27325	II	I					C2S1
Ödemiş	27324	II	I					C2S1
Ödemiş	27323	I	I					C2S1
Ödemiş	27322	I	I					C2S1
Ödemiş	27321	II	I					C2S1
Ödemiş	27320	II	I					C2S1
Ödemiş	27319	II	I					C2S1
Ödemiş	27318	I	I					C2S1
Ödemiş	27465	II	III					C2S1
Ödemiş	21920	I	I					C2
Ödemiş	21922	II	I					C2
Ödemiş	21923	II	I					C2S1
Ödemiş	21924	II	I					C2S1
Ödemiş	21921	II	I					C2
Ödemiş	20321	I	I					C2S1
Ödemiş	20322	I	I					C2S1
Ödemiş	20323	I	I					C2
Ödemiş	18643	I	I					C1S1
Ödemiş	18644	I	I					C1S1
Ödemiş	20324	I	I					C2S1
Ödemiş	20325	I	I					C2S1
Ödemiş	15792	II	I					C2
Ödemiş	00984	II	I					C3
Ödemiş	10571	II	I					C2S1
Ödemiş	10572	II	I					C2S1
Ödemiş	10573	II	I					C2S1
Ödemiş	10574	II	I					C2S1
Ödemiş	07889-B	II	I					C2S1
Ödemiş	07889-C	II	I					C2S1
Ödemiş	13426-A	II	I					C2
Ödemiş	13426-B	II	I					C2
Ödemiş	01006	II	I					C2S1
Ödemiş	12219	II	I					C2
Ödemiş	12218	II	I					C2
Ödemiş	12217	II	I					C2
Ödemiş	12216	I	I					C2
Ödemiş	12215	II	I					C2

Table I.3 continued.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
Ödemiş	10065	I	I					C1S1
Ödemiş	00012	I	I					C2
Ödemiş	00014	II	I					C2
Ödemiş	00015	I	I					C2S1
Ödemiş	00017	I	I					C2
Ödemiş	00018	II	I					C2
Ödemiş	00019	II	I					C2
Ödemiş	00020	I	I					C1
Ödemiş	00021	I	I					C1
Ödemiş	00022	I	I					C2
Selçuk	45691	II	I					C2S1
Selçuk	45692	II	I					C2S1
Selçuk	41660	II	I					C2S1
Selçuk	22330	IV	I					C3S1
Selçuk	24855	III	I					C3
Selçuk	24854	II	I					C3
Selçuk	24853	IV	I					C3
Selçuk	21381	III	I	IV				C3
Selçuk	20045	II	I				I	C3S1
Selçuk	20046	IV	I					C3S1
Selçuk	20047	IV	I					C3S1
Selçuk	18495	II	I					C3
Selçuk	01000	II	I					C2S1
Tire	50241	I	I			I		C2
Tire	41886-A	I	I					C2S1
Tire	41886-B	II	I					C2S1
Tire	40932	I	I					C2S1
Tire	34215	II	I					C3S1
Tire	30301	II	I					C2S1
Tire	28552	II	I					C2S1
Tire	26886	I	I					C2S1
Tire	30204	I	I					C1S1
Tire	30203	I	I					C2S1
Tire	30202	II	I					C2S1
Tire	30201	I	I					C2S1
Tire	24858	I	I					C2S1
Tire	24857	I	I					C2S1
Tire	24856	I	I					C2
Tire	30300-B	I	I					C2S1
Tire	30299	I	I					C2S1
Tire	30298	I	I					C2S1
Tire	30297	I	I					C2S1
Tire	30296-B	I	I					C2S1
Tire	30296-A	II	I	IV				C2S1
Tire	14356	II	I					C2S1
Tire	14355	II	I					C2S1
Tire	14354	II	I					C2S1
Tire	14353	II	I					C2S1
Tire	14352	II	I					C2S1
Tire	14351	I	I					C2S1
Tire	00982	II	I					C2
Tire	00983	II	I					C3
Tire	10066-A	I	I					C1S1
Tire	07264	II	I					C2

Table I.3 continued.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
Tire	00011	I	I					C2
Torbalı	50242-A	II	I	I		I		C2
Torbalı	50242-B	II	I	I		I		C2
Torbalı	49671	II	I	I				C2
Torbalı	49670	I	I	I				C2
Torbalı	48535	I	I	I				C2
Torbalı	46652	II	I	I		II		C3
Torbalı	46651	II	I					C2
Torbalı	46652-B	I	I	I		II		C2
Torbalı	46650	II	I	I		II		C1
Torbalı	46649	I	I	I				C3
Torbalı	46648-B	II	I	I		I		C2
Torbalı	46048	I	I					C2S1
Torbalı	46049	II	I					C2S1
Torbalı	46050	II	I		III		I	C2S1
Torbalı	46051	I	I					C2S1
Torbalı	45749	II	I					C3S1
Torbalı	45748	II	I					C3S1
Torbalı	45746	I	I					C2S1
Torbalı	45745-B	II	I					C3S1
Torbalı	45747	II	I		III			C2S1
Torbalı	49683	II	I	I		II		C2
Torbalı	45745-A	I	I					C2S1
Torbalı	43018	I	I					C2S1
Torbalı	42436	I	I					C2S1
Torbalı	42492	I	I					C2S1
Torbalı	42435	I	I				I	C2S1
Torbalı	36742	I	I					C2S1
Torbalı	36741	I	I					C2S1
Torbalı	33270	I	I					C2S1
Torbalı	40923	I	I					C2S1
Torbalı	34493	I	I					C2S1
Torbalı	39488	II	I					C2S1
Torbalı	39489-A	II	III					C3S1
Torbalı	39486	II	I		III			C2S1
Torbalı	39487	II	I		III			C2S1
Torbalı	39485	II	I		III			C3S1
Torbalı	39495	II	I					C3S1
Torbalı	39494	II	I					C2S1
Torbalı	39493	II	I					C2S1
Torbalı	39492	II	I					C2S1
Torbalı	39491	II	I					C2S1
Torbalı	39490	II	I					C3S1
Torbalı	35493	II	I					C2S1
Torbalı	39489-B	II	III					C3
Torbalı	35250	I	I					C3S1
Torbalı	33271	I	I					C2S1
Torbalı	29866	II	I					C2S1
Torbalı	29865	II	I					C2S1
Torbalı	29863	II	I					C2S1
Torbalı	29864	II	I					C2S1
Torbalı	31482	II	I					C2S1
Torbalı	26777	II	I					C2S1
Torbalı	30311	I	I					C3S1

Table I.3 continued.

City	Well No	Cl	SO_4	B	N-NO_2	Fe	N-NH_4	Salinity-SAR
Torbalı	30310	I	I					C2S1
Torbalı	30309	I	III					C3S1
Torbalı	30307	I	I					C2S1
Torbalı	26802	II	I					C2S1
Torbalı	33133	II	I					C2S1
Torbalı	33274	II	I					C2S1
Torbalı	33273	I	I					C2S1
Torbalı	33275	II	I					C2S1
Torbalı	28554	II	I					C2S1
Torbalı	27414	II	I					C3S1
Torbalı	27416	II	I					C3S1
Torbalı	27415	II	I					C3S1
Torbalı	26907	II	I					C3S1
Torbalı	26887	II	III					C2
Torbalı	28858	II	I					C3S1
Torbalı	28857	II	I					C2S1
Torbalı	28856	II	I					C2S1
Torbalı	28854	II	I					C2S1
Torbalı	28853	II	I					C2S1
Torbalı	30206	II	I					C2S1
Torbalı	27422	I	I					C2
Torbalı	27421	II	I					C2
Torbalı	27420	II	I					C3S1
Torbalı	27419	II	I					C3S1
Torbalı	27418	II	I					C3
Torbalı	27417	I	I					C3S1
Torbalı	22214	I	I					C3
Torbalı	22331	I	I					C2S1
Torbalı	00993	I	I					C2
Torbalı	00994	I	I					C2S1
Torbalı	01005	I	I					C2S1
Torbalı	10063-B	II	I					C2S1
Torbalı	10063-C	II	I					C2S1
Torbalı	10064-A	II	I					C2S1
Torbalı	07260	II	I					C2
Torbalı	07261	II	I					C2
Torbalı	00028	I	I					C2
Torbalı	00026	I	I					C2
Torbalı	00027	I	I					C2S1
Torbalı	00030	I						C2S1

Table I.4. Locations of the DSİ monitoring wells. Distribution of the locations is shown in Figure I.3.

DSİ No	New DSİ No	Explanation	Sheet	East	North	Depth (m)
1	L20-K005	Kiraz, İ.S.K.	L20-d2	607200	4229300	97
2	L20-K002	Haliller, İ.S.K.	L20-c1	613550	4226700	12
3	L20-K004	Ceritler, İ.S.K.	L20-a3	601800	4236600	12
4	L20-K003	Karaburç, İ.S.K.	L20-c1	611550	4229750	55
5	L20-K001	Ören, İ.S.K.	L20-c2	622700	4232700	
6	L20-K006	Yenişehir, İ.S.K.	L20-d2	607600	4224650	48
7	L20-K007	Beydağ, İ.S.K.	L20-d3	606650	4218450	38
8	L20-K008	Sarıkaya, İ.S.K.	L20-d3	603300	4219400	32
9	L20-K009	Kaymakçı, K.K.	L20-d2	599050	4224700	100
10	L20-K010	Kurucaova	L20-d1	593500	4224050	
11	L20-K011	Yolüstü, K.K., 39107	L20-d1	589200	4227600	130
12	L20-K012	Küçükavulcuk, 32514	L20-d1	590150	4232800	150
13	L19-K001	Ödemiş, İ.S.K., Prison	L19-c2	586250	4233400	100
14	L19-K002	Mehmet Bardakçı (Datbey)	L19-b3	584900	4235250	128
15	L19-K003	Demircili, K.K., 39073	L19-c2	581100	4231950	130
16	L19-K004	Yeniköy, K.K., 21923	L19-c2	577600	4228600	106
17	L19-K005	Karakova kahve well	L19-c2	582550	4225800	20
18	L19-K006	Kahrat, K.K., 30304	L19-c1	575150	4223300	100
19	L20-K013	Emirli, İ.S.K.	L20-d1	597400	4220600	50
20	L20-K014	Mescitli, İ.S.K.	L20-d1	594400	4221050	120
21	L20-K015	Bademli, DSİ	L20-d4	592950	4215700	
22	L20-K016	Adagide, İ.S.K.	L20-d1	590275	4221800	100
23	L19-K007	Konaklı, Jica	L19-c2	587200	4221600	
24	L19-K008	Kazanlı, İ.S.K.	L19-c2	582275	4222450	102
25	L19-K009	Kızılcaavlu, İ.S.K.	L19-c2	577400	4222750	75
26	L19-K010	Gökçen, K.K., 30301	L19-c4	576050	4219350	102
27	L19-K011	Çiniyeri, İ.S.K.	L19-c4	570600	4218400	60
28	L19-K012	Tire, İ.S.K., East	L19-c4	566900	4217550	106
29	L19-K013	Tire, İ.S.K., West	L19-d3	562600	4216300	90
30	L19-K014	Tire, İ.S.K., North	L19-d2	562800	4222700	100
31	L19-K015	Kayaköy, İ.S.K.	L19-c1	573650	4229200	80
32	L19-K016	Derebaşı, İ.S.K.	L19-c1	568300	4222500	40
33	L19-K017	Zeytinova, K.K., 39483	L19-c1	563450	4227450	88
34	L19-K018	Yusuflu, K.K., new27361	L19-c1	559850	4229850	
35	L19-K019	Bayındır, Yanıkkavak kahvesi	L19-c1	557300	4225850	88
36	L19-K020	Bayındır, İ.S.K.	L19-c1	556700	4224400	
37	L19-K021	Tokatbaşı, İ.S.K.	L19-d1	554100	4223700	90
38	L19-K022	Elifli, K.K., 39398	L19-d1	549500	4227800	
39	L19-K023	Arıkbaşı, K.K., 14492	L19-d1	543900	4226050	
40	L19-K024	Hasköy, K.K.	L19-d1	545450	4221950	
41	L18-K003	Havuzbaşı, K.K.	L18-c2	540900	4224350	40
42	L18-K004	Aslanlar, K.K., 45748	L18-c2	535900	4225100	82
43	L18-K005	Ţehitler, K.K., 33274	L18-c2	536600	4222100	107
44	L18-K006	Ayrancılar, Çözümsan	L18-c1	525700	4231900	83
45	L18-K007	Kuşçuburnu, İ.S.K.	L18-c1	528900	4229800	64
46	L18-K008	Torbalı, K.K., 27414	L18-c1	539100	4226400	120
47	L18-K009	Çapak, Ege Mine	L18-c1	532600	4231300	130

Table I.4 continued.

DSİ No	New DSİ No	Explanation	Sheet	East	North	Depth (m)
48	L18-K010	Çaybaşı Coop. Area. Kavaklık	L18-c1	532500	4220200	100
49	L18-K011	Pamukyazı, K.K., 30307	L18-c3	536350	4219050	120
50	L18-K012	Atalan, K.K.	L18-c3	540650	4219300	100
51	L19-K025	Yenioba, Mustafa Yılmazsu	L19-d1	550000	4220000	68
52	L19-K026	Karateke, İ.S.K.	L19-d2	558600	4221600	75
53	L19-K027	Çayırlı, Çavuş fauntain	L19-d3	558075	4214500	95
54	L19-K028	Tire, Akyurt, Kayalar Bi. Olive oil factory.	L19-d4	553700	4212600	85
55	L19-K029	Kurțak Village, K.	L19-d4	550150	4213200	40
56	L19-K030	Küçükkale, Mehmet Çelik	L19-d4	545400	4209600	78
57	L18-K001	Belevi, İ.S.K.	L18-c3	539200	4207500	81
58	L18-K002	Tulumköy, İ.S.K.	L18-c3	538600	4216700	45
59	L18-K013	Yeniköy near coop. K.	L18-c4	530600	4217100	
60	L18-K014	Tulum, Söğütdibi, Urfalı Farm	L18-c3	539700	4212950	100
61	M18-K001	Selçuk road	M18-b2	535700	4204400	60
62	M18-K002	Selçuk, I. Part	M18-b2	533500	4201400	
63	M18-K003	Selçuk II. Part	M18-b1	531300	4200400	
64	M18-K004	Selçuk, İ.S.K.	M18-b1	526950	4299250	100
65	M18-K005	Zeytinköy, İ.S.K.	M18-b1	524900	4205900	40
66	M18-K006	Kazancı spring	M18-b1	523250	4206000	
67	L18-K015	Ahmetbeyli, Sevgi 7/11	L18-d3	516650	4205900	8
68	L18-K016	Çile, Düzgün 7/11	L18-d3	517000	4211200	67
69	L18-K017	Çömönü, K.K.	L18-d3	517150	4219100	150
70	L18-K018	Palamutarası Kahvesi	L18-d3	519600	4216250	70
71	L18-K019	Karakuyu (Mehmet Emin Bedel)	L18-d2	521000	4220900	65
72	L18-K020	Pancar, Wheat Factory	L18-d2	520250	4226700	20
73	L18-K021	YeniBulgurca, DSİ	L18-d2	519900	4230400	220
74	L18-K022	Oğlananası, Kavurlar Pump F.	L18-a3	521400	4235250	60
92	L18-K023	Menderes, İ.S.K.	L18-d2	517700	4233400	100
93	L18-K024	Develi, Muharrem Bozdağlı	L18-d2	513900	4228500	130
94		Selçuk K.K., 18495	M18-b2	533250	4201300	79
95		Selçuk, K.K., 20046	M18-b2	533325	4201450	105
96		Selçuk, K.K., 20047	M18-b2	533225	4201450	86
97		Selçuk, K.K., 21381	M18-b1	531050	4200350	70
98		Selçuk, K.K., 24854	M18-b1	531500	4200380	156
99		Selçuk, K.K., 24855	M18-b1	530875	4200300	60

Table I.5. Chemical analyses of the DSİ monitoring well waters. Distribution of the locations is shown in Figure I.3.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
1	6,95	7.20	620	44.37	1.56	4.54			0.00	246.48	76.58	14.89	0.53
1	9,95	7.20	525	10.81	0.39	5.03			0.00	292.85	13.12	16.33	0.49
1	6,96	7.10	861	38.62	1.17	7.24			0.00	276.38	141.10	21.13	0.00
1	9,96	7.50	447	10.81	0.39	4.12			0.00	171.44	53.18	13.93	0.00
1	6,97	7.60	1525	70.81	2.35	12.29			0.00	559.46	91.47	176.76	0.39
1	9,97	7.30	357	33.57	1.17	2.80			0.00	160.46	23.75	47.55	0.57
2	6,95	7.30	526	38.39	1.17	3.67			0.00	232.45	31.20	32.66	0.20
2	9,95	7.20	539	25.98	0.78	4.50			0.00	228.79	32.26	47.55	0.25
2	6,96	7.90	563	16.09	0.39	5.20			0.00	195.23	35.45	82.13	0.00
2	9,96	7.70	535	16.09	0.39	4.80			0.00	222.69	34.74	42.27	0.23
2	6,97	8.10	508	41.15	1.56	4.32			0.00	204.38	45.38	73.01	0.10
2	9,97	7.70	482	36.79	1.17	4.20			0.00	198.89	34.03	77.33	0.78
3	6,95	7.30	461	14.25	0.39	4.16			0.00	222.69	21.27	25.94	0.32
3	9,95	7.10	595	37.25	1.17	4.79			0.00	302.61	22.69	40.35	0.45
3	6,96	7.50	569	19.77	0.78	6.09			0.00	214.15	28.36	79.73	0.00
3	9,96	7.60	582	29.43	1.17	4.68			0.00	281.87	31.91	22.58	0.01
3	6,97	7.90	535	37.02	1.17	4.68			0.00	244.04	25.53	76.85	0.00
3	9,97	7.40	535	39.31	1.56	5.27			0.00	253.19	34.74	90.78	0.14
4	6,95	7.30	582	54.72	1.96	4.02			0.00	262.34	45.38	70.61	0.04
4	9,95	7.10	567	28.97	1.17	4.67			0.00	281.87	31.20	21.61	0.51
4	6,96	7.80	568	27.82	0.78	4.73			0.00	234.28	40.42	47.07	0.27
4	9,96	7.60	534	12.87	0.39	4.93			0.00	244.04	35.45	24.02	0.00
4	6,97	7.60	443	17.24	0.78	3.94			0.00	174.49	28.01	50.91	0.00
4	9,97	7.60	516	16.09	0.39	5.10			0.00	225.13	38.29	49.95	0.14
5	6,95	7.30	452	19.31	0.78	3.84			0.00	241.60	17.73	11.53	0.00
6	6,95	7.30	623	33.11	1.17	5.00			0.00	299.56	35.45	26.90	0.06
6	9,95	7.20	568	30.12	1.17	4.62			0.00	299.56	24.82	16.81	0.43
6	6,96	7.60	681	24.37	0.78	7.10			0.00	284.92	39.00	115.76	0.00
6	9,96	7.50	698	31.04	1.17	5.81			0.00	295.29	39.71	59.08	0.00
6	6,97	7.70	688	31.04	1.17	5.90			0.00	261.12	45.38	82.62	0.00
6	9,97	7.20	707	55.18	1.96	5.47			0.00	290.41	44.32	91.74	0.33
7	6,95	7.50	742	45.06	1.56	5.71			0.00	278.21	44.67	90.78	0.00
7	9,95	7.00	1014	58.63	1.96	7.04			0.00	445.37	69.49	18.25	0.32
7	6,96	7.70	663	27.13	0.78	5.70			0.00	204.99	77.29	65.32	0.00
7	9,96	7.40	987	42.76	1.56	8.27			0.00	347.76	73.03	115.76	0.00
7	6,97	7.60	910	41.38	1.56	7.39			0.00	250.14	102.81	107.11	0.11
7	9,97	7.40	316	15.86	0.39	3.00			0.00	133.61	25.53	37.95	0.33
8	6,95	7.40	735	42.07	1.56	5.77			0.00	295.90	36.16	85.02	0.16
8	9,95	7.20	803	31.04	1.17	7.05			0.00	321.52	36.87	101.83	0.30
8	6,96	7.70	769	87.83	3.13	7.10			90.01	249.53	49.63	120.56	0.00
8	9,96	7.50	782	29.20	1.17	6.75			0.00	269.05	43.25	116.24	0.00
8	6,97	8.00	730	39.31	1.56	6.10			0.00	279.43	54.24	83.58	0.00
8	9,97	7.20	723	59.32	1.96	6.30			0.00	336.17	49.63	97.02	0.12
9	6,95	7.20	740	62.08	1.96	4.94			0.00	287.97	58.85	62.92	0.56
9	9,95	7.10	731	51.04	1.96	5.89			0.00	290.41	50.34	95.10	0.66
9	6,96	8.50	675	22.53	0.78	6.02			21.60	225.13	48.93	59.08	0.33
9	9,96	7.60	646	28.51	1.17	5.38			0.00	311.76	45.38	13.45	0.54
9	6,97	7.70	728	47.82	1.56	5.82			0.00	326.40	51.05	55.24	0.00
9	9,97	7.30	690	34.95	1.17	5.87			0.00	308.10	46.80	50.43	0.35
10	6,95	7.60	813	54.03	1.96	3.94			0.00	300.17	30.14	28.82	0.00
10	9,95	6.90	1003	89.43	3.13	6.56			0.00	359.96	136.85	36.98	1.13
10	6,96	9.00	550	19.54	0.78	4.80			10.80	224.52	47.86	13.45	0.00
10	9,96	7.80	508	13.33	0.39	4.64			0.00	248.31	32.62	11.53	0.78
10	6,97	8.10	559	37.71	1.17	4.70			0.00	242.21	39.00	62.44	0.31
10	9,97	7.50	534	37.02	1.17	4.50			0.00	244.65	33.68	56.68	0.94
11	6,95	7.40	519	48.05	1.56	3.26			0.00	256.24	32.62	12.97	0.29
11	9,95	7.20	560	22.53	0.78	4.90			0.00	276.38	33.33	19.69	0.45
11	6,96	7.50	506	20.00	0.78	4.42			0.00	269.66	17.73	18.73	0.44
11	9,96	7.50	481	29.20	1.17	3.65			0.00	219.64	40.42	10.09	0.00
11	6,97	7.80	506	22.99	0.78	4.66			0.00	244.04	32.62	36.50	0.00
12	9,96	7.90	538	21.84	0.78	4.57			0.00	258.68	32.62	18.25	0.00
12	6,97	7.80	484	36.79	1.17	3.80			0.00	198.89	38.29	52.35	0.00
12	9,97	7.20	505	25.06	0.78	4.60			0.00	237.94	32.62	42.75	0.14
13	6,95	7.60	410	16.09	0.39	3.55			0.00	174.49	26.59	29.78	0.69
13	6,96	7.70	419	31.50	1.17	3.00			0.00	200.72	30.49	14.89	0.01
13	9,96	7.50	476	32.88	1.17	3.44			0.00	234.89	27.65	12.97	1.79
13	6,97	8.60	453	37.71	1.17	3.30			46.81	130.56	24.11	28.34	0.55

