State of Israel
Ministry of National Infrastructures
Water Commission
Demand Management Division

Water in Israel

Consumption and Production

2001

December 2002

This is the third edition of the publication Water in Israel - Consumption and Production, prepared by the Demand Management Division

The last four years have been characterized by little rainfall and sparse flows in the water sources. This has meant a drastic cut of 50% on average in the quantity of water for agriculture (in the three-basin system), and a call to the public to save water.

The data in this volume reflect the implementation of this policy.

Furthermore, because of the consecutive dry years, the Water Commissioner has modified the water policy and has succeeded in persuading decision makers in the government to follow his lead: to desalinate large quantities of water that will meet the needs of the country during both dry and regular years, as well as to recycle increasing quantities of wastewater effluents to replace fresh water previously used in agriculture, thus freeing it for domestic use.

This publication contains data relating to the production and consumption of water in the years 1999-2001. These data were collected, checked, and processed by Demand Management Division workers. The reader will also find a new chapter entitled "With a View to the Future," in which the forecast water consumption up to 2010 is presented. This chapter provides a numerical representation of water policy in the coming decade.

We shall be pleased to receive comments, responses, and suggestions for the improvement of this booklet.

Noga Blitz

Divisional Manager

Foreword

The water sector has in recent years undergone a change of image.

The government decisions from July 2000 till the present time have placed water management policy on a firm foundation, in contrast to the crises management policy that guided decision makers in the past.

Produced (as opposed to natural) water, recycled wastewater effluents, and desalinated water, will by the end of the decade form 40% of the water potential in Israel. About a billion cubic meters of desalinated water (50%) and recycled effluents (50%) will serve the various water consumers: domestic, industrial, agricultural, and natural resources; recycled wastewater effluents of appropriate quality (Inbar Committee quality) will form the major source of water for agriculture and will also be used for industrial and urban needs (mainly gardening). Water quality for all needs will be improved, water in the National Carrier will be filtered, and desalinated plants will supply water of very high quality to the national system.

Steps will be taken to reduce the accumulation of salts in natural water sources. The diversion of salty springs and the drilling of boreholes in the Western Kinneret will reduce the salinity of the water in the lake. Desalination and water treatment plants will remove salt and pollutants from the coastal aquifer water. Treatment of industrial pollutants will be initiated to prevent their spreading to clean parts of the aquifer and to remove them from the groundwater systems.

The prevention of water wastage must become a way of life in this region, for both economic and environmental reasons. This applies not only to dry years but to rainy ones as well.

These steps will permit a balance to be achieved between water consumption and water sources, will restore the reliability of the water supply system and will place it on a firm foundation both for us and for the coming generations.

Shimon Tal

Water Commissioner

Contents

Consumption and Allocation of Water

Water is a vital commodity that permits a more comfortable way of life on both the personal and the environmental levels. The problem in Israel and the entire region is that there is a shortage of water.

Consequently, Israel's water resources necessitate government intervention for their management, production, distribution, development, pricing, etc. Currently it is not possible to produce or use water without permission. It is necessary to allocate water, specifying the quantity, quality, and price.

The supply of water for domestic, industrial and agricultural consumption in quantities that will meet all needs, both in dry and rainy years, without harming the water sources presents a problem that the water sector must cope with, particularly in recent years.

Recent winters have been especially dry, being characterized by small quantities of rainfall. Flows in water sources and natural replenishment during these winters were significantly less than average. The quantities of water available for the various uses (agricultural, industrial, and domestic) were consequently lower, calling for far-reaching cuts in the quantities of fresh water allocated to agriculture, as well as rigorous actions directed at saving water in the domestic and industrial sectors.

In accordance with a government decision, budgets were allocated for advancing the desalination of 400 MCM (million cubic meters) of seawater, development of plants for recycled wastewater effluents, connection of private boreholes to the national system, etc.

The policy of supply reliability to the various sectors is reflected in the priorities established: water for domestic use takes first priority, water for industrial use takes second priority, and the supply of water for agriculture takes third priority. Because of its flexibility regarding the quality and quantity of the water it uses, agriculture is given smaller allocations of fresh water during periods of water shortage. Indeed, from 1999 until the present time, the consumption of fresh water for agriculture has been cut by 50% on average per year. In this way it has been possible to balance the uses of water, ensure impartial management of the water sources and their allocation for the various uses.

In general, the water consumption data over the years (since 1958) indicate a trend of increased water consumption in all the sectors. This is attributed to the higher standard of living in the country, population growth, the peace agreements, and development of the economy in general. The drought years of 1999-2001, as well as those of 1986 and 1991, arrested this trend. The water shortage in recent years has caused a reduction in the consumption of fresh water for agriculture, a halting of the consumption grows in the domestic sector, and stability in industrial consumption.

Overall consumption in 2001 totaled 1,800.4 MCM, of which 1021.9 MCM was for agriculture (56%), 120.1 MCM for industry (7%), and 658.4 MCM for domestic use (37%). Consumption of fresh water accounts for about 72% of the total amount, the rest being marginal water.

In 2001, because of the change in the definition of water quality by Mekorot, there was a significant decrease in the consumption of fresh water and an increase in the consumption of brackish water. Most of the water consumption of the Beit She'an consumers, Afek consumers, and some of the consumers in the Negev, was defined as consumption of brackish water from 2001 on.

Starting in 1993, the data for water consumption in agriculture include use of effluents from private production plants. Consumption in 1988 was relatively low and resulted from an administrative change in the licensing year - from a year beginning in April to a calendar year beginning in January.

Water is supplied to the various consumers using production facilities of Mekorot (67%) and private production facilities (wells, surface water, stormwater and wastewater effluents).

Other countries in the region have not escaped the water shortages caused by the drought years.

Water has assumed an important place in the list of subjects in the Peace Agreement between Israel and Jordan. After decades of direct and indirect discussions, rules were formulated in the agreement itself for the allocation of the water and its method of distribution, for the development of new sources of water, and for preserving the existing common resources.

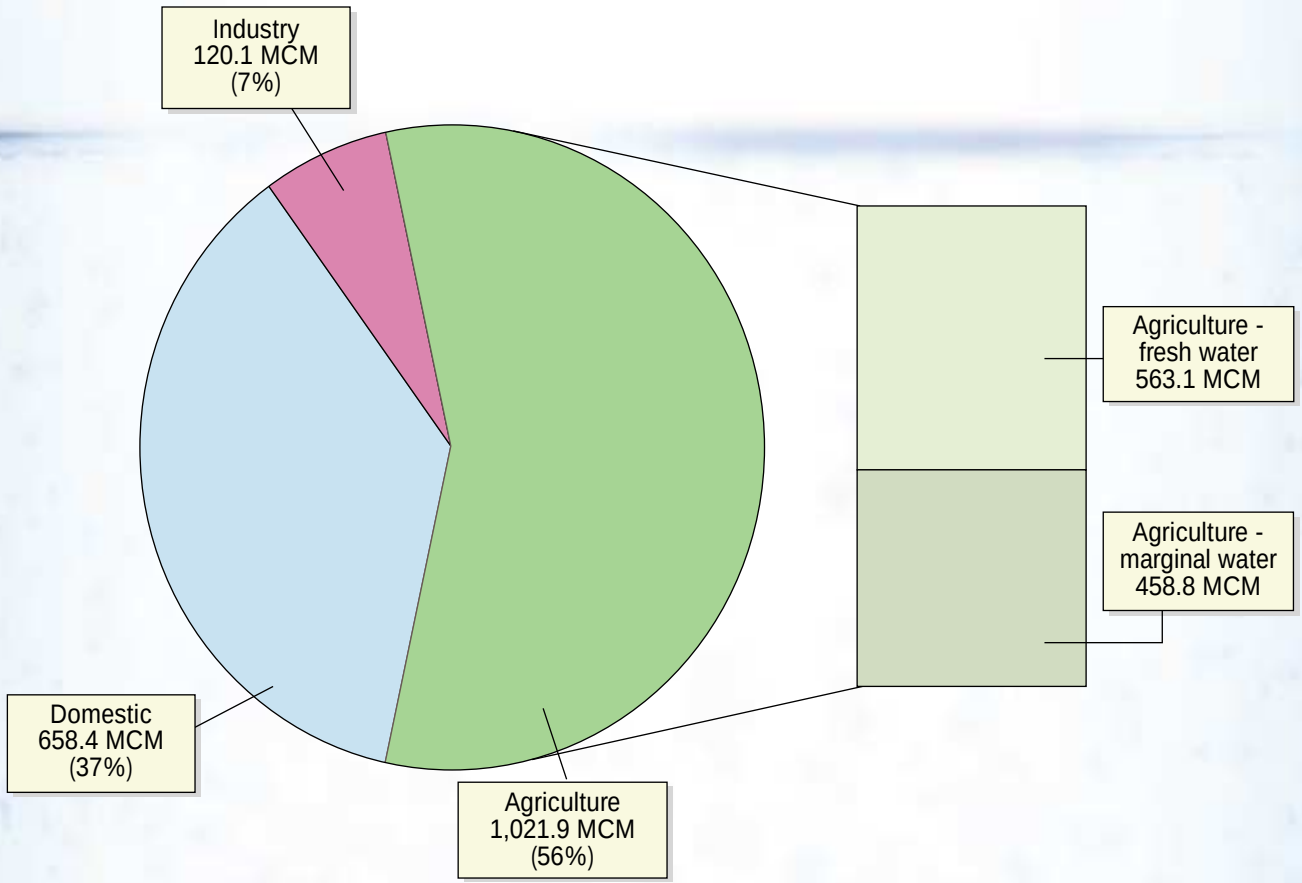
The Peace Agreement signed between the Kingdom of Jordan and the State of Israel reflects the following basic positions:

- Both parties lack sufficient water to supply all their needs.
- The agreement between them and the mutual commitments are intended to lead to practical and agreed upon solutions that are not based on legal or abstract principles or ideologies.
- Existing uses will be maintained and improved, while adding limited quantities of water to the Kingdom of Jordan and establishing future cooperation with further utilization of water by Israel in the Arava.

As part of the Peace Agreement with the Kingdom of Jordan and as part of later agreements, Israel supplies the Kingdom of Jordan in regular years with about 55 MCM of water. The supply is conditional on the pumping of 20 MCM from the Yarmukh, which Israel pumps in the winter and supplies to Jordan in the summer.

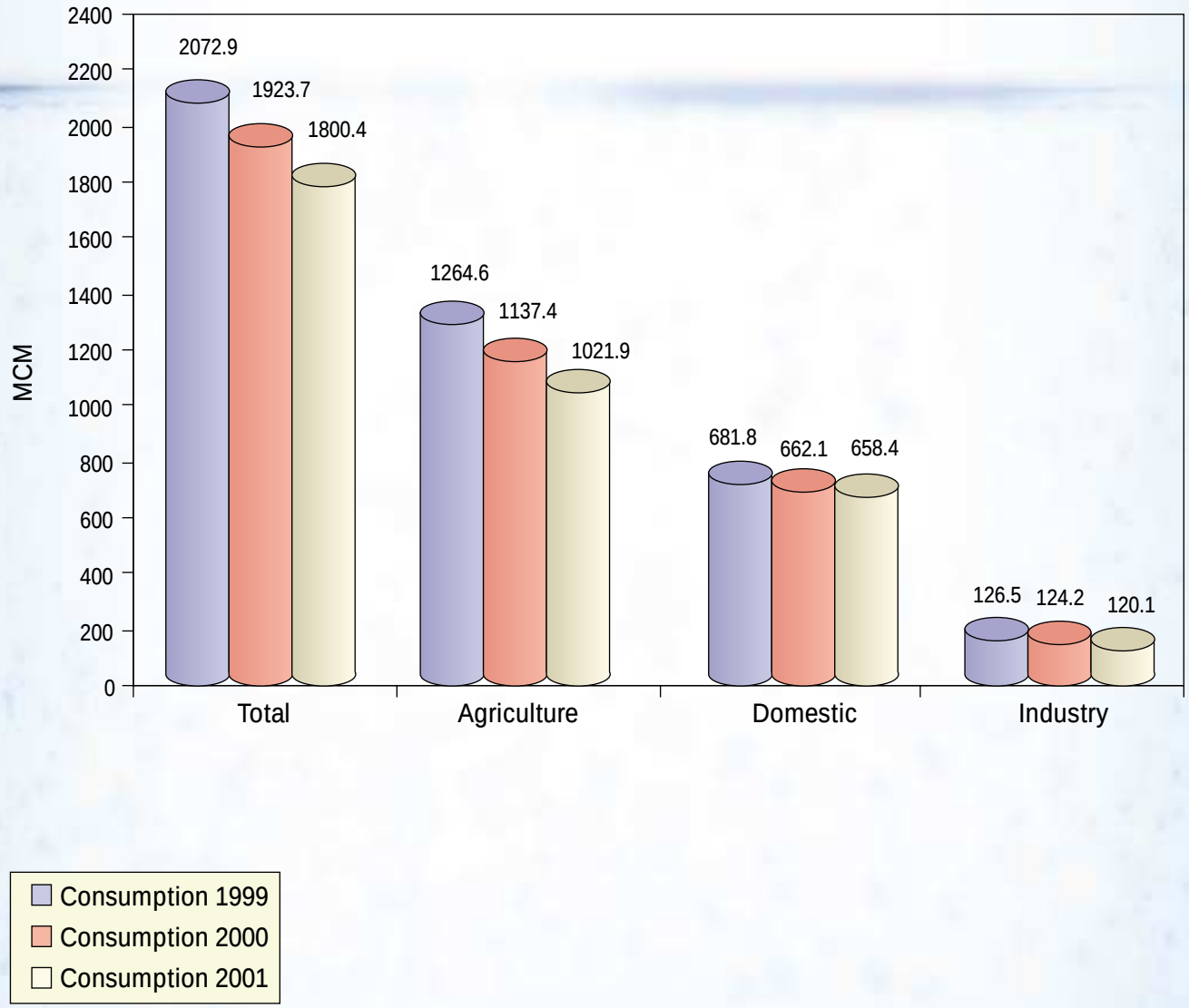
As part of the intermediate agreements reached with the Palestinians, including the Gaza and Jericho agreement, Israel supplies about 34 MCM to the Palestinian Authority in Judea and Samaria and about 5 MCM in Gaza. These quantities of water are supplied from the territory of the State of Israel, from the national system, and do not include Palestinian self-production, which totals 30 MCM. It need hardly be said that despite the tense security situation at the present time, the supply of water to the Palestinians is continuing as usual, based on an understanding and agreement between the parties that the subject of water is external to the dispute.

