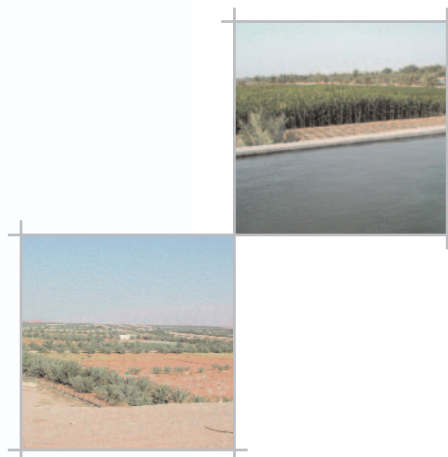




EAD Mission

Environment Agency-Abu Dhabi (EAD) mission is to assist the Abu Dhabi Government in the conservation and management of the Emirate's natural environment, resources, wildlife and biological diversity. This is to be done through scientific research, proactive planning and coordination, environmental awareness promotion, policy formulation and enforcement that balances sustainable economic development with protection of the environment for this and future generations.

The EAD strategic goal in Water Resources Management is to develop and implement a plan to help “manage the overall water resources of the Emirate of Abu Dhabi in a sustainable, economically viable and environmentally sound way that will allow the long-term socio-economic development of the Emirate of Abu Dhabi”.



Introduction

Abu Dhabi Emirate, one of the seven Emirates which comprise the United Arab Emirates (UAE), occupies an area of about 67,000 km², about 80% of the total area of UAE. The Environment Agency - Abu Dhabi (EAD), based in Abu Dhabi, was established in 1996 and in the year 2000 was designated as the “competent authority” for environmental issues in the Emirate of Abu Dhabi.

One of the six strategic goals which comprise the current EAD environmental strategy action plan for the Emirate of Abu Dhabi, 2003-2007, is “a management regime for water resources”.

This annual water resources statistics bulletin for the year 2003 is the third to be issued by EAD. The purpose of the publication is to disseminate important, basic information on water resources sources and users in the Emirate of Abu Dhabi. As such, it is intended to benefit a wide audience, ranging from the general public to scientific research organizations.

The first stage of EAD’s action plan in satisfying its strategic goal of developing and implementing a water resources management Plan for the Emirate of Abu Dhabi, is baseline information and ambient monitoring. EAD’s work will identify all missing information and follow a process to fill all the gaps of missing information.