Table I.5 continued.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
13	9,97	6.60	383	20.69	0.78	3.00			0.00	147.64	23.04	40.83	1.35
14	6,95	7.50	598	17.47	0.78	5.43			0.00	300.17	34.03	15.85	0.00
14	9,95	7.20	573	25.52	0.78	4.88			0.00	282.48	35.45	18.25	0.31
14	6,96	8.60	488	7.59	0.39	4.78			42.61	128.12	46.09	14.41	0.85
14	9,96	7.20	634	75.87	2.74	3.16			0.00	266.00	38.29	52.35	0.70
14	9,97	7.60	592	32.65	1.17	4.35			0.00	260.51	34.03	27.38	1.02
15	6,95	7.50	529	14.71	0.39	4.85			0.00	269.05	27.65	14.89	0.00
15	9,95	7.20	516	25.06	0.78	4.30			0.00	269.05	22.69	17.29	0.42
15	6,96	8.10	505	9.43	0.39	4.78			0.00	261.12	25.53	9.61	0.19
15	9,96	7.20	512	30.35	1.17	3.92			0.00	206.21	27.65	53.32	0.36
15	6,97	8.00	471	29.20	1.17	3.61			0.00	220.25	24.11	29.78	0.00
15	9,97	7.50	455	12.42	0.39	4.00			0.00	209.87	22.34	23.06	0.00
16	6,95	7.90	456	30.12	1.17	3.40			0.00	222.69	30.49	11.05	0.00
16	9,95	7.30	463	28.05	1.17	3.61			0.00	226.96	27.65	17.29	0.30
16	6,96	7.90	601	35.87	1.17	4.60			0.00	287.36	42.54	13.45	0.14
16	9,96	7.40	439	64.83	2.35	2.16			0.00	183.03	44.67	37.46	1.95
16	9,97	7.10	473	25.98	0.78	3.25			0.00	186.08	36.16	15.85	1.47
17	6,95	7.60	607	44.60	1.56	4.33			0.00	289.19	41.83	18.73	0.18
17	9,95	7.30	603	30.12	1.17	4.99			0.00	231.84	41.13	65.80	0.61
17	6,96	7.80	688	61.39	1.96	4.47			0.00	308.71	55.31	22.58	0.12
17	9,96	7.60	468	54.95	1.96	2.38			0.00	178.76	35.81	32.66	2.25
17	9,97	7.10	439	25.52	0.78	3.25			0.00	179.37	31.20	26.90	0.50
18	6,95	7.60	297	5.75	0.39	2.82			0.00	139.10	10.64	24.02	0.23
18	9,95	7.30	400	13.10	0.39	3.62			0.00	195.23	17.73	24.02	0.28
18	6,96	8.10	281	11.73	0.39	2.27			0.00	123.85	19.85	14.41	0.49
18	9,96	7.50	342	18.39	0.78	2.70			0.00	171.44	21.98	4.32	1.05
18	9,97	7.20	298	4.83	0.39	2.85			0.00	113.48	18.79	23.06	1.41
19	6,95	7.20	504	22.07	0.78	4.26			0.00	235.50	37.58	15.37	0.18
19	9,95	7.30	581	15.17	0.39	5.43			0.00	222.69	23.40	85.98	0.25
19	6,96	8.00	617	8.51	0.39	5.00			0.00	208.65	32.62	49.95	0.00
19	9,96	8.00	466	10.12	0.39	4.35			36.01	150.69	31.20	12.01	0.00
19	6,97	8.30	494	18.85	0.78	4.40			0.00	201.33	26.24	57.64	0.00
19	9,97	7.50	502	42.53	1.56	4.76			0.00	235.50	30.14	93.18	0.00
20	6,95	7.40	281	8.97	0.39	2.52			0.00	129.34	21.98	8.65	0.19
20	9,95	7.30	448	22.07	0.78	3.72			0.00	244.65	14.18	13.93	0.40
20	6,96	8.20	280	15.17	0.39	2.21			0.00	132.39	18.44	9.13	0.00
20	9,96	7.80	432	18.85	0.78	3.61			0.00	219.64	22.69	10.09	0.00
20	6,97	8.00	256	12.42	0.39	2.20			0.00	123.85	13.47	16.33	0.00
20	9,97	7.30	305	14.94	0.39	2.40			0.00	128.12	23.75	13.93	0.08
21	6,95	7.10	774	15.86	0.39	7.34			0.00	384.36	47.51	19.21	0.86
21	9,95	7.10	761	37.25	1.17	6.35			0.00	394.73	36.16	21.13	0.67
21	6,96	7.60	712	21.38	0.78	6.45			0.00	359.96	41.13	16.33	0.00
21	9,96	7.50	735	13.56	0.39	6.97			0.00	366.06	42.54	17.77	0.30
21	9,97	7.00	594	37.02	1.17	4.74			0.00	268.44	35.45	47.07	0.17
22	6,95	7.30	501	39.31	1.17	3.52			0.00	253.19	28.36	14.89	0.10
22	9,95	7.20	541	36.79	1.17	4.05			0.00	246.48	32.62	34.58	0.28
22	6,96	7.70	500	23.91	0.78	4.09			0.00	234.28	37.58	12.01	0.00
22	9,96	7.60	506	23.22	0.78	4.18			0.00	247.70	31.91	12.01	0.00
22	6,97	8.10	533	22.30	0.78	4.80			0.00	282.48	21.27	26.90	0.00
22	9,97	7.20	494	30.81	1.17	2.67			0.00	233.06	23.75	26.42	0.63
23	6,95	7.10	715	44.37	1.56	5.46			0.00	338.00	53.18	18.73	0.35
23	9,95	7.10	773	20.23	0.78	7.21			0.00	384.36	49.63	19.69	0.44
23	6,96	8.20	664	37.25	1.17	5.19			0.00	240.99	67.36	47.55	1.60
23	9,96	7.50	708	75.87	2.74	3.92			0.00	200.11	56.72	115.76	0.00
23	9,97	7.00	661	28.97	1.17	5.32			0.00	250.14	49.63	53.32	1.98
24	6,95	7.10	572	42.76	1.56	4.04			0.00	257.46	44.67	22.09	0.11
24	9,95	7.10	554	40.00	1.56	4.03			0.00	255.63	47.51	13.45	0.20
24	6,96	8.10	578	42.30	1.56	4.07			0.00	204.38	59.56	44.19	0.23
24	9,96	7.10	606	88.29	3.13	2.26			0.00	154.36	67.36	84.06	1.65
24	9,97	6.70	585	49.43	1.56	3.85			0.00	239.16	55.31	26.90	0.61
25	6,95	7.40	365	14.25	0.39	3.16			0.00	183.03	19.14	12.01	0.05
25	9,95	7.50	352	12.87	0.39	3.12			0.00	156.19	25.53	19.69	0.10
25	6,96	8.10	357	7.36	0.39	3.35			0.00	158.02	31.20	10.09	0.59
25	9,96	7.70	355	10.81	0.39	3.18			0.00	173.88	21.98	9.13	0.09
25	9,97	6.90	355	17.70	0.78	2.93			0.00	147.03	25.53	25.46	1.12
26	6,95	7.40	417	11.96	0.39	3.80			0.00	208.65	24.82	10.09	0.22
26	9,95	7.50	376	11.96	0.39	3.41			0.00	186.69	19.85	15.37	0.32
26	6,96	8.10	435	18.85	0.78	3.64			0.00	205.60	30.49	12.01	0.04

Table I.5 continued.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
26	9,96	7.50	472	54.49	1.96	2.44			0.00	212.31	22.69	35.54	1.25
26	9,97	7.60	379	19.54	0.78	2.90			0.00	160.46	21.98	24.98	0.50
27	6,95	7.20	740	39.08	1.17	5.96			0.00	251.36	100.69	35.06	0.25
27	9,95	7.10	644	33.34	1.17	5.28			0.00	262.34	74.10	17.77	0.24
27	6,96	8.10	543	32.65	1.17	4.14			36.01	128.73	73.03	10.57	0.18
27	9,96	7.30	519	11.50	0.39	4.84			0.00	217.81	58.50	6.24	0.65
27	9,97	7.40	475	21.61	0.78	3.79			0.00	165.34	42.54	40.35	1.88
28	6,95	7.40	541	26.44	0.78	4.51			0.00	214.15	22.69	73.49	0.48
28	9,95	7.20	466	23.68	0.78	3.84			0.00	220.25	39.00	13.45	0.42
28	6,96	8.10	453	29.89	1.17	3.34			0.00	156.19	44.67	40.83	0.01
28	9,96	7.30	482	54.95	1.96	2.52			0.00	167.78	40.77	50.91	1.22
28	6,97	7.80	538	39.31	1.56	4.42			0.00	244.04	46.80	40.83	0.76
28	9,97	7.10	735	44.83	1.56	5.43			0.00	262.95	58.50	70.13	2.32
29	6,95	7.20	310	9.66	0.39	2.82			0.00	166.56	9.57	12.01	0.20
29	9,95	7.20	364	15.40	0.39	3.14			0.00	161.68	26.94	19.69	0.16
29	6,96	8.00	381	24.37	0.78	2.84			0.00	170.83	32.62	9.61	0.36
29	9,96	7.30	394	51.96	1.96	1.75			0.00	153.14	23.40	4.32	3.43
29	9,97	7.20	748	63.00	2.35	4.68			0.00	256.24	65.94	68.21	1.04
30	6,95	7.30	793	52.42	1.96	5.91			0.00	294.68	40.42	109.03	0.20
30	9,95	7.20	825	50.58	1.56	6.42			0.00	409.38	53.89	20.65	0.28
30	6,96	7.80	824	46.90	1.56	6.57			0.00	358.13	64.52	46.11	0.51
30	9,96	7.30	860	112.89	3.91	3.85			0.00	179.98	63.11	198.37	0.00
30	6,97	7.70	803	34.72	1.17	6.90			0.00	348.37	52.47	60.04	0.46
30	9,97	7.30	844	49.20	1.56	6.35			0.00	287.97	51.76	112.88	1.58
31	6,95	7.50	439	22.76	0.78	3.55			0.00	214.76	26.94	13.45	0.42
31	9,95	7.20	855	57.94	1.96	6.40			0.00	402.67	64.52	26.42	0.40
31	6,96	8.20	391	22.76	0.78	3.02			0.00	165.34	40.42	8.65	0.12
31	9,96	7.50	394	23.22	1.17	2.72			0.00	157.41	25.53	37.46	0.00
31	6,97	8.50	473	49.66	1.56	3.33			56.41	126.29	40.06	21.61	0.00
31	9,97	7.60	373	19.54	0.78	2.97			0.00	171.44	23.04	18.25	0.13
32	6,95	7.40	532	32.88	1.17	4.07			0.00	238.55	46.09	15.37	0.61
32	9,95	7.40	445	18.16	0.78	3.86			0.00	214.76	31.91	12.01	0.50
32	6,96	8.00	616	30.81	1.17	4.97			0.00	242.82	34.03	67.24	0.00
32	9,96	7.30	749	68.74	2.35	4.66			0.00	198.89	39.71	159.95	0.30
32	6,97	8.50	517	17.70	0.78	4.80			43.81	122.63	29.78	61.48	0.00
32	9,97	7.40	522	7.13	0.39	5.00			0.00	189.13	28.36	68.21	2.27
33	6,95	7.20	553	38.39	1.17	3.94			0.00	259.29	41.83	10.09	0.22
33	9,95	7.40	527	33.57	1.17	4.04			0.00	269.05	29.07	14.41	0.22
33	6,96	7.70	560	33.57	1.17	4.39			0.00	257.46	47.15	15.85	0.27
33	9,96	7.30	590	80.01	2.74	2.59			0.00	183.64	48.22	82.13	0.00
33	6,97	8.30	424	39.54	1.17	3.68			64.21	87.24	41.83	32.66	0.00
33	9,97	7.30	533	28.05	0.78	4.19			0.00	234.28	37.23	25.94	2.31
34	6,95	7.40	524	23.91	0.78	4.38			0.00	261.12	30.49	14.41	0.20
34	9,95	7.00	620	44.37	1.56	4.54			0.00	293.46	41.13	25.94	0.24
34	6,96	7.90	541	48.05	1.56	3.55			0.00	256.24	39.71	17.29	0.02
34	9,96	7.30	471	63.46	2.35	2.03			0.00	197.67	30.49	36.02	0.99
34	6,97	7.60	474	22.30	0.78	3.96			0.00	228.18	27.65	20.65	0.00
34	9,97	7.30	470	35.64	1.17	3.26			0.00	222.69	29.43	17.29	0.00
35	6,95	7.50	427	26.44	0.78	3.27			0.00	183.03	41.13	13.45	0.10
35	9,95	7.00	539	27.36	0.78	4.44			0.00	260.51	32.62	22.09	0.15
35	6,96	8.10	444	31.73	1.17	3.16			0.00	209.26	31.91	11.53	0.37
35	9,96	7.30	472	70.81	2.35	1.72			0.00	171.44	22.69	67.73	0.00
35	6,97	7.90	409	24.83	0.78	3.62			0.00	213.53	31.91	15.37	0.00
35	9,97	7.50	422	23.91	0.78	3.23			0.00	211.09	21.27	11.05	1.24
36	6,95	7.50	511	40.00	1.56	3.53			0.00	260.51	26.24	14.41	0.48
36	9,95	7.10	477	26.21	0.78	3.84			0.00	199.50	36.87	33.14	0.47
36	6,96	8.10	448	24.37	0.78	3.63			0.00	200.11	35.45	15.85	0.00
36	9,96	7.40	455	40.69	1.56	2.88			0.00	145.20	31.91	67.73	1.68
36	6,97	7.80	422	35.64	1.17	3.46			0.00	217.81	35.45	22.58	0.00
36	9,97	7.50	475	25.98	0.78	3.69			0.00	209.26	36.52	18.25	2.13
37	6,95	7.50	430	31.50	1.17	2.98			0.00	201.33	31.91	8.65	0.47
37	9,95	7.30	424	25.75	0.78	3.31			0.00	195.84	31.55	16.81	0.45
37	6,96	8.40	383	13.10	0.39	3.34			35.11	109.82	29.07	6.24	0.01
37	9,96	7.70	402	12.19	0.39	3.60			0.00	189.13	29.07	10.57	0.00
37	6,97	8.40	387	17.93	0.78	3.22			3.00	175.71	26.59	15.37	0.42
37	9,97	7.50	477	1.84	0.39	4.66			0.00	211.09	30.14	21.13	0.02
38	6,95	7.30	612	35.41	1.17	4.73			0.00	269.05	56.72	13.93	0.45
38	9,95	7.40	426	28.74	1.17	3.19			0.00	203.16	31.91	11.53	0.28

Table I.5 continued.

DSİ No	Date	pH	EC μS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
38	6,96	8.20	625	44.83	1.56	4.57			0.00	295.90	49.63	14.89	0.35
38	9,96	7.50	657	18.62	0.78	5.94			0.00	305.05	47.51	20.65	0.53
38	6,97	8.00	606	59.09	1.96	4.81			0.00	317.25	62.04	23.06	0.07
38	9,97	7.20	683	15.40	0.39	6.14			0.00	289.80	47.86	34.58	0.36
39	6,95	7.30	556	24.37	0.78	4.70			0.00	251.36	48.93	13.93	0.35
39	9,95	7.20	719	56.10	1.17	5.05			0.00	353.25	43.96	24.50	0.33
39	6,96	8.10	550	45.29	1.56	3.71			0.00	254.41	35.45	26.42	0.04
39	9,96	7.60	519	5.98	0.39	5.94			0.00	257.46	31.91	11.05	0.00
39	6,97	7.90	561	25.75	0.78	5.00			0.00	262.34	34.03	42.27	0.25
39	9,97	7.50	527	28.05	0.78	4.13			0.00	232.45	31.91	31.70	0.00
40	6,95	7.40	300	5.75	0.39	2.80			0.00	109.82	39.71	9.61	0.11
40	9,95	7.30	552	39.54	1.56	4.09			0.00	286.75	27.65	17.77	0.32
40	6,96	8.30	319	25.06	0.78	2.18			12.00	109.21	31.91	9.61	0.00
40	9,96	7.70	301	0.00	0.00	3.75			0.00	129.95	29.07	7.20	0.00
40	6,97	7.90	435	45.29	1.56	3.64			0.00	215.98	57.43	23.54	0.59
40	9,97	7.80	564	50.58	1.56	3.51			0.00	242.82	32.26	41.31	0.00
41	6,95	7.30	561	39.31	1.17	4.09			0.00	275.16	35.45	15.37	0.33
41	9,95	7.30	578	72.65	2.35	3.74			0.00	255.63	43.96	73.49	0.39
41	6,96	7.90	641	33.34	1.17	5.12			0.00	265.39	51.76	37.95	0.14
41	9,96	7.50	566	34.03	1.17	4.32			0.00	264.17	43.96	12.49	0.76
41	6,97	8.10	548	4.83	0.39	5.25			0.00	228.79	43.25	24.02	0.41
41	9,97	8.00	549	36.79	1.17	4.17			0.00	263.56	37.23	20.65	0.00
42	6,95	7.10	752	63.46	2.35	5.00			0.00	403.89	28.36	19.21	0.64
42	9,95	7.00	804	36.10	1.17	6.84			0.00	439.27	28.36	21.13	0.79
42	6,96	7.70	690	48.97	1.56	4.94			0.00	350.20	31.91	22.58	0.42
42	9,96	7.30	921	82.08	2.74	5.85			0.00	443.54	36.52	57.16	0.00
42	6,97	7.10	819	102.08	3.52	4.94			0.00	454.52	35.45	48.99	0.81
42	9,97	7.60	874	89.43	3.13	4.85			0.00	455.74	38.29	12.97	0.99
43	6,95	7.30	577	21.38	0.78	5.05			0.00	302.61	24.82	16.33	0.67
43	9,95	7.20	610	0.00	0.00	5.24			0.00	312.37	32.62	17.29	0.63
43	6,96	7.50	814	33.34	1.17	6.90			0.00	370.33	32.97	51.87	0.97
43	9,96	7.40	556	16.55	0.39	5.00			0.00	279.43	29.43	15.85	0.63
43	6,97	7.70	588	39.31	1.56	5.54			0.00	305.05	48.22	44.67	0.10
43	9,97	7.80	565	35.87	1.17	4.27			0.00	304.44	19.14	15.85	0.62
44	6,95	7.50	498	12.65	0.39	4.61			0.00	244.04	31.91	12.97	0.25
44	9,95	7.20	767	33.57	1.17	6.56			0.00	381.31	38.29	34.58	0.23
44	6,96	7.60	754	30.81	1.17	6.40			0.00	395.34	36.52	12.49	0.27
44	9,96	7.30	752	46.21	1.56	5.70			0.00	369.72	4.25	27.38	0.00
44	6,97	8.50	428	23.22	0.78	4.20			54.31	118.36	39.71	14.89	0.49
44	9,97	7.60	755	26.44	0.78	6.45			0.00	317.25	78.71	9.61	0.05
45	6,95	6.90	790	64.60	2.35	5.34			0.00	415.48	36.16	18.25	0.66
45	9,95	7.20	855	106.45	3.52	4.25			0.00	464.90	31.91	21.61	0.64
45	6,96	7.30	785	62.54	2.35	5.31			0.00	371.55	37.58	16.33	0.36
45	9,96	7.30	843	28.74	1.17	7.40			0.00	439.27	36.16	22.09	0.27
45	6,97	7.40	775	63.69	2.35	5.56			0.00	425.24	39.71	14.41	0.25
45	9,97	6.90	730	48.74	1.56	5.17			0.00	365.45	39.00	11.53	0.33
46	6,95	7.00	786	80.93	2.74	4.58			0.00	417.31	31.91	20.65	0.55
46	9,95	7.40	781	49.89	1.56	5.99			0.00	411.21	36.52	20.65	0.70
46	6,96	8.00	533	32.42	1.17	4.05			0.00	262.34	33.33	12.01	0.38
46	9,96	7.40	635	6.90	0.39	6.23			0.00	309.32	33.33	25.46	0.00
46	6,97	8.00	621	71.50	2.35	5.06			0.00	363.62	56.72	32.18	0.79
46	9,97	7.40	610	27.59	0.78	5.24			0.00	305.66	29.07	29.30	0.17
47	6,95	7.60	480	28.97	1.17	3.70			0.00	231.84	31.55	14.41	0.29
47	9,95	7.70	574	20.46	0.39	5.32			0.00	294.07	31.91	14.41	0.40
47	6,96	8.40	718	29.66	1.17	6.08			0.00	254.41	71.62	58.12	0.11
47	9,96	7.30	752	9.43	0.39	6.04			0.00	311.15	39.71	11.53	0.03
47	6,97	8.00	669	54.49	1.96	6.00			0.00	393.51	43.25	36.02	0.22
47	9,97	8.40	568	7.82	0.39	5.55			45.61	189.13	36.87	11.53	0.46
48	6,95	7.10	759	38.85	1.17	6.17			0.00	392.90	37.23	19.21	0.16
48	9,95	7.60	756	28.51	1.17	6.66			0.00	390.46	35.45	25.46	0.29
48	6,96	7.20	2781	469.02	16.42	6.99			0.00	397.18	54.95	948.63	0.00
48	9,96	7.10	1031	75.87	2.74	7.25			0.00	428.29	53.18	100.87	0.00
48	6,97	7.90	733	34.72	1.17	6.76			0.00	334.94	57.43	57.16	0.48
48	9,97	7.50	955	67.82	2.35	7.41			0.00	472.22	56.72	51.87	0.65
49	6,95	7.30	538	22.76	0.78	4.58			0.00	274.54	27.65	14.89	0.74
49	9,95	7.40	540	20.23	0.78	4.80			0.00	264.17	26.94	27.86	0.72
49	6,96	7.80	602	28.74	1.17	4.97			0.00	305.05	34.03	11.53	0.26
49	9,96	7.60	481	15.63	0.39	4.26			0.00	209.87	35.45	24.50	0.00

Table I.5 continued.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
49	6,97	7.80	578	31.04	1.17	4.92			0.00	303.83	31.20	22.58	0.27
49	9,97	7.90	518	7.13	0.39	5.09			0.00	270.27	21.98	16.81	0.54
50	6,95	7.40	364	8.97	0.39	3.38			0.00	170.83	27.65	9.61	0.70
50	9,95	7.50	414	20.69	0.78	3.42			0.00	195.84	28.36	15.85	0.68
50	6,96	8.00	570	35.64	1.17	4.29			0.00	284.92	35.45	9.61	0.81
50	9,96	7.50	631	69.20	2.35	3.32			0.00	270.88	43.25	35.06	0.00
50	6,97	8.00	397	27.82	0.78	2.75			0.00	179.98	26.59	13.45	0.37
50	9,97	8.00	387	38.85	1.17	2.26			0.00	197.67	18.44	10.57	0.34
51	6,95	7.60	509	48.05	1.56	3.16			0.00	262.95	24.11	14.41	0.32
51	9,95	7.60	400	43.45	1.56	3.11			0.00	244.04	25.53	15.37	0.31
51	6,96	8.60	497	60.01	1.96	2.44			15.00	218.42	27.65	12.49	0.01
51	9,96	7.80	485	17.01	0.78	4.24			0.00	226.96	24.82	27.86	0.08
51	6,97	8.10	509	40.00	1.56	3.66			0.00	269.66	26.94	12.49	0.30
51	9,97	8.10	508	22.99	0.78	4.14			0.00	239.77	35.10	11.53	0.23
52	6,95	7.30	900	100.01	3.52	4.92			0.00	424.02	70.91	19.69	0.52
52	9,95	7.40	738	35.87	1.17	6.12			0.00	366.67	45.38	21.13	0.57
52	6,96	8.90	796	60.47	1.96	5.68			15.60	232.45	70.91	97.50	0.15
52	9,96	7.30	793	97.48	3.52	3.84			0.00	183.64	67.36	156.58	1.70
52	6,97	7.70	844	53.57	1.96	7.09			0.00	335.55	75.16	88.86	0.09
52	9,97	7.50	834	27.13	0.78	7.24			0.00	268.44	71.62	97.02	0.08
53	6,95	7.20	586	44.60	1.56	4.11			0.00	270.88	26.24	43.71	0.89
53	9,95	7.20	610	24.37	0.78	5.32			0.00	331.28	22.69	15.85	0.84
53	6,96	8.40	588	51.04	1.96	3.90			18.00	218.42	35.45	47.55	0.73
53	9,96	7.30	638	104.61	3.52	1.90			0.00	221.47	26.94	104.71	1.67
53	9,97	7.50	582	8.05	0.39	5.68			0.00	230.62	63.82	22.09	0.11
54	6,95	7.30	571	41.15	1.56	4.10			0.00	305.05	21.98	14.89	0.13
54	9,95	7.40	562	17.47	0.78	5.12			0.00	296.51	23.40	18.25	0.20
54	6,96	7.40	531	14.02	0.39	4.90			0.00	288.58	17.02	14.89	0.00
54	9,96	7.30	554	51.04	1.96	3.44			0.00	293.46	25.17	9.13	0.51
54	6,97	8.50	266	7.59	0.39	2.61			54.01	14.64	21.98	13.93	0.00
54	9,97	7.50	563	34.26	1.17	4.16			0.00	282.48	28.01	12.49	0.27
55	6,95	7.30	548	25.75	0.78	4.55			0.00	284.31	27.65	12.01	0.67
55	9,95	7.50	458	9.66	0.39	4.37			0.00	216.59	31.91	16.81	0.64
55	6,96	7.80	550	0.00	0.39	5.95			0.00	281.87	27.65	18.25	0.00
55	9,96	7.30	539	65.98	2.35	2.62			0.00	204.38	31.20	63.40	1.85
55	9,97	7.50	551	9.89	0.39	5.16			0.00	265.39	32.97	15.37	0.08
56	6,95	7.30	820	56.79	1.96	6.00			0.00	393.51	58.14	20.65	0.68
56	9,95	7.20	808	16.55	0.39	7.75			0.00	403.89	50.70	20.65	0.65
56	6,96	7.60	793	28.74	1.17	7.05			0.00	395.34	47.51	24.50	0.00
56	9,96	7.30	656	80.24	2.74	3.30			0.00	244.04	37.58	85.50	0.00
56	9,97	7.40	753	29.20	1.17	6.34			0.00	358.13	40.77	29.78	0.72
57	6,95	7.10	1061	58.63	1.96	8.43			0.00	507.60	78.71	23.54	0.87
57	9,95	7.10	1043	37.71	1.17	9.28			0.00	514.31	69.49	26.90	0.86
57	6,96	7.80	985	37.48	1.17	8.49			0.00	371.55	92.18	70.13	0.16
57	9,96	7.30	1074	88.29	3.13	7.14			0.00	475.88	92.18	31.70	0.67
57	6,97	7.50	809	37.02	1.17	6.14			0.00	330.67	57.43	35.54	0.26
57	9,97	7.80	926	64.37	2.35	7.30			0.00	427.07	78.71	45.15	0.00
58	6,95	7.40	549	44.14	1.56	3.74			0.00	254.41	33.33	28.34	0.16
58	9,95	7.70	529	28.05	1.17	4.27			0.00	257.46	34.03	16.33	0.00
58	6,96	8.30	581	34.26	1.17	4.46			8.10	257.46	43.25	12.97	0.75
58	9,96	7.80	550	33.11	1.17	4.19			0.00	250.14	46.09	12.49	0.00
58	6,97	8.70	523	53.11	1.96	2.98			13.80	173.27	59.56	17.29	0.27
58	9,97	7.70	587	17.93	0.78	5.18			0.00	269.66	44.32	14.89	0.41
59	6,95	7.50	573	6.67	0.39	5.65			0.00	272.10	36.16	22.58	0.47
59	9,95	7.50	612	41.38	1.56	4.58			0.00	306.88	35.45	18.73	0.47
59	6,95	7.70	646	18.62	0.78	5.82			0.00	309.32	32.62	31.70	0.01
59	9,96	7.30	629	10.35	0.39	6.02			0.00	309.93	40.77	12.01	0.31
59	6,97	7.60	534	9.43	0.39	4.42			0.00	237.94	23.40	13.45	0.17
59	9,97	7.80	727	33.80	1.17	5.82			0.00	347.15	47.51	9.13	1.04
60	6,95	7.40	792	52.19	1.96	5.91			0.00	330.06	85.09	20.17	0.18
60	9,95	7.30	816	48.97	1.56	6.39			0.00	355.08	80.12	23.06	0.75
60	6,96	7.70	790	75.87	2.74	4.77			0.00	329.45	87.21	13.45	0.35
60	9,96	7.00	847	66.90	2.35	5.75			0.00	373.38	79.77	16.81	0.71
60	6,97	7.60	876	71.27	2.35	6.42			0.00	433.78	70.20	21.61	0.76
60	9,97	7.40	895	80.70	2.74	5.78			0.00	427.68	68.07	20.65	0.04
61	6,95	7.50	900	73.11	2.35	6.12			0.00	427.07	69.13	19.69	0.44
61	9,95	7.40	929	49.66	1.56	7.55			0.00	453.30	57.08	34.10	0.49
61	6,96	8.90	894	67.36	2.35	6.31			16.80	392.29	78.35	4.80	0.01