Water consumption according to objectives, 2001

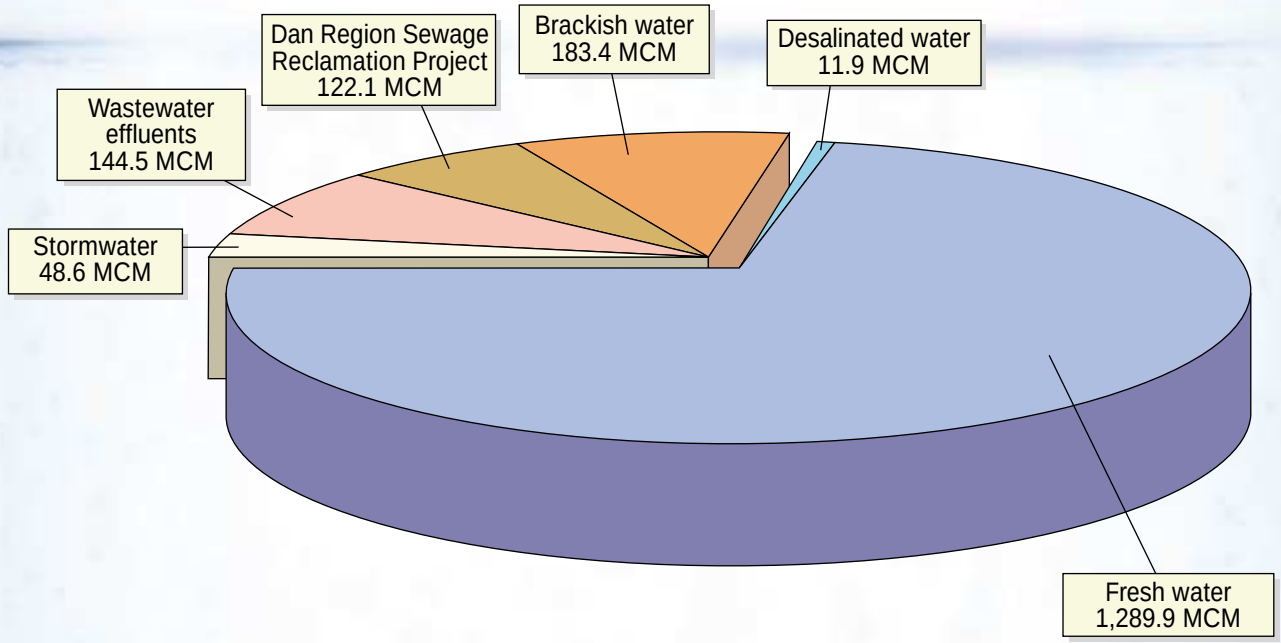


Total - 1,800.4 MCM

Water consumption according to objectives, 1999-2001

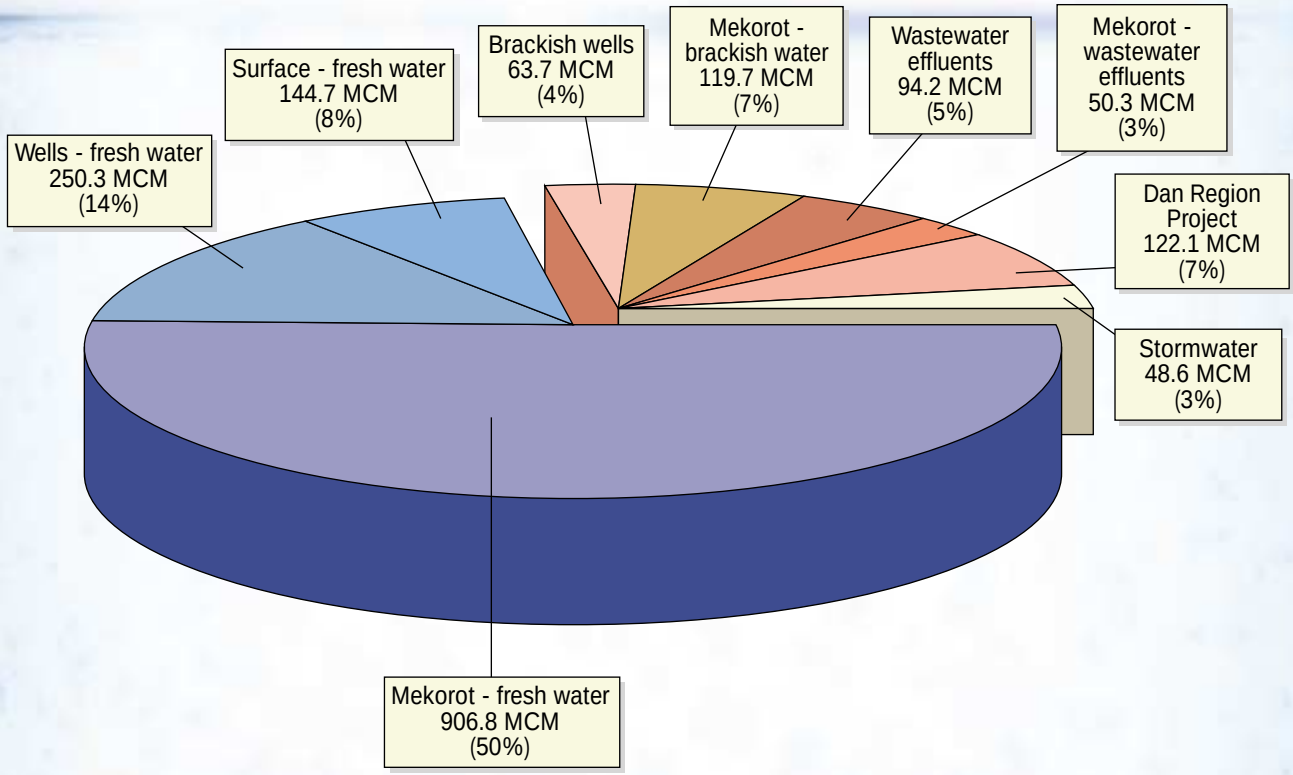


Water consumption by quality, 2001



Total 1,800.4 MCM

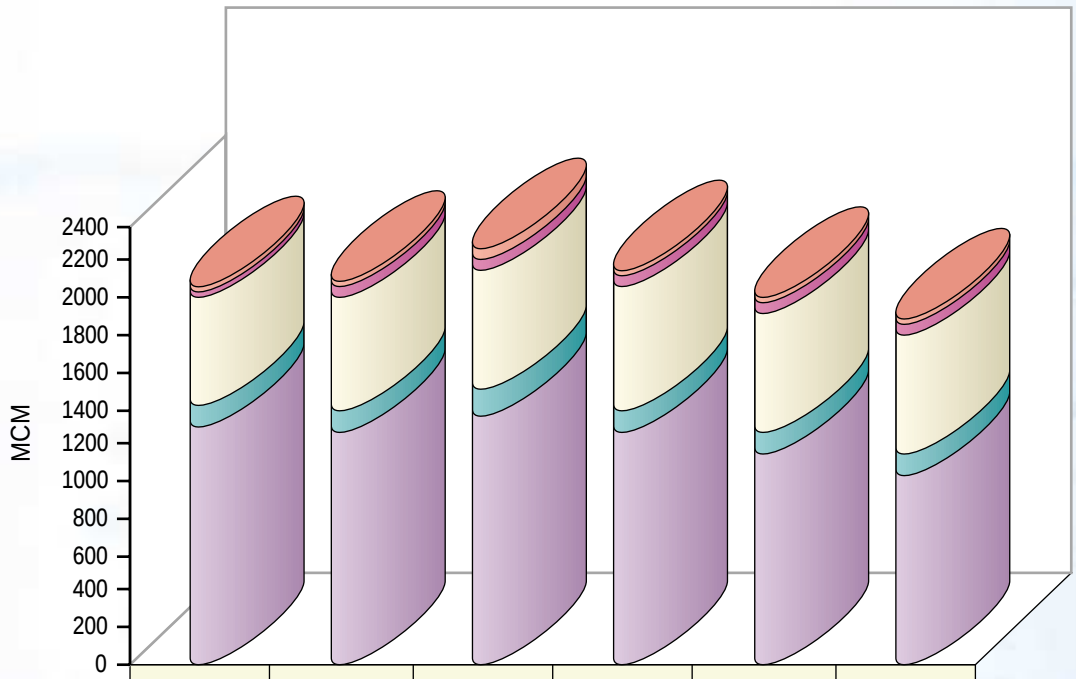
Water consumption by quality, 2001
(including Mekorot and private producers)



Total for Mekorot	*1198.9*	*MCM (67%)*
Total for private production	*601.5*	*MCM (33%)*

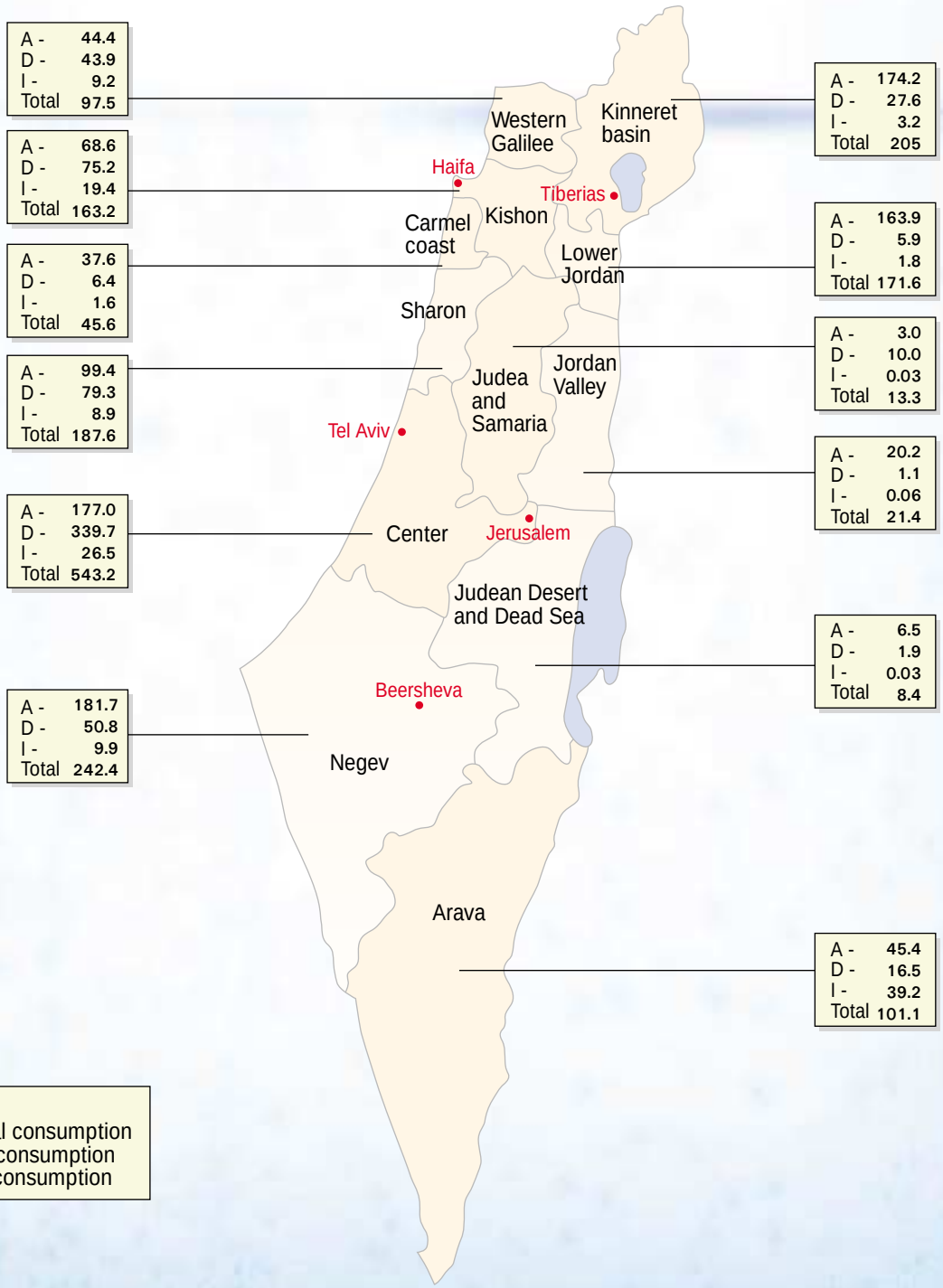
Overall water consumption

Including supply to the Kingdom of Jordan and the Palestinian Authority



	1996	1997	1998	1999	2000	2001
Palestinian Authority	30.8	34.8	37.2	40.2	39.9	39.3
Kingdom of Jordan	31.6	49.0	59.0	44.5	54.2	46.1
Domestic consumption	604.0	621.2	671.7	681.8	662.1	658.4
Industrial consumption	124.4	122.8	129.2	126.5	124.2	120.1
Agricultural consumption	1284.3	1263.8	1364.9	1264.6	1137.4	1021.9

Water consumption (MCM) according to Water Commission planning regions 2001



Legend
A - Agricultural consumption
D - Domestic consumption
I - Industrial consumption

Water consumption from 1958 (MCM)

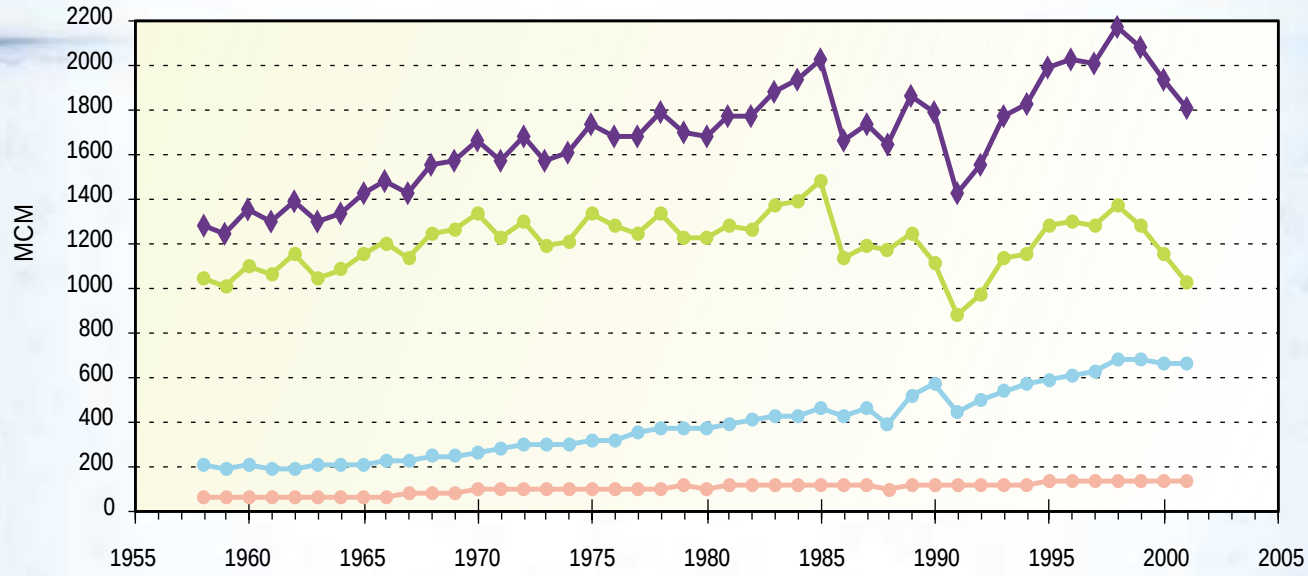
Year	Total	Agriculture	Industry	Domestic
1958	1274.3	1032.3	46.1	195.9
1959	1230.1	993.2	51.0	185.9
1960	1338.0	1087.0	54.0	197.0
1961	1287.0	1047.0	56.0	184.0
1962	1373.1	1144.2	55.1	173.8
1963	1288.4	1038.6	57.2	192.6
1964	1328.9	1075.4	54.4	199.1
1965	1418.5	1152.9	59.2	206.4
1966	1474.5	1203.0	60.8	210.7
1967	1410.6	1133.3	66.0	211.4
1968	1536.8	1235.4	70.2	231.2
1969	1563.9	1249.3	74.9	239.7
1970	1659.0	1319.0	86.3	253.7
1971	1564.8	1210.1	87.1	267.6
1972	1675.6	1297.3	92.4	285.9
1973	1565.1	1179.9	97.0	288.2
1974	1596.2	1207.1	94.4	294.7
1975	1727.8	1327.9	94.5	305.4
1976	1669.7	1271.2	91.2	307.3
1977	1673.4	1231.5	94.3	347.6
1978	1786.7	1325.0	96.2	365.5
1979	1690.1	1220.0	100.1	370.1
1980	1678.9	1211.6	99.7	367.6
1981	1769.7	1281.7	103.0	385.1
1982	1758.7	1254.6	103.2	400.9
1983	1877.8	1355.7	103.2	418.8
1984	1920.1	1388.7	109.0	422.4
1985	2024.3	1464.7	108.1	451.5
1986	1652.2	1125.3	103.8	423.1
1987	1732.7	1178.7	107.5	446.5
1988	1629.4	1157.8	83.0	388.6
1989	1850.8	1236.3	113.8	500.6
1990	1776.1	1113.0	108.4	554.8
1991	1419.9	874.8	100.4	444.8
1992	1551.3	955.3	105.8	490.1

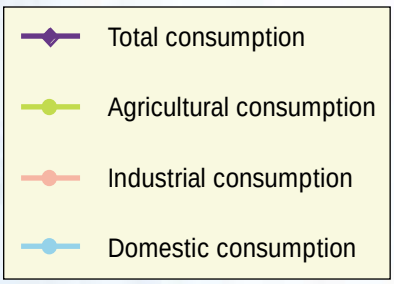
Water consumption according to objectives, 1993-2002 (MCM)

Year	Total	Agriculture (*)						Industry			Domestic(*)
		Total	Fresh water(**)	Dan Region Project	Waste-water Effluents	Brackish water	Storm-water	Total	Fresh water(**)	Marginal (***)	
1993	1762.4	1125.4	846.4	102.4	97.3	58.8	20.5	110.0	79.9	30.5	527.0
		64%	75%					**6%**	73%		**30%**
1994	1813.0	1143.6	841.4	113.3	106.0	63.8	19.1	113.9	86.6	27.3	555.5
		63%	74%					**6%**	76%		**31%**
1995	1981.3	1273.8	896.8	129.5	120.5	60.5	66.5	119.4	89.9	29.5	588.1
		64%	70%					**6%**	75%		**30%**
1996	2012.7	1284.3	892.3	140.6	129.4	76.3	45.7	124.4	94.5	29.9	604.0
		64%	69%					**6%**	76%		**30%**
1997	2007.8	1263.8	854.1	129.4	126.0	92.4	61.9	122.8	87.8	35.0	621.2
		63%	68%					**6%**	72%		**31%**
1998	2165.8	1364.9	918.3	136.2	134.8	96.4	79.2	129.2	92.6	36.6	671.7
		63%	67%					**6%**	72%		**31%**
1999	2072.9	1264.6	824.3	137.5	148.0	100.8	54.0	126.5	91	35.5	681.8
		61%	65%					**6%**	72%		**33%**
2000	1923.7	1137.4	729.1	116.6	143.1	99.9	48.7	124.2	90.2	34	662.1
		60%	64%					**6%**	73%		**34%**
2001	1800.4	1021.9	563.2	121.9	144.5	145.1	47.3	120.1	85.4	34.7	658.4
		56%	55%					**7%**	71%		**37%**

(*)The percentages represent the proportion of consumption for the objective out of total consumption.
(**)The percentages represent the proportion of fresh water out of total consumption for that objective.
(***)Most of the marginal water in the industrial sector is brackish.