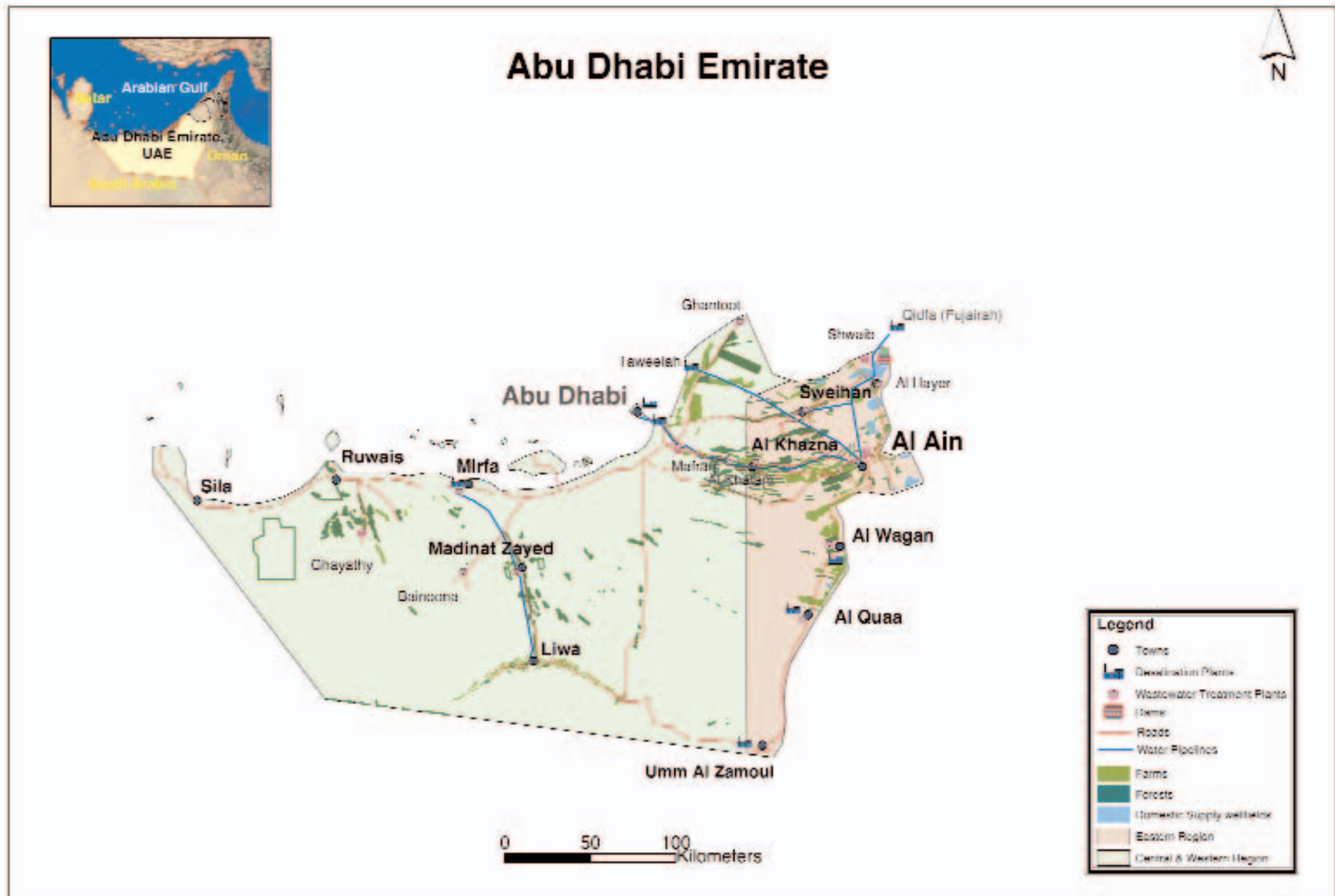
The water resources statistics bulletin will be updated each year by EAD.

EAD wishes to thank all stakeholders involved in our water resources management project who contributed data and information necessary for the publication of this bulletin.

For further enquiries please contact:

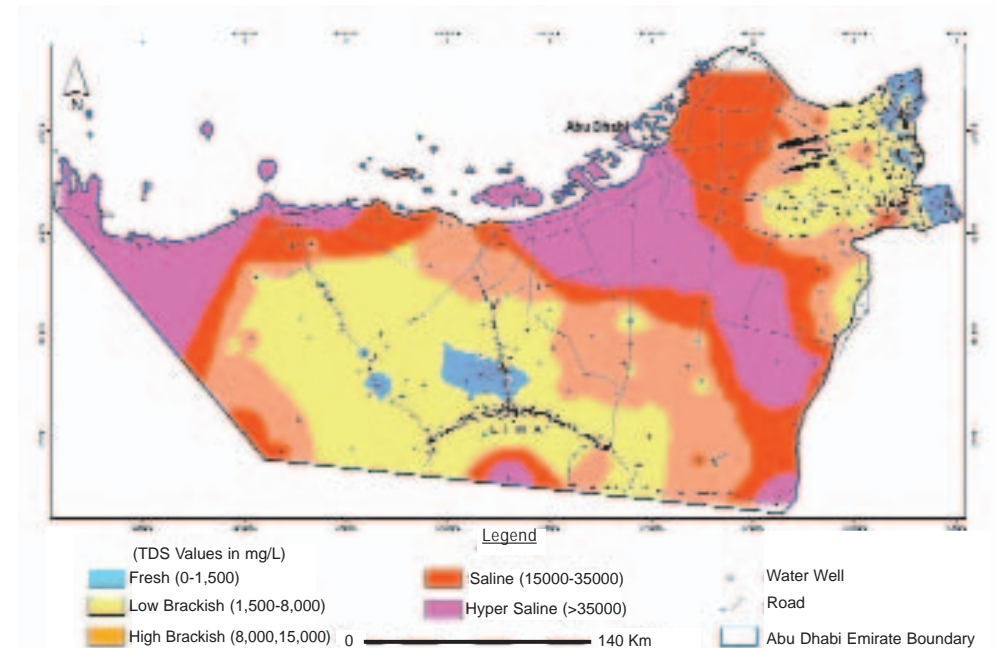
The Manager
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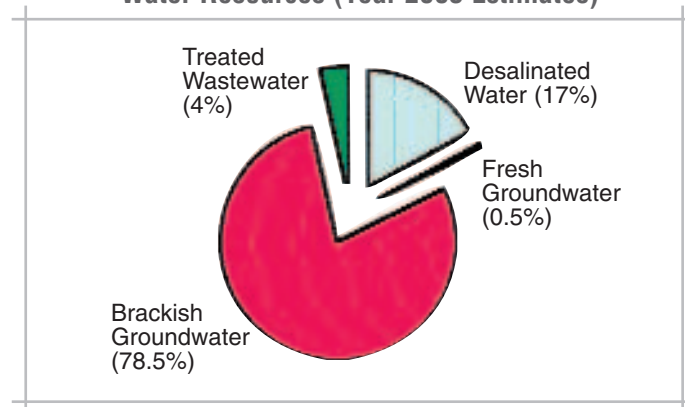


