STATE OF ISRAEL MINISTRY OF NATIONAL INFRASTRUCTURES
WATER COMMISSION HYDROLOGICAL SERVICE

HYDROLOGICAL YEARBOOK OF ISRAEL 1999/2000

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1. GENERAL

This Hydrological Yearbook for the year 1999/00 is the 50th volume in the yearbook series*. It contains location maps of active stations of the Hydrological Service and of gauged springs; water level records for lakes; streamflow and springflow discharges and chemical data; and precipitation depths for the time span from 1/10/1999 through 30/9/2000.

2. PRECIPITATION**

Depth of precipitation during the year 1999/00 was lower than average over most regions of Israel. The exception stretches over the northern and the coastal regions, where about 95 - 110% of the mean annual value were recorded. Depths reaching 85 - 90% of the mean annual values were observed in the Galilee, Golan, Yizre'el Valley and the southern coastal region; 70 - 80% of the mean were observed in the Judea Mountains and the Jordan Valley; 45-55% of the mean were observed in the northern Negev and the Judea desert, and only 40% of the mean was observed in the central and the southern Negev. Depths higher than average were recorded at a few stations in the northern and central regions (Haifa 106%, Kefar Hess 107%), within the Yarqon and Ayyalon watersheds (Horeshim 102%, Tel-Aviv 111%) and in the Shomeron (Nablus 125%). Annual depth of precipitation over the Upper Jordan River Catchment reached only 75 - 80 % of the average.

*a. 1 volume of Hydrological Measurements prior to October 1944;
b. 2 volumes of Hydrological Measurements in 1944/45 and 1945/46;
c. 44 volumes of Hydrological Yearbooks for Israel from 1946/47 to 1998/99;
d. 2 volumes of condensed records prior to October 1967 and to October 1990.

** After data provided by the Israel Meteorological Service and analyses by the Meteorological Service and Meteotech Co.

Annual and monthly depths of precipitation at representative stations and their percentage of normal are listed in **Table A.**

Fall of rain commenced this year in mid-September. Accumulated depth of precipitation through December was lower than 20 - 40% of the mean over the northern and the central region and less than 20% over the southern region. Such low depths for this sub-season were recorded also in the preceding hydrological year (1998/99) and no more than 6-8 times in the last 60 years.
January 2000 depths were extremely high, 2.0 - 3.5 times of mean values over most areas of Israel except for the Arava area and the Negev Mountains. January 2 depths over the Coastal Plain ranked second highest for the last 60 years (the highest ones fell in 1974). Recurrence interval of January precipitation depth over the Northern region was about 10 -15 years.
Depths of precipitation during February and March were 40 - 90% of normal. No rain fell at most stations in April, and low depths fell at the few other stations.
Number of raindays in 1999/00 at representative stations, with respect to threshold depths, is presented in **Table B.** Number of days with depths exceeding 1 and 10 mm was substantially smaller than normal for all regions. Number of raindays with more than 25 mm a day did not exceed the normal for any stations (with the exception of Mt. Kena'an). Yet, number of rain days in January, when three major events occurred, was large.

3. SURFACE RUNOFF

Volume of runoff during the year 1999/00 at the Mediterranean Watershed was 87% of the mean - about 153 MCM. The runoff coefficient (i.e. ratio of runoff volume to precipitation volume) for this watershed was 4.8%, a value higher than the mean, of 3.8%, for the period of 1966/67 - 1999/00. Runoff volumes at the

Table A: Monthly and annual precipitation depths and percentiles of normal at representative stations

Hydrologic Region	Meteorologic Station	November		December		January		February		March		Annual	
		mm	%	mm	%	mm	%	mm	%	mm	%	mm	%
Galilee	‘Evron	6	7	97	66	330	215	80	76	59	92	578	92
	Ayyelet haShahar	6	10	37	38	231	185	54	57	43	74	385	83
Northern and Central Med. Watershed	Haifa	35	51	62	42	356	268	69	81	38	79	567	106
	En haHoresh	19	23	35	23	368	244	49	54	54	95	525	90
	Kefar Hess	30	35	38	25	439	299	90	92	50	75	652	107
Yarqon - Ayyalon	Horeshim	26	39	48	31	444	277	113	99	40	47	673	102
	Tel Aviv	21	26	47	35	425	340	41	51	39	76	577	111
Southern Med. Watershed	Jerusalem	9	15	35	33	249	186	56	50	70	77	421	77
	Bet Guvrin	10	23	23	26	195	179	46	55	29	53	321	78
Northern Negev	Ruhama	5	11	13	19	213	223	26	36	30	70	287	81

Table A: (cont.)