Water consumption according to objectives, 1958-2001





General production

Water supply in Israel is based mainly on the pumping of water from groundwater reservoirs, from Lake Kinneret and from other surface sources, and conveyance to consumers via highly developed delivery systems.

The National Water Carrier links all reservoirs and consumers along its length and enables the water sector to be managed as a single three-basin unit.

Most of the production is by Mekorot (68%) and the rest by private producers. The permitted quantity for production is determined annually in accordance with the recommendation of the Operation Committee of the Water Commission within the limitations of the production capability.

Major Water Sources

The coastal (Pleistocene) aquifer

The coastal aquifer extends from the edge of the Judean mountains in the east to the sea shore in the west. It may be divided into three sub-regions: the southern coastal aquifer, the Dan metropolitan region, and the northern coastal aquifer (between the Yarkon and Caesarea) stretches from the Gaza Strip to Nahal Taninim in the north.

This aquifer consists of layers of calcareous sandstone (kurkar) interspersed with clay units.

It has enough storage capacity and is fed mainly by rainfall on the sandy outcrops overlying the kurkar layers. The aquifer is also artificially recharged by stormwater and wastewater effluents at selected sites - the Nahalei Menashe plant, the Shikma plant, and the recharge system at the Dan Region Sewage Reclamation Project.

The aquifer's storage capacity and geographical extension (stretching over the entire length and breadth of the coastal plain) permit its variegated utilization. The aquifer acts as a multi-annual reservoir, enabling the storage of water from rainy years for use in dry years.

The aquifer is exposed various damage of pollution: industrial, wastewater effluents, solid waste, fuel tanks, insecticides and fertilizers. Furthermore, the proximity of the aquifer to the sea is liable to allow intrusion of seawater in certain places as a result of the lowering of the water levels following excessive pumping.

Production from this aquifer which totalled 493.3 MCM in 2001.

The Mountain Aquifer

The mountain aquifer is located in the center of the country, between the Yizreel Valley in the north and the Beersheva Valley in the south; the Jordan Valley - Dead Sea in the east, and the edge of the coastal plain in the west. It may be divided into three sub-basins: the western basin, the eastern basin, and the northern basin.

The aquifer is composed of a series of limestone and dolomite rocks of marine origin, with intermediate layers of chalk and marl. The limestone and dolomite rocks are very hard, but the large degree of jointing and the existence of karstic systems allow the flow of water in the mountainous region and create a void that permits the "storage" of relatively large amounts of water. This water is of high quality and may be used for all purposes.

Production from this aquifer is done principally in the Yarkon-Taninim western basin. The natural effluents from the basin are the Yarkon and Nahal Taninim springs, as a result of which it is commonly referred to as the YarTan aquifer. Because the levels of the YarTan aquifer reached the "red lines" in 2000, it was decided to permit production in 2000 from this aquifer only in quantities corresponding to the natural replenishment in the winter of 2000-2001.

The Kinneret

Israel is poor in natural surface reservoirs. The only significant natural surface reservoir in the country is Lake Kinneret, which is fed by flows from the upper Jordan and its catchment basin, and rivers of Mt. Hermon, the Golan Heights, and the Naftali and Eastern Galilee mountains. The operational rules for utilization of water from Lake Kinneret are specified in the Water Law and its regulations, and are used to determine the maximum and minimum levels of the lake.

The permitted upper level is 208.9 m below sea level. (A higher level is liable to cause damage to numerous coastal facilities around the lake.) Until 1998/9, the permitted lower level was 213 m below sea level.

Because of the drought in the years 1999-2001, the water levels in the various aquifers dropped significantly. As a result, and in order to prevent irreversible damage being caused to the aquifers, the Water Commissioner in the autumn of 1999 permitted pumping from Lake Kinneret to be continued until a low level of 213.5 m below sea level was reached. This was reflected in the Water Law regulations. In 2000 the level dropped to 213.8 m below sea level and in the autumn of 2001 the level reached an all-time low of 214.87 m below sea level. It may be reasonably assumed that in 2002 the level will rise by 50 cm. Data on Lake Kinneret levels are provided by the Hydrological Service of the Water Commission.

The quantity of water produced in 2001 totalled 390 MCM (65 MCM of which came from boreholes in the Kinneret catchment basin). About 160 MCM were pumped from Lake Kinneret to the National Water Carrier (Sapir Station) and the remainder was consumed in the region.

Other sources of water

Two aquifers exist in the Arava region: the Arava alluvial fill aquifer and the Nubian sandstone aquifer on the edge of the Arava. These aquifers form the major sources of water supply for the region, and water is supplied, depending on its quality (fresh or brackish) to the settlements in the Arava, the Sedom Plain, and the Dead Sea Works.

Artificial reservoirs for interception of stormwater in the winter and collection of wastewater effluents are distributed throughout the country. They are used to increase the water potential for agricultural consumption during the summer months.

Additional action taken to increase the water potential is the recharge of water to the groundwater aquifer using infiltration reservoirs (direct recharge) and by boreholes.

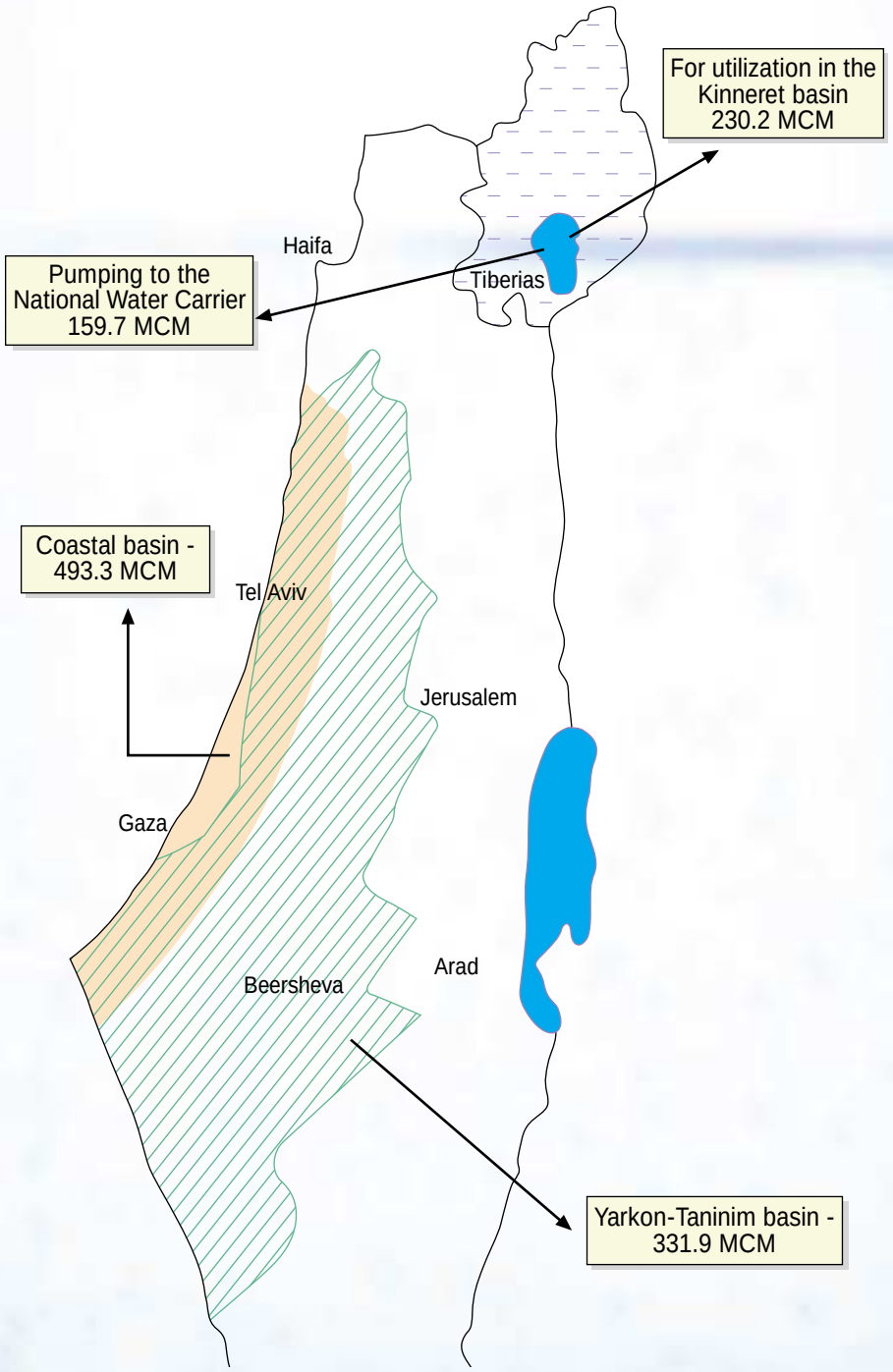
In recent years most of the recharged water is from the Dan Region Sewage Reclamation Project, recharged in a limited region in the coastal aquifer containing no fresh water wells. The process of recharge improves the effluents and brings them to a quality permitting unrestricted irrigation, including that of vegetables for human consumption.

The data appearing in most of the diagrams indicate gross production and also include data related to the utilization of wastewater effluents, even though these do not represent a natural source of water.

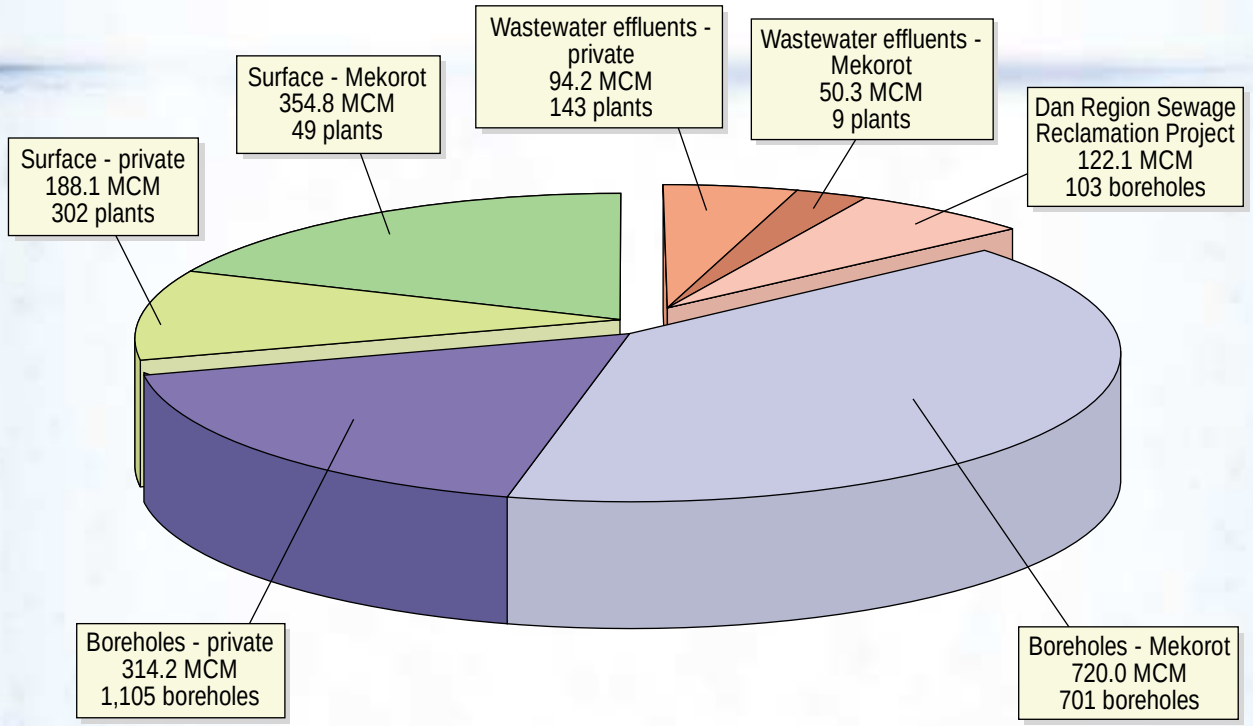
In the historical review (1958-2001) the total gross production is displayed, as well as recharge and total net production.

This review includes the production from natural water sources (groundwater, surface water) and Dan Region Sewage Reclamation Project, but does not include the production from other wastewater effluent plants.

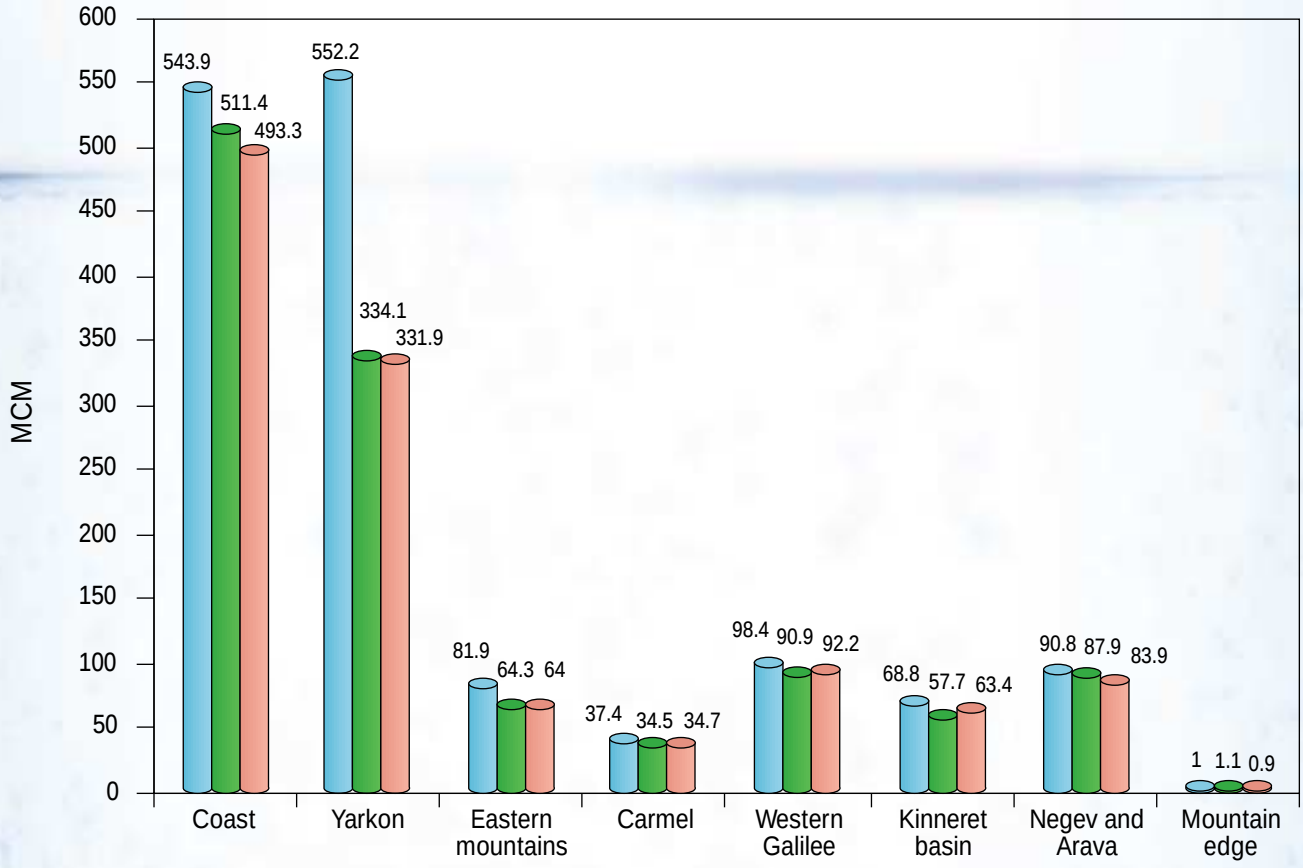
Production from principal water sources, 2001