Area	67 340 km ²
Maximum Elevation Point	1163 mamsl, Jebel Hafeet
Population*	
Western Region - Abu Dhabi	847032
Eastern Region - Al Ain	411320
Total	1258352
Annual Population Growth 2002-3*	3.7%
Annual Rainfall, 2003**	
Abu Dhabi City	51.7mm
Al Ain City (Airport)	79.8mm
Annual Temperatures* (min/max)	
Abu Dhabi City	9.1 / 47.7 °C
Al Ain City	7.3 / 48.3 °C
* Statistical Yearbook 2003, Department of Planning, Abu Dhabi	
** Dept Civil Aviation, Abu Dhabi	

Groundwater Salinity of the Shallow Aquifers of Abu Dhabi Emirate



Water Resources (Year 2003 Estimates)

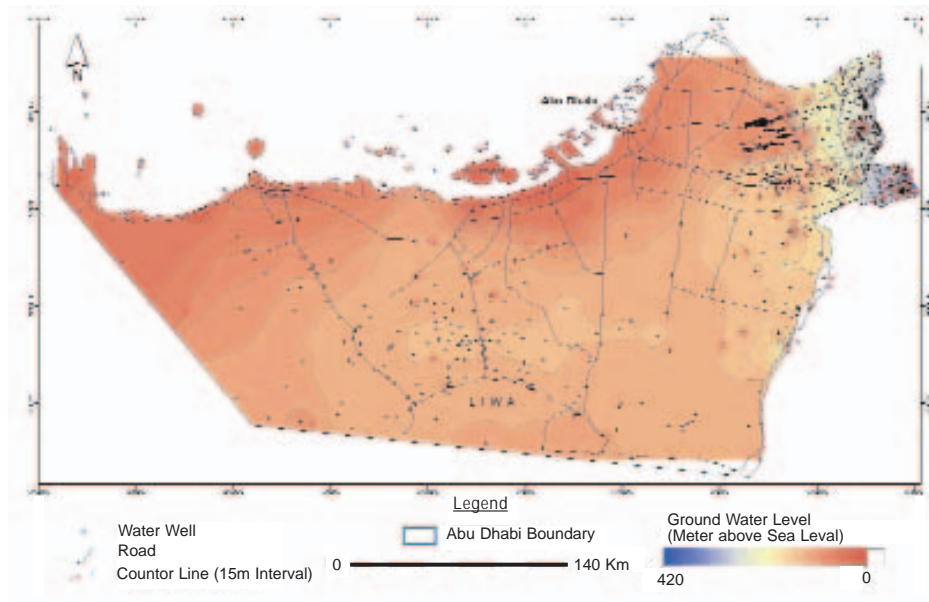


Groundwater generally originates as recharge from rainfall runoff in the eastern region and moves West and North- West towards the Arabian Gulf where it discharges into sabkhas and the sea. This regional flow process takes more than 15,000 years.