Table I.5 continued.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
61	9,96	7.50	915	45.98	1.56	7.38			0.00	334.33	126.21	18.25	0.00
61	6,97	8.10	925	60.93	1.96	6.64			0.00	373.38	90.05	32.66	0.08
61	9,97	8.30	812	71.27	2.35	5.07			21.60	292.24	82.25	19.21	0.07
62	12,75	7.80	757	38.17	3.91		88.18	17.02	0.00	324.57	74.45	6.72	0.00
62	9,91	7.10	821	47.36	1.56		42.28	50.45	0.00	345.93	86.51	12.01	0.00
62	894	7.20	1019	72.19	2.35		72.14	43.28	0.00	347.15	147.48	24.50	0.00
62	6,95	7.40	1054	88.29	3.13	7.04			0.00	379.48	149.61	24.98	0.52
62	9,95	7.40	1028	94.95	3.13	6.58			0.00	386.80	132.95	33.62	0.52
62	6,96	7.70	993	105.99	3.52	5.63			0.00	367.89	132.95	26.42	0.23
62	9,96	7.40	1237	105.07	3.52	8.08			0.00	290.41	265.90	23.06	0.13
62	6,97	7.60	938	45.29	1.56	7.81			0.00	305.05	137.56	45.15	0.02
62	9,97	8.10	972	84.38	3.13	6.03			0.00	333.11	132.95	27.38	0.00
63	279	7.30	1906	229.91	28.94	9.10			0.00	359.96	407.71	117.20	0.00
63	9,91	7.10	2200	286.47	9.78		55.91	82.66	0.00	356.30	508.04	102.31	0.00
63	894	7.00	2250	307.62	4.69		76.75	64.06	0.00	400.84	524.70	59.08	0.00
63	6,95	7.30	2530	600.52	20.72	9.66			0.00	407.55	604.12	604.72	0.64
63	9,95	7.30	2540	391.08	13.69	9.31			0.00	469.78	589.23	112.88	1.17
63	6,96	7.60	1217	163.70	5.87	5.51			0.00	499.67	116.99	61.96	0.01
63	9,96	7.30	1185	64.60	2.35	9.33			0.00	409.99	179.04	21.13	0.00
63	6,97	8.40	986	100.70	3.52	5.54			47.41	174.49	165.92	42.75	0.60
63	9,97	7.80	1281	99.78	3.52	8.46			0.00	539.33	121.25	31.22	0.00
64	6,95	7.40	1618	172.20	5.87	9.18			0.00	420.97	289.30	84.54	0.56
64	9,95	7.30	1490	145.99	5.08	8.85			0.00	453.91	240.37	53.32	1.03
64	6,96	7.50	1509	211.06	7.43	6.47			0.00	383.75	281.50	77.33	0.35
64	9,96	7.20	1360	87.14	3.13	10.27			0.00	379.48	258.10	30.74	0.00
64	6,97	7.30	1409	118.86	4.30	9.51			0.00	340.44	288.59	51.39	0.79
64	9,97	7.60	1358	126.68	4.30	8.06			0.00	546.04	146.07	29.30	0.00
65	6,95	7.50	863	66.21	2.35	6.03			0.00	338.61	104.23	23.06	0.17
65	9,95	7.40	693	28.51	1.17	6.00			0.00	312.98	60.27	21.13	0.89
65	6,96	7.70	670	56.56	1.96	4.46			0.00	289.80	65.23	18.25	0.00
65	9,96	7.40	634	22.76	0.78	5.52			0.00	183.03	114.16	14.89	0.00
65	6,97	7.90	627	42.30	1.56	5.64			0.00	342.88	59.56	10.57	0.00
65	9,97	7.80	843	71.04	2.35	5.34			0.00	375.82	72.32	13.93	0.00
66	6,95	7.50	1344	189.45	6.65	5.56			0.00	354.47	268.02	28.82	0.21
66	9,95	7.50	1420	180.94	6.26	6.88			0.00	424.63	254.55	36.98	0.79
66	6,96	7.70	2020	313.83	10.95	7.28			0.00	403.89	477.91	53.32	0.42
66	9,96	7.30	2080	271.06	9.38	9.81			0.00	373.38	517.61	53.80	0.00
66	6,97	7.90	1948	236.35	8.21	9.59			0.00	356.91	476.13	38.43	0.60
66	9,97	7.70	2030	328.77	11.34	5.78			0.00	877.32	191.45	28.34	0.00
67	6,95	7.30	1880	225.54	7.82	9.54			0.00	564.34	334.32	41.79	0.72
67	6,96	7.30	2230	346.93	12.12	8.02			0.00	506.38	479.32	76.85	0.22
67	9,96	7.10	2630	405.79	14.08	9.61			0.00	483.81	638.15	81.17	0.00
67	6,97	6.90	2360	353.60	12.12	8.72			0.00	458.80	553.07	61.96	0.57
67	9,97	7.30	2540	302.79	10.56	12.00			0.00	605.22	505.21	61.00	0.00
68	6,95	7.60	641	52.65	1.96	4.32			0.00	281.87	56.02	22.09	0.49
68	9,95	7.60	764	63.91	2.35	5.18			0.00	305.05	48.22	79.73	0.00
68	6,96	7.90	766	60.24	1.96	5.22			0.00	320.30	44.67	66.28	0.10
68	9,96	7.50	738	33.34	1.17	6.09			0.00	354.47	50.34	18.73	0.27
68	6,97	7.70	650	17.70	0.78	5.88			0.00	269.66	49.63	40.83	0.00
68	9,97	7.80	919	76.10	2.74	6.34			0.00	408.16	81.54	35.06	0.00
69	6,95	7.50	691	20.00	0.78	6.29			0.00	329.45	31.91	42.27	0.29
69	9,95	7.10	697	10.35	0.39	6.83			0.00	311.15	27.65	68.69	0.48
69	6,96	7.60	761	46.90	1.56	6.76			0.00	371.55	42.54	74.45	0.00
69	9,96	7.30	793	51.04	1.96	5.90			0.00	373.99	39.71	44.19	0.00
69	6,97	7.40	725	38.17	0.00	6.92			0.00	411.82	44.67	28.82	0.70
69	9,97	7.80	807	63.00	6.26	7.10			0.00	433.17	238.24	56.68	0.25
70	6,95	7.60	578	17.47	0.78	5.17			0.00	310.54	21.98	11.53	0.16
70	9,95	7.50	546	26.67	0.78	4.55			0.00	281.26	26.59	17.77	0.78
70	6,96	7.80	567	13.10	0.39	5.26			0.00	282.48	26.24	22.58	0.06
70	9,96	7.60	548	37.94	1.17	3.96			0.00	256.85	26.59	32.66	0.16
70	6,97	7.80	535	24.14	0.78	4.85			0.00	289.80	31.20	13.93	0.66
70	9,97	8.10	583	29.43	1.17	4.57			0.00	299.56	28.36	8.17	0.35
71	6,95	7.60	513	18.62	0.78	4.50			0.00	258.07	28.36	14.41	0.66
71	9,95	7.50	520	28.05	0.78	4.22			0.00	256.24	31.91	17.29	0.64
71	6,96	7.90	523	48.97	1.56	3.22			0.00	256.85	28.36	18.25	0.15
71	9,96	7.50	526	37.25	1.17	3.77			0.00	259.90	36.16	6.72	0.01
71	6,97	7.90	530	28.97	1.17	4.52			0.00	273.93	35.45	15.37	0.00
71	9,97	8.10	551	35.41	1.17.	4.00			0.00	269.66	32.97	10.57	0.58

Table I.5 continued.

DSİ No	Date	pH	EC µS/cm	Na mg/l	K mg/l	Ca+Mg meq/l	Ca mg/l	Mg mg/l	CO_3 mg/l	HCO_3 mg/l	Cl mg/l	SO_4 mg/l	B mg/l
72	6,95	7.50	738	42.76	1.56	5.77			0.00	377.04	40.42	16.81	0.43
72	9,95	7.20	686	31.50	1.17	5.78			0.00	342.88	40.42	20.17	0.57
72	6,96	7.60	741	32.42	1.17	6.19			0.00	366.06	48.93	12.01	0.91
72	9,96	7.20	620	34.72	1.17	4.85			0.00	306.88	42.54	7.69	0.47
72	6,97	7.50	740	51.73	1.96	6.38			0.00	433.17	48.22	10.57	0.25
72	9,97	7.90	695	23.45	0.78	5.97			0.00	361.18	35.45	4.32	0.15
73	6,95	7.40	645	22.99	0.78	5.68			0.00	341.66	29.07	13.45	0.40
73	9,95	7.20	651	12.42	0.39	6.28			0.00	344.10	26.59	21.13	0.25
73	6,96	7.80	667	23.45	0.78	5.83			0.00	341.05	34.74	14.41	0.03
73	9,96	7.30	654	31.50	1.17	6.34			0.00	339.83	35.45	8.17	0.05
73	6,97	7.60	611	52.42	1.96	4.54			0.00	355.08	31.91	7.20	0.41
73	9,97	7.80	650	7.82	0.39	6.20			0.00	325.18	40.77	3.36	0.13
74	6,95	7.40	736	49.20	1.56	5.47			0.00	331.89	46.09	43.71	0.49
74	9,95	7.30	700	53.57	1.96	4.97			0.00	335.55	43.96	29.30	0.50
74	6,96	7.80	776	34.26	0.78	6.78			0.00	280.65	54.60	88.86	0.90
74	9,96	7.50	690	29.89	1.17	5.78			0.00	308.71	53.18	26.42	0.01
74	6,97	7.60	648	36.56	0.78	5.48			0.00	319.08	43.25	31.22	0.15
74	9,97	8.00	472	22.07	0.78	4.35			0.00	256.24	28.36	15.85	1.36
92	9,95	7.30	606	25.98	0.78	5.23			0.00	312.98	17.02	36.98	0.35
92	6,96	8.10	479	9.66	0.39	4.50			0.00	239.16	28.36	10.09	0.57
92	9,96	7.60	470	20.92	0.78	3.91			0.00	225.74	36.87	4.80	0.00
92	6,97	8.10	584	16.09	0.39	5.34			0.00	305.05	32.62	6.24	0.00
92	9,97	7.90	613	48.05	1.56	4.00			0.00	256.24	26.59	56.68	0.00
93	6,96	8.30	1008	151.51	5.08	3.86			0.00	369.72	67.36	124.40	4.19
93	9,96	7.60	1385	260.95	8.99	2.69			0.00	488.08	125.50	131.13	3.37
93	6,97	8.40	1243	250.37	8.60	2.21			0.00	487.47	77.29	98.47	4.12
93	9,97	7.80	849	89.66	3.13	4.65			0.00	373.38	56.02	44.67	2.92
94	873	7.50	948	39.08	3.52	7.00			0.00	341.66	92.18	28.34	0.00
94	9,91	7.00	1092	85.99	2.35		47.49	59.81	0.00	350.20	168.40	29.30	0.00
94	894	7.30	1428	140.70	1.96		87.57	53.00	0.00	373.38	272.99	51.87	0.00
94	9,95	7.40	1493	197.95	7.04	6.90			0.00	323.96	336.80	42.27	0.01
95	176	7.50	2064	303.48	14.47		106.21	38.90	0.00	338.61	443.16	193.09	0.00
95	9,91	6.80	1752	166.22	5.47		96.39	66.49	0.00	331.89	365.87	87.42	0.00
95	894	7.80	2320	367.86	5.08		67.53	45.95	0.00	344.10	590.29	47.55	0.00
95	9,95	7.30	2310	361.65	12.51	8.20			0.00	499.67	525.06	60.04	0.22
96	276	7.50	2064	303.48	14.47		106.21	38.90	0.00	338.61	443.16	193.09	0.00
96	9,91	7.00	1015	53.34	1.56		53.91	62.85	0.00	334.33	143.23	33.62	0.00
96	894	7.10	2420	330.15	4.69		87.17	67.71	0.00	979.21	609.08	56.20	0.00
96	9,95	7.40	1296	141.39	5.08	7.32			0.00	355.08	249.59	35.54	0.00
97	1076	7.40	1958	229.91	10.95	9.00			0.00	332.50	393.53	131.13	0.00
97	9,91	7.30	1277	87.60	2.35		46.09	81.81	0.00	375.21	222.64	22.58	0.00
97	894	7.10	1427	160.94	2.35		66.93	40.60	0.00	353.86	283.62	30.74	0.00
97	9,95	7.40	1241	147.14	5.08	6.50			0.00	394.73	206.34	35.54	0.00
98	379	7.60	1174	142.54	6.26	6.70			0.00	488.08	81.54	132.57	0.00
98	9,91	7.20	1133	46.44	1.56		52.30	82.78	0.00	496.62	89.34	39.39	0.00
98	794	7.10	1097	69.43	1.96		92.58	40.97	0.00	464.90	104.94	23.06	0.00
98	9,95	7.30	1183	115.87	3.91	7.28			0.00	543.60	100.69	3.36	0.01
99	479	6.80	1756	193.12	14.86	8.80			0.00	359.96	340.35	99.91	0.00
99	9,91	7.30	1237	68.74	2.35		61.32	78.04	0.00	402.67	178.33	43.23	0.00
99	894	7.20	870	67.36	1.56		79.76	23.46	0.00	366.06	80.12	29.78	0.00
99	9,95	7.30	894	82.08	2.74	5.74			0.00	401.45	80.12	25.94	0.40

Table I.6. Quality classes of the DSİ monitoring well waters with respect to the limits of inland water sources (WCCR, 1988) and the limits of irrigation water (WCCR, 1991)*. For explanation see caption of Table 3.4.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Kiraz Sub-basin										
1	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
1	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
1	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
1	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
1	6,97	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	I
1	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	II
2	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
2	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
2	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
2	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
2	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
2	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
3	6,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
3	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
3	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
3	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
3	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
3	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
4	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
4	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
4	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
4	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
4	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
4	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
5	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
6	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
6	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
6	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
6	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
6	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
6	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
Ödemiş Sub-basin										
7	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
7	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
7	6,96	F2-CaMgMix	II	I	I	C2S1	II	I	I	I
7	9,96	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	I
7	6,97	F2-CaMgMix	II	I	I	C3S1	III	I	I	I
7	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
8	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
8	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
8	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
8	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
8	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
8	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
9	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
9	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
9	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
9	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II

Table I.6 continued.

DSİ No	Date	Type	Cl	SO$_4$	B	Salinity-SAR	*EC	*Cl	*SO$_4$	*B
Ödemiş Sub-basin continued.										
9	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
9	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
10	6,95	F1-CaMgHCO3	II	I	I	C3S1	III	I	I	I
10	9,95	F2-CaMgHCO3	II	I	IV	C3S1	III	I	I	III
10	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
10	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
10	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
10	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
11	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
11	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
11	6,96	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
11	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
11	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
11	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
12	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
12	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
12	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
12	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
12	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
12	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
13	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
13	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
13	9,96	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
13	6,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	II
13	9,97	F1-CaMgHCO3	I	I	IV	C2S1	II	I	I	III
14	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
14	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
14	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
14	9,96	F1-NaHCO3	II	I	I	C2S1	II	I	I	II
14	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	II
15	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
15	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
15	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
15	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
15	6,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
15	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
16	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
16	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
16	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
16	9,96	F1-NaHCO3	II	I	IV	C2S1	II	I	I	III
16	9,97	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
17	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
17	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
17	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
17	9,96	F1-NaHCO3	II	I	IV	C2S1	II	I	I	IV
17	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
18	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
18	9,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
18	6,96	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
18	9,96	F1-CaMgHCO3	I	I	IV	C2S1	II	I	I	II

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Ödemiş Sub-basin continued.										
18	9,97	F1-CaMgHCO3	I	I	IV	C2S1	II	I	I	III
19	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
19	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
19	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
19	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
19	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
19	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
20	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
20	9,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
20	6,96	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
20	9,96	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
20	6,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
20	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
21	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
21	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
21	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
21	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
21	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
22	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
22	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
22	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
22	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
22	6,97	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
22	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	II
23	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
23	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
23	6,96	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
23	9,96	F1-CaMgMix	II	I	I	C2S1	II	I	I	I
23	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
24	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
24	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
24	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
24	9,96	F1-NaMix	II	I	IV	C2S1	II	I	I	III
24	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
25	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
25	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
25	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
25	9,96	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
25	9,97	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	II
26	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
26	9,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
26	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
26	9,96	F1-CaMgHCO3	I	I	IV	C2S1	II	I	I	III
26	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
27	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
27	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
27	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
27	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
27	9,97	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
28	6,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Ödemiş Sub-basin continued.										
28	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
28	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
28	9,96	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
28	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
28	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	IV
29	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
29	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
29	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
29	9,96	F0-NaHCO3	I	I	IV	C2S1	II	I	I	IV
29	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	II
30	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
30	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
30	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
30	9,96	F1-NaMix	II	I	I	C3S1	III	I	II	I
30	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
30	9,97	F2-CaMgHCO3	II	I	IV	C3S1	III	I	I	III
31	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
31	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
31	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
31	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
31	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
31	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
32	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
32	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
32	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
32	9,96	F2-CaMgMix	II	I	I	C2S1	II	I	I	I
32	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
32	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	IV
Bayındır-Torbalı Sub-basin										
33	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
33	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
33	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
33	9,96	F1-NaMix	II	I	I	C2S1	II	I	I	I
33	6,97	F1-CaMgMix	II	I	I	C2S1	II	I	I	I
33	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	IV
34	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
34	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
34	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
34	9,96	F1-NaHCO3	II	I	I	C2S1	II	I	I	II
34	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
34	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
35	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
35	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
35	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
35	9,96	F0-NaHCO3	I	I	I	C2S1	II	I	I	I
35	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
35	9,97	F1-CaMgHCO3	I	I	IV	C2S1	II	I	I	III
36	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
36	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
36	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Bayındır-Torbalı Sub-basin continued.										
36	9,96	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
36	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
36	9,97	F1-CaMgHCO3	II	I	IV	C2S1	II	I	I	IV
37	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
37	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
37	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
37	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
37	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
37	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
38	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
38	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
38	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
38	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
38	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
38	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
39	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
40	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
40	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
40	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
40	9,96	F1-CaMgHCO3	II	I	I	C2	II	I	I	I
40	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
40	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
41	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
41	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
41	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
41	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
41	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
41	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
42	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
42	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
42	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
42	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
42	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
42	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
43	6,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	II
43	9,95	F2-CaMgHCO3	II	I	I	C2	II	I	I	II
43	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
43	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
43	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
43	9,97	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	II
44	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
44	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
44	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
44	9,96	F2-CaMgHCO3	I	I	I	C3S1	III	I	I	I
44	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Bayındır-Torbalı Sub-basin continued.										
44	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
45	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
45	9,95	F2-NaHCO3	II	I	I	C3S1	III	I	I	II
45	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
45	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
45	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
45	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
46	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
46	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
46	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
46	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
46	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
46	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
47	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
47	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
47	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
47	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
47	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
47	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
48	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
48	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
48	6,96	F2-NaSO4	II	IV	I	C4S2	IV	I	IV	I
48	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
48	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
48	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
49	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
49	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
49	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
49	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
49	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
49	9,97	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	II
50	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
50	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
50	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
50	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
50	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
50	9,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
51	6,95	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
51	9,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
51	6,96	F1-NaHCO3	II	I	I	C2S1	II	I	I	I
51	9,96	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
51	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
51	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
52	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
52	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
52	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
52	9,96	F1-NaMix	II	I	IV	C3S1	III	I	I	III
52	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
52	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
53	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Bayındır-Torbalı Sub-basin continued.										
53	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	II
53	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
53	9,96	F0-NaHCO3	II	I	IV	C2S1	II	I	I	III
53	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
54	6,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
54	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
54	6,96	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
54	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
54	6,97	F1-CaMgHCO3	I	I	I	C2S1	II	I	I	I
54	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
55	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
55	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
55	6,96	F2-CaMgHCO3	II	I	I	C2	II	I	I	I
55	9,96	F1-NaHCO3	II	I	IV	C2S1	II	I	I	III
55	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
56	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
56	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
56	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
56	9,96	F1-NaHCO3	II	I	I	C2S1	II	I	I	I
56	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
57	6,95	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	II
57	9,95	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	II
57	6,96	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	I
57	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
57	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
57	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
58	6,95	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
58	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
58	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
58	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
58	6,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
58	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
59	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
59	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
59	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
59	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
59	6,97	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
59	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	II
60	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
60	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
60	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
60	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
60	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
60	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
69	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
69	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
69	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
69	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
69	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
69	9,97	FB2-CaMgMix	III	I	I	C3S1	III	II	I	I

Table I.6 continued.

DSİ No	Date	Type	Cl	SO₄	B	Salinity-SAR	*EC	*Cl	*SO₄	*B
Bayındır-Torbalı Sub-basin continued.										
70	6,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
70	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
70	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
70	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
70	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
70	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
71	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
71	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
71	6,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
71	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
71	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
71	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	II
72	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
72	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
72	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
72	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
72	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
72	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
73	9,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
74	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
74	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
74	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
74	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
74	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
74	9,97	F2-CaMgHCO3	II	I	IV	C2S1	II	I	I	III
92	9,95	F2-CaMgHCO3	I	I	I	C2S1	II	I	I	I
92	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
92	9,96	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
92	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
92	9,97	F1-CaMgHCO3	II	I	I	C2S1	II	I	I	I
93	6,96	F1-NaHCO3	II	I	IV	C3S1	III	I	I	IV
93	9,96	F1-NaHCO3	II	I	IV	C3S1	III	I	I	IV
93	6,97	F1-NaHCO3	II	I	IV	C3S2	III	I	I	IV
93	9,97	F2-CaMgHCO3	II	I	IV	C3S1	III	I	I	IV
Selçuk Sub-basin										
61	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
61	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
61	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
61	9,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
61	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
61	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
62	12,75	F2-CaHCO3	II	I	I	C3S1	III	I	I	I
62	9,91	F2-MgHCO3	II	I	I	C3S1	III	I	I	I
62	8,94	F2-CaHCO3	II	I	I	C3S1	III	II	I	I
62	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	II	I	II

Table I.6 continued.