Production by water sources 2001



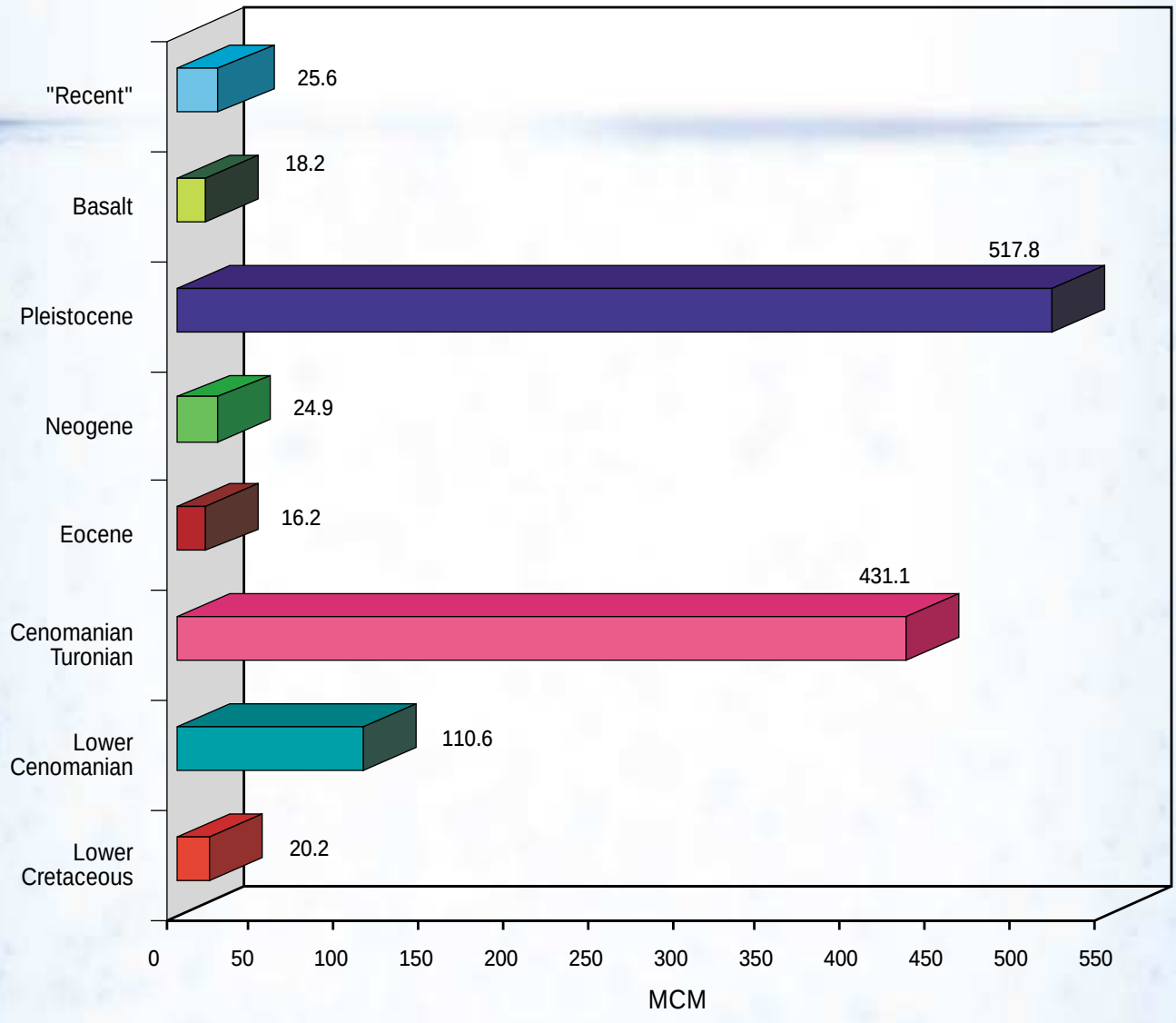
Production from boreholes by basins, 1999-2001



Total production in 1999 1,474.4 MCM
Total production in 2000 1,181.6 MCM
Total production in 2001 1,164.6 MCM

Production from the coastal basin includes that from boreholes in the Dan Region Sewage Reclamation Project.

Production from boreholes by hydrogeological units, 2001



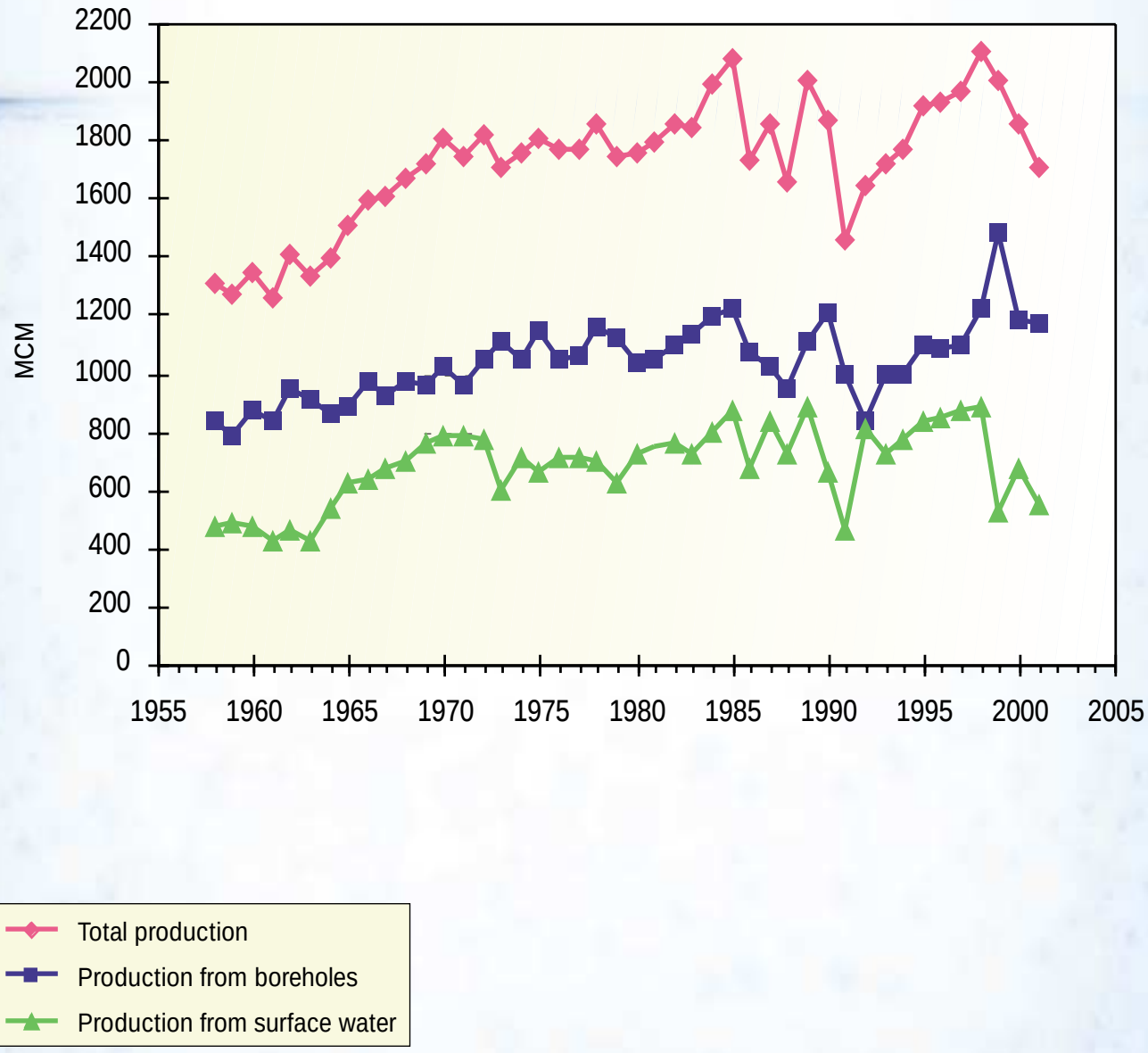
Total production - 1,164.6 MCM

The production from Pleistocene includes that from boreholes in the Dan Region Sewage Reclamation Project.

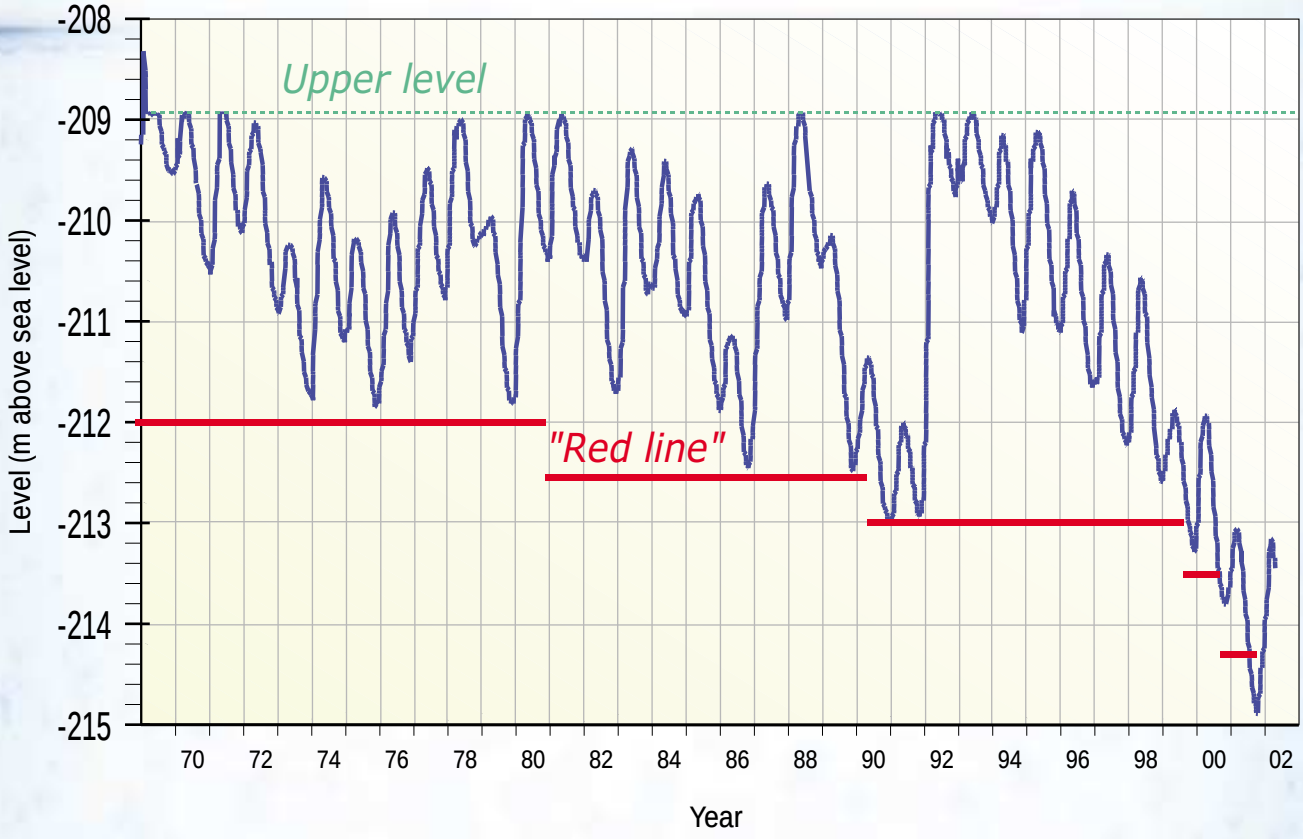
Production by water source, 1958-2001 (MCM)

Year	Total production	Total net production	Production from boreholes	Production from surface water	Recharge
1958	1303.8		833.7	470.1	
1959	1271.6		784.9	486.7	
1960	1337.9		869.8	468.1	
1961	1256.6		834.0	422.6	
1962	1407.7		950.8	456.9	
1963	1325.8		902.1	423.7	
1964	1393.2		861.9	531.3	
1965	1506.4		882.3	624.1	
1966	1595.9		966.0	629.9	
1967	1599.0		925.8	673.2	
1968	1668.4		973.6	694.8	
1969	1710.7		957.4	753.3	
1970	1805.9		1024.2	781.7	
1971	1739.5		954.2	785.3	
1972	1813.2		1043.4	769.8	
1973	1703.7		1110.6	593.1	
1974	1756.5		1042.1	714.4	
1975	1800.9		1139.5	661.4	
1976	1761.6		1048.1	713.5	
1977	1762.8		1051.6	711.2	
1978	1853.6		1161.5	692.1	
1979	1743.3		1119.6	623.7	
1980	1747.2		1028.6	718.6	
1981	1788.5		1040.3	748.2	
1982	1855.3		1092.4	762.9	
1983	1844.2		1129.1	715.1	
1984	1989.0		1191.0	798.0	
1985	2078.0		1213.1	864.9	
1986	1729.1		1064.0	665.1	
1987	1850.2		1015.7	834.5	
1988	1657.6		942.1	715.5	
1989	1997.4	1852.1	1109.9	887.5	145.3
1990	1863.0	1764.9	1209.0	654.0	98.1
1991	1450.2	1348.9	990.4	459.8	101.3
1992	1643.4	1429.5	837.8	805.6	213.9
1993	1712.2	1573.2	990.3	721.9	139.0
1994	1769.5	1617.1	996.5	773.0	152.4
1995	1918.7	1798.2	1089.2	829.5	120.5
1996	1928.3	1828.2	1081.0	847.3	100.1
1997	1966.6	1840.3	1093.3	873.3	126.3
1998	2103.7	1978.1	1222.6	881.1	125.6
1999	2002.0	1890.6	1474.4	527.6	111.4
2000	1850.7	1981.3	1181.6	669.1	130.6
2001	1707.5	1578.6	1164.6	542.9	128.9

Production by water source, 1958-2001



Kinneret level 1969-2002



Water in the agricultural sector

Water for agricultural consumption is allocated for both private and planned agriculture (Kibbutzim and Moshavim). Allocation for private agriculture began with the enactment of the Water Law, 1959, and the rationing regulations enacted in accordance with it. In the first stage recognition was given to water use rights that had existed when the law was promulgated. This was done by photographing the agricultural area, its designation, and the quantity of water consumed at that time. Subsequently, water use norms were established for various crops, and the norms multiplied by the crop area determined the water quota to the farmer.

The allocation of water to planned settlements was determined according to the means of production of land and water and according to units defining the maximum size of the settlement. The maximum allocation of water to the settlement is equal to the number of planned farming units multiplied by the quota per unit.

Development of the agricultural sector, as well as the drought years experienced have dictated modifications and revisions in the allocation of water to agriculture. Since 1986 the Water Commission has adopted a policy of cuts in the allocations of fresh water for agriculture. The cuts have been made mainly in the three-basin national system – Lake Kinneret, the coastal aquifer, and the Yarkon-Taninim aquifer, together with the sources feeding them.

The regions of the Arava, Jordan Valley, Beit She'an, and Harod Valley, which are not connected to the three-basin system, function as a closed water system having no interrelationship with the national system. In general, no cuts in the allocation of fresh water for agriculture have been made in these regions.

Since 1999, which marked the beginning of a series of drought years, cuts for agriculture for each farm have been made according to its crop composition. The cuts range from 20% to 70% of the basic allocation (1989 quantity).

In order to minimize the damage caused by the cuts, the extent of the cuts has been determined according to the various kinds of crops.

The minimum cut applies to perennial crops (orchards) and to capital-intensive crops (greenhouses). The maximum cut has been determined for cotton and field crops.

The extent of the cuts for the various crops was determined as follows for 2001: livestock – 0%; flowers in greenhouses – 30%; livestock for fattening; orchards, citrus fruits, and vegetables in greenhouses – 35%; flowers in net houses – 40%; bananas and fishponds – 50%; vegetables – 70%; fodder – 75%; field crops – 100%.

The extent of the cuts for each consumer was derived by weighting of the cut for his basket of crops.

The water policy aims to recycle treated wastewater effluents for agricultural use. Recycling of effluents serves two purposes:

- Prevention of health hazards to the environment and to the water sources by utilizing the effluents for irrigation, instead of their uncontrolled discharge.
- Directing the fresh water that is currently used for agriculture and industry to urban use.

Encouragement of the use of effluents takes the form of significantly reduced tariffs. These tariffs are also tiered, so that their price drops with increasing consumption. Furthermore, during drought years, when the quantities of fresh water for agricultural use are considerably cut, no cuts are made in the quantities of effluents.

In 2000 and 2001 a minimal cut (10%-20%) was made in the allocations of effluents from the Dan Region Sewage Reclamation Project and the Kishon complex, for operational reasons. In recent years the Water Commission has operated a fund intended mainly to encourage and support the construction of plants for recycling of effluents for agricultural use. Established with private initiative, these plants would be aimed at replacing fresh water with wastewater effluents.

It should be emphasized that the operating policy of the effluent plants states that as far as possible these plants should not be reinforced with fresh water, particularly in light of the drought years. Indeed, since 1999 not a single drop of fresh water has been added to the Dan Region Sewage Reclamation Project, the Hefer Valley plant, the Hadera plant, and the Latrun plant. In the Kishon Complex, the reinforcement was reduced and was stopped entirely in 2000.