Groundwater, despite its heavy utilization over the last 30 years, still provides the majority of the water source for Abu Dhabi Emirate. The aquifers developed to date are primarily unconsolidated, Quaternary sands and alluvium found at depths of generally less than 50 -100m below ground level. A total of 253,000 Mm³ occurs as a resource, but only 7% is fresh, the remainder is brackish or saline. Fresh groundwater, with salinity of less than 1500 mg/l TDS, occurs in belts along the Eastern region on the border with the Sultanate of Oman and also as a large basin in the Liwa – Beda Zayed area.

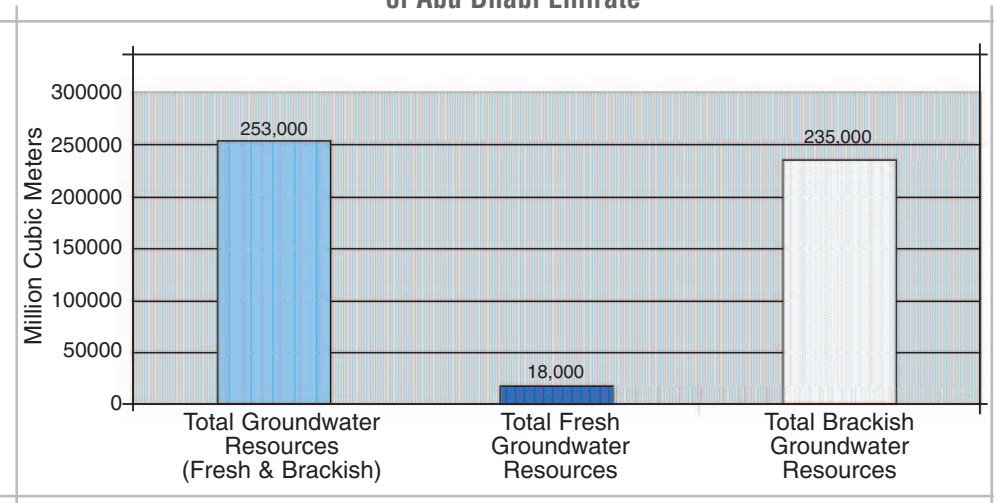
Groundwater Levels in the Shallow Aquifers of Abu Dhabi Emirate



Government policies to date have encouraged and promoted the general greening of the Emirate’s desert landscape and in 2003, a total of 6% of the total area of the Emirate may be considered as “green” and supported by some means of irrigation.

Given declining water levels, and a general deterioration in groundwater quality, the protection and conservation of all groundwater of all quality is of vital importance.

Groundwater Resources (Fresh and Brackish) of Abu Dhabi Emirate



Groundwater constitutes 79% (78.5% brackish, 0.5% fresh) of all the Emirate’s sources, followed by desalinated seawater (17%) and treated wastewater (4%). Groundwater is mostly used in agriculture, forestry and amenity/ recreation irrigation. Only a small amount of groundwater is abstracted for municipal drinking water supply (potable wellfields are now found only in the Eastern, Al Ain region; 15 wellfields contribute only 4% of the total domestic water supply requirements), however, there are still a large number of private household wells which abstract water for domestic use.

Dam and Reservoir Projects

Name of the Project	Facility	Capacity, (Mm ³)
Shwaib Dam	Length 3000 m, height 11m	5
Approach Channel	Length 3600 m, width 150 m	5.5
Shwaib Reservoirs	Seven reservoirs	21
Total Shwaib Dam		

Source: Al Ain Municipality, Road & Dams Department

Abu Dhabi topography is not generally suitable for the construction of recharge dams. In fact, only one recharge structure, a diversion bund with several downstream recharge basins, exists in the Emirate. The more mountainous terrain of the Northern Emirates is far more suitable for their construction; more than 100 dams have been constructed with a combined capacity of greater than 100 Mm³.