DSİ No	Date	Type	Cl	SO₄	B	Salinity-SAR	*EC	*Cl	*SO₄	*B
Selçuk Sub-basin continued.										
62	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	II
62	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
62	9,96	FB3-CaMgCl	III	I	I	C3S1	III	III	I	I
62	6,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
62	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
63	2,79	B3-NaCl	IV	I	I	C3S1	III	III	I	I
63	9,91	B3-NaCl	IV	I	I	C3S1	IV	IV	I	I
63	8,94	B3-NaCl	IV	I	I	C4S1	IV	IV	I	I
63	6,95	B3-NaMix	IV	IV	I	C4S2	IV	IV	IV	II
63	9,95	B3-NaCl	IV	I	IV	C4S1	IV	IV	I	III
63	6,96	F2-NaHCO3	II	I	I	C3S1	III	I	I	I
63	9,96	FB3-CaMgHCO3	II	I	I	C3S1	III	II	I	I
63	6,97	FB2-CaMgMix	II	I	I	C3S1	III	II	I	II
63	9,97	F3-CaMgHCO3	II	I	I	C3S1	III	I	I	I
64	6,95	FB3-CaMgMix	III	I	I	C3S1	III	III	I	II
64	9,95	FB3-CaMgMix	III	I	IV	C3S1	III	II	I	II
64	6,96	FB2-NaCl	III	I	I	C3S1	III	III	I	I
64	9,96	FB3-CaMgCl	III	I	I	C3S1	III	III	I	I
64	6,97	TB3-CaMgCl	III	I	I	C3S1	III	III	I	II
64	9,97	F3-CaMgHCO3	II	I	I	C3S1	III	II	I	I
65	6,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
65	9,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	II
65	6,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
65	9,96	F2-CaMgMix	II	I	I	C2S1	II	I	I	I
65	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
65	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
66	6,95	FB2-NaCl	III	I	I	C3S1	III	III	I	I
66	9,95	FB2-NaMix	III	I	I	C3S1	III	III	I	II
66	6,96	B2-NaCl	IV	I	I	C3S1	IV	IV	I	I
66	9,96	B3-NaCl	IV	I	I	C3S1	IV	IV	I	I
66	6,97	B3-NaCl	IV	I	I	C3S1	III	IV	I	II
66	9,97	FB2-NaHCO3	II	I	I	C3S1	IV	II	I	I
67	6,95	B3-NaMix	III	I	I	C3S1	III	III	I	II
67	6,96	B3-NaCl	IV	I	I	C3S1	IV	IV	I	I
67	9,96	B3-NaCl	IV	I	I	C4S1	IV	IV	I	I
67	6,97	B3-NaCl	IV	I	I	C4S1	IV	IV	I	II
67	9,97	B3-NaCl	IV	I	I	C4S1	IV	IV	I	I
68	6,95	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
68	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
68	6,96	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
68	9,96	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
68	6,97	F2-CaMgHCO3	II	I	I	C2S1	II	I	I	I
68	9,97	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
94	8,73	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
94	9,91	FB2-MgHCO3	II	I	I	C3S1	III	II	I	I
94	8,94	FB3-CaCl	III	I	I	C3S1	III	III	I	I
94	9,95	B2-NaCl	III	I	I	C3S1	III	III	I	I
95	1,76	B3-NaCl	IV	I	I	C3S1	IV	IV	II	I
95	9,91	B3-MgCl	III	I	I	C3S1	III	III	I	I
95	8,94	B2-NaCl	IV	I	I	C4S1	IV	IV	I	I

Table I.6 continued.

DSİ No	Date	Type	Cl	SO_4	B	Salinity-SAR	*EC	*Cl	*SO_4	*B
Selçuk Sub-basin continued.										
95	9,95	B3-NaCl	IV	I	I	C4S1	IV	IV	I	I
96	2,76	B3-NaCl	IV	I	I	C3S1	IV	IV	II	I
96	9,91	F2-MgHCO3	II	I	I	C3S1	III	II	I	I
96	8,94	B3-NaMix	IV	I	I	C4S1	IV	IV	I	I
96	9,95	FB2-CaMgCl	III	I	I	C3S1	III	III	I	I
97	10,76	B3-NaCl	III	I	I	C3S1	III	III	I	I
97	9,91	FB3-MgMix	III	I	I	C3S1	III	II	I	I
97	8,94	FB2-NaCl	III	I	I	C3S1	III	III	I	I
97	9,95	FB2-NaMix	III	I	I	C3S1	III	II	I	I
98	3,79	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
98	9,91	F3-MgHCO3	II	I	I	C3S1	III	I	I	I
98	7,94	F2-CaHCO3	II	I	I	C3S1	III	I	I	I
98	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I
99	4,79	B3-CaMgCl	III	I	I	C3S1	III	III	I	I
99	9,91	FB3-MgHCO3	II	I	I	C3S1	III	II	I	I
99	8,94	F2-CaHCO3	II	I	I	C3S1	III	I	I	I
99	9,95	F2-CaMgHCO3	II	I	I	C3S1	III	I	I	I

APPENDIX II

Previous Surface Water Data

The DSİ monitors the chemistry of the streams in the basin. This monitoring program initiated in 1985 with a single point on the K. Menderes River near Selçuk and expanded to 14 locations in 1995, covering all the major streams in the basin. Three of these points are located on the K. Menderes River (Beydağ Dam axe, Etibank mining facilities, Selçuk), 3 points are on the Fertek stream (upstream, north of Torbalı, south of Torbalı), and one point each on Gelinbözü, Rahmanlar, Aktaş, Falaka (Değirmendere), Ergenli (Ilıca), Pirinçci, Eğridere and Akyurt streams. The monitoring locations are shown in Figure II.1. Chemical analyses of the collected waters and their annual average concentrations are listed in Table II.1 and Table II.2, respectively. The water qualities of the annual average data estimated using the inland water sources limits of the measured parameters are listed in Table II.3.

Percent concentration distributions of the cations and anions in the surface waters are shown in Figure II.2. Percent concentration distributions of the cations and anions using the overall average data in the surface waters are also given in Figure II.3. The average cation concentrations indicate that the Aktaş, Falaka (Değirmendere), and Ergenli (Ilıca) streams are Ca type whereas the others are mix type. Among these mix types, the waters of K. Menderes and Fertek include higher Na but lower Mg concentrations. The average anion concentrations indicate that the Fertek (north of Torbalı) waters are mix type, Fertek (upstream) water is SO_4 type and the others are HCO_3 type. When the surface waters with more than one monitoring point (K. Menderes and Fertek) are investigated in terms of spatial distribution, it is observed that the cation concentrations do not deviate much. However, the anion concentrations of the K. Menderes River become higher in HCO_3 at Selçuk area and those of Fertek increase in HCO_3 and decrease in SO_4 from upstream to downstream at the south of Torbalı. The average data trends of same parameters are shown in Figure II.4. The ion concentrations measured during the DSİ monitoring program are compared with the data collected in this work in section 3.3.

According to the salinity classification, waters of the Fertek stream at the sampling point located to the north of Torbalı have the highest (C3) salinity in the basin (Table II.3). On the other hand, the Pirinçci stream waters have the lowest (C1) salinity. Salinity of the other streams is in medium (C2) class. According to the TDS, B, Cl, F, N-NO_3, Pb inland water sources limits, all the surface waters are either in high quality (I) or in medium quality (II) class (Table II.3). In terms of Fe content, waters of the Ergenli, Rahmanlar, Akyurt, Pirinçci, and Fertek (south of Torbalı) streams are in high quality, waters of K. Menderes (Selçuk), Falaka, Eğridere, Fertek (north of Torbalı) are in medium quality and waters of K. Menderes (Beydağ Dam axe and Etibank mining facilities), Fertek (upstream) and Gelinbözü are in low quality (III) class. While the Fertek (upstream) surface waters are in very low quality (IV) in terms of the SO_4 inland water sources limits, the other waters are in high quality (I) class. Finally, the K. Menderes River after the Etibank mining facilities are in low quality (III) class with respect to Hg limits.

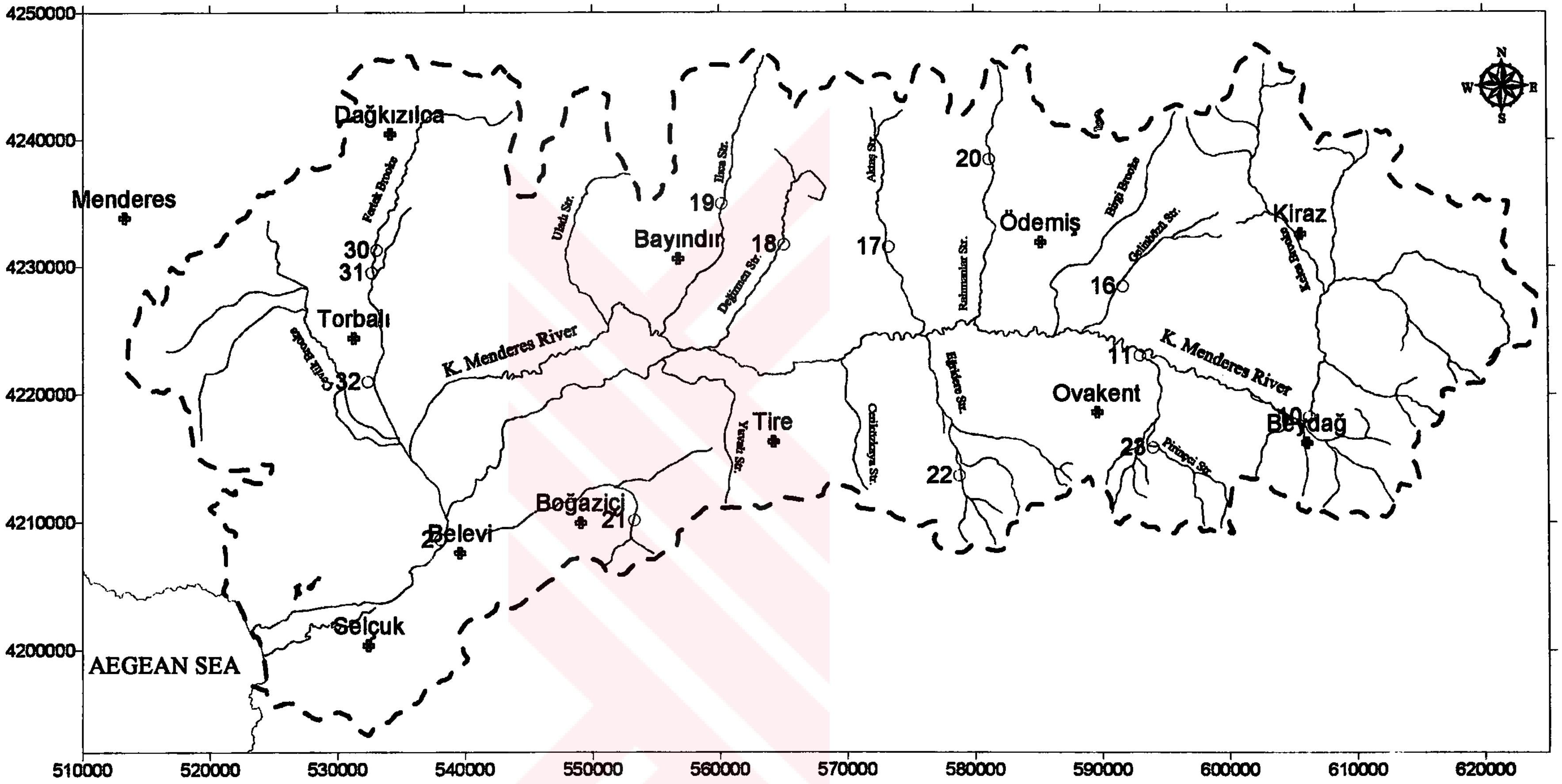


Figure II.1. Geographic distribution of the DSİ surface water monitoring locations.

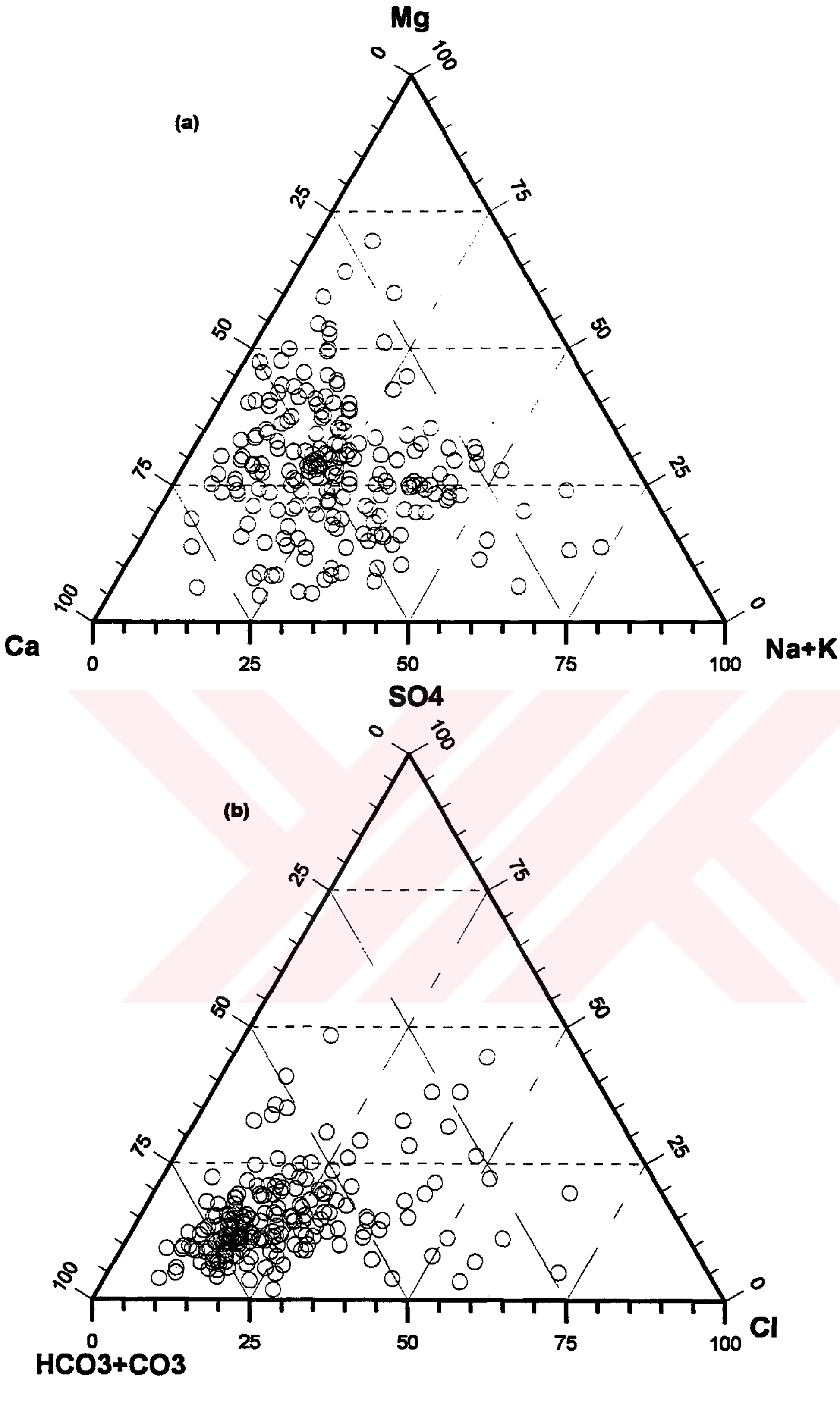


Figure II.2. Percent distributions of (a) cations and (b) anions in the surface water monitoring locations (all data). For monitoring locations see Figure II.1

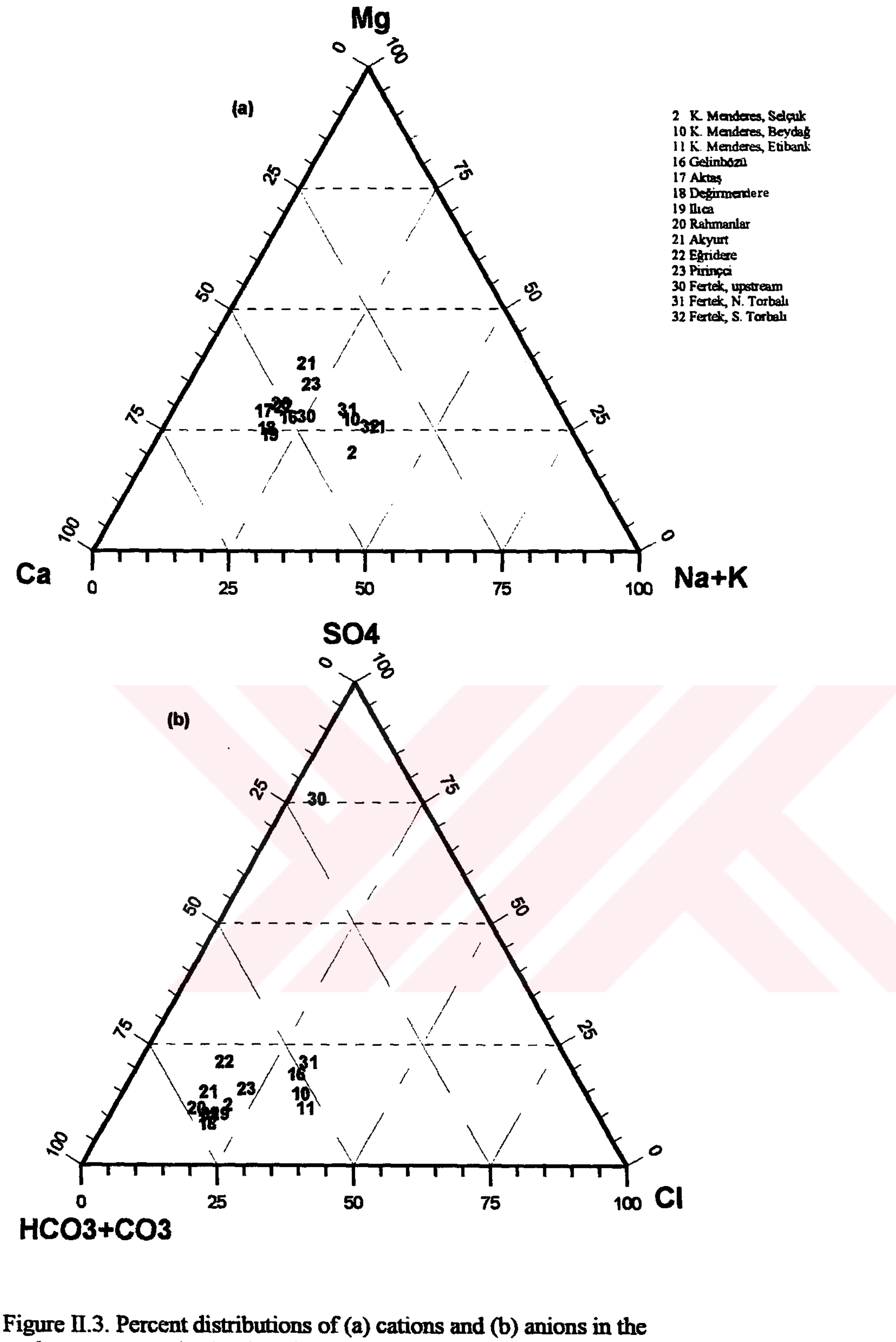


Figure II.3. Percent distributions of (a) cations and (b) anions in the surface water monitoring locations (average data). For monitoring locations see Figure II.1.

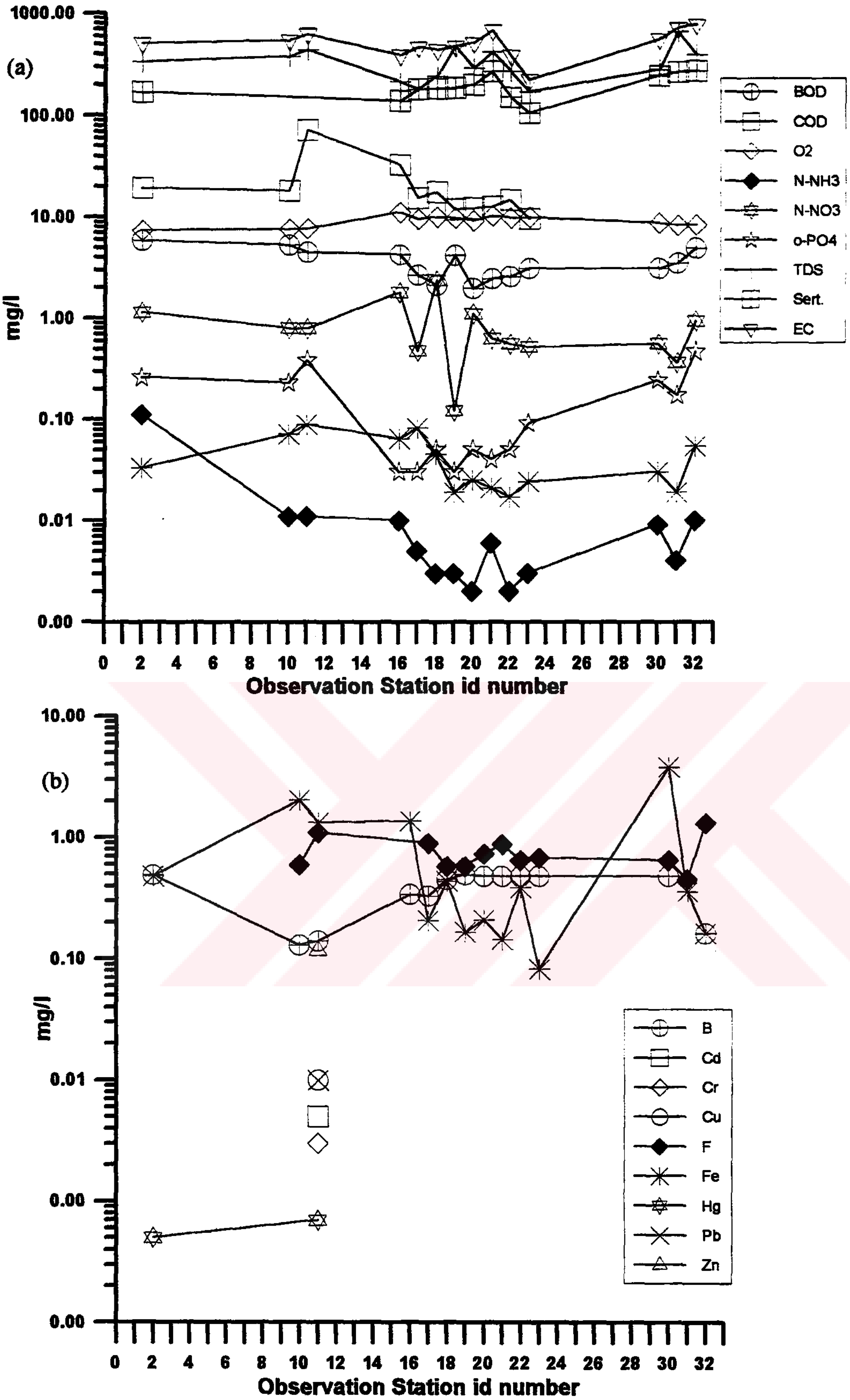


Figure II.4. Average data trends of some parameters in the surface water monitoring locations. For monitoring locations see Figure II.1.

Table II.1. Chemical analyses of the DSİ monitoring surface waters. Distribution of the locations in the basin is shown in Figure II.1.