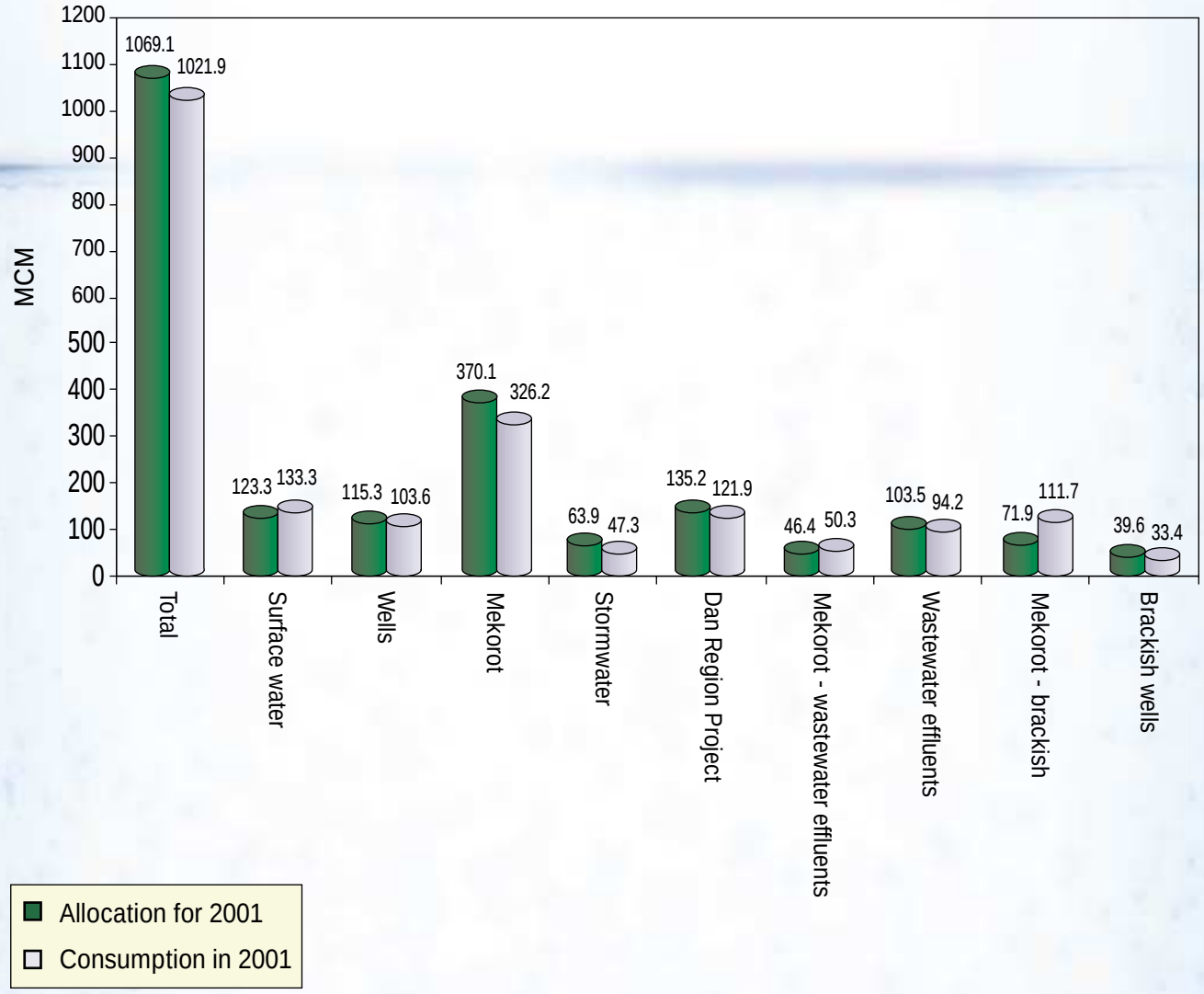
A direct result of this policy was the reduction in consumption of water from the Dan Region Sewage Reclamation Project and from other effluent plants in 2000. However, in 2001 a trend towards an increase in consumption of effluents as a result of the increased production capacity of the plants became evident. The increase in utilization of "real" effluents (without the addition of fresh water) in 2001 relative to 1999 totalled 35 MCM.

In 2001, as a result of the change in the definition of water quality by Mekorot, a significant drop in the consumption of fresh water became noticeable, together with an increase in the consumption of brackish water. Most of the water consumption by the Beit She'an and Afek consumers and a number of consumers in the Negev was from 2001defined as consumption of brackish water.

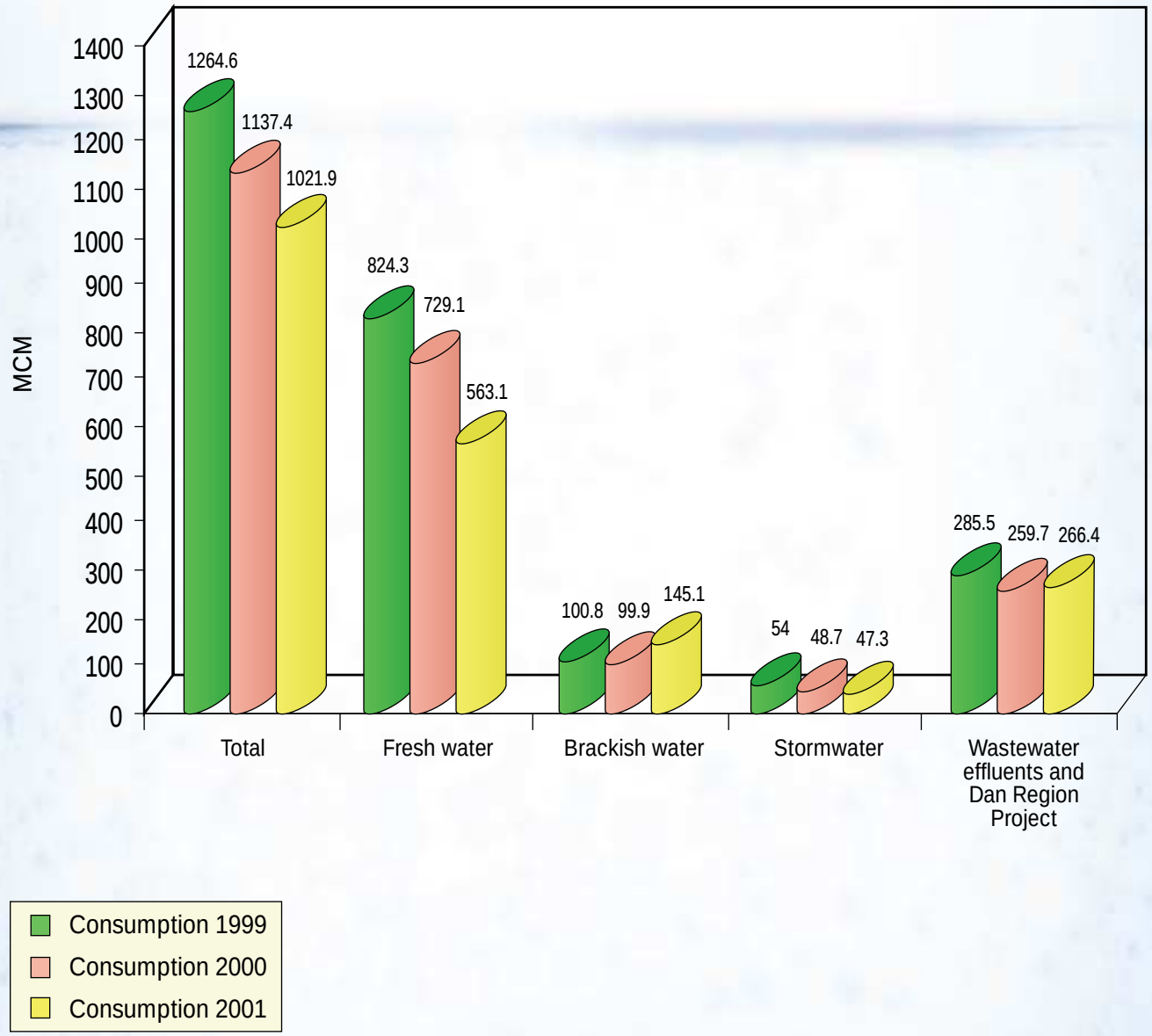
In addition to the above administrative change, a real drop occurred in the consumption of fresh water for agriculture. This drop in consumption can be explained by the *Shmita* year that fell in 2001[1], as well as by the program for foregoing the right to fresh water that encouraged farmers to receive financial compensation for non-use of water, the replacement of fresh water by wastewater effluents, and more intensive supervision and enforcement.

1. According to Jewish law, the seventh year in a seven-year cycle during which land in Israel must lie fallow.

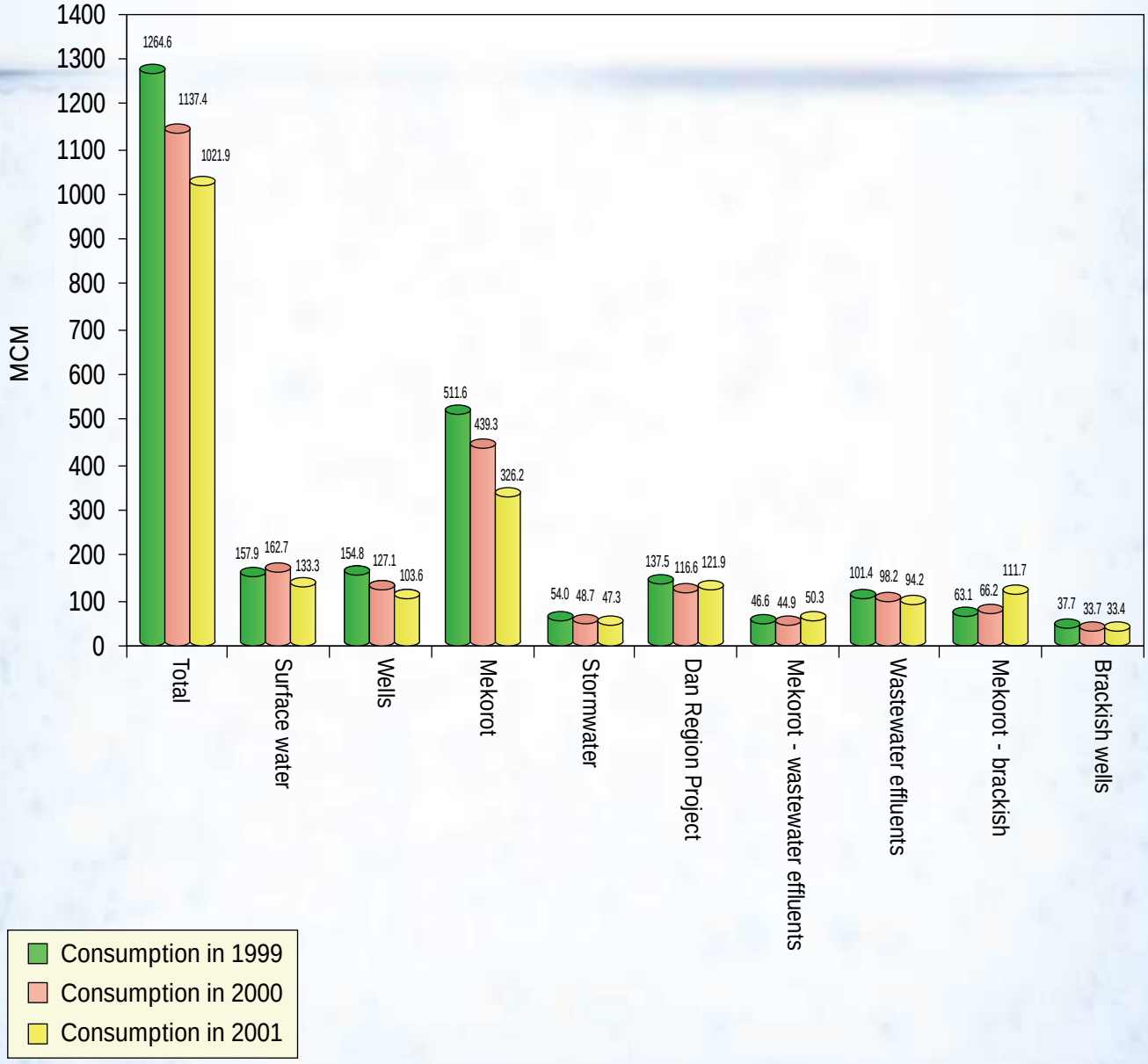
Agriculture: water allocation/consumption by quality, 2001



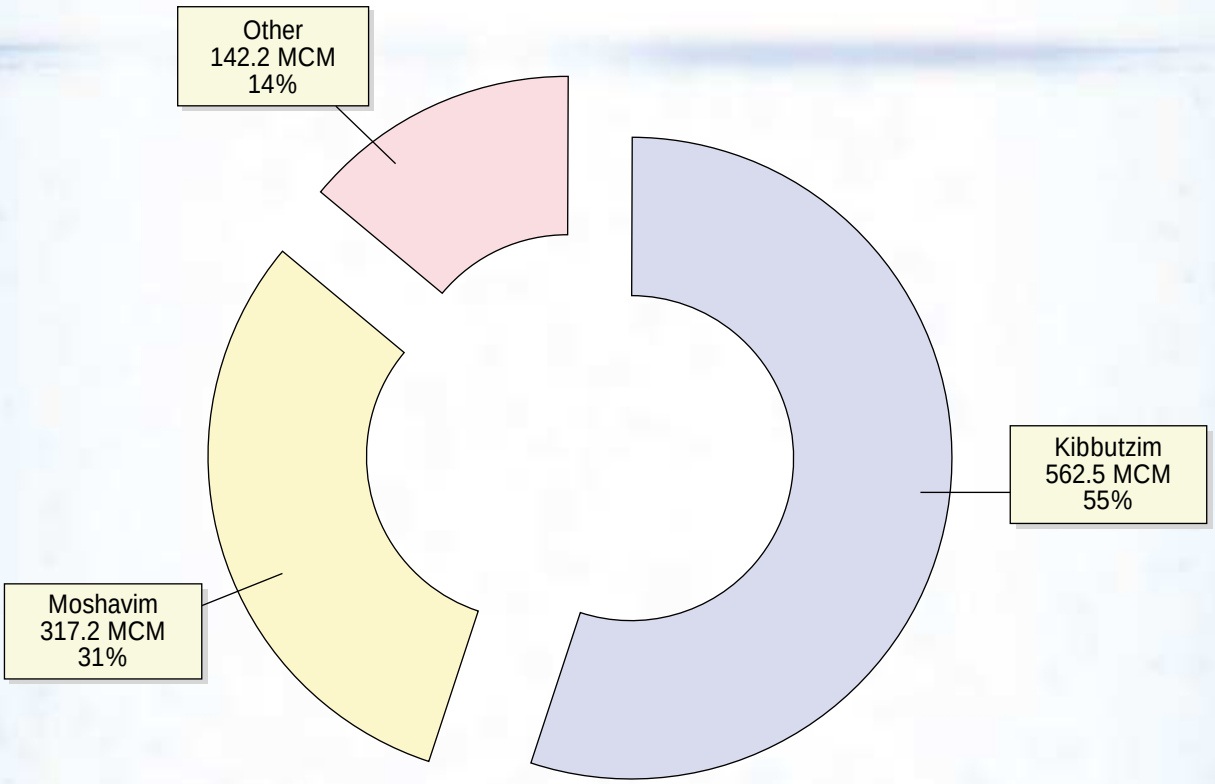
Water consumption in agriculture by quality, 1999-2001