Hydrologic Region	Meteorologic Station	November		December		January		February		March		Annual	
		mm	%	mm	%	mm	%	mm	%	mm	%	mm	%
Negev Mounts	Sede Boqer	0.6	6	0	0	17	77	2	12	15	105	34	35
	Be'er Sheva'	1	5	2	5	85	170	3	8	20	71	114	56
Arava	Sedom ponds	0	0	0	0	6	59	1	13	0.8	6	7	15
	Elat	0	0	0	0	2	46	0.1	2	0	0	2	7
Upper Jordan	Dafna	11	44	43	34	275	192	83	72	62	69	491	79
	Mt. Kena'an	20	24	68	47	323	186	92	72	65	66	593	84
Golan	Gamla	12	18	61	49	305	249	86	72	61	60	541	92
Shomeron	Jericho	2	10	8	25	56	160	17	61	27	99	108	66
	Nablus	14	23	36	30	525	370	92	81	72	63	746	125

Table B: Number of raindays exceeding threshold depths at representative stations and its deviation from normal

Station	Threshold (mm)					
	=<1		=<10		=<25	
	No	Dev.	No	Dev.	No	Dev.
'Evron	44	-9	17	-5	5	-2
Ayyelet haShahar	40	-11	10	-6	5	0
En ha'Horesh	39	-12	13	-6	6	0
Jerusalem	40	-5	10	-7	5	-2
Bet Guvrin	35	-3	7	-7	4	0
Ruhama	28	-6	11	-2	2	-1
Sede Boqer	8	-10	0	-2	0	0
Be'er Sheva'	20	-7	3	-3	1	0
Elat	1	-4	0	-1	0	0
Dafha	40	-15	16	-5	6	0
Mt. Kena'an	46	-13	19	-4	8	1

main stations of the Eastern Watershed were only 20 - 60% of the mean, with exceptions of up to 90% for a few streams in the Golan. There were no flows in the Paran stream.

Most runoff events were generated from January and February rainfalls. Recurrence intervals of their discharges did not exceed 2-3 years. Most of high runoff events occurred on January and only few of them on February. The few relatively high discharges in this year and their exceedance probabilities are presented in **Table C.**

Table C: Relatively high discharges in 1999/00

Station		Previous maximum			1999/00 maximum		
No	Stream and Location	Day	Q	P	Day	Q	P
GOLAN							
31155	Meshushim - Dardara	22.02.97	211	0.5	20.01.00	159	14
31155	Meshushim - Dardara	22.02.97	211	0.5	27.01.00	150	14
NORTHERN REGION							
15120	Alexander - Elyashiv	25.02.95	160	4	27.01.00	83	18
YARQON and AYYALON							
17168	Ayyalon - Shekhunat 'Ezra	08.02.95	168	-	27.01.00	103	-
NORTHERN NEGEV							
21105	Shiqma - Tel Milha	10.11.97	82	1.5	28.01.00	23	20
21130	Shiqma - Beror Hayil	23.03.91	178	2	28.01.00	58	15

Legend: Q is discharge (m^3/s) and P is annual exceedance probability (%), - Probability not computed because of short observational period

High discharges with exceedance probability of 14% were recorded at the Meshushim stream on 20 and 27 January, with exceedance probability of 18% at the Alexander stream on 27 January and with exceedance probability of 15 - 20% at the Shiqma stream on 28 January. Evidently those discharges were lower than the previous observed maxima.

4. LAKES

Water level elevation of Lake Kinneret on 1.11.99 was at the lowest historical elevation of -212.99 m.a.s.l, which is 74 cm lower than the elevation a year earlier. The level declined to a seasonal minimum of -213.17 m.a.s.l on 11-13.12.99 and steadily increased by 1.25 m during the winter to the seasonal maximum of -211.92 m.a.s.l on 27.04.00 - 5.05.00. The level declined during the summer months and

late October 2000 it was 72 cm lower than on 1.11.99. Elevations of Lake Kinneret level are reported from this Yearbook according to the updated reference benchmark, which is 11 cm higher than the previous elevation. Depth of precipitation over the Lake's watershed in 1999/00 was 88% of normal. Annual volume of available water to the Lake (streamflow, springflow and direct precipitation over the Lake surface minus evaporation) from November 1999 to October 2000 was only 184 MCM (10^6 m^3). Inflow volume from the Jordan River was 254 MCM (vs. 208 MCM in 1998/99). The volume of saline springs diverted from reaching Lake Kinneret was 12 MCM and diverted volume from the Yarmouk River was 22 MCM. The supply to the Kingdom of Jordan was 52 MCM. The supply to the National Water Carrier was 234 MCM (vs. 121 MCM in 1998/99) and that to local customers was 92 MCM. Chlorinity of the lake water ranged from 247 mg/1 in November 1999 to 258 mg/1 in January 2000 (the highest value). Chlorinity of Lake water was rather high during the spring and the summer months. A more elaborate information on the water balance of Lake Kinneret is available in the Mekorot Report: "Water, salinity and Energy balance of Lake Kinneret at 1999/00".
Dead Sea water level declined from -412.80 m.a.s.l. on 1.10.99 to -413.42 m.a.s.l. on 27.04.00. The 2000 spring water level was by 1.30 m lower than that in the previous spring. Declining of the sea water level continued in the summer months and ended at -414.12 on 28.09.00.