Station-date	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	Cr mg/l	Cu mg/l	EC µS/cm	F mg/l	Fe mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Zn mg/l
2-02,85				28.4			395				150			0	0.016	0.95		0		7.8				
2-05,85				42.5			600				255			0.1	0.012	2.3	0.08	50		8.2	0.48			
2-12,85				17.7			190				60			0	0.003	0.4	0.03	0		7.7	0.4			
2-02,86	0			24.8			330				130			0.12	0.004	1.9	0.04	0		7.7	2.56			
2-05,86	0			39			520				229						0.8	0		7.4	2.8			
2-02,87				22.3			390				100.5			0	0			0		7.2	3.6			
2-05,87				27.2			490				222			0.1	0.018			0		7.7	3.68			
2-02,88				39.4			500				236							0		8	6.88		331	
2-05,88				39			560				221			0.14	0.038			0		8	7.84		442	
2-11,88				86.9			580				204			0.05	0.035	1.8	0.8	0		8.4	3.45		544	
2-01,89				34.52			500				305.6			0.09	0.004		0.15	0		7.38	0		340.6	
2-03,89				25.84			449				219.6			0.09	0.003		0.12	0		8.23	0.16		351.4	
2-05,89				41.2			492				254.1			0.7	0.01	1.5	1.1	0		7.28	1.44		369	
2-06,89				46.7			720				427.1			0.9	0.2	1.7	1.2	0		7.72	1.71		540	
2-01,90				49.9			588				234.2			0.6	0	1.4	0.07	0		8.3	3.8		441	
2-03,90				18.3			335							0.1	0	1.2	0.05	0		7.5	4.16		395.4	
2-05,90				34.6			539				201.3			0.1	0	1.4	0.05	21.1		7.3	2.8		361.1	
2-01,91				38.6			657				236			0.095	0.005	0	0.1	0		7.4	27		416	
2-04,91				26.2			396				135			0.032	0.089	1.86	0.11	0		7.4	10.9		962	
2-07,91				38.4			658				230			0.01	0.015	2.18	0.1	0		7.6	9.8		418	
2-01,92	0	24.4		76.9			578			1.56	64	19.9	51.52	0.18	0.042	1.58	0.06	52		9.2	3.25	31.2	298	
2-04,92	0	26.6		47.5			466		0.07	1.56	105.5	17	45.31	0	0	0	0	20		8.3	2.46	43.4	200	
2-01,93	2.07	62.4		104.5			1077		0	3.9	321.5	18.7	127.9	0.12	0.035	0	0.92	0		7.5	5.17	45.2	30	
2-04,93	0.34	26		16.6			311		0.01	0.78	117.5	10.5	29.21	0	0.05	2.05	0.1	0		8	0.36	30.9	300	
2-02,95	0.39	46.6		43.9			483		0.27	0.78	121.5	10.4	30.82	0	0.19	0	0.12	0		7.8	6.48	42.5	250	
2-04,95	0	40		35.8			320		0.29	0.78	101	6.2	28.29	0	0.019	1.52	0.01	0		7.8	1.27	35.2	260	
2-06,95	0	48.2		41.8			492		0.65	1.56	263	27.3	57.5	0	0.024	0	0.22	0		8	2.24	36.9	372	
2-01,96	0.21	54.4		48.9			921		1.97	0.78	212	17.7	36.8	0.03	0.081	0	0.42	0		7.6	9.16	32.8	354	
2-04,96	0	64.4		30.4			520		0.72	0.39	125	15.8	10.59	0.01	0.059		0.09	0		8.4	0.82	23.1	238	
2-01,97	0.8	45.4		44.1			422		0.64	0.78	137.5	9.477	42.09	0	0.008	0	0.05	0		7.7	0.95	42.7	248	
2-04,97	0	38		33.25			353			1.17	101	6.926	31.51	0	0.019	1.22	0.09	25.5		8.5	0.99	18.8	273	
2-01,98	0.58	55.6		33.6			432		0.42	0.78	192.5	2.8	32.2	0	0.013	0.17	0.08	0		8.1		29.2	196	
2-04,98		53		43.8			439			1.56	206	10	52.9	0	0.021	0.37	0.11	0		8		21.5	273	
10-02,95	0.87	20		31.9			191		0	0.39	36	6.8	11.27	0	0.7	0.29	0.06	0		7.1	0	21.3		
10-04,95	0	32.8		11.3			180		5.94	0.39	76	3.4	21.39	0	0.025	0.64	0.11	0		7.9	1.54	49	86	
10-06,95	0	55		29			487		0.4	0.78	187	23.9	30.13	0	0.17	4.98	0	0		7.8	0.44	71.8	434	
10-12,95	0.05	53.2		31.9			428		0.62	0.39	179.5	24.3	9.2	0.01	0.045	0.2	0.15	0		7.2	1.72	28.2	268	
10-02,96		20.8		22.7			365		0.8	0.78	109	10.8	30.82	0.02	0.018		0.04	0		7.8	0	22.8	184	
10-04,96	0.42	13		43.9			330		0.35	0.39	54	21.1	11.27	0	0.015		0.08	0		7.4	0	26.8	194	
10-10,96	0	117.8		288.5			2370		7.58	5.46	450	48.2	180.6	0.1	0.016	0.65	1.25	0		6.8	3.9	34	1368	
10-12,96	0	46		105			552	0.1	5.2	0.78	125	24.3	37.72	0	0.009	0	0.12	0		8.1	0.9	23.1	328	
10-02,97		29.2		22.4			253	1.1	4.45	1.56	122.5	14.82	46.92	0	0.005	0.29	0.07	0		8.1	1.16	80.1	188	
10-04,97	0.05	32		30.1			253			0.78	77.5	8.870	25.3	0	0.013	0.94	0.08	35		8.3	0.98	16.5	187	
10-06,97	0	58		184.8			925			2.34	129	42.89	80.5	0	0.015	0.62	0.06	57		8.5	1.10	47.7	574	
10-08,97	0.11	29		24.15			260			0.78	91	6.440	30.82	0.04	0.009	0.51	0.11	0		7.2	1.02	39.8	160	
10-10,97	0.44	55.2		113.8			832			2.34	222	34.26	69.69	0.03	0.069	1.49	1.88	0		6.5	1.04	47.5	780	
10-12,97	0.1	25		40.3			282		0.8	0.39	70	8.9	21.39	0	0.008	0.08	0.13	0		8	1.01	18		
10-02,98	0	36.8		22			243		0.19	0.39	59.5	7.8	5.06	0	0.019	0.01	0.03	10		9.6		22.5	140	
10-04,98	0	72.6		23.4			248		-	0.39	63	7.8	9.2	0	0.01	0.29	0.11	13		9.4		28.7	243	

Table II.1 continued.

Station-date	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	Cr mg/l	Cu mg/l	EC µS/cm	F mg/l	Fe mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Na mg/l	$N-NH_3$ mg/l	$N-NO_2$ mg/l	$N-NO_3$ mg/l	$o-PO_4$ mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Zn mg/l
10-06,98	0	74.6		37.6			442		-	9.75	211.5	20.2	56.81	0	0.015	0	0.17	0		7.1		32.2	276	
10-08,98	0	30.6		61.7			817		0	26.91	147.5	17.3	77.97	0	-	3.45	0.02	131		8.4		92.3	760	
10-10,98	0	34.4		78.7			603		0	9.75	224.5	16	54.97	0	0.004	0.13	0.05	0		7.8		42.5		
10-12,98		32		17			299		0.81	3.9	118	11.9	11.96	0	0.011	0.09	0.03	0		7.8		28.9	217	
11-02,95	0.17	14		22.6			211		0	0.39	66	15.2	11.27	0	0.2	0.68	0.07	0		7.1		23.7	102	
11-04,95	0	27.6	0.005	9.9	0.005	0.019	200		6.92	0.78	87.5	3.8	29.67	0	0.015	0.79	0.1	0	0.026	7.9	1.41	47.5	272	0.241
11-06,95	0	49		78.7			489			2.34	223.5	22.2	77.74	0	0.551	0	0.7	0			0.44	49.8	432	
11-08,95		38.8		381.4			1960		0.09	8.58	178.5	25	250.0	0	0.955	11.6	0.25	0		7.8	0	36.8	1093	
11-10,95		47.4		359.8			1960			8.97	359	52.3	253.9	0	0	0.3	2.08	0			1.88	29.8	734	
11-11,95			0.005		0.005	0.011													0.019					0.167
11-12,95	0.25	76		92.1			1005			2.34	344	31.1	89.24	0.02	0.018	0.01	0.78	0			2.04	39.5	720	
11-01,96																								
11-02,96		35.4		21.3			317		0.79	0.39	113	12.7	12.19	0.03	0.023		0.06	0		7.8	0	23.8	272	
11-03,96																								
11-04,96	0	21.4	0.005	21.2	0.005	0.005	354		0.24	0.78	90	9.1	26.45	0	0.024		0.1	0	0.006	7.6	0	28.6	180	0.096
11-06,96	0.95	91.2		69.6			659		0.39	1.56	180	10.5	47.15	0.01	0.047		0.05	0		8.8	1.2	50.9	380	
11-10,96		68		72.3			1065		0	0.78	230	35.4	28.98	0.08		0.27	0.18	0		7.9	2.8	46.2	418	
11-12,96	0	53.6		38.3			300	0		0.39	168	18.4	18.63	0	0.012	0		0		8	0.9		264	
11-02,97		36.6		77			394	1.1	2	0.39	81.5	19.08	20.93	0	0.005	0	0.16	0		7.7	1.76	23.6	256	
11-04,97	0	40.2		33.25			261			0.39	50.5	3.159	14.49	0.01	0.019	0.82	0.09	26.5		8.2	1.72	20.2	901	
11-06,97	0	64.6		81.9			640			0.39	115	37.30	3.45	0.01	0.02	0.68	0.11	50		8.8	1.86	39.4	370	
11-08,97		37		42.35			426			1.56	150	12.03	47.84	0	0.005	0.44	0.07	50		8.2	1.97	36.2	264	
11-10,97	0.25	54.6		140			969			1.56	252.5	53.22	60.03	0	0.058	1.61	1.36	0		6.6	1.71	34.4	698	
11-12,97	0.1	50.4		44.1			344		0.88	0.78	104.5	4	31.51	0	0.022	0	0.1	20		8.3	1.78	23.9		
11-02,98	0	30.4		16.3			229		0.61	0.39	59.5	6.6	5.75	0	0.031	0.03	0.23	10		10		22.9	214	
11-04,98	0	25		19.5			315		-	0.39	89	17	11.73	0	0.017	0.39	0.13	16		10		29.3	-	
11-06,98		38.4	0	36.9	0	0.01	439		-	8.97	209	16.3	55.89	0	0.017	0	0.17	0	0	7.6		34.1	282	0.053
11-08,98	0.12	54.4		95.7			883		0.68	48.75	282	7.4	107.87	0.09	-	0.42	1.88	0		7.8		45	686	
11-10,98	0	37		52.8			502		0	9.75	212	25.6	55.89	0	0.004	0	0.03	0		8		42.9		
11-12,98		32		10.6			332		3.44	4.68	132.5	18.5	12.88	0	0.011	0.11	0.12	0		7.6		41	242	
16-04,95	0.5	36.2		45.1			348		2.48	0.58	102.5	17.2	25.41	0	0.139	2.51	0.02	22		8.1	2.29	33.3		
16-03,96	0.33	32.6		28.4			460	0	1.09	0.39	70.5	9.7	18.86	0	0.034		0.06	0		8.5	1.04	23.6	214	
16-03,98	0.18	43		24.9			341		0.53	0.39	62	10.3	11.04	0.01	0.019	1.04	0	50		9.2		26.5	208	
17-04,95	0.45	34.4		34.2			308		0.27	0.39	109	12.2	15.57	0	1.1	1.16	0	0		7.8	0.27	25.5		
17-05,95	0			26.5			398		0	0.39	87.5		8.28	0	0.002	1.21	0	0		8.3		16.1		
17-06,95	0	47.6		28.3			490		0.53	0.39	200	26.6	11.73	0	0.011	0	0	0		8	0.71	13.7		
17-07,95	0.15	56		23.3			384		0.24	0.78	155	4.37	23.46	0	0.02	0	0	0		7.7	2.48	21.2	2	
17-01,96	0.05			26.2			661		0.1	0.39	166.5	19.4	10.81	0	0.008	0.22	0	0		7.8	0	15.8	228	
17-03,96	0.35	36.6		25.6			500		0.19	0.39	127	12.7	17.94	0	0.014		0.01	0		8.1	0	20.2	198	
17-05,96	0	43.2		24.8			591		0.4	0.39	112.5	10.2	7.13	0	0.024		0.01	0		8.5	0	18	268	
17-09,96	1.48	65.6		35.4			815		0		236	17.1	37.95		0.045		0.05	0		7	1.3	30.8	324	
17-11,96	0	71.2		41.1			860	0.9	0.11	0.39	206	20.6	14.49	0	0.012	0.66	0	0		8	1.2	30.2	342	
17-01,97	0.74	55.2		30.1			398		0.1	0.78	158	7.533	23.69	0	0	0	0.03	0		8.1	0	19.5	240	
17-03,97	0	49.2		30.8			474		0.9	0.78	168	18.35	19.55	0	0.007	0	0	0		8.1	0.8	17.5	272	
17-05,97	0	31.6		25.2			318	0.9	0.23	0.39	70	13.85	13.57	0	0	0.4	0	46		8.8	0.49	13.6	370	
17-11,97	0	48.4		29.4			437	0.9	0	0.39	183	16.16	21.62	0	0.02	0	0.04	0		8.2	0	9.6	236	
17-01,98	0	38.8		23.8			278		0.2	0.39	156	15.2	20.24	0.01	0.014	0.13	0.18	0		7.9		13.5	74	
17-03,98	0.37	46.2		19.6			379		0	0.39	123	20.9	5.06	0	0.011	2.55	0	42		8.3		19.1	163	
17-05,98	-	42		21.3			322		0.18	0.39	121	12.2	6.44	0	0.021	0.29	0.07	0		7.9		18.2	-	

Table II.1 continued.

Station-date	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	Cr mg/l	Cu mg/l	EC µS/cm	F mg/l	Fe mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Zn mg/l
17-11,98	1.43	43		15.6			415		0	1.95	188.5	18.8	23.92	0.01	0.007	0	0.03	0		8.1		28.2	230	
18-04,95	0.58	34.7		24.1			284		0.66	0.39	119.2	10.5	12.19	0	0.59	0.56	0.03	0		7.8	0	19.8		
18-05,95	0			33.6			367		0.22	0.39	115		2.99	0	0.053		0.02	0		8.1		11.6		
18-06,95	0	46.2		27.6			441		0.27	0.39	176	15.4	22.08	0	0.014	0	0.02	0		8.1	0.96	12		
18-07,95	0	46.6		25.5			435		0.25	0.78	177	13.3	25.76	0	0.038	0	0	0		7.9	0	15	224	
18-08,95	0.73	72		32.6			505		0.29	0.78	203.5	9.7	24.61	0	0	0	0	0		7.6	1.51	24		
18-09,95	0.48	59.87		27.6			468		0.18	0.39	193.5	26.2	16.33	0	0	0		0		7.4	0	17.7	272	
18-01,96	0.3	49.6		22.6			530		0.12	0.39	143.5		7.13	0	0.008	0.74	0	0		7.8	0	14.8	198	
18-03,96	0	36.8		24.8			450	0.5	0.13	0.39	100	8.8	11.04	0	0.012		0	0		8.2	0	16.9	158	
18-05,96	0	44.8		26.9			365		0.25		107	6.2	23.23	0.01	0.022		0.01	0		8.7	0	13.5	210	
18-07,96	0	68.4		29.8			680		0	0.39	168.5	9.4	17.71	0	0.027		0.03	20			0.9	17.6		
18-09,96	1.66	63.8		31.9			664		0		211.5	5.7	42.32	0	0.039		0.09	0		6.9	0.89	18.9	268	
18-11,96	0	45.4		39.7			584	0.11	0.78	0.39	137.5	15.9	12.42	0		1.12	0.01	0			0.78	12.6	228	
18-01,97	1.23	54		35			410		1.95	0.39	156.5	11.66	22.54	0.01	0.012	0	0.1	0		7.2	0	24.9	178	
18-03,97	0.87	52.8		27.3			435		2.9	0.39	171	18.71	8.97	0.02	0.028	0.06	0.02	0		7.3	0	18.6	304	
18-05,97	0.12	39		22.75			316	0.8	0.25	0.39	60.5	11.66	5.98	0	0.01	0.31	0	52.5		8.4	0.62	13.2	232	
18-09,97	2.1	65		28			515		0	0.78		13.00	32.2	0	0.019	0.16	0.11	0		8.1	0	20.2	322	
18-11,97	0.11	60		31.5			409	0.9	0	0.39		10.94	21.85	0	0.015	0	0.04	0		8.3	0	12.5	272	
18-01,98	0	40.4		27.3			372		0.32	0.39	163.5	25.3	5.52	0.01	0.017	0.21	0.18	0		7.5		14.5	280	
18-03,98	0	43.2		21.7			284		0.49	0.39	123.5	13.5	20.93	0	0.019	0.19	0	46		9		9.1	158	
18-05,98	0.11	28.4		20.2			282		0.22	0.39	64	14.6	12.65	0	0.07	0.31	0.08	40		8.9		25.8	-	
18-09,98		37		15.6			418		0	3.9	221.5	15.8	41.86	0	0.011	0.12	0.25	0		7.6		9.5	260	
18-11,98	1.07	35		19.5			375		0	1,95	143	13.9	19.78	0	0.005	0.25	0.02	0		8		19.2	200	
19-04,95	0.3	36.6		122.7			277		0.06		108.5	38.8	8.04	0	0.03	0.37	0	0		7.8		20.6		
19-05,95	0.47			30.1			405		0.15		140.5		23.23	0	0.016	0.41	0	0		8.1		22.7		
19-06,95	0	53		26.2			498		0.17		210	10.5	43.01	0	0.011	0	0	0		8.1	1.53	22.8		
19-07,95	0.75	56.2		34.7			544		0.21		207.5	15.9	37.03	0	0.142	0	0.04	0		7.7	0	30	268	
19-08,95	0.56	48.8		32.2			496		0.17		198	9.9	46.23	0	0	0	0	0		7.4	1.33	21.3		
19-09,95	0.15	78.4		28.7			528		0.06	0.39	222	21.6	17.94	0	0	0	0	0		7.2	0	26.2	2322	
19-01,96	0.78	54.8		23.3			585		0	0.39	157	11	14.26	0.01	0.007	0	0	0		7.8	0	23.4	224	
19-03,96	0.9	43.4		20.6			473	0.4	0.1	0.39	131	12.9	10.12	0	0.012		0	0		8.1	0	23.2	192	
19-05,96	0	43.2		24.8			550		0.28	0.39	114	12.3	3.68	0	0.019		0	0		8.3	0	17.6	218	
19-07,96	0	44		39			819		0	0.39	147.5	17.2	22.31	0	0.026		0	0		8.1	0	26.5		
19-09,96	1.13	76.6		46			907		0		236	7.4	54.74	0	0.042			0		7	0	40.3		
19-11,96	0	78		63.4			754	0.11	0.27	0.39	226.5	22.3	15.87	0	0.008	0.32	0	0		7.9	0	5.8		
19-01,97	0.38	62.2		26.95			422		0.44	0.78	150	2.552	23.69	0	0.006	0.15	0.08	0		7.8	0.95	28.7	248	
19-03,97	0.32	51		25.2			370		0.89	0.39	140	11.42	9.43	0.01	0.012	0.12	0	0		8	0	19.1	250	
19-05,97	0.28	40.4		27.3			344	0.9	0.22	0.39	66.5	11.66	15.41	0	0	0.18	0	56		8.4	0.58	20.5	234	
19-11,97	0	59		14.7			466	0.9	0	0.78	175	10.33	24.38	0	0.016	0	0.04	0		8.1	0.36	20.3	32	
19-01,98	0	48.6		24.5			360		0.03	0.39	199.5	9.5	31.39	0	0.011	0.15	0.12	0		7.8		16.9	196	
19-03,98	0	37.2		22.4			290		0	0.39	85	12.5	4.6	0.01	0.021	0.06	0	25		8.6		12.5	117	
19-05,98		31.8		22.7			272		0.09	0.39	96.5	10.2	14.03	0	0.03	0.09	0.05	0		7.7		23.3	184	
19-11,98	0.76	42.4		19.9			350		0	0.78	145	14.2	17.94	0	0.003	0	0.05	0		7.8		30.6	206	
20-04,95	0.37	34.7		23.4			290		2.13	0.39	123.7	13.8	16.33	0	0.138	2.63	0.13	0		7.8	0.2	36		
20-05,95	0			19.1			475		0.21	0.39	162.5		13.57	0	0.106	3.4	0.11	0		8		27.6		
20-06,95	0	41		21.6			476		0.16	0.78	200	12.6	44.85	0	0.017	2.82	0	0		8.1	0.35	22		
20-07,95	0.07	67.6		28.3			514		0.1	0.78	212	10.4	31.74	0	0.025	1.22	0	0		7.8	0	29	338	
20-08,95	0.38	68.4		20.5			474		0.2	0.78	204	11.1	17.94	0	0	1.21	0	0		7.7	0.98	22.8		
20-09,95	0	68.2		22.3			571		0.13	0.39	245	37	12.88	0	0.007	0	0	0		7.5		13.9	346	

Table II.1 continued.

Station-date	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	Cr mg/l	Cu mg/l	EC µS/cm	F mg/l	Fe mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Zn mg/l
20-01,96	0.18	42.6		23			680		0	0.39	188	26.9	11.5	0	0.009	1.33	0.04	0		7.7	0	22	258	
20-03,96	0.63	35.8		22.7			500	0.4	0.05	0.39	126	16.3	10.12	0	0.015		0	0		8	0	19.1	218	
20-05,96		34.6		19.8			545		0.21	0.39	130	12.5	20.24	0	0.027		0.01	0		8.5	0	23.5	222	
20-07,96		41.8		24.8			733		0	0.39	165	23.7	13.11	0	0.027		0.01	0		8.4	0.4	37.4		
20-09,96	0.89	74.4		27.6			808		0	0.78	234.5	10		0	0.04		0.02	0		7.1	0.35		339	
20-11,96		69.6		31.9			590	0.5	0.12	0.39	213	19.4	17.25	0	0.014	0.59	0	0		8.1	0.18	32.8	330	
20-01,97	0.89	50.8		23.8			388		0.27	0.39	167	13.73	19.32	0	0	0.81	0.03	0		8	0	24.2	222	
20-03,97	0.44	44.8		25.55			365		0.59	0.39	145.5	17.38	8.74	0	0.006	1.56	0.09	0		8	0	20.1	266	
20-05,97	0	61.2		24.5			451		0.3	0.39	97	12.52	21.85	0	0	3.28	0.05	87		8.7	0	32.3	143	
20-07,97	0	38		22.75			509	0.8	0.09	0.39	150	33.41	12.88	0	0.028	0.55	0.03	45		8.5	0	32.1	371	
20-09,97	1.99	54.6		25.2			537		0	0.78	245	26.97	32.43	0	0.02	0.33	0.09	0		8.2	0	36.3	306	
20-11,97	0	68.2		29.05			509	1.2	0	0.39	187	16.77	7.13	0	0.013	0.17	0.05	0		8.1	0	25.8	346	
20-01,98	0	57		29.4			476		0.07	0.78	199.5	19.6	25.07	0.01	0.019	0.27	0.23	0		7.3		35.8	224	
20-03,98	0	48.6		21.7			302		0.21	0.39	71	7.4	4.37	0	0.012	0	0	50		9		9.9	239	
20-05,98	0	27		23			344		0.1	0.78	65.5	10.7	30.59	0	0.024	0.29	0.05	48.5		8.6		31.2	234	
20-07,98	0.64	36		78			704		0.05	25.74	231.5	28.2	62.79	0	0.029	1.02	0.01	0		8.1		32.8	262	
20-09,98	0	37.8		13.8			424		0	5.07	229	18.3	35.88	0	0.011	0.12	0.28	0		7.7		24.9	280	
20-11,98	1.22	39.2		19.1			408		0	1.95	172	23	15.87	0	0.007	0.66	0	0		8		29.5	226	
21-04,95	0.29	59.4		28			607		0.25	0.78	248	33	22.08	0	0.023	1.59	0.02	0		7.8	0.2	49.7		
21-05,95	0.32			26.9			710		0.14	0.78	289		24.61	0	0.075	2.28	0.02	0		7.8		49.9		
21-06,95	0	48.4		43.2			733		0.2	1.56	271	39.8	45.54	0	0.015	0.44	0	0		7.7	0.37	51.4		
21-01,96	0	75.6		32.6			1154		0	1.56	309	17.9	65.09	0	0.008	0.3	0.04	0		7.7	0	49.8	478	
21-03,96	0.03	67.6		32.6			960	0.6	0.05	0.78	250.5	23.6	32.66	0.01	0.015		0	0		8	0	44.5	358	
21-05,96	0	39.2		35			993		0.17	0.39	159	31.3	14.26	0	0.027		0	0		8.2	0	48	360	
21-07,96	0.15	47		48.2			1155		0	0.39	177	36.9	17.02	0	0.024		0	0		7.9	0.7	60.1		
21-11,96	0	67.6		46			1060	0.7	0	0.78	268	32.9	37.72	0.03	0.013	0.77	0	0		7.8	0.5	52.6	480	
21-01,97	1.05	40		23.45			325		0.61	0.39	97	8.991	17.02	0	0.008	0	0.06	20		8.6	0	23		
21-03,97	0.41	47.2		42.7			136		0.04	0.78	200	31.47	22.54	0	0.006	0	0	0		8.1	0.76	47.1		
21-05,97	0.24	54.4		33.6			499	1.1	0.22	0.39	236.5	36.9	22.08	0	0.015	0.56	0	0		7.8	0.61	50.1		
21-01,98	0	69.6		29.4			604		0.04	0.39	251.5	38.4	6.21	0	0.015	0.17	0.3	0		7.5		50.9	354	
21-03,98	0	50.8		31.5			483		0.07	0.39	107	24.1	8.28	0	0.024	0	0	50		8.6		41	423	
21-05,98	0.24	52		35.8			550		0.08	0.39	184.5	27.9	20.47	0	0.035	0.53	0.21	0		7.6		52.9	404	
21-07,98	0.36	38.4		79.1			665		0.03	22.62	218	27.1	69	0.01	0.019	0.42	0	0		8.2		54.8	336	
21-11,98	1.34	62.4		26.9			762		0	3.9	319.5	38.2	34.96	0.01	0.005	0.57	0.02	0		7.7		35.2	472	
22-04,95	0.33	29.2		23.8			298		0.19	0.39	107	14.4	15.87	0	0.031	1.03	0.02	0		8	0.2	37.4		
22-05,95	0			20.5			329		0	0.39	123.5		17.71	0	0.021	0.92	0.01	0		8		30		
22-06,95	0	53.4		29			427		0		168	12.7	27.14	0	0.007	1.47	0.01	0		8	0.56	35.6		
22-07,95	0.3	40.6		21.9			530		0	0.39	194	36	10.12	0	0.033	2.4	0	0		8	0	45.7	352	
22-01,96	0.12	47		14.1			505		0.09	0.39	156	13.4	18.63	0	0.008	0	0.05	0		7.8	0	36.9	178	
22-03,96	0	31.2		16.3			382	0.5	0.04	0.78	116.5	3.7	28.29	0.01	0.015		0.03	0		8		30.6	146	
22-05,96	0	38.6		17			432		0.3		118.5	8.4	20.7	0	0.026		0	0		8.5	0	32.7	216	
22-07,96	0	45.2		31.9			770		0		158	31.1	6.9	0	0.026		0	0		8.6		51.8		
22-09,96	1.06	65.6		22.7			527		0	0.78	150	4.5	22.54	0	0.033		0	0		7.2		48.6	264	
22-11,96	0	89.2		26.5			540	0.11	0.2		178	19.9	9.2	0	0.015	0.69	0	0		7.4		106.1	556	
22-01,97	1.34	22		18.2			138		4.47	0.39	56	7.533	14.72	0.02	0.001	0.05	0.04	0		7.8	0	34.9	354	
22-03,97		25.4		15.4			281		0.04	0.39	27.5	13.49	7.13	0	0.006	0	0	60		9.2	0.38	24.5	174	
22-05,97	0.04	32		23.8			250	0.9	0.25	0.39	100	12.15	17.25	0	0.014	0.58	0.01	0		8.2	0	32.9	176	
22-11,97	0.23	59.8		26.6			443	1.1	0	0.39	146.5	11.91	13.57	0	0.018		0.05	0		8.2	0.2		372	
22-01,98	0.56	38		24.5			302		0.3	0.78	162.5	15.1	33.35	0	0.013	0.13	0.25	0		7.7		32.1	136	

Table II.1 continued.