Water consumption in agriculture by quality, 1999-2001

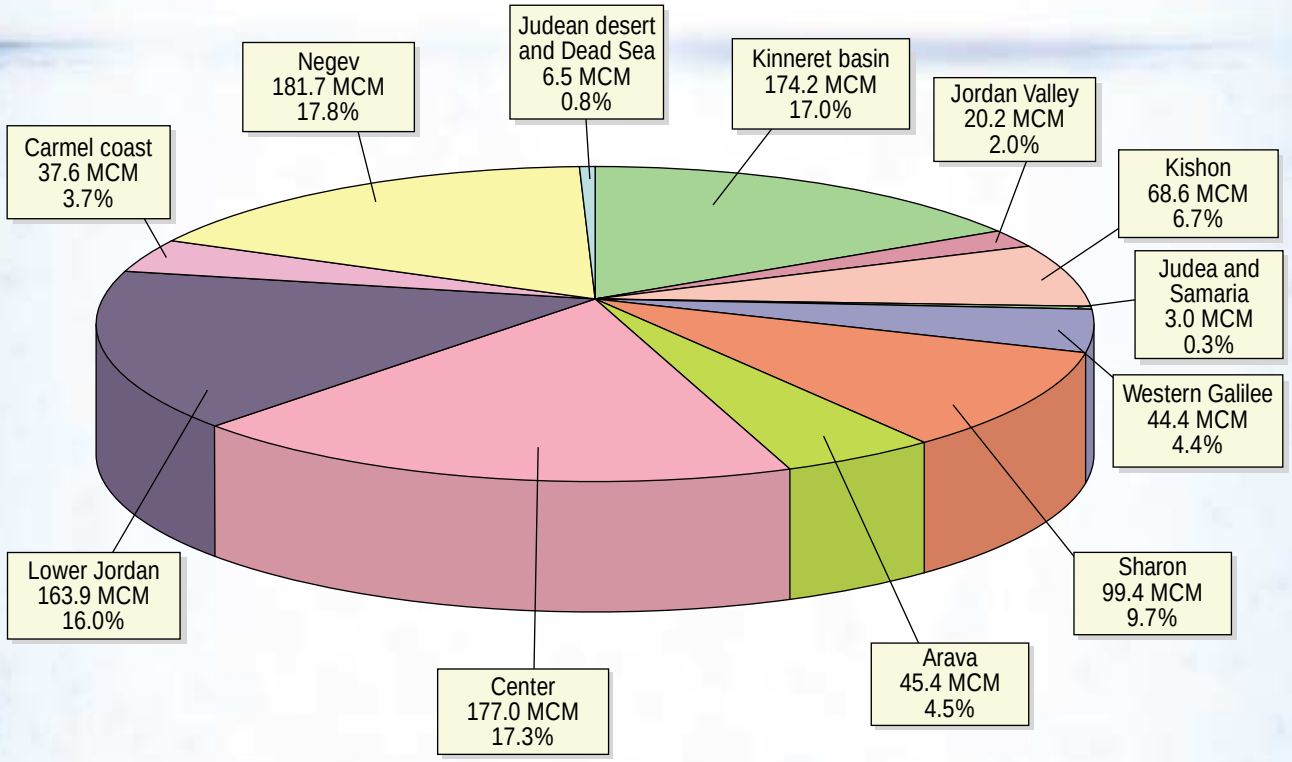


Water consumption in agriculture by type of settlement, 2001



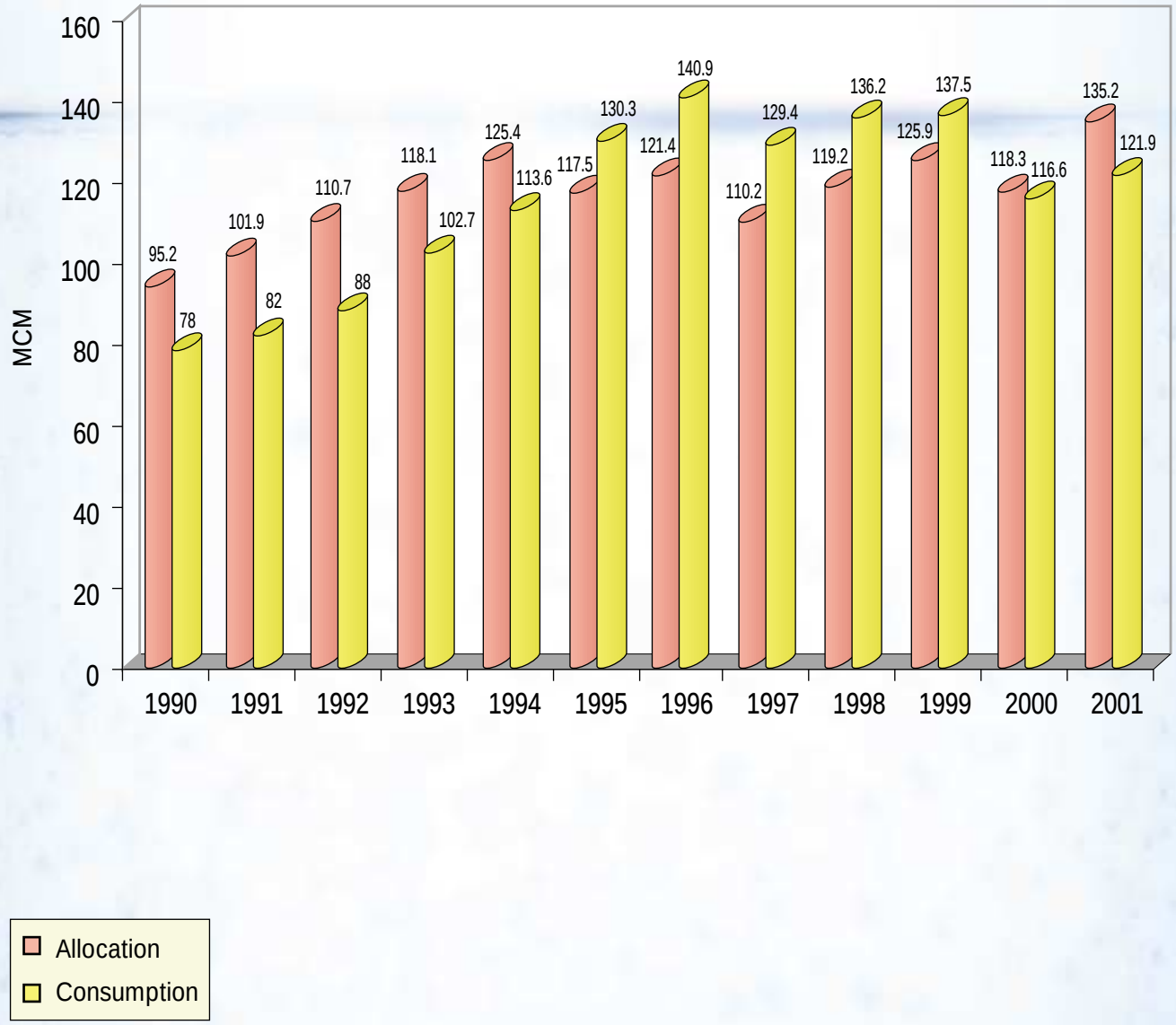
Total 1021.9 MCM

Water consumption in agriculture by Water Commission planning regions, 2001

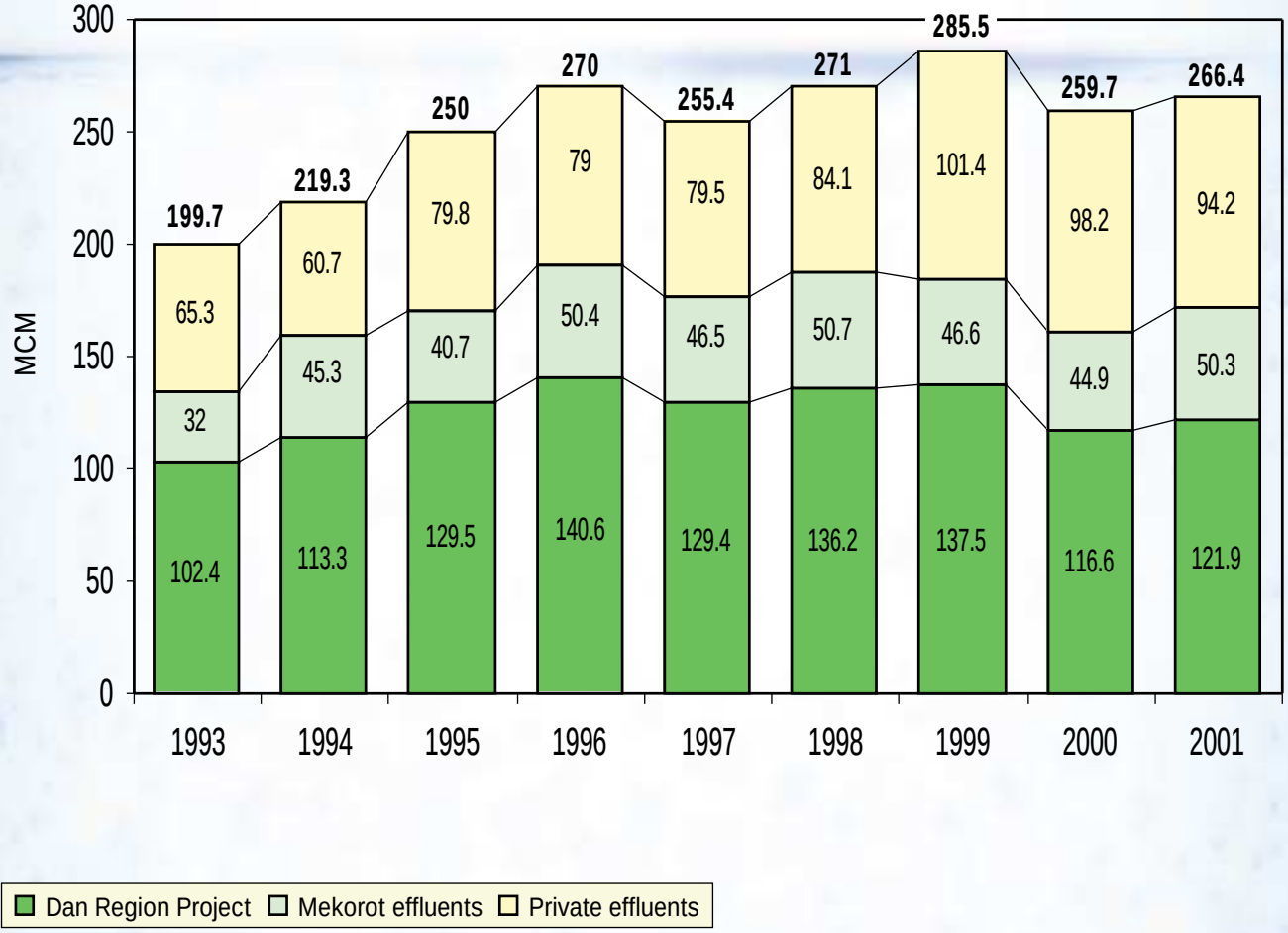


Total 1021.9 MCM

Allocation/consumption of water from the Dan Region Sewage Reclamation Project

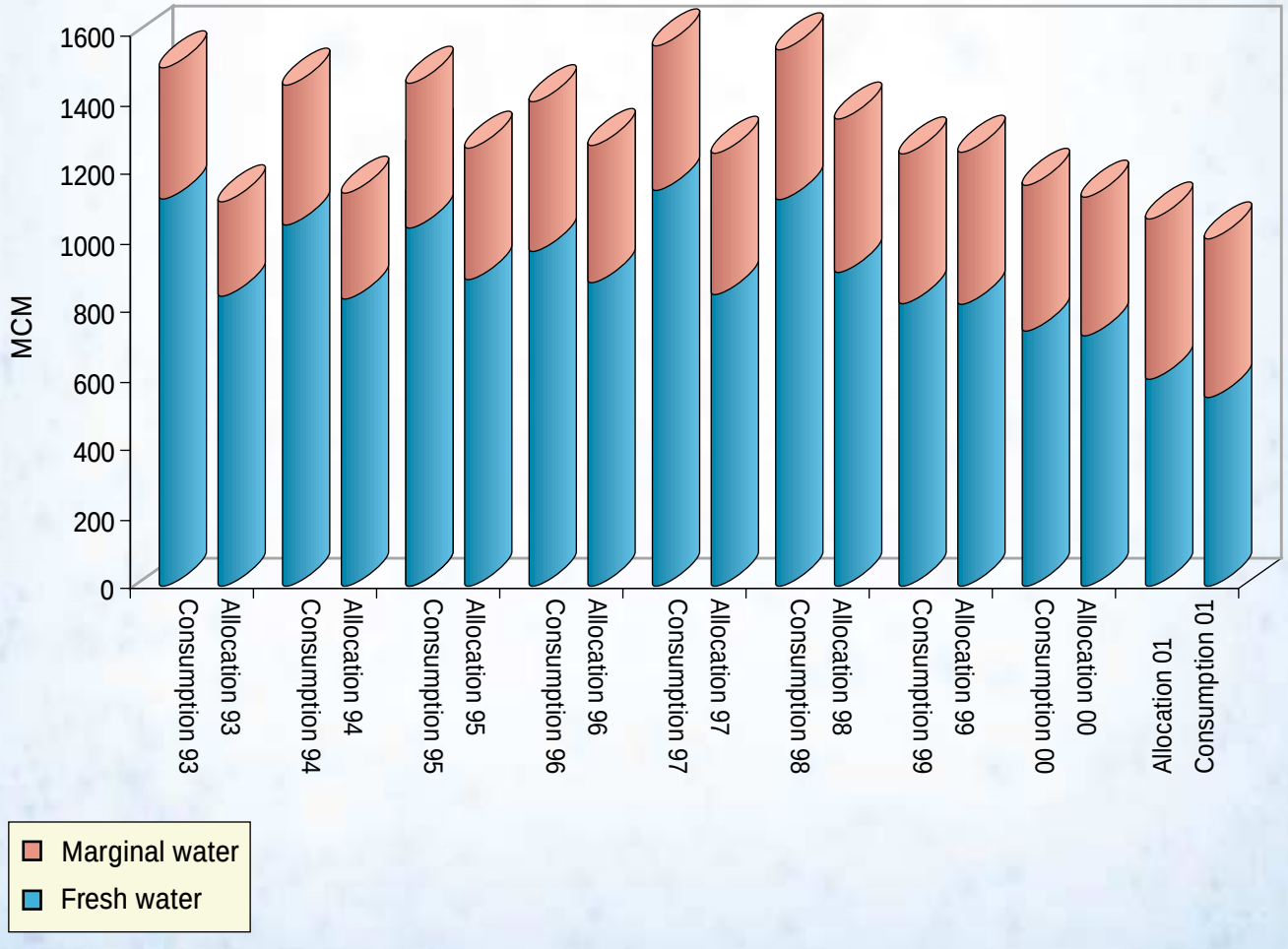


Consumption of wastewater effluents in agriculture, 1993-2001



Allocation/consumption in agriculture, 1993-2001 (MCM)

Year	Allocation			Consumption		
	Fresh water	Marginal water	Total	Fresh water	Marginal water	Total
1993	1132.7	374.5	1507.2	846.4	279.0	1125.4
1994	1056.1	400.9	1457.0	841.4	302.2	1143.6
1995	1034.8	394.8	1429.6	896.8	377.0	1273.8
1996	985.9	423.2	1409.1	892.3	392.0	1284.3
1997	1150.4	421.2	1571.6	854.1	409.7	1263.8
1998	1130.9	434.9	1565.8	918.3	446.6	1364.9
1999	823.7	439.3	1263.0	824.3	440.3	1264.6
2000	755.8	433.7	1189.5	729.1	408.3	1137.4
2001	608.7	460.4	1069.1	563.1	458.8	1021.9



Water in the Industrial Sector

Water according to the industrial classification is allocated by law to factories whose annual consumption for manufacturing processes exceeds 5,000 m3. The water tariff for industry is higher than that for agriculture but lower that that for domestic consumers.

Water is allocated on an individual basis for each factory. A factory does not automatically receive the quantity of water it requests. The process of checking the eligibility for water allocation for a factory includes examination of the use of water in the production processes and checking the possibility of supplying lower grade water (non-potable) for factories and processes that may use it.

The magnitude of the allocation is based on the maximum quantities of consumption (norms) per product unit, for use of the water in the production process, and subject to the method of treatment of the factory wastewater. The Water Commissioner is authorized by law to demand that industrial water consumers dispose of their wastewater in accordance with standards that ensure preservation of the environment, prevent pollution of water sources, and enable recycling for irrigation.

Consumption in industry in recent years has ranged from 120 to 130 MCM per year, of which 30% is marginal (mainly brackish) water. The reduction in consumption in the years 2000 and 2001 reflects the efforts towards improved efficiency and the action taken to recycle factory water in industrial plants (as well as the economic depression and the reduction in industrial activity).

About half of the industrial consumption is accounted for by chemical factories. The food industry accounts for a further 18% of the total consumption, and the rest is divided between construction and quarrying, textiles, oil refineries, Israel Electric Corporation (IEC), paper and paper products, the high-tech sector, and the metal industry.

When dividing the factories into industrial sectors, metal coating factories were grouped with the chemical industry, while military and Ministry of Defense plants were included in the metal industry.

Most of the water consumption (45%) is in the southern part of the country, from Kiryat Gat southwards. The trend of moving factories from the Dan metropolitan area to the periphery is reflected in the reduction of the proportion of industrial consumption in the center of the country from 27% in 1998 to 25% in 2001. In the northern part of the country, north of Hadera, the quantity of water consumed represented 30% of the total.