5. SPRINGFLOW

The 1999/00 springflow volumes were lower than average for almost all springs. Exceptions are found for Yivqa', Allona and Barta'a springs in the Western Watershed and Shahal, Tavor - Lower and Homa in the Eastern Watershed. Volumes of the large springs Dan, Tanninim and Yarqon were lower than those in the dry 1997/98 -1998/99 years. Responding to the heavy rainfall in January, many ephemeral springs (Ga'ton, Na'aman, Yiftah'el, Shamir, Aviv, Rewaya etc.) emerged then. The sharp increase of springflows discharges was recorded in February rather then in January. Large spring (like Banyas) discharges remained high through April. The majority of

small spring discharges dropped down already in March. Springflow discharges fluctuated in accordance with the variations in monthly precipitation depths. These depend also on particular times lag between rainfall and the Springflow.

6. GROUND WATER

Ground-water levels of the Coastal aquifer declined during the 1999/00 winter season over large sectors of this aquifer. Water levels in the spring were, on average, 1« than those in the preceding autumn over about 90% of the Southern sector of the aquifer, 50% of the Central sector and 10% of the Northern sector. Depths of decline were mostly smaller than a meter with an exception for the Nir'am region where a deeper decline was observed. Seasonal rise of water level (of up to one meter) observed over the majority of the Northern and the Central sectors. Relatively high rises, of more than 1 m, were observed around the Hadera, 'Emeq Refer, Rishon Le Zion and Nir'am regions, and in the Dan Region Sewage Reclamation Project.

Annual decline in water levels, from April 1999 to April 2000, was observed over 90% of the aquifer area. Decline of more than one meter was observed mostly around withdrawal sites from Rehovot and further to the South and over the eastern area of the aquifer from Dan Region to 'Emeq Hefer. Local annual rises in water level (of no more than one meter) were observed in the eastern sector south to Holon, near Ashqelon and Hadera and in the western Sharon and Dan regions.

Levels of the Yarqon - Tanninim aquifer declined during the 1999/00 winter season in the southern sector only. This decline amounted to 0.6 m. Seasonal rise was observed over the northern sector and ranged from 1.6 m at Gezer to 2.5 m at Menashe.

Annual decline in water levels of the Yarqon - Tanninim aquifer was 2-3 m. This declining process continues since 1993, when maximum levels were observed. In general, water levels of the Yarqon - Tanninim aquifer in the spring of 2000 were almost similar to those occurred in the spring of 1991. The 1999/00 yield from the Coastal and the Yarqon - Tanninim aquifers amounted to 969 MCM, which is smaller than that in the preceding year (1115 MCM).

Table D: Volumes of artificial recharge (MCM)

Region	Year					
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Coastal Aquifer						
Menashe Streams	25.3	1.3	9.8	5.8	2.1	12.5
Emeq Hefer	0.3	0.0	0.0	0.6	0.0	0.0
Northern Sharon	1.6	0.4	0.0	1.3	0.04	0.01
Southern Sharon	2.6	0.2	0.3	1.0	0.25	0.2
Holon	0.3	0.2	0.0	0.0	0.0	0.0
Shefelaof Judea	10.1	7.2	0.3	5.4	0.15	0.3
Northern Negev	7.3	8.8	0.5	4.7	1.6	0.1
Shiqma	10.2	0.0	2.0	0.7	0.0	3.6
Dan Sewage - Rishon	15.1	17.2	18.7	12.9	18.5	22.1
Dan Sewage - Yavne	58	65.8	78.0	90.8	88.6	92.4
Zohar Reservoir	4.2	2.7	3.0	2.5	0.5	0.3
Coastal Total	135.0	103.8	112.6	125.7	111.8	131.5
Yarqon - Tanninim and Carmel						
Northern Y. T.	0.0	2.6	3.5	0.0	0.0	0.01
Central Y. T.	0.6	0.0	0.2	0.2	0.08	0.0
Tut	0.0	0.0	0.0	0.0	0.0	0.0
Mountain Total	0.6	2.6	3.7	0.2	0.08	0.01
General Total	135.6	106.4	116.3	125.9	111.9	131.5

7. ARTIFICIAL RECHARGE

Volumes of artificial recharge during the recent years are listed in **Table D.** Recharge volume during 1999/00 totaled 131.4 MCM, and it was almost entirely directed into the Coastal aquifer. Practically, all of this volume (114.5 MCM) was recharged through the Dan Region Sewage Reclamation Project, 3.65 MCM through the Shiqma Project and 12.5 MCM through the Menashe Streams Project.