Station-date	B mg/l	Ca mg/l	Cd mg/l	Cl mg/l	Cr mg/l	Cu mg/l	EC µS/cm	F mg/l	Fe mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Zn mg/l
22-03,98	0.56	38		24.5			307		0.3	0.78	162.5	15.1	33.35	0	0.013	0.13	0.25	0		9.7		32.1	136	
22-05,98	0	35		20.92			291		0.2	0.78	58.5	7.8	21.39	0	0.023	0.18	0.13	47		8.4		31	176	
22-11,98	1.22	35.4		14.18			375		0	4.68	95.5	17.7	12.88	0	0.005	0.26	0.02	0		7.9		76.9	210	
23-04,95	0.32	17.7		20.5			160		0.1	0.39	55.5	35.2	8.51	0	0.028	0.52	0.03	0		8	0	15.5		
23-05,95	0.19			21.9			196		0.08	0.39	53		10.35	0	0.073	0.47	0.04	0		8.2		12.8		
23-06,95	0	36		24.8			272		0.31	0.78	97.5	3.1	32.2	0	0.015	0.29	0.05	0		7.9	0.56	16.8		
23-07,95	0.18	38.8		21.2			328		0.02	0.39	119	14.8	8.05	0	0.06	0.53	0.06	0		7.9	0	26	184	
23-01,96	0.21	26.2		15.5			215		0.17	0.39	96	5.3	16.1	0	0.01	0.28	0.02	0		7.8	0.6	9.9	160	
23-03,96	0	14.8		15.9			138	0.4	0.05	0.39	27	3.9	6.21	0	0.012		0.01	0		8.5	0	8.1	80	
23-05,96	0	27.8		18			149		0.22	0.39	50	1.1	9.66	0.01	0.026		0.01	10		9	0.6	0	122	
23-07,96	0.28	32.4		18.4			303		0	0.39	92.5	14.2	2.76	0	0.025		0.09	0		8.4	0.9	27		
23-09,96	1.86	34.8		25.5			437		0		150	12.8	33.58	0	0.039		0.11	0		7	0.9	27.1	180	
23-11,96		64		28.3			392		0.09	0.39	163	88.01	19.78	0.03	0.026	1	0.35	0		7.5	0.8	32.5	314	
23-01,97	1.61	24		17.5			138		0.06	0.39	38	1.823	9.66	0.02	0.001	0.15	0.08	0		7.6	0	24.8	354	
23-03,97	1.61	20.4		11.2			138		0.06	0.39	37	0.972	3.68	0	0.007	0.09	0.2	0		7.8	0	10.3	104	
23-05,97	0	18.8		19.25			149	1.2	0.2	0.39	37	2.795	7.59	0	0.001	0.53	0.04	0		8.3	0	11	98	
23-07,97	0	34.2		15.4			293		0.08	0.39	87.5	11.79	16.79	0	0.025	1	0.1	32.5		8.3	0	27.7	157	
23-09,97	2.53	40		23.8			375		0	0.39	80	14.6	19.09	0	0.018	2.06	0.05	0		8.2		36.5	252	
23-11,97	0	31.4		18.2			271	0.7	0	0.39	107.5	13.24	7.82	0	0.021	0.27	0.15	0		8.3	0	16.3	192	
23-01,98	0.52	20		26.25			144		0.05	0.39	95	18.1	6.44	0	0.013	0.19	0.21	0		7.7		6.4	73	
23-03,98	0.5	19.2		18.9			147		0	0.78	84	4	36.57	0	0.021	0.06	0	30		9.1		3.9	130	
23-05,98	0.15	15.4		21.3			121		0.15	0.39	49	4	13.8	0	0.024	0.25	0.23	0		7.6		8.5	84	
23-07,98		14		29.1			25		0.03	18.72	92.5	6.1	49.91	0	0.025	0.59	0	35		8.5		23.4	190	
23-11,98	1.55	27		13.5			248		0	3.9	53.5	9.1	13.8	0	0.009	0.22	0.08	0		7.9		65.3	134	
30-03,97	0.91	70.6		41.3			655		0.66	1.95	275.5	14.34	61.64	0.05	0.01	1.6	1.02	0		7.7	0	36.4	427	
30-04,97		77.6		46.55			520		0.2	1.17	152	4.010	40.48	0	0.015	0.44	0	57		8	0	23.4	358	
30-05,97		52.2		42			616	0.7		1.56	237.5	24.67	45.31	0	0.001	0.5	0.01	0		8.2	0	33.9	204	
30-11,97		60					665	0.6		0.78	237.5	26.49	34.5	0	0.015	0	0.11	0		7.7		45.3	70	
30-12,97		61.6					528			0.39	237.5	26.24	19.09	0	0.022	0.2	0.08	0		7.9		3109	318	
30-03,98	0.23	49.6		28.4			424		0	0.39	98	17.9	8.51	0.01	0.021	0.88	0	50		9.1		27.4	318	
30-04,98		50.4		32.6			412		0.8	0.39	113	18.6	13.11	0	0.019	0.31	0.31	46		9		25.5	361	
30-05,98		52		35.5			585		3	0.78	227.5	21.5	35.42	0	0.028	0.36	0.03	0		8.1		18.6	428	
30-12,98		18.2		0			566		24.84	68.4	0		1.95	0.019	0.12	12.2	25.3	20.6		7.9		0	312	
31-03,97	0	70.2		77			918		1.56	1.56	320	18.10	39.56	0.02	0.016	0.45	0.34	0		7.9	0	83.1	427	
31-04,97		68.4		55.30			580		0.19	1.95	200.5	22.36	60.95	0	0.018	0.16	0.12	70		8.7	0	47.8	412	
31-05,97		54.4		110.6			1025	0.5		4.68	213	42.04	143.5	0	0.009	0.71	0.07	136		8.5	1.78	117.3	408	
31-11,97		66.2		343.9				0.4	0.53	13.3	314.5	26.37		0	0.019	0.85	0.28			8.4		217	1632	
31-12,97		60		343.9					0	1.56	314.5	19.81		0	0.025	0.34	0.04			7.9		34.8	372	
31-03,98	0	46.4		29.8			574		0	0.78	147	27.2	27.83	0.01	0.024	0.31	0	35		8.8		63.2	372	
31-04,98		48.2		31.9			582		0.25	0.78	181	28.1	28.29	0	0.015	0.2	0.2	31		8.6		39.9	416	
31-05,98		62		39			596		0.32	0.39	220.5	31.6	11.5	0	0.023	0.23	0.09	0		8.2		33.9	406	
31-12,98		47.2		21.3			553		0	3.9	229	19.6	27.83	0	0.021	0.1	0.03	0		8		27.2	340	
32-03,97	0.32	73.6		67.9			850		0.24	2.34	324	28.19	67.62	0.02	0.006	0.01	0.15	0		7.7	0	28.1	532	
32-04,97		52		58.1			616		0.18	1.95	200	32.32	57.5	0	0.019	0	0.2	60		8.7	0	45.7	532	
32-05,97		78		77			887	1.2		1.56	307.5	33.66	49.68	0.03	0.361	4.98	0.21	0		7.6	8.59	24.9	468	
32-11,97		57		42.7			682	1.4	0.63	2.34	267.5	17.74	67.85	0.01	0.021	1.73	1.66	0		7.8	0.50	36.2	358	
32-12,97		54.4		43.4			635		0	2.34	304	22.60	69.92	0.01	0.022	0.53	0.06	0		8	1.30	60.1	35	
32-03,98	0	62.8		59.5			912		0.12	2.34	244.5	27.9	84.87	0.01	0.024	0.65	0.17	30		8.7		96.5	205	
32-12,98		47.2		25.6			671		0	3.9	288	19.6	64.86	0	0.02	0.12	0.02	0		7.9		19.3	432	

Table II.2. Annual and overall chemical averages of the SHW monitoring surface waters.

Year-station	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	COD mg/l	Cr mg/l	Cu mg/l	Diss. O_2 mg/l	EC µS/cm	F mg/l	Fe mg/l	Hg mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Mn mg/l
85-2		3			29.53				9.467	395					155		
86-2		4.45			31.9				10.65	425					179.5		
87-2		4			24.75				9.35	440					161.25		
88-2		6.133			55.1				7.967	546.7					220.33		
89-2		4.825			37.07				5.875	540.3					301.60		
90-2		1.3			34.27				4.2	487.3					217.75		
91-2		21			34.4				5.933	570.3					200.33		
92-2		3	25.5		62.2	20			5.3	522		0.07		1.56	84.75	18.45	
93-2	1.21	8.3	44.2		60.55	18			4.85	694		0.005		2.34	219.5	14.6	
95-2	0.13	3.07	44.93		40.5	20			7.960	431.7		0.403	0.0005	1.04	161.83	14.633	
96-2	0.11	3.385	59.4		39.65				6.61	720.5		1.345		0.585	168.5	16.75	
97-2	0.4	8.1	41.7		38.68				10.8	387.5		0.64		0.975	119.25	8.201	
98-2	0.58		54.3		38.7					435.5		0.42		1.17	199.25	6.4	
AVG.-2	**0.49**	**5.88**	**45.01**		**40.56**	**19.33**			**7.41**	**507.4**		**0.481**	**0.0005**	**1.28**	**183.76**	**13.17**	
95-10	0.23	4.09	40.25		26.03	12			7.7	321.5		1.74		0.488	119.63	14.6	
96-10	0.14	6.25	49.4		115.0				8.425	904.3	0.1	3.483		1.853	184.5	26.1	
97-10	0.14	5.4	38.07		69.25	24			6.48	467.5	1.1	2.625		1.365	118.67	19.364	
98-10	0		46.83		40.07					442		0.25		8.52	137.33	13.5	
AVG.-10	**0.13**	**5.25**	**43.64**		**62.59**	**18.00**			**7.54**	**533.8**	**0.60**	**2.025**		**3.06**	**140.03**	**18.39**	
95-11	0.11	4.75	42.13	0.005	157.4	89.3	0.005	0.015	6.92	970.8		2.337	0.0007	3.9	209.75	24.933	
96-11	0.32	6.55	53.92	0.005	44.54		0.005	0.005	9.84	539		0.355		0.78	156.2	17.22	
97-11	0.09	2	47.23		69.77	52			6.1	505.7	1.1	1.44		0.845	125.67	21.463	
98-11	0.03		36.2	0	38.63		0	0.01		450		1.18		12.16	164	15.23	
AVG.-11	**0.14**	**4.43**	**44.87**	**0.005**	**77.59**	**70.65**	**0.003**	**0.01**	**7.62**	**616.4**	**1.10**	**1.328**	**0.0007**	**4.42**	**163.91**	**19.71**	
95-16	0.5		36.2		45.1	32				348		2.48		0.58	102.5	17.2	
96-16	0.33	4.2	32.6		28.4				11	460		1.09		0.39	70.5	9.7	
98-16	0.18		43		24.9					341		0.53		0.39	62	10.3	
AVG.-16	**0.34**	**4.20**	**37.27**		**32.80**	**32.00**			**11.00**	**383**		**1.367**		**0.45**	**78.33**	**12.40**	
95-17	0.15		46		28.08	20				394.9		0.26		0.488	137.88	14.39	
96-17	0.38	2.775	54.15		30.62	10.4			9.564	685.4	0.9	0.16		0.39	169.6	16	
97-17	0.19	2.5	46.1		28.88				9.275	406.8	0.9	0.308		0.585	144.75	13.973	
98-17	0.6		42.5		20.08					348.5		0.095		0.78	147.13	16.78	
AVG.-17	**0.33**	**2.64**	**47.19**		**26.92**	**15.20**			**9.42**	**458.9**	**0.90**	**0.206**		**0.56**	**149.84**	**15.29**	
95-18	0.30		51.87		28.5	17.3				416.7		0.312		0.52	164.03	15.02	
96-18	0.33	1.74	51.47		29.28				11.75	545.5	.305	0.213		0.39	144.67	9.2	
97-18	0.89	2.42	54.16		28.91				7.98	417	.85	1.02		0.468	129.33	13.195	
98-18	0.3		36.8		20.86					346.2		0.206		1.27	143.1	16.62	
AVG.-18	**0.45**	**2.08**	**48.58**		**26.89**	**17.30**			**9.87**	**431.4**	**0.58**	**0.438**		**0.66**	**145.28**	**13.51**	
95-19	0.37		54.6		45.77	20				458		0.137		0.39	181.08	19.34	
96-19	0.47	3.42	56.67		36.18	3.33			9.973	681.3	0.255	0.108		0.39	168.67	13.85	
97-19	0.25	4.845	53.15		23.54				9.425	400.5	0.9	0.388		0.585	132.88	8.991	
98-19	0.25		40		22.38					318		0.03		0.49	131.5	11.6	
AVG.-19	**0.49**	**4.13**	**51.11**		**31.97**	**11.67**			**9.70**	**464.5**	**0.58**	**0.166**		**0.46**	**153.53**	**13.45**	
95-20	0.14		55.98		22.53	17.3				466.7		0.488		0.585	191.2	16.98	
96-20	0.57	2.28	49.8		24.97	6.67			10.32	642.7	0.45	0.063		0.455	176.08	18.133	
97-20	0.55	1.617	52.93		25.14				7.767	459.8	1	0.208		0.455	165.25	20.129	
98-20	0.31		40.93		30.83					443		0.072		5.79	161.42	17.87	

Year-station	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Tot. Hard. mg/l $CaCO_3$	Zn mg/l
85-2		0.033	0.01	1.217	0.055	16.67		7.9	0.44				
86-2		.12	.004	1.9	0.42			7.55	2.68				
87-2		0.05	0.009					7.45	3.64				
88-2		0.095	0.037	1.8	.8			8.13	6.057		439		
89-2		0.445	.054	1.6	0.643			7.65	0.828		400.25		
90-2		0.267		1.333	0.057	7.033		7.7	3.587		399.17		
91-2		0.046	0.036	1.347	0.103			7.47	15.9		598.67		
92-2	48.415	0.09	0.021	0.79	0.03	36		8.75	2.855	37.3	249		
93-2	78.545	0.06	0.043	1.025	0.51			7.75	2.765	38.05	165		
95-2	38.87		0.078	0.507	0.116			7.87	3.33	38.2	294		
96-2	23.695	0.02	0.07		0.255			8	4.99	27.95	296	201.25	
97-2	36.8		0.014	0.61	0.07	12.75		8.1	0.971	30.75	260.5	138	
98-2	42.55	0	0.017	0.27	0.095	0		8.05		25.35	234.5		
AVG.-2	**44.81**	**0.111**	**0.033**	**1.13**	**0.26**	**14.49**		**7.87**	**4.00**	**32.93**	**333.61**	**169.63**	
95-10	17.998	0.003	0.235	1.528	0.08			7.5	0.925	42.575	262.67		
96-10	65.09	0.03	0.015	0.325	0.373			7.53	1.2	26.675	518.5		
97-10	45.77	0.012	0.02	0.655	0.388	15.33		7.77	1.050	41.6	377.8		
98-10	36	0	0.012	0.662	0.068	25.67		8.35		41.18	327.2		
AVG.-10	**41.21**	**0.011**	**0.071**	**0.79**	**0.23**	**20.50**		**7.79**	**1.06**	**38.01**	**371.54**		
95-11	118.64	0.003	0.290	2.23	0.663		0.023	7.6	1.154	37.85	558.83		0.204
96-11	26.68	0.024	0.027	0.135	0.098		0.006	8.02	0.98	37.375	302.8		0.096
97-11	29.708	0.003	0.022	0.592	0.315	16.08		7.97	1.799	29.617	497.8		
98-11	41.67	0.015	0.016	0.158	0.427	4.33	0	8.5		35.87	356		0.053
AVG.-11	**54.17**	**0.011**	**0.089**	**0.78**	**0.38**	**10.21**	**0.01**	**8.02**	**1.31**	**35.18**	**428.86**		**0.118**
95-16	25.41		0.139	2.51	0.02	22		8.1	2.29	33.3		136	
96-16	18.86		0.034		0.06			8.5	1.04	23.6	214	136	
98-16	11.04	0.01	0.019	1.04	0	50		9.2		26.5	208		
AVG.-16	**18.44**	**0.010**	**0.064**	**1.78**	**0.03**	**36.00**		**8.60**	**1.67**	**27.80**	**211.00**	**136.00**	
95-17	14.76		0.283	0.593				7.95	1.153	19.125	2	167.5	
96-17	17.664		.021	0.44	0.014			7.88	0.5	23	272	196.5	
97-17	19.608		0.007	0.1	0.018	11.5		8.3	0.322	15.05	279.5	172.75	
98-17	13.92	0.005	0.0133	0.743	0.07	10.5		8.05		19.75	155.67		
AVG.-17	**16.49**	**0.005**	**0.081**	**0.47**	**0.03**	**11.00**		**8.05**	**0.66**	**19.23**	**177.29**	**178.92**	
95-18	17.327		0.116	8.112	0.014			7.82	0.494	16.683	248	180.42	
96-18	18.975	0.002	0.022	0.93	0.023	3.333		7.9	0.428	15.717	212.4	168.58	
97-18	18.308	0.006	0.017	0.106	0.054	10.5		7.86	0.123	17.88	261.6	189.7	
98-18	20.15	0.002	0.024	0.216	0.106	17.2		8.2		15.62	224.5		
AVG.-18	**18.69**	**0.003**	**0.045**	**2.34**	**0.05**	**10.34**		**7.95**	**0.35**	**16.48**	**236.63**	**179.57**	
95-19	29.247		0.033	0.13	0.007			7.72	0.715	23.933	1295	180	
96-19	20.163	0.002	0.019	0.16				7.87		22.8	211.33	198.67	
97-19	18.228	0.003	0.009	0.113	0.03	14		8.08	0.472	22.15	191	169.88	
98-19	16.99	0.003	0.016	0.075	0.055	6.25		7.98		20.83	175.75		
AVG.-19	**21.16**	**0.003**	**0.019**	**0.12**	**0.03**	**10.13**		**7.91**	**0.59**	**22.43**	**468.27**	**182.85**	
95-20	22.885		0.049	1.88	0.04			7.82	0.383	25.217	342	174.72	
96-20	14.444		0.022	0.96	0.013			7.97	0.155	26.96	273.4	198.83	
97-20	17.058		0.011	1.117	0.057	22		8.25		28.467	275.67	215.17	
98-20	29.1	0.002	0.017	0.393	0.095	16.42		8.12		27.35	244.17		

Table II.2 continued.