Water Production

An analysis of all water produced shows that the vast majority (79%) is groundwater abstracted from boreholes and shallow hand dug wells, the remainder is produced from desalination of seawater (17%) and from 23 sewage treatment plants (4%). Desalinated water is produced from five main plants, four situated along the Arabian Gulf coastline at Mirfa, Abu Dhabi, Sas Al Nakhl and Taweelah and one on the Gulf of Oman at Qidfa, Fujairah. The latter commenced production this year and provided for the first inter-emirate transfer of water. Abu Dhabi Emirate will use its allocation of the produced water from Fujairah in the domestic, agriculture and forestry sectors. In the agriculture sector, this desalinated water is now blended with in-situ, brackish groundwater in order to produce an overall water quality which will allow for the irrigation of a much larger variety of vegetables and fruits.

The largest sewage treatment plant is located at Mafraq, 40 km from Abu Dhabi City, which treats all domestic and Industrial sewer mains waste for Abu Dhabi Island and surroundings, catering for a population in excess of 500,000. Generally, a large proportion of all domestic & industrial wastewater is treated and re-used, but this forms only about 4% of all water produced.

Due to declining water tables, there are now no totally natural flowing aflaj systems (traditional irrigation canals used for agriculture in oasis areas of Al Ain) left in the Emirate; all those operating are either fully or partially supplemented from groundwater which is abstracted from nearby wells drilled within the oasis areas.

Water used for domestic purposes is abstracted from 15 wellfields, but the bulk is supplied from the five main desalination plants described above, plus small desalination units which treat brackish ground water in the region south of Al Ain. Due to the extension of potable water transmission lines south of Al Ain, these 25 small desalination plants have now been de-commissioned.



Water Production

Municipal Wellfields				
Eastern Region ¹	Well Field	Total Wells	Operating Wells	Production, Mm ³ /yr
(potable supply and blended with desalination water)	SHUWAIB NORTH	74	49	2.8125
	SHUWAIB SOUTH	112	74	6.3163
	AL KHADAR	50	20	2.5040
	AL HAIYER	28	15	0.2067
	AL KARAA	62	45	4.4066
	BIDA BINT SAUD	62	38	2.7706
	GHASHABA	11	0	Closed
	AL ZAROUB	12	9	0.2944
	KASHONA	30	29	4.4319
	AL HAIYER N. VILLAGE	4	2	0.1951
	UM GHAFSA	25	22	0.9069
	AL ASHOOSH	80	0	Closed
	JABAL OHA	3	3	0.1805
	AL SAA	2	0	Closed
	SABABA	1	0	Closed
	AL WAGAN	16	10 (Closed on 1/3/03)	0.1166
	AL QUAA	9	5 (Closed on 1/3/03)	0.1413
	AL ASLAB (based on 2002 production)	9	9	0.3187
	SEIH AL RAHEEL	10	3	0.1832
	Total	600	333	25.7853
Central and Western Region ² (non-potable)	Busaddain, Liwa	21	21	
	Jawalood, Ghayathi	9	9	
	Total	30	30	3.67
Total Water Production from Municipal Wells:		630	363	29.46
Aflaj Systems (only present in Eastern Region) ³				
	Aflaj Name	Number of Aflaj		
Partially supported by wells	Al Daoudi Falaj Al Aini Falaj (Al Ain City)	2		
Supported entirely by wells	Al Mutared Falaj Al Mouajji Falaj Al Jimi Falaj Al Qattara Falaj Al Hili Falaj Maziad Falaj	6		
Not operating	Al Jahili Falaj Saa Falaj Al Mazimi Falaj Al Raki Falaj	4		
	Total	12		
		Production, Mm³/yr		
		0.5		
Forestry Wellfields				
Eastern Region		122.85		
Central and Western Region		484.45		
Agriculture (wells & aflaj)				
Eastern Region		1109.07		
Central and Western Region		843.29		