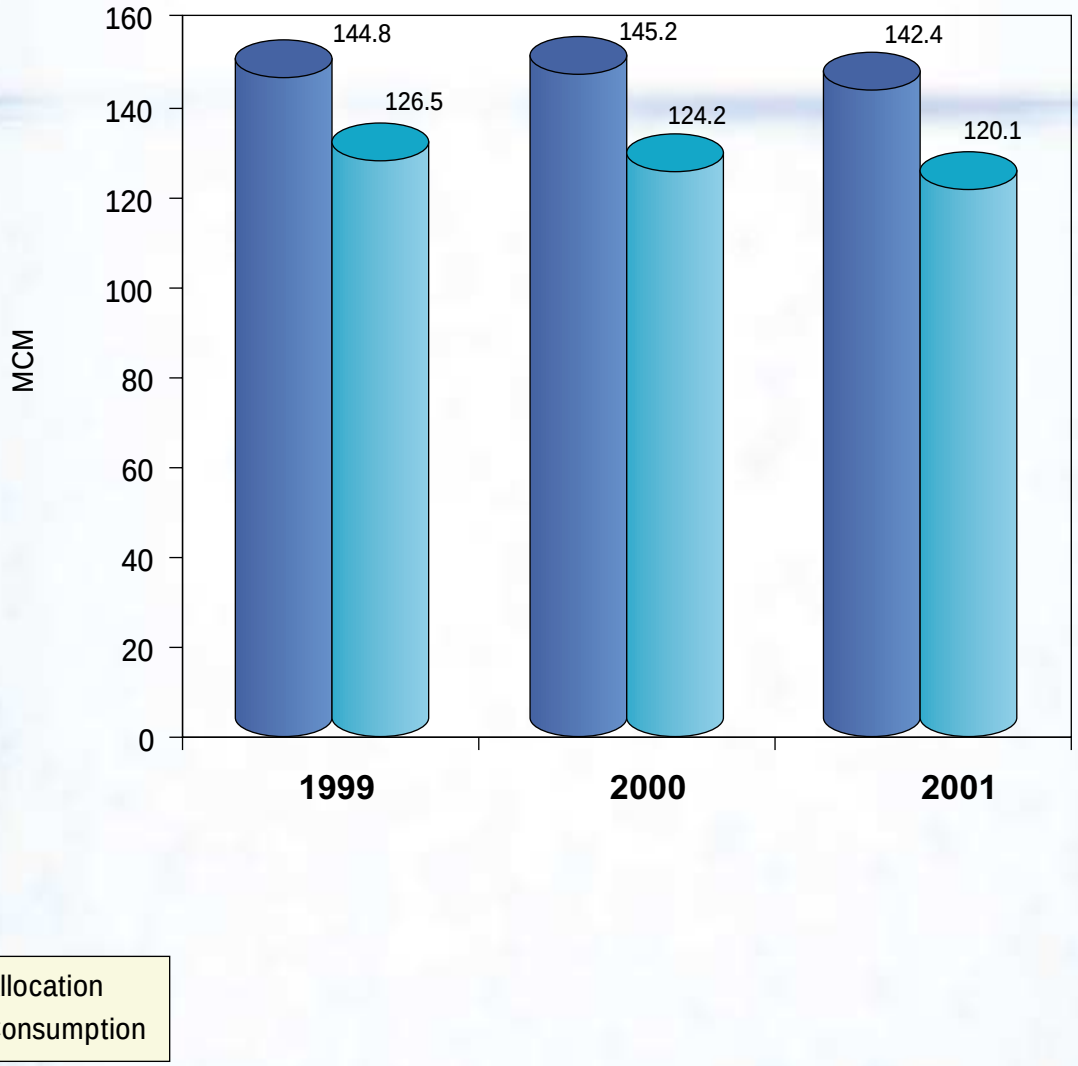
The Water Commission's policy is to encourage the use of low grade water in industry. This policy is reflected in the increased consumption of brackish water in the chemical industry. Efforts are being made to incorporate the use of effluents and brackish water in several quarries. Although at this stage only small quantities are involved, it is hoped that examination of the effect of use of low grade water on the quality of the product over time will show that it is possible to significantly increase the use of this kind of water instead using fresh water.

The factories' willingness to introduce low grade water depends on the quality and availability of the water. A large-scale project involving effluent consumption in cooling towers of power stations in the country is beginning to take shape. The predicted consumption of effluents at the Gezer site is about 5 MCM, and another three or four similar units are expected to be constructed at various sites throughout the country. At the same time the possibility is being examined of constructing a cooling system based on dry cooling (air) in these power stations.

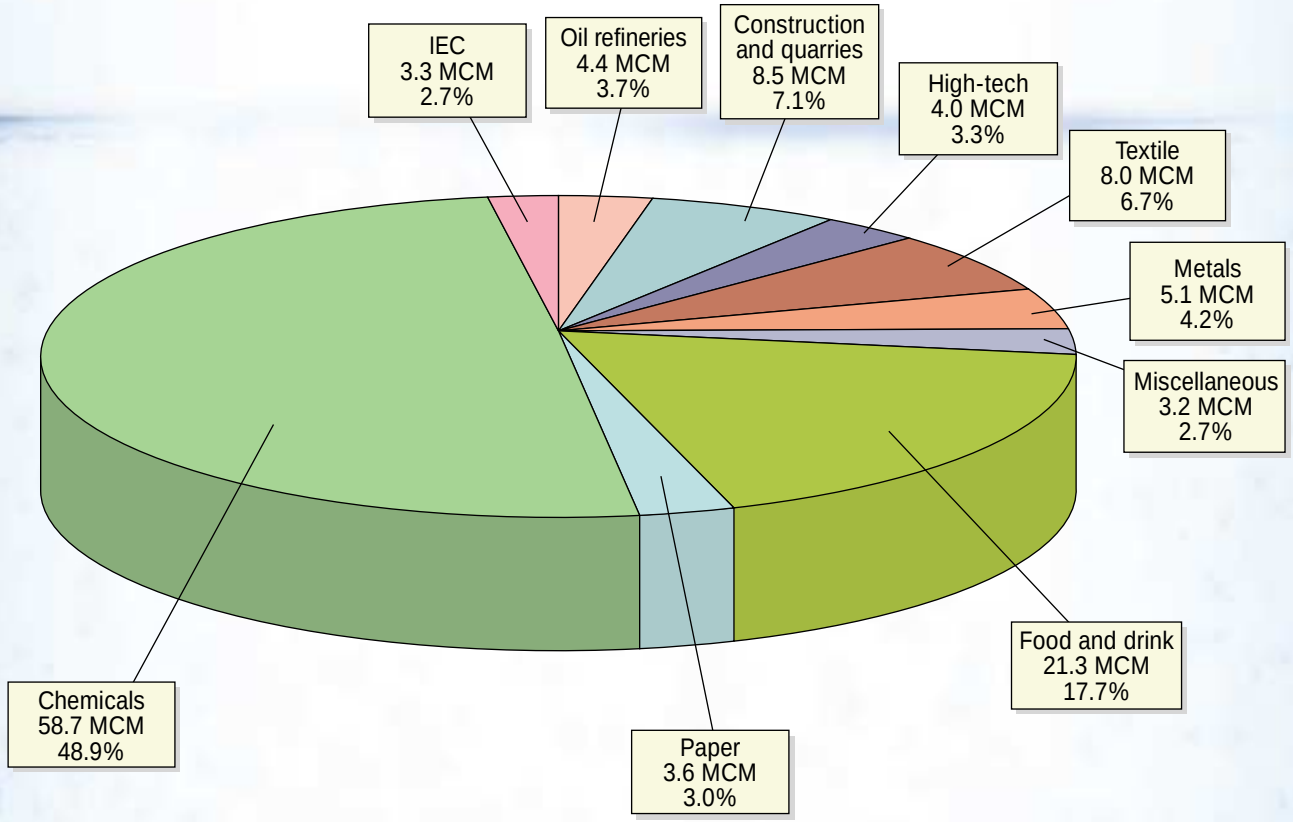
Reduction of water consumption in factories generally also leads to reduction in energy and chemical consumption. Recommended steps to reduce water consumption in factories are:

- Metering of water flow in the factories and prevention of localized wastage of water.
- Replacement of water-cooled systems with air-cooled ones.
- Improved operation of cooling water systems - minimal drainage of these systems.
- Increasing the efficiency of reverse osmosis (RO) systems.
- Use of brines from RO systems for flushing and internal purposes.
- Correct operation of the steam system - reuse and minimal drainage of condensate, monitoring, and routine servicing of steam traps.
- Reduction of water consumption for cleaning purposes. Switching to water-free cleaning (sweeping and vacuum cleaning).
- Recycling of water in the factory; routing of the water from the last flushing of the product to the first flushing in the process; recycling of process water in clarifiers in concrete production plants; recycling of process water in the metal coating industry and in the textile industry.

Industry - consumption and allocation of water

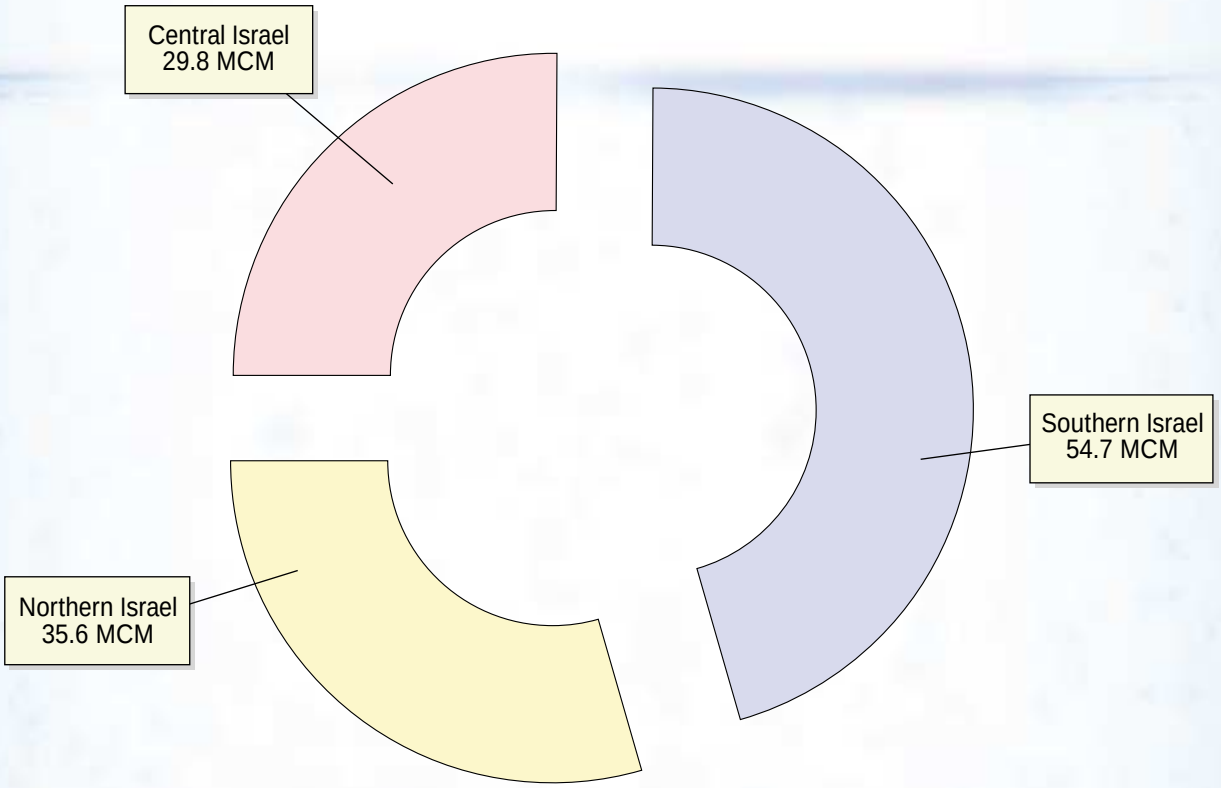


Water consumption in industry by industrial sub-sectors, 2001



Total 120.1 MCM

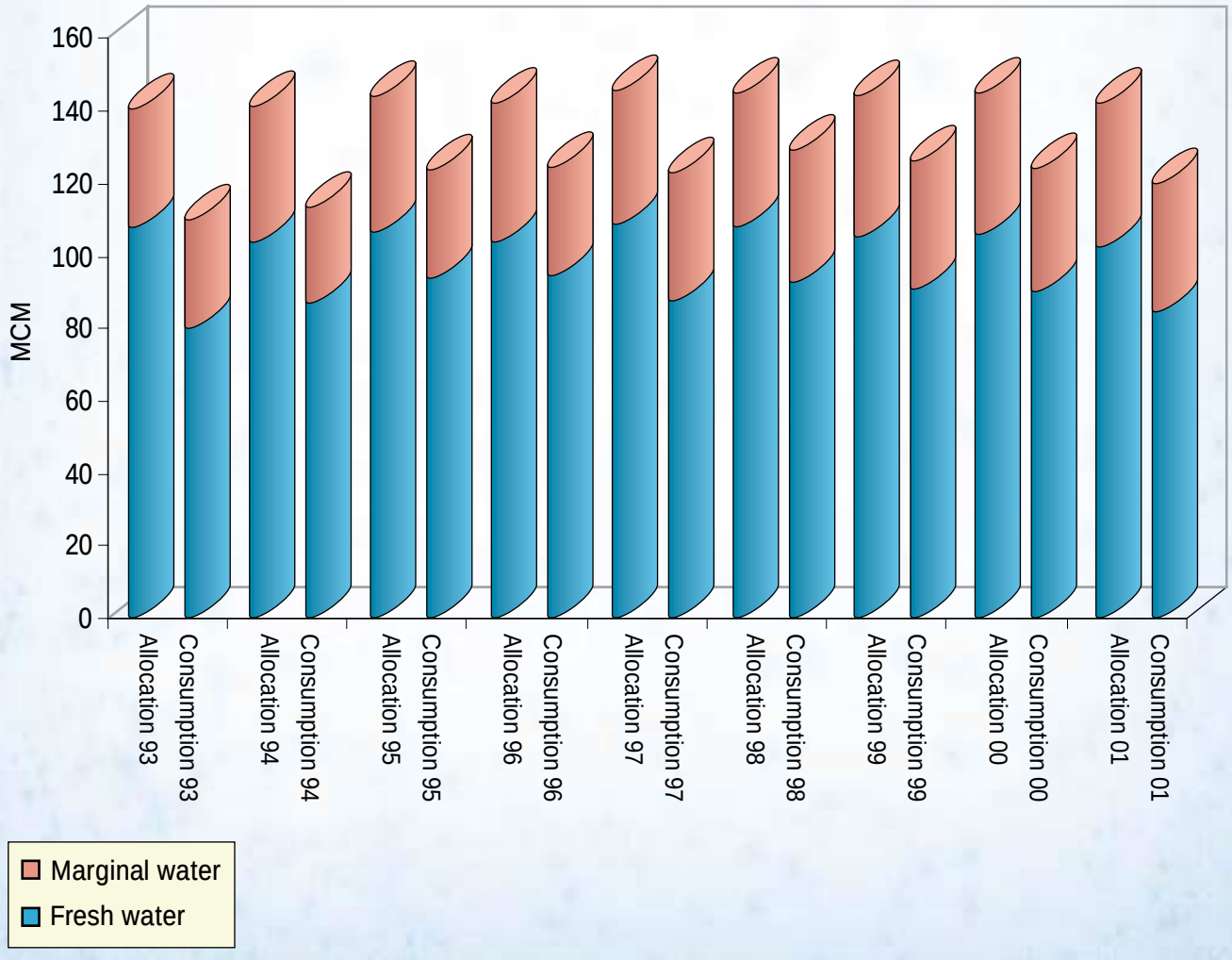
Water consumption in industry - nationwide distribution, 2001



Total 120.1 MCM

Allocation/consumption of water in industry, 1993-2001 (MCM)

Year	Allocation			Consumption		
	Fresh water	Marginal water	Total	Fresh water	Marginal water	Total
1993	107.8	33.4	141.2	79.9	30.1	110.0
1994	103.1	38.2	141.3	86.6	27.3	113.9
1995	105.9	38.2	144.1	89.9	29.5	119.4
1996	103.9	38.4	142.3	94.5	29.9	124.4
1997	108.2	37.9	146.1	87.8	35.0	122.8
1998	108.7	36.8	145.5	92.6	36.6	129.2
1999	105.1	39.6	144.8	91.0	35.5	126.5
2000	105.5	39.6	145.2	90.2	34.0	124.2
2001	102.7	39.7	142.4	85.4	34.7	120.1



Water in the Domestic and the Municipal Sector

Consumption in this sector consists mainly of urban and public consumption in local authorities (Municipalities and local councils), domestic consumption in rural settlements (Kibbutzim and Moshavim), and domestic consumption in community settlements and minorities villages.

Water consumption by consumers such as IDF camps, hotels, educational institutions and service stations, which do not receive water through local authorities and in which the water is not used for agricultural or industrial purposes, is also included in this category.