Year-station	B mg/l	BOD mg/l	Ca mg/l	Cd mg/l	Cl mg/l	COD mg/l	Cr mg/l	Cu mg/l	Diss. O_2 mg/l	EC µS/cm	F mg/l	Fe mg/l	Hg mg/l	K mg/l	M-Alk. mg/l $CaCO_3$	Mg mg/l	Mn mg/l	Na mg/l	N-NH_3 mg/l	N-NO_2 mg/l	N-NO_3 mg/l	o-PO_4 mg/l	P-Alk. mg/l $CaCO_3$	Pb mg/l	pH	Org. Mat. mg/l	SO_4 mg/l	TDS mg/l	Tot. Hard. mg/l $CaCO_3$	Zn mg/l
AVG.-20	**0.48**	**1.95**	**49.91**		**25.87**	**11.99**			**9.04**	**503.1**	**0.73**	**0.208**		**1.82**	**173.49**	**18.28**		**20.87**	**0.002**	**0.025**	**1.09**	**0.05**	**19.21**		**8.04**	**0.27**	**27.00**	**283.81**	**196.24**	
95-21	0.20		53.9		32.7	20				683.3		0.197		1.04	269.33	36.4		30.743		0.038	1.437	0.013			7.77	0.285	50.333		298.17	
96-21	0.04	1.925	59.4		38.88	5			10.37	1064	0.65	0.044		0.78	232.7	28.52		33.35	0.008	0.017	0.535	0.008			7.92	.24	51	419	266.8	
97-21	0.57	2.9	47.2		33.25				9.833	320	1.1	0.29		0.52	177.83	25.787		20.547		0.010	0.187	0.02	6.667		8.17	0.457	40.067		228.17	
98-21	0.39		54.64		40.54					612.8		0.044		5.54	216.1	31.14		27.78	0.004	0.02	0.338	0.106	10		7.92		46.96	397.8		
AVG.-21	**0.48**	**2.41**	**53.79**		**36.34**	**12.50**			**10.10**	**670**	**0.88**	**0.144**		**1.97**	**223.99**	**30.46**		**28.11**	**0.006**	**0.021**	**0.62**	**0.04**	**8.33**		**7.95**	**0.33**	**47.09**	**408.40**	**264.38**	
95-22	0.1		41.07		23.8	20				396		0.048		0.39	148.13	21.033		17.71		0.023	1.455	0.01			8	0.253	37.175	352	118.85	
96-22	0.2	1.68	52.8		21.42	3.33			9.475	526	0.31	0.105		0.65	146.17	13.5		17.71	0.002	0.021	0.345	0.013			7.92		51.117	272	190.17	
97-22	0.54	3.375	34.8		21	20			9.900	278	1	1.19		0.39	82.5	11.269		13.168	0.005	0.01	0.21	0.025	15		8.35	0.145	30.767	269	133.38	
98-22	0.59		36.6		21.03					318.75		0.2		1.76	119.75	13.925		25.24	0	0.014	0.175	0.163	11.75		8.43		43.03	164.5		
AVG.-22	**0.48**	**2.53**	**41.32**		**21.81**	**14.44**			**9.69**	**379.7**	**0.65**	**0.386**		**0.80**	**124.14**	**14.93**		**18.46**	**0.002**	**0.017**	**0.55**	**0.05**	**13.38**		**8.18**	**0.20**	**40.52**	**264.38**	**147.47**	
95-23	0.17		30.83		22.1	20				239		0.128		0.488	81.25	17.7		14.778		0.044	0.453	0.045			8	0.187	17.775	184	94.75	
96-23	0.47	3.125	33.33		20.27	3.33			10.37	272.3	0.4	0.088		0.39	96.417	20.885		14.682	0.007	0.023	0.64	0.098	1.667		8.03	0.633	17.433	171.2	113.5	
97-23	0.96	2.935	28.13		17.56	–5			9.233	227.3	0.95	0.067		0.39	64.5	7.536		10.772	0.003	0.012	0.683	0.103	5.417		8.08		21.1	192.83	101.33	
98-23	0.68		19.12		21.81					137		0.046		4.84	74.8	8.26		24.10	0	0.018	0.262	0.104	13		8.16		21.5	122.2		
AVG.-23	**0.48**	**3.03**	**27.85**		**20.44**	**9.44**			**9.80**	**218.9**	**0.68**	**0.082**		**1.53**	**79.24**	**13.60**		**16.08**	**0.003**	**0.024**	**0.51**	**0.09**	**6.69**		**8.07**	**0.41**	**19.45**	**167.56**	**103.19**	
97-30	0.91	3.025	64.4		43.28				8.58	596.8	0.65	0.43		1.17	228	19.148		40.204	.01	0.013	0.548	0.244	11.4		7.9		649.6	275.4	239.8	
98-30	0.23		42.55		24.13					496.75		7.16		17.49	109.63	19.33		14.75	0.007	0.047										
AVG.-30	**0.48**	**3.03**	**53.48**		**33.71**				**8.58**	**546.8**	**0.65**	**3.795**		**9.33**	**168.82**	**19.24**		**27.48**	**0.009**	**0.030**	**0.55**	**0.24**	**11.40**		**7.90**		**649.60**	**275.40**	**239.80**	
97-31		3.45	63.84		186.1				8.18	841	0.45	0.57		4.602	272.5	25.734		81.343	0.004	0.017	0.502	0.17	68.67		8.28	0.592	100	650.2	263.5	
98-31	0		50.95		30.5					576.25		0.143		1.46	194.38	26.63		23.86	0.003	0.021	0.21									
AVG.-31	**0.00**	**3.45**	**57.40**		**108.3**				**8.18**	**708.6**	**0.45**	**0.357**		**3.03**	**233.44**	**26.18**		**52.60**	**0.004**	**0.019**	**0.36**	**0.17**	**68.67**		**8.28**	**0.59**	**100.00**	**650.20**	**263.50**	
97-32	0.32	4.825	63		57.82				8.220	734	1.3	0.263		2.106	280.6	26.900		62.514	0.014	0.086	1.449	0.456	12		7.96	2.08	39	385	268.2	
98-32	0		55		42.55					791.5		0.06		3.12	266.25	23.75		74.87	0.005	0.022	0.385									
AVG.-32	**0.16**	**4.83**	**59.00**		**50.19**				**8.22**	**762.8**	**1.30**	**0.162**		**2.61**	**273.43**	**25.33**		**68.69**	**0.010**	**0.054**	**0.92**	**0.46**	**12.00**		**7.96**	**2.08**	**39.00**	**385.00**	**268.20**	

Table II.3. Quality classes of the annual and overall chemical averages of the DSİ monitoring surface waters with respect to the limits of inland water sources (WCCR, 1988). For explanation see caption of Table 3.4.

Year-station	B	BOD	Ca	Cd	Cl	COD	Cr	Diss. O_2	EC	F	Fe	Hg	Mn	N-NO_2	N-NO_3	o-PO_4	Pb	SO_4	TDS	Zn	Salinity-SAR
85-2		I			II				II					II	I	II					
86-2		II			II				II					II	I	III					
87-2		I			I				II					II							
88-2		II			II				II					III	I	IV			I		
89-2		II			II				II					IV	I	III			I		
90-2		I			II				II						I	II			I		
91-2		IV			II				II					III	I	II			II		
92-2		I			II				II		I			III	I	II		I	I		C2S1
93-2	IV	III			II				II		I			III	I	III		I	I		C2S1
95-2	I	I			II				II		II	II		IV	I	II		I	I		C2S1
96-2	I	I			II				II		III			IV		III		I	I		C2S1
97-2	I	III			II				II		II			III	I	II		I	I		C2S1
98-2	I				II				II		II			III	I				I		
AVG.-2	**I**	**II**			**II**				**II**		**II**	**II**		**III**	**I**	**III**		**I**	**I**		**C2S1**
95-10	I	II			II				II		III			IV	I	II		I	I		C2S1
96-10	I	II			II				III	I	III			III	I	III		I	II		C3S1
97-10	I	II			II				II	II	III			III	I	III		I	I		C2S1
98-10	I				II				II		I			III	I				I		
AVG.-10	**I**	**II**			**II**				**II**	**I**	**III**			**IV**	**I**	**III**		**I**	**I**		**C2S1**
95-11	I	II		II	II		I	I	III		III	III		IV	I	IV	III	I	II	II	C3S1
96-11	I	II		II	II		I	I	II		II			III	I	II	I	I	I	I	C2S1
97-11	I	I			II				II	II	III			III	I	III		I	I		C2S1
98-11	I				II		I		II		III			III	I		I		I	I	
AVG.-11	**I**	**II**		**II**	**II**		**I**	**I**	**II**	**II**	**III**	**III**		**IV**	**I**	**III**	**I**	**I**	**I**	**I**	**C2S1**
95-16	I				II				II		III			IV	I	I		I			C2S1
96-16	I	II			II				II		III			III		II		I	I		C2S1

Table II.3 continued.

Year-station	B	BOD	Ca	Cd	Cl	COD	Cr	Diss. O_2	EC	F	Fe	Hg	Mn	N-NO_2	N-NO_3	o-PO_4	Pb	SO_4	TDS	Zn	Salinity -SAR
98-16	I				I				II		II			III	I				I		
AVG.-16	**I**	**II**			**II**				**II**		**III**			**IV**	**I**	**II**		**I**	**I**		**C2S1**
95-17	I				II				II		I			IV	I			I	I		C2S1
96-17	I	I			II				II	I	I			III	I	I		I	I		C2S1
97-17	I	I			II				II	I	II			II	I	I		I	I		C2S1
98-17	I				I				II		I			III	I				I		
AVG.-17	**I**	**I**			**II**				**II**	**I**	**I**			**IV**	**I**	**I**		**I**	**I**		**C2S1**
95-18	I				II				II		II			IV	II	I		I	I		C2S1
96-18	I	I			II				II	I	I			III	I	II		I	I		C2S1
97-18	I	I			II				II	I	III			III	I	II		I	I		C2S1
98-18	I				I				II		I			III	I				I		
AVG.-18	**I**	**I**			**II**				**II**	**I**	**II**			**III**	**I**	**II**		**I**	**I**		**C2S1**
95-19	I				II				II		I			III	I	I		I	II		C2S1
96-19	I	I			II				II	I	I			III	I			I	I		C2S1
97-19	I	II			I				II	I	II			II	I	II		I	I		C2S1
98-19	I				I				II		I			III	I				I		
AVG.-19	**I**	**II**			**II**				**II**	**I**	**I**			**III**	**I**	**I**		**I**	**I**		**C2S1**
95-20	I				I				II		II			III	I	II		I	I		C2S1
96-20	I	I			I				II	I	I			III	I	I		I	I		C2S1
97-20	I	I			II				II	I	I			III	I	II		I	I		C2S1
98-20	I				II				II		I			III	I				I		
AVG.-20	**I**	**I**			**II**				**II**	**I**	**I**			**III**	**I**	**II**		**I**	**I**		**C2S1**
95-21	I				II				II		I			III	I	I		I			C2S1
96-21	I	I			II				III	I	I			III	I	I		I	I		C3S1
97-21	I	I			II				II	II	I			II	I	I		I			C2S1
98-21	I				II				II		I			III	I				I		

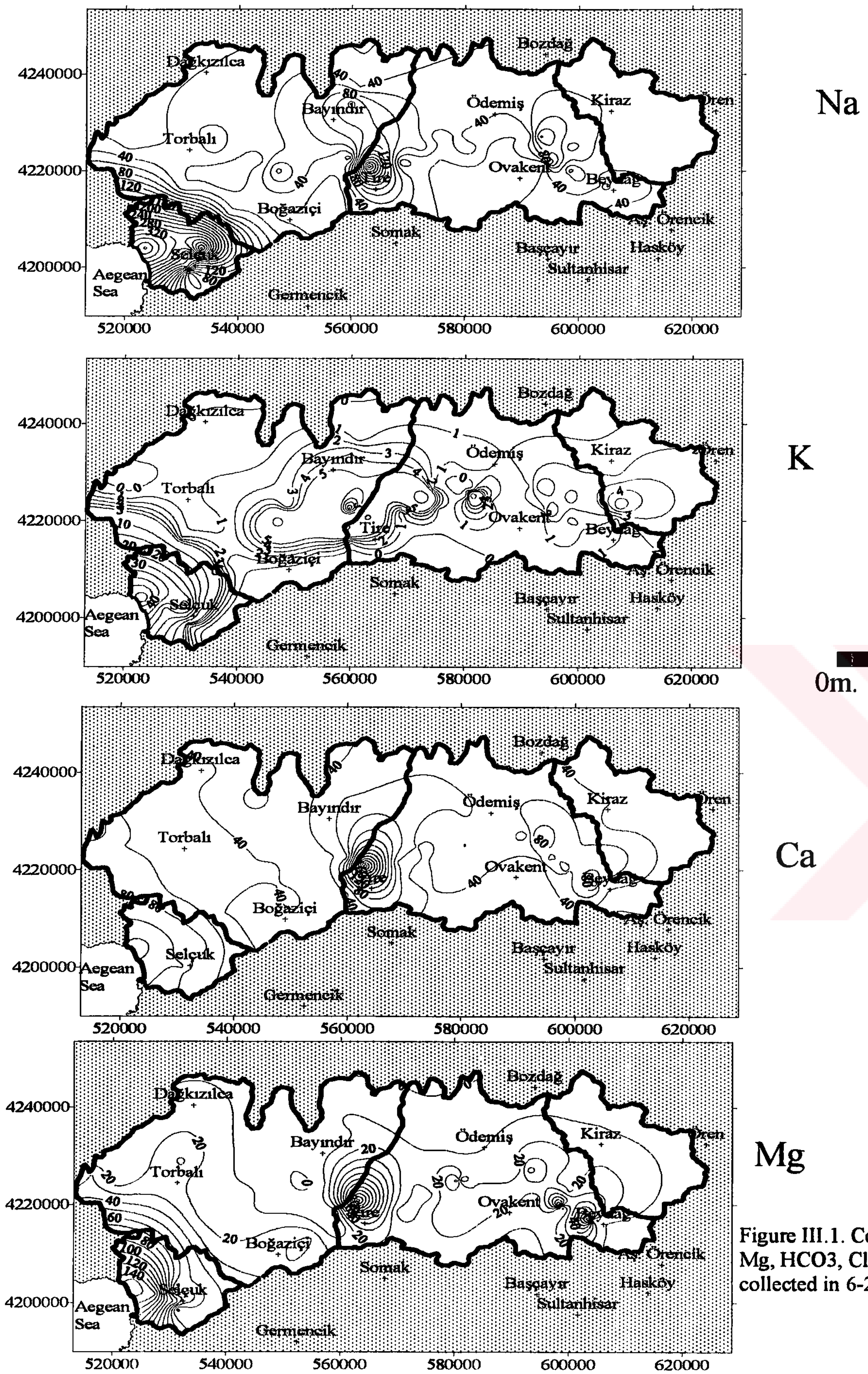
Table II.3 continued.

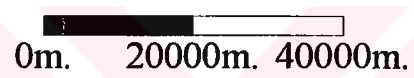
Year-station	B	BOD	Ca	Cd	Cl	COD	Cr	Diss. O_2	EC	F	Fe	Hg	Mn	N-NO_2	N-NO_3	o-PO_4	Pb	SO_4	TDS	Zn	Salinity -SAR
AVG.-21	**I**	**I**			**II**				**II**	**I**	**I**			**III**	**I**	**I**		**I**	**I**		**C2S1**
95-22	I				I				II		I			III	I	I		I	I		C2S1
96-22	I	I			I				II	I	I			III	I	I		I	I		C2S1
97-22	I	I			I				II	I	III			II	I	II		I	I		C2S1
98-22	I				I				II		I			III	I				I		
AVG.-22	**I**	**I**			**I**				**II**	**I**	**II**			**III**	**I**	**I**		**I**	**I**		**C2S1**
95-23	I				I				I		I			III	I	II		I	I		C1S1
96-23	I	I			I				II	I	I			III	I	II		I	I		C2S1
97-23	I	I			I				I	I	I			III	I	II		I	I		C1S1
98-23	I				I				I		I			III	I				I		
AVG.-23	**I**	**I**			**I**				**I**	**I**	**I**			**III**	**I**	**II**		**I**	**I**		**C1S1**
97-30	I	I			II				II	I	II			III	I	III		IV	I		C2S1
98-30	I				I				II		IV			III							
AVG.-30	**I**	**I**			**II**				**II**	**I**	**III**			**III**	**I**	**III**		**IV**	**I**		
97-31		I			II				III	I	II			III	I	III		I	II		C3S1
98-31	I				II				II		I			III	I						
AVG.-31	**I**	**I**			**II**				**II**	**I**	**II**			**III**	**I**	**III**		**I**	**II**		
97-32	I	II			II				II	II	I			IV	I	III		I	I		C2S1
98-32	I				II				III		I			III	I						
AVG.-32	**I**	**II**			**II**				**III**	**II**	**I**			**IV**	**I**	**III**		**I**	**I**		

APPENDIX III

Maps

This appendix includes concentration and water quality distribution maps of the basin.





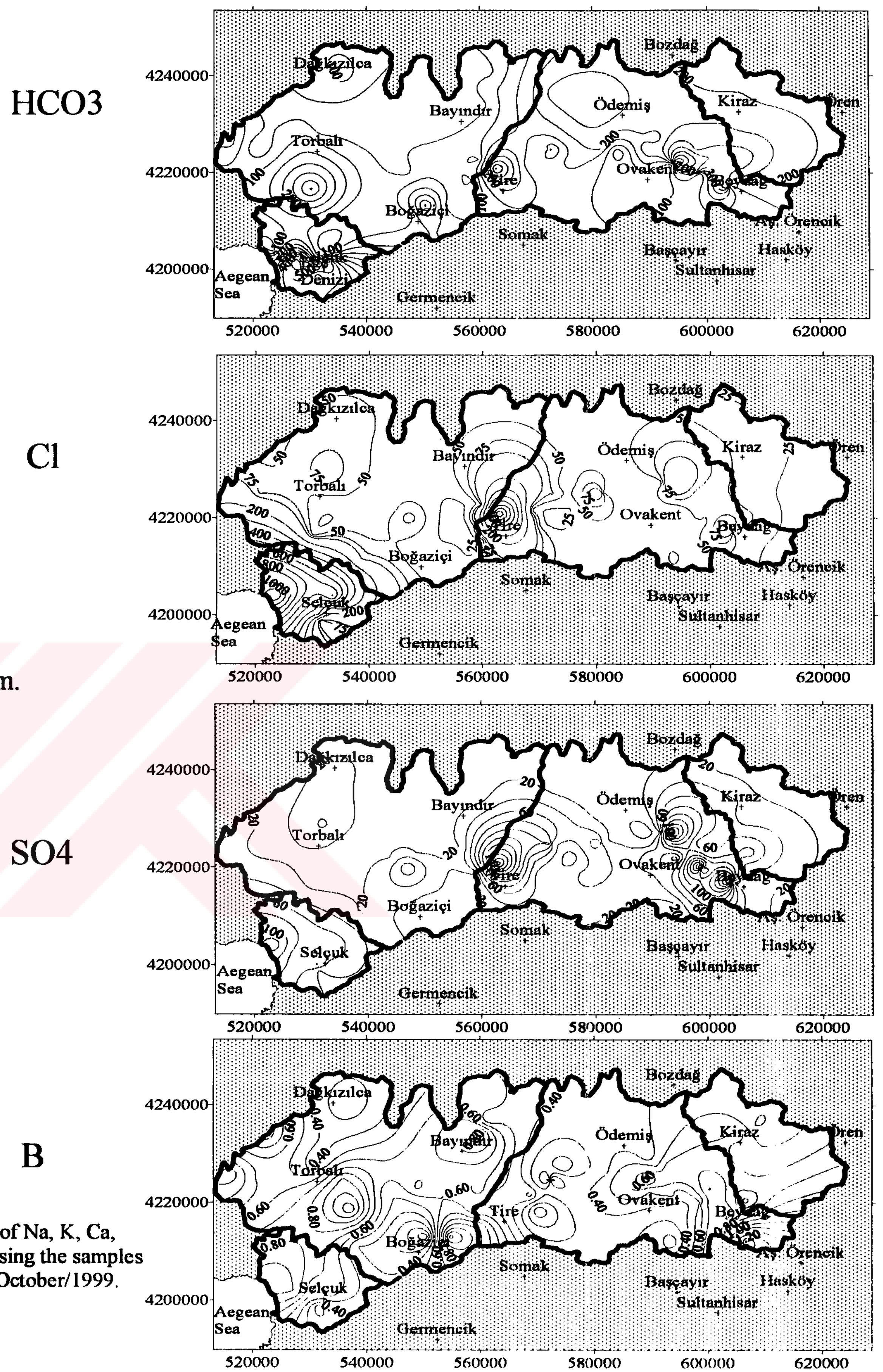


Figure III.1. Concentration distributions of Na, K, Ca, Mg, HCO3, Cl, SO4 and B ions drawn using the samples collected in 6-22/July/1998 and in 8-11/October/1999.

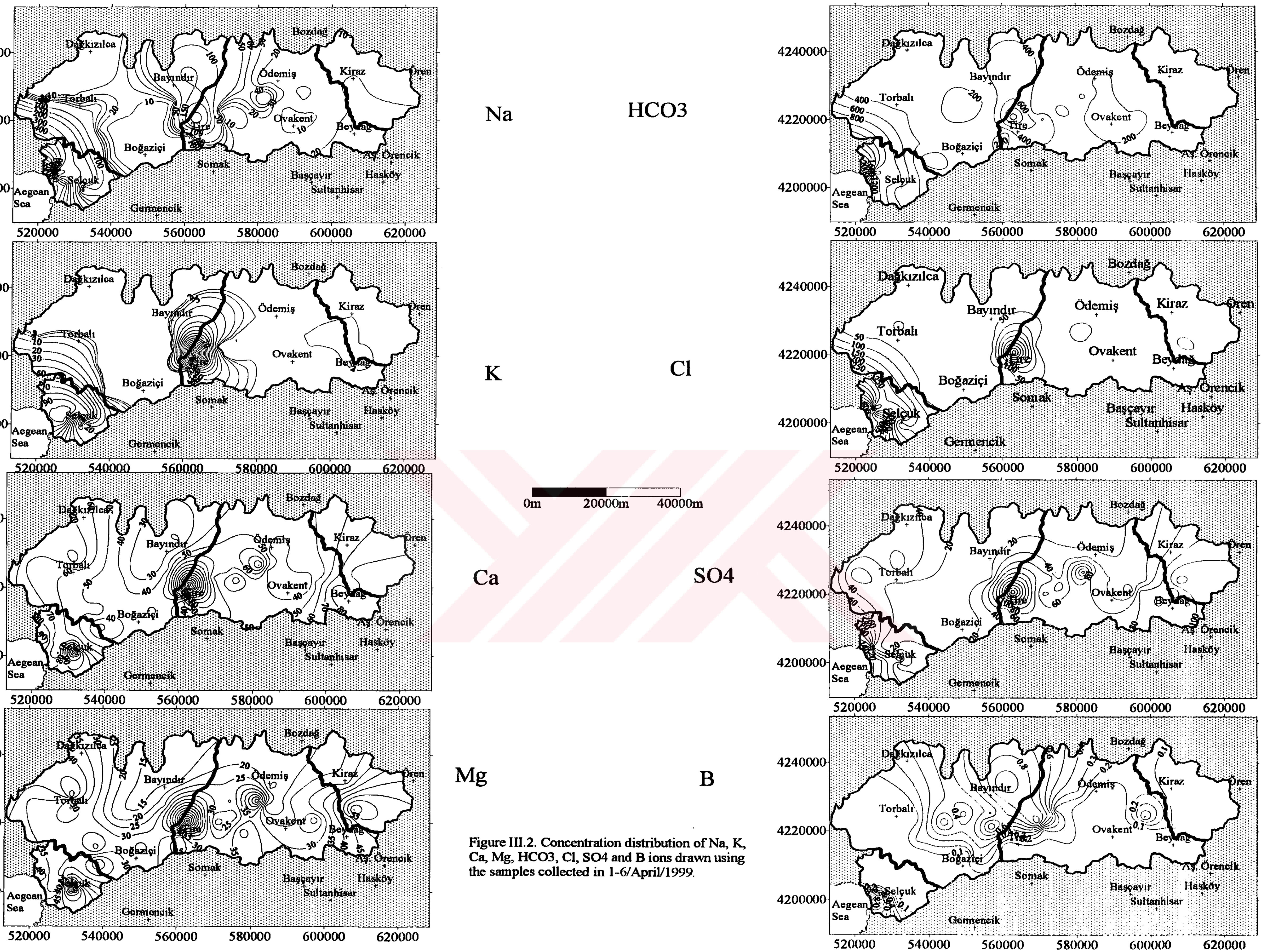


Figure III.2. Concentration distribution of Na, K, Ca, Mg, HCO3, Cl, SO4 and B ions drawn using the samples collected in 1-6/April/1999.