Water Production

Desalination Production				
Eastern Region ¹	Desalination Plant	Number of Plants		Production, Mm ³ /yr
Note all plants in Eastern region closed on 1/3/03	In Al Wagan	11		0.11658
	In Al Quaa	12		0.1413
	In Um Al Zamool	2		0.31279
	Total	25		0.57067
Central and Western Region ⁴ :	Desalination Plant	Company	Plant Type	Production, Mm ³ /yr
	Taweelah A	Bainounah Power Company	ADWEA GDs	0.00
	Abu Dhabi steam turbines			22.15
	Sub Total			22.15
	Sas Al Nakhl East A	Arabian Power Company	IWPPs	22.38
	Sas Al Nakhl East B			26.96
	Sas Al Nakhl 1-6			40.06
	Sas Al Nakhl 7-8			37.14
	Sas Al Nakhl 9-10			9.76
	Sas Al Nakhl B Distillers			85.42
	Sub Total			221.72
	Taweelah B	Al Taweelah Power Company	ADWEA GDs	88.79
	Taweelah B2 extension			5.98
	Sub Total			94.77
	Al Mirfa	Al Mirfa Power Company	ADWEA GDs	31.49
	Taweelah A1	Gulf Total Tractebel Power Company	IWPPs	105.73
	Taweelah A2	Emirates CMS Power Company	IWPPs	71.57
Inter-Emirate Water Transfer :	Qidfa Fujairah	Union Water & Electricity Company	Only production sold to Abu Dhabi Emirate shown	6.24
Exports to Al Ain	22.7% of total produced			125.73
Total Desalinated Water Production				554.24
Other Wellfield Production e.g amenity, recreation etc				
Eastern Region:	Calculated from balance			89.71
Central and Western Region:	of treated effluent production			20.81

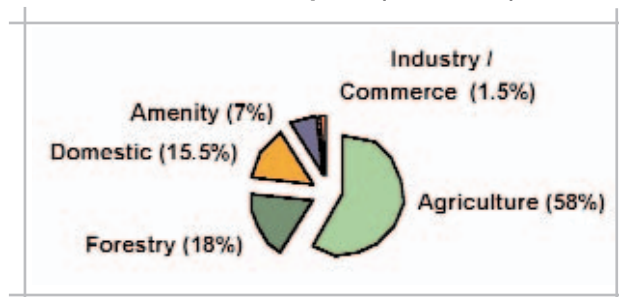
Treated Wastewater Production				
Eastern Region ⁵	Sewage Treatment Plant			Production, Mm ³ /yr
	CLPT			Flows go to M4
	STP-M4			19.70
	Al Khazna			0.19
	Al Hayer			0.365
	Sweiha			0.183
	Shuwaib			0.183
	Wadi Flaie			0.128
	Al Quaa's			0.146
	Al Wagan			0.256
	Al Faqah			0.073
		Al Dhahira (Package Treatment Plant)		
	Seih Gharaba (Package Treatment Plant)			0.011
	Remah			Under Construction
	Bukraiyyah			Under Construction
	Total			21.283
Central & Western Region ⁵	Sewage Treatment Plant			Production, Mm ³ /yr
	Mafraq			106.58
	Madinat Zayed			1.28
	Bainoona			0.13
	Mirfa			0.75
	Canning Factory			0.07
	Ghayathi Ww T Plant			0.37
	Delma Island			0.14
	Khatam			0.119
	Ghantoot			0.129
	Sir Bani Yas Island			0
	Abu Al Abyad Island			0
	Liwa			Under Construction
	Baaya-Sila			0
	Ghuwaifat			Under Construction
	Total			109.568
Total Treated Wastewater Production				130.85
Total Water Production				3385.23

- ¹ Al Ain Distribution Company
- ² Abu Dhabi Distribution Company
- ³ Al Ain Municipality, Falaj Department
- ⁴ ADWEC, Operating Results 2003
- ⁵ Keo Consultants

Water Consumption

Water is consumed in the domestic, industrial, commercial, agricultural, forestry and amenity sectors.

Water Consumption (Year 2003)



Water of drinking quality, which meets the Abu Dhabi Emirates standards (2004), as specified by the Regulation and Supervision Bureau, is supplied for domestic, industrial and

commercial use and accounts for 17% of the total water resource consumed.

Although consumption has reduced slightly since 2002, by far the largest user (58%) of water is the agricultural sector, comprising nearly 25,000 small citizens farms and a few, large state farms whose numbers have been declining in recent years. Water used in this sector is mostly brackish in quality, and almost exclusively groundwater.