The local authority acts as a water supplier for domestic consumption within its region. This consumption includes use of water for domestic purposes, for gardens, parks, general services, workshops, commerce, etc.

Since 1995 the production license of the local authority does not specify the quantity of water allocated for domestic consumption. The local authority is empowered to consume water for domestic consumption according to its needs.

The population living in local authorities represents about 91% (about 5.9 million people) of the population of the country.

Consumption in local authorities in 2001 totalled 541.3 MCM, including about 60 MCM in losses.

Water losses or unaccounted for water defined as the difference between water received (the total quantity of water produced or purchased by the local authority) and the quantity of water sold for domestic consumption in a specified period of time. A local authority in which the losses exceed 13%, whether these are administrative losses (lack of water meters) or a result of leaks, is charged a special fee.

Consumption data of the local authorities are sent directly to the Water Commission in digital form by the Local Authorities Automation Company. This method of reporting provides a reliable picture of the water consumption data for different purposes, minimizes errors, and enables real-time monitoring of water losses in the authorities. In recent years the local authorities have verified the consumption data received from the Automation Company before sending them to the Water Commission.

The average per capita water consumption in the domestic and public sector was 101.2 m3 in 2001. The per capita consumption is defined as the total water consumption in the domestic and public sector for a specific year, divided by the number of residents in the country in that year.

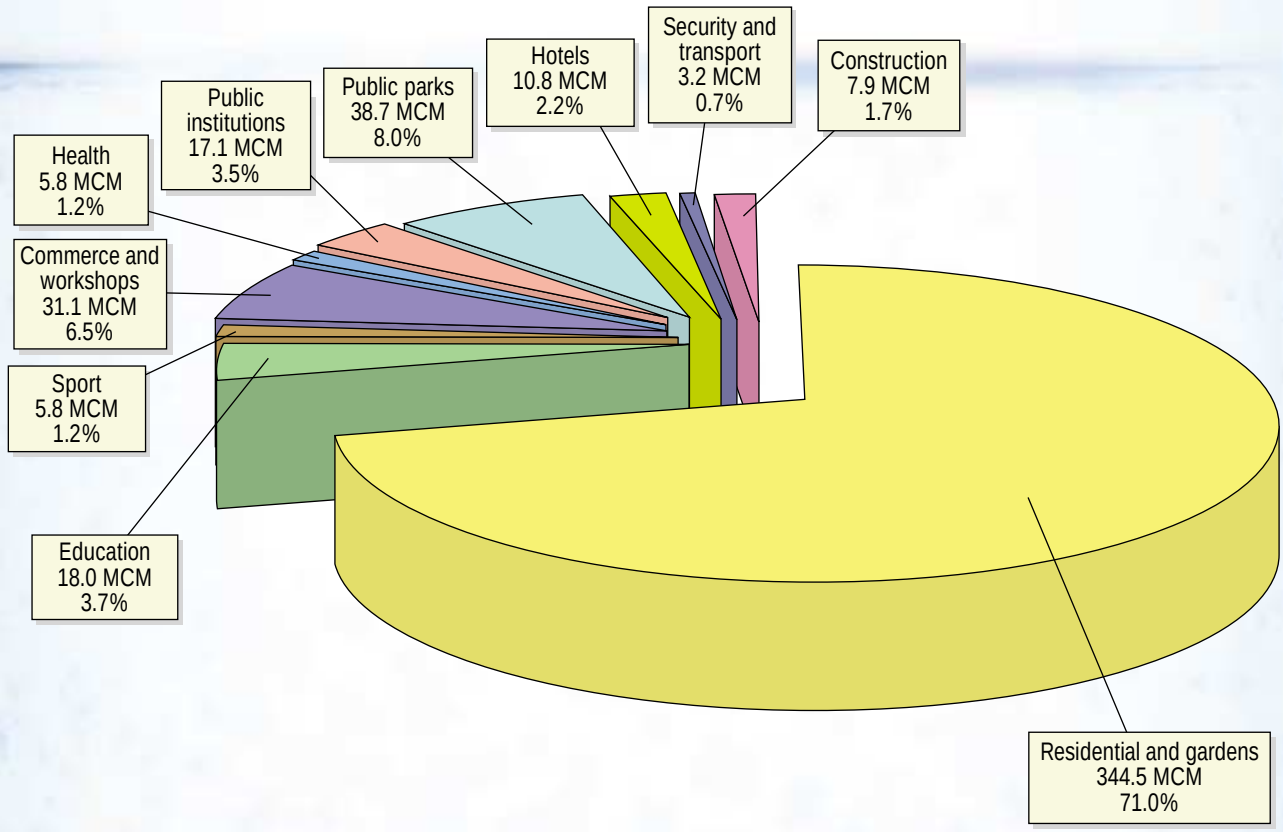
The Water Commission and the Ministry of National Infrastructures, in cooperation with the water sector manager in the Ministry of the Interior, have been very active in drought years in order to achieve savings in water consumption and reducing the magnitude of losses in local authorities and in general. In the future it will remain worthwhile to continue to use water efficiently because of the significantly low cost of these activities as compared with the cost of the alternative source of water (desalination).

The range of activities employed in order to reduce consumption includes education, public awarness campains and information, installation of water-saving devices (dual-capacity lavatory cisterns and water saving devices) in private homes, public buildings, hospitals, hotels, and IDF camps. Care must be taken to install water meters as required by law, in order to significantly reduce losses of water. Emphasis is also placed on new legislation that prohibits the washing of cars and paved areas with running water and required the recycling of wash water in car wash facilities.

Recommendations for water-saving gardening include replacement of water-intensive plants with water-conserving ones; restricting watering to the early hours of the morning or to the evening or night only; covering the soil with dry materials (gravel, pebbles, etc.); and installing automatic irrigation systems.

Action of this kind has caused a reduction in general domestic consumption. Although there is no decrease in natural growth a trend towards reduction of per capita consumption is apparent.

Distribution of water consumption in local authorities by type of use, 2001



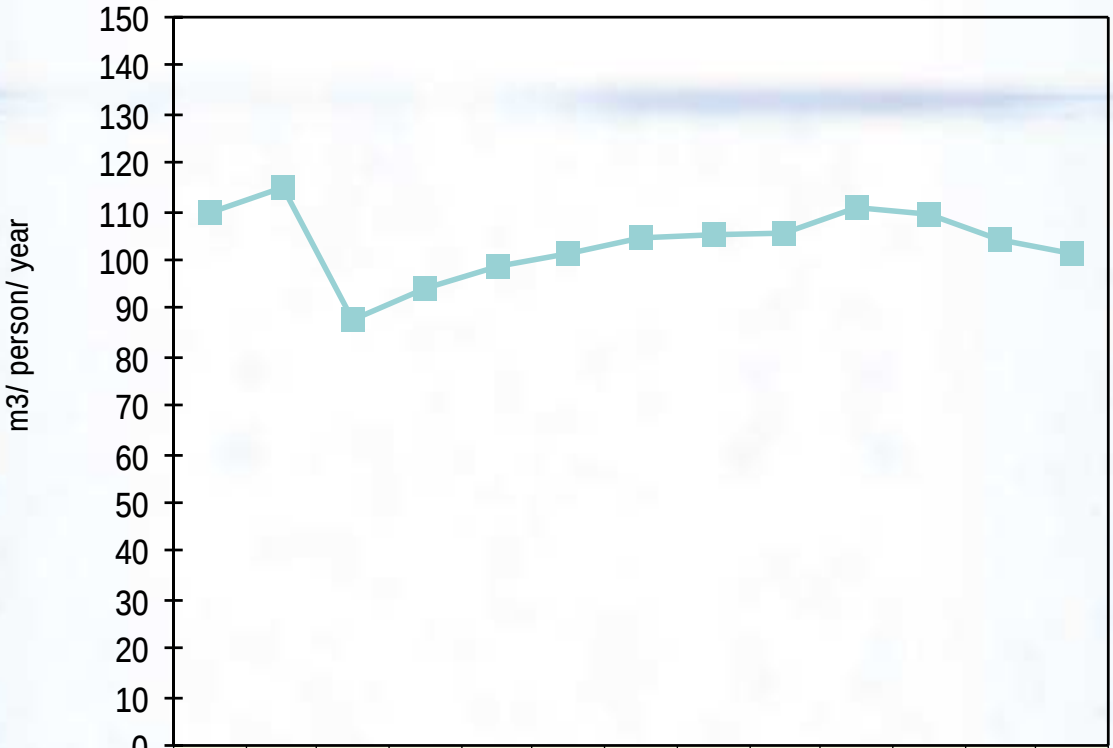
Total 482.9 MCM

Per capita water consumption in the Domestic and the Municipal Sector

Consumption - General

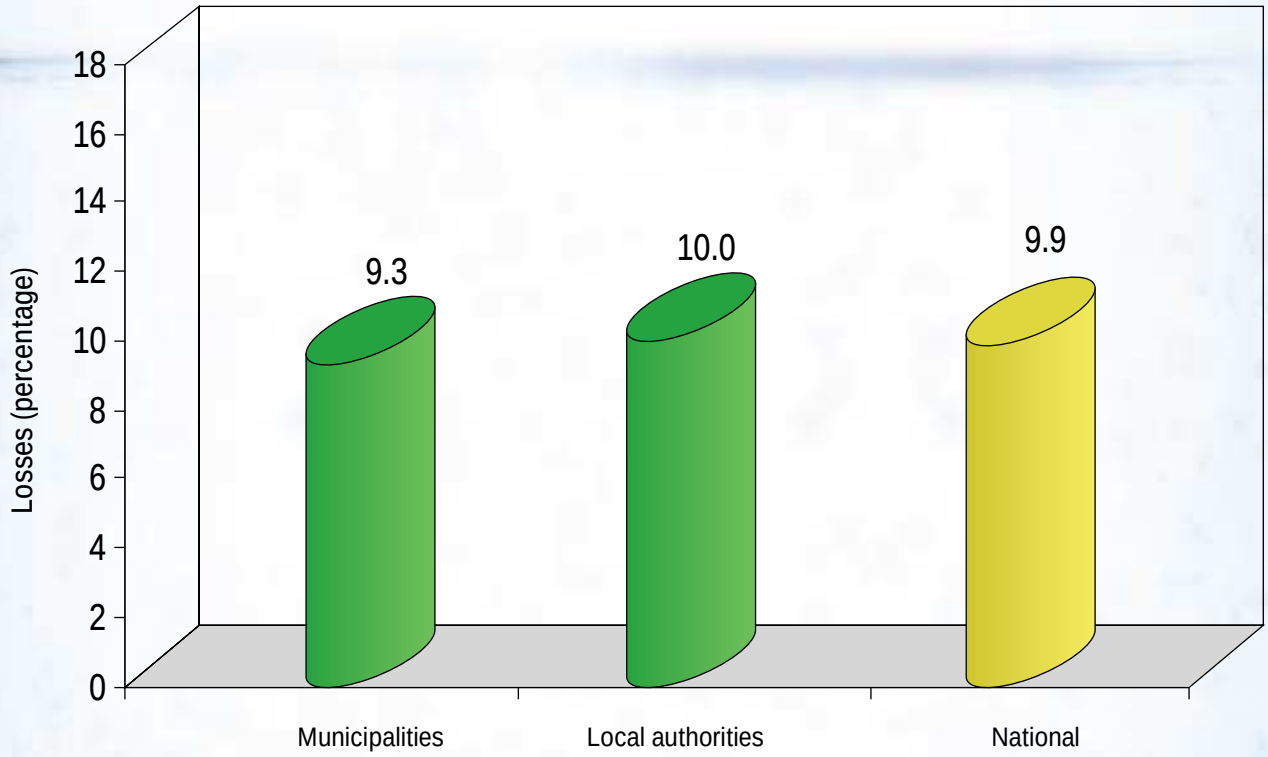
Year	Population (thousands)	Water consumption (MCM)	Per capita consumption (m3)
1990	4,821.7	554.8	115.1
1992	5,195.9	490.1	94.3
1994	5,471.5	555.5	101.5
1995	5,612.3	588.2	104.8
1996	5,757.9	604.0	104.9
1997	5,900.0	621.2	105.3
1998	6,041.4	671.7	111.2
1999	6,209.1	681.8	109.8
2000	6,369.3	662.1	104.0
2001	6,508.8	658.4	101.2

Per capita water consumption in the Domestic and the Municipal Sector



1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
109.8	115.1	87.9	94.3	98.9	101.5	104.8	104.9	105.3	111.2	109.8	104.0	101.2

Extent of losses in local authorities, 2001



Extent of losses in local authorities, 1996-2001

With a View to the Future

The future demand of water for the various sectors is estimated periodically. It is taken into account in the regional and national water balances and in development programs with the aim of finding solutions that will permit transition from a state of shortage to one characterized by the restoration of reservoirs and a capability for supplying all water needs for domestic and industrial use, tourism and nature, at high level of reliability.

The consumption forecast for 2010, prepared as part of the master plan for development of the water sector (Planning Division, Water Commission, June 2002) also includes, apart from agricultural, industrial, and domestic consumption, the supply of water for nature and landscaping (environment) needs and for external bodies (the Kingdom of Jordan and the Palestinian Authority).

Year	Population of Israel (millions)	Water consumption (MCM)												
		Domestic	Industry				Agriculture				PA	Jordan	Nature and Landscaping	Total Consumption
			Fresh	Effluents	Brackish	Total	Fresh	Effluents	Brackish	Total				
2001	6,509	658	85	0	35	120	563	266	145	974	39	46	0	1,837
2005	6,789	784	103	0	37	140	530	403	129	1,062	70	35	26	2,417
2010	7,300	876	110	13	44	167	530	496	96	1,122	81	35	50	2,531

Agricultural Consumption Forecasts

Agriculture is expected to retain about 4,000 MCM of cultivated land, of which about half will be irrigated, in order to maintain self-production capabilities and national land.

The government decision of December 22, 1999 stated that the quantity of water of any quality to be provided for agriculture will be 1,160 MCM, of which 530 MCM will be fresh water and the rest low grade water (wastewater effluents, brackish water and stormwater).

The consumption of fresh water in 2001, after a cut of 50%, totalled about 560 MCM. This amount approaches the target figure proposed by the government. The water sector must act to develop the capability of supplying low grade water and improving its quality in order to meet the target of 1,160 MCM.

Domestic consumption forecasts

The total domestic and public consumption has been calculated by multiplying the population by the specific per capita consumption. The population of the State of Israel is currently about 6.5 million. According to data provided by the Ministry of the Interior (TAMA 2/6), by 2010 the population will increase to 7.3 million.

The per capita consumption target is 120 m3. This reflects a historical statistical analysis, the expected rise in the standard of living of the non-Jewish sector, and implementation of water saving policy.

The consumption of fresh water by this sector will increase from 650 MCM in 2001 to 876 MCM in 2010.

Industrial consumption forecasts

The forecasts for industrial consumption were prepared using historical statistical data, while they were also based on subjective estimates. The forecast consumption is 167 MCM (110 MCM fresh water, 44 MCM brackish water, and 13 MCM effluents). According to subjective estimates of the trends, consumption will increase in the high-tech and construction industries, and decrease in the textile industry. Wastewater effluents will be used for cooling purposes, and there will be switch to the use of brackish water or wastewater effluents in the heavy chemical industries in the south (Dead Sea, Rotem Plain, and Ramat Hovav).

Nature and landscaping

Located on the edge of the desert, Israel attached ecological importance to the preservation of moist habitats for unique fauna and flora. Constant water shortages have led to the neglect of the water needs for nature. The environment and nature will be defined in the future as a consumer sector like the others, and will receive the water allocations due to them.

Overseas entities

Future consumption by the Kingdom of Jordan has been based on the existing agreements, which specified that Israel will provide the Kingdom of Jordan in regular years with about 55 MCM. This is conditional on the pumping of 20 MCM from the Yarmukh, which Israel will pump in the winter and supply in the summer.

At present time the State of Israel and the Kingdom of Jordan are taking steps to develop an additional 50 MCM for the Kingdom of Jordan by desalinating brackish water in the west and east of the Jordan Valley.

As part of the intermediate agreements made with the Palestinians, Israel supplies about 34 MCM to the Palestinian Authority in Judea and Samaria and about 5 MCM to the Palestinian Authority in Gaza. It is expected that a further 5 MCM will be supplied until the construction of a local desalination plant. Future consumption by the Palestinian Authority is based on an average increase of 4% per year.

Development activities

In order to meet future needs and preserve natural water resources, Israel is making efforts to develop and produce additional sources. By 2007 about 350-400 MCM of seawater will be desalinated, and about 500 MCM of wastewater effluents will be upgraded, permitting their use in agriculture and industry.

At the same time steps are being taken to increase the utilization of natural water that is currently not being used, employing the following methods:

Desalination of brackish water, connection of private boreholes to the national system, and improvement of polluted wells.