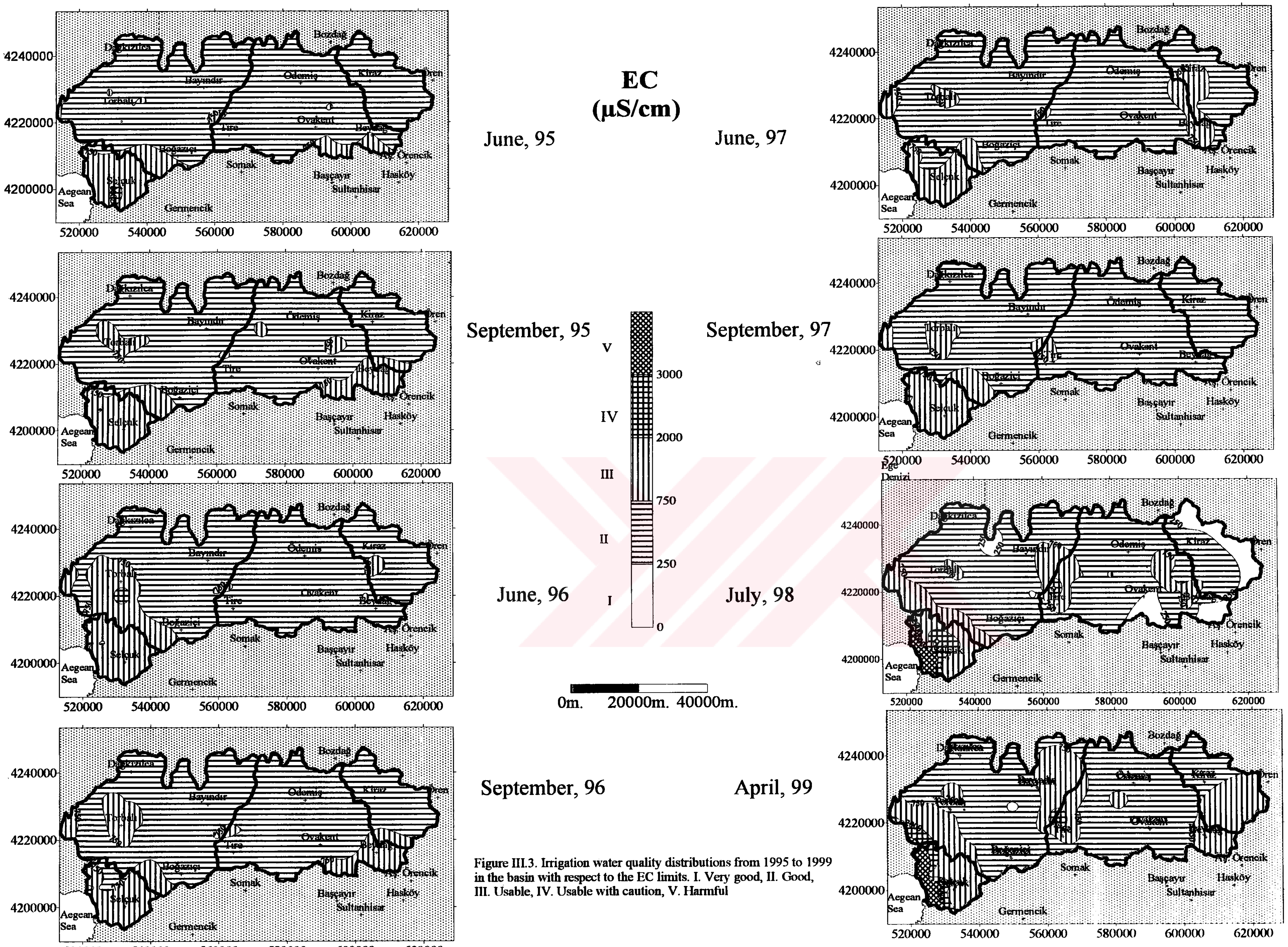


Figure III.3. Irrigation water quality distributions from 1995 to 1999 in the basin with respect to the EC limits. I. Very good, II. Good, III. Usable, IV. Usable with caution, V. Harmful

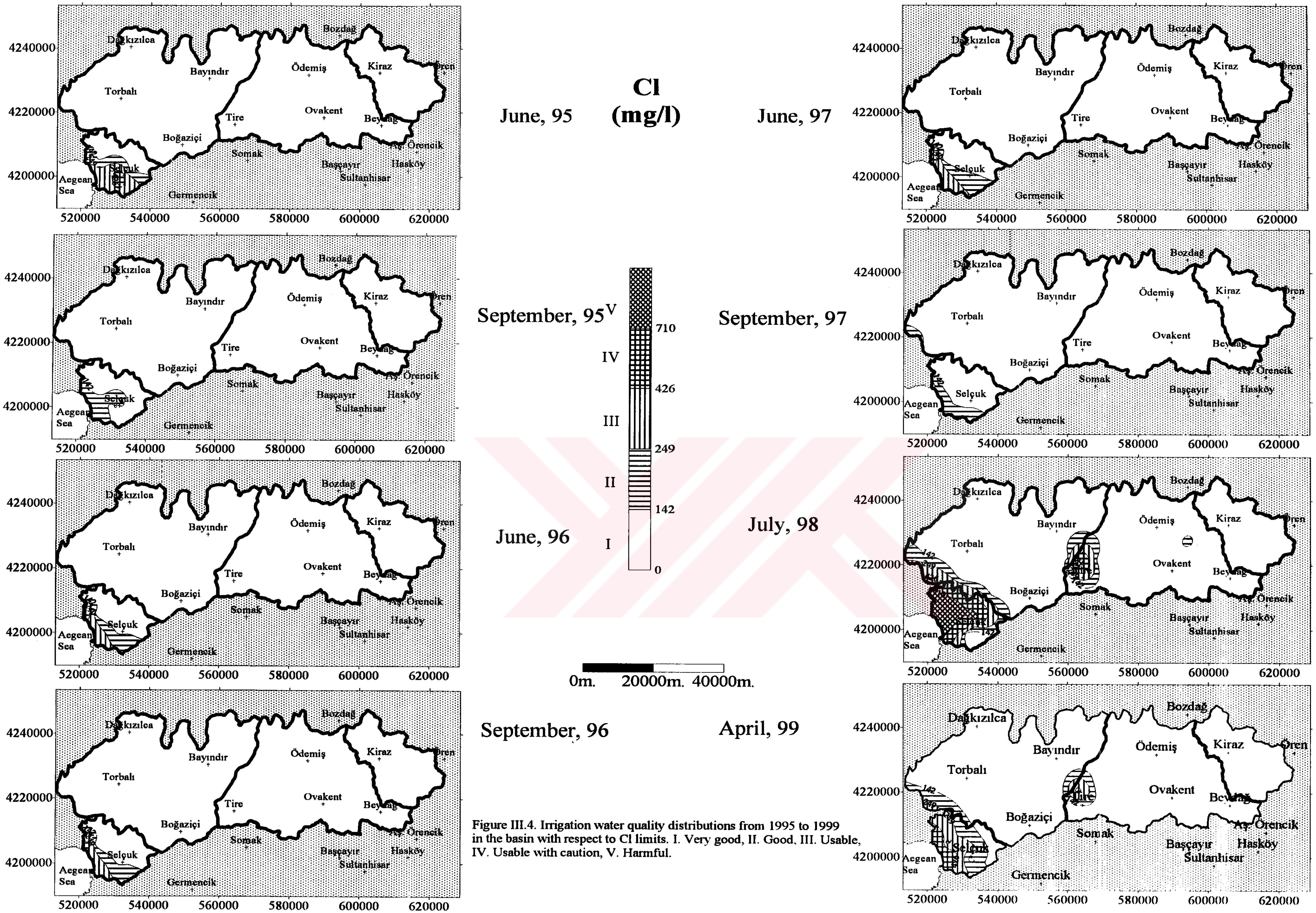


Figure III.4. Irrigation water quality distributions from 1995 to 1999 in the basin with respect to Cl limits. I. Very good, II. Good, III. Usable, IV. Usable with caution, V. Harmful.

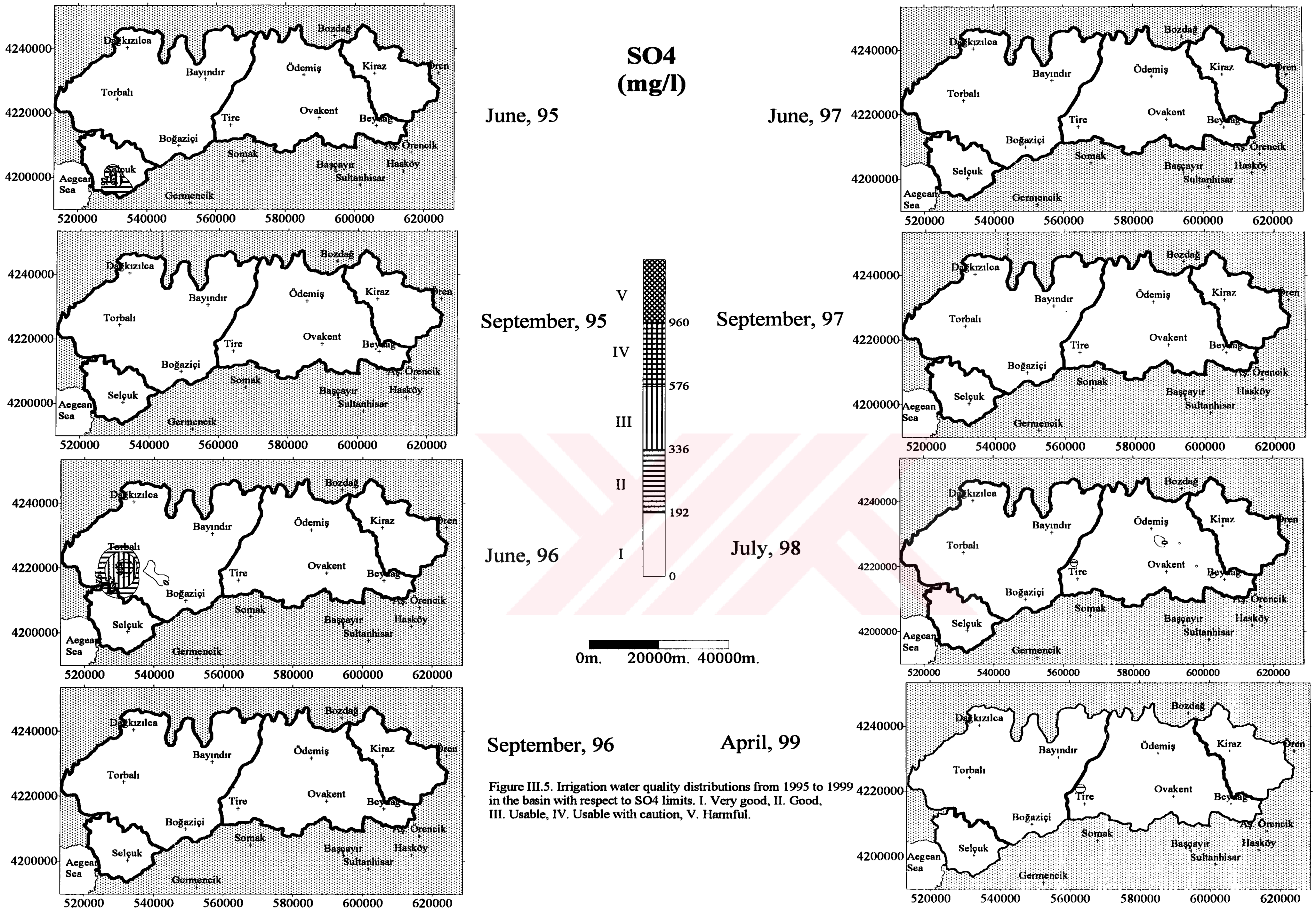


Figure III.5. Irrigation water quality distributions from 1995 to 1999 in the basin with respect to SO4 limits. I. Very good, II. Good, III. Usable, IV. Usable with caution, V. Harmful.

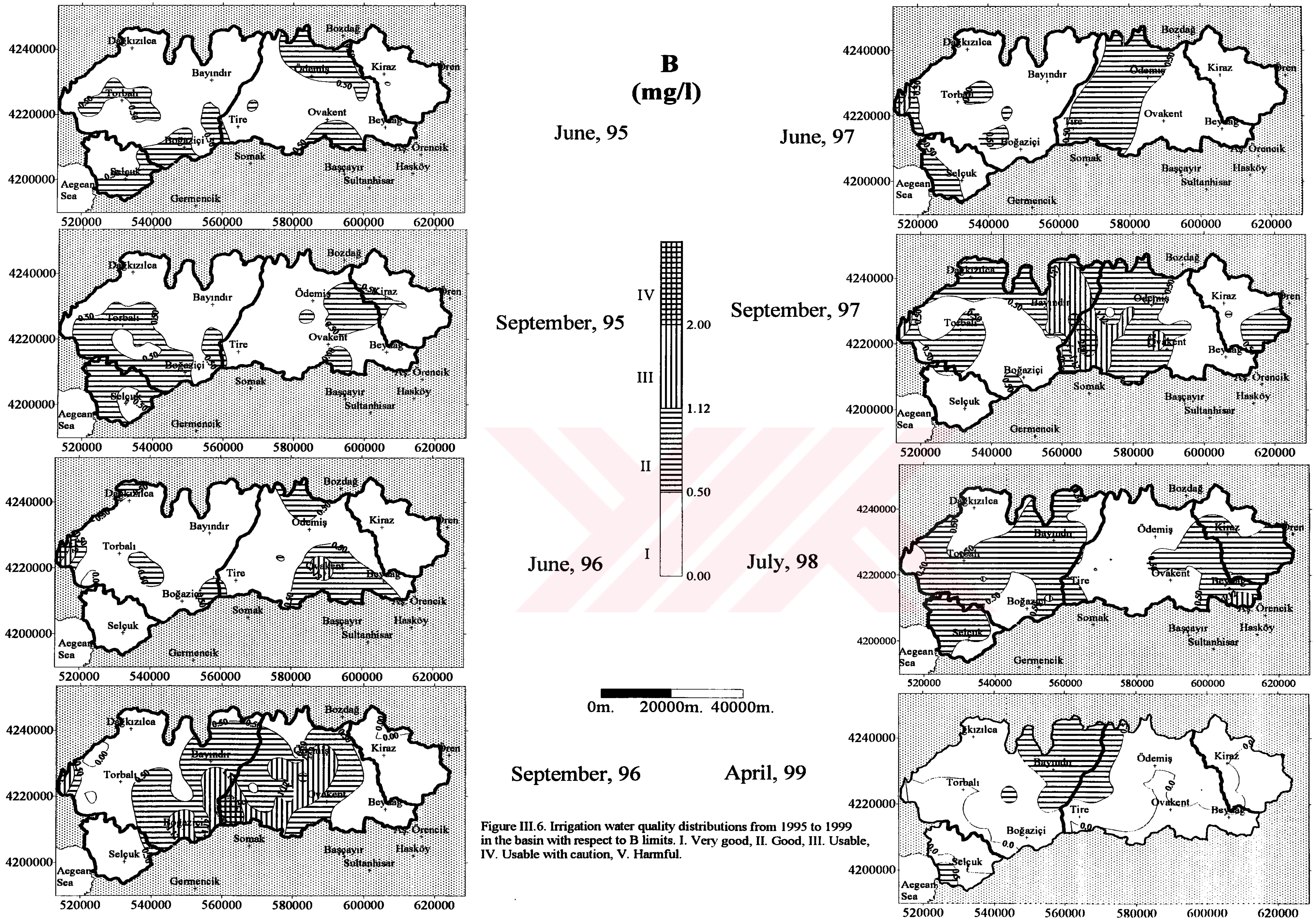


Figure III.6. Irrigation water quality distributions from 1995 to 1999 in the basin with respect to B limits. I. Very good, II. Good, III. Usable, IV. Usable with caution, V. Harmful.

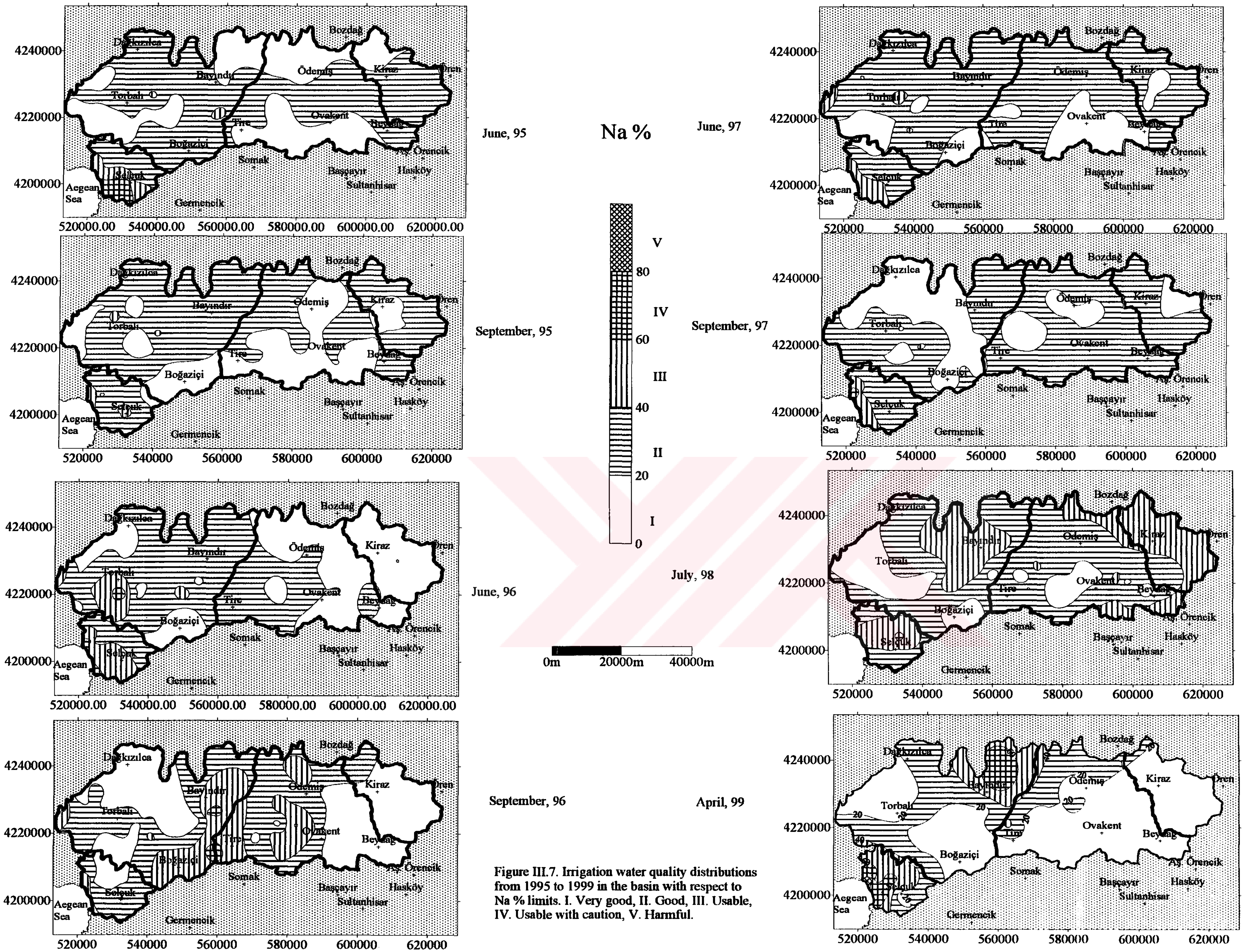


Figure III.7. Irrigation water quality distributions from 1995 to 1999 in the basin with respect to Na % limits. I. Very good, II. Good, III. Usable, IV. Usable with caution, V. Harmful.

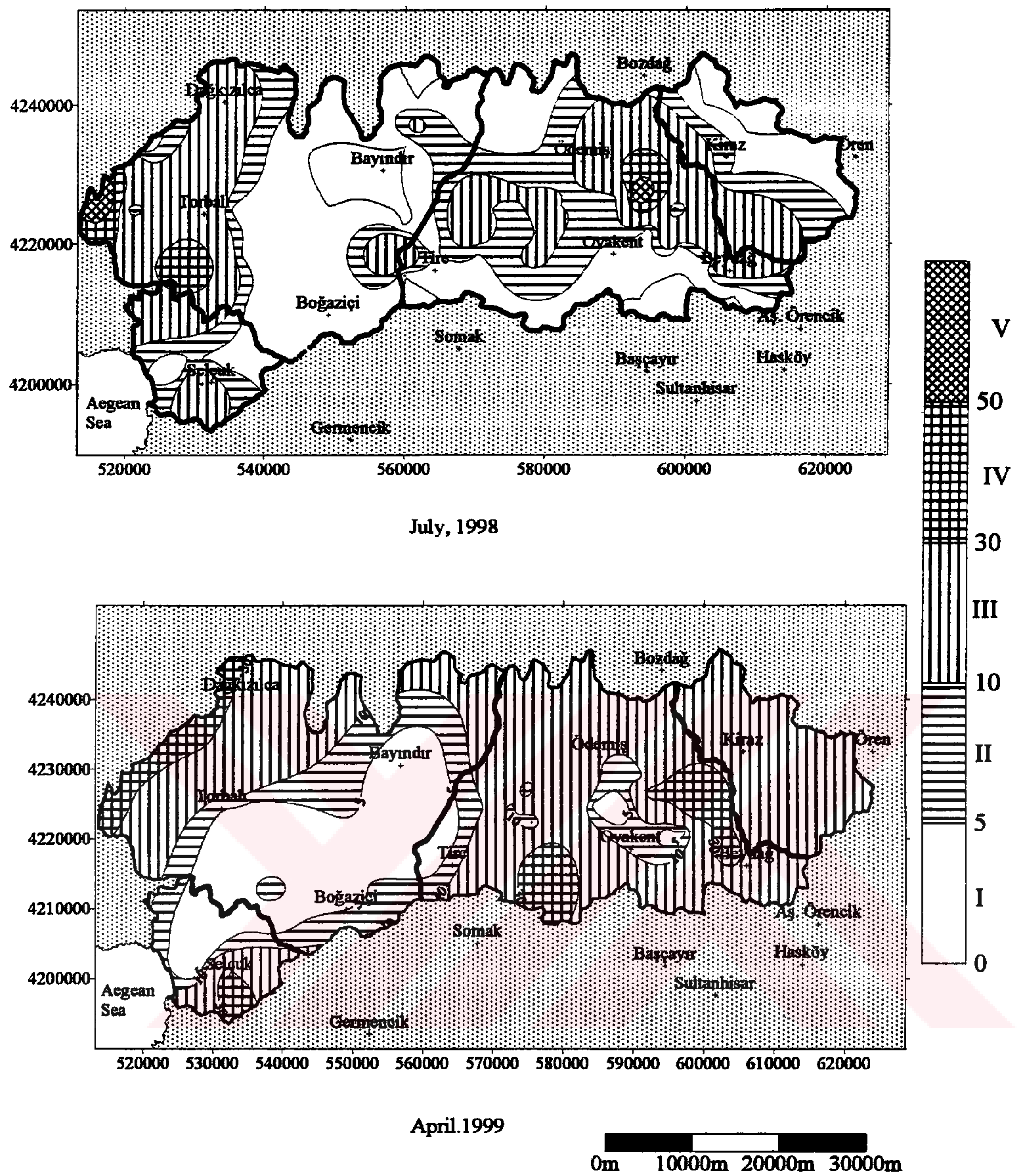


Figure III.8. Irrigation water quality distributions from 1998 to 1999 in the basin with respect to NO3 limits. I. Very Good, II. Good, III. Usable, IV. Usable with caution, V. Harmful.

APPENDIX IV

Griding

Following information is complied from MapInfo Vertical Mapper V2 help file.

Grids represent the basic structural component for the contouring, modelling and display of spatial data in a continuous form. The term griding is used to describe the construction of an evenly spaced lattice of equally sized cells. At each cell node in the grid, a value is estimated that is a reflection of the surrounding observed data values. There are several techniques to grid (TIN, inverse distance weight, natural neighbourhood, etc.). Each technique creates a characteristic surface of information estimated from scattered point observations where one decides which is the most "appropriate" surface given the type of data being grided. I have obtained the best solution in natural neighbourhood griding method as my data show clustered distribution and I can control such distribution with this method in detail. To fill the gaps within the data collection points, I have interpolated the data from sample points to form the grid. Interpolation is a process of estimating grid values using measured observations taken from a point table. New values calculated from the original point observations form a continuous and evenly spaced grid surface that "fills in the gaps" between the non-continuous points.

Triangular Irregular Network (TIN)

Triangulation is a process of grid generation that is most commonly applied to data that requires no regional averaging, such as elevation readings. The surface that is created by triangulation passes through (honours) all of the original data points while generating some degree of "overshoot" above local high values and "undershoot" below local low values. Elevation is an example of point values that are best "surfaced" with a technique that predicts some degree of over- and under-estimation. In trying to model a topographic surface from scattered elevation readings, it is not reasonable to assume that data points were collected at the absolute top or bottom of each local rise or depression in the land surface. This is especially true in modelling sub-surface layers using elevation readings from borehole data. Using triangulation, the interpolated surface passes through the original data points but peaks and valleys extending beyond the local maximum and minimum are expected.

Triangulation involves a process whereby all original data points are connected in space by a network of triangular faces, drawn as equilateral as possible, forming what is referred to as a Triangular Irregular Network (TIN). Points are connected based on a nearest neighbour relationship (the Delaunay criterion) which states that a circumcircle drawn around any triangle will not enclose the vertices of any other triangle.

Triangles with centroids farther from the vertex being solved have less influence on the slope calculation than triangles whose centroids are closer, or triangles with greater areas have greater influence in the slope calculation than triangles with a smaller area. The end result is a smoothing process that significantly reduces the frequency of angular artifacts, representing remnants of the original TIN facets, in the final grided surface.

Natural Neighbourhood (NN)

The Natural Neighbour interpolation method is a geometric estimation technique that uses natural neighbourhood regions generated around each point in the data set. The method is particularly effective for dealing with a variety of spatial data themes exhibiting clustered or highly linear distributions. Natural Neighbour Interpolation is a technique that builds a grid to an outer user-defined boundary that may lie beyond the convex hull of the point data set. I have entered the boundary in order to extend to the basin margin; therefore, it must be keep in mind that this creates some estimation error in inter and extrapolations.

In simple terms, the Natural Neighbour method makes use of an area-stealing or area-weighting technique to determine a new value for every grid node. A natural neighbourhood region is first generated for each data point. Then, at every node in the new grid, a new natural neighbourhood region is generated that effectively overlies various portions of the surrounding NN regions defining each point. The new grid value is calculated as the average of the surrounding point values proportionally weighted according to each intersecting area. A Constant Value interpolator in which each grid node takes on the value of the underlying natural neighbourhood region.

A Linear Solution, where the grid value is determined by averaging the point values associated with surrounding natural neighbour regions and weighted according to the area that is encompassed by a temporary natural neighbour region generated around the grid cell. A Slope-based Solution where the grid value is determined by averaging the extrapolated slope of each surrounding natural neighbour region and area weighted as in the Linear Solution. By examining the adjacent points, a determination is made as to whether that point represents a local maximum or minimum value. If such is the case, a slope value of zero is assigned to that value and the surface will therefore honour that point by neither overshooting nor undershooting it. This method is particularly effective for dealing with a variety of spatial data themes exhibiting clustered or highly linear distributions.