The second largest user of water is the Forestry sector (18%) comprising over 300,000 hectares distributed between 250 separate plantations. Like agriculture, most of the water used is brackish groundwater, but in some cases, higher than sea-water salinity groundwater is used for irrigation. The overall percentage of the total water resources used in this sector has increased from 16% (2002) to 18%.

Amenity irrigation for parks, gardens and recreational areas e.g. golf courses etc. accounts for just over 7% of total consumption, slightly less than the previous year. This sector relies mostly on treated effluent as a source, but wells are also utilized.

Finally, the Industrial/Commercial sector, whilst expanding, still accounts for only 1.5% of all water consumed. Industries are located in a small number of dedicated Industrial estates.

Total Water Consumption 2003

Compared with the 2002 water resources statistics, 2003 shows an overall increase of 5% in total water resource consumption for the Emirate; domestic consumption has increased from 441 to 522 Million Cubic Meters (MCM) and forestry from 512 to 607 MCM, but there have been small recorded reductions of 1% and 5% in the agriculture and amenity sectors respectively. A smaller consumption in the agriculture sector is as a result of a policy to reduce the area under irrigation in large state fodder farms; the 2002 irrigated area of 24,000 ha reduced to 17,000 ha in 2003.

	EASTERN REGION (Mm ³)	%	WESTERN REGION (Mm ³)	%	TOTAL (Mm ³)	% TOTAL	% Change Since 2002
Domestic	136.87	9.16	385.13	20.41	522.00	15.44	+18%
Industry	15.21	1.02	42.79	2.27	58.00	1.72	0%
Agriculture	1109.07	74.19	840.29	44.54	1949.36	57.64	-1%
Forestry	122.85	8.22	484.45	25.68	607.30	17.96	+18%
Amenity	111.00	7.42	134.04	7.10	245.04	7.25	-5%
TOTAL	1495.00	100.00	1886.70	100.00	3381.70	100.00	+5%

Water Consumption

Domestic Consumption ¹		
Eastern Region	Water Use	Consumption, Mm ³ /yr
	Municipal from Wells	25.78
	Municipal Desalinated (from local plants ⁴)	0.57
	Municipal Desalinated (from Taweelah, Sas Al Nakhl and Qidfa Imports)	125.73
Central & Western Region	Municipal from Wells	None, no potable wellfields
	Municipal Desalinated	427.9
Total Domestic Consumption¹ (-incl 10% for Industry)		580.0
Agricultural Consumption		
Eastern Region ²	Water Use	Consumption, Mm ³ /yr
Citizens Farms irrigated by 49894 wells (74% producing)	11603 farms occupying 45,072 ha	913.55
Government Entities	State Fodder Farms - 16792 ha	185.52
Traditional Date Gardens (Oases)	Al Ain Date plantations	10
Central & Western Region:		
Citizens Farms	13166 farms occupying 30377 ha	615.7
Government Entities - 2414 wells, pumping 12 hrs/day in 21 wellfields	Farms and Forestry occupying 24978 ha	224.59
Total Agricultural Consumption		1949.00

Water Consumption

Forestry Consumption		
Eastern Region ²	Water Use	Consumption, Mm ³ /yr
Plantations established since 1970- 61749 hectares, irrigated by over 2800 groundwater wells irrigating 12264320 trees	Forestry plantations	122.85
Central & Western Region ²		
Plantations established since 1969 - 243494 hectares, over 2850 groundwater wells irrigating 51317276 trees	Forestry plantations	484.45
Total Forestry Consumption		607.3
Amenity and Recreation Consumption ²		
Eastern		111
Central Region	Parks, Gardens etc	129.4
Western Region		4.64
Total Amenity Consumption		245.04
Industrial and Commercial Consumption ³		
		Consumption, Mm ³ /yr
Eastern Region		15.21
Central and Western Region	Parks, Gardens etc	42.79
Total Industrial & Commercial (incl. in ADWEC bulk consumption)		58
TOTAL EMIRATE CONSUMPTION 2003		
Eastern Region		1495
Central & Western Region:		1886.70
ABU DHABI EMIRATE TOTAL ALL WATER SECTORS		3221.29

¹ ADWEC. Operating results, 2003

² From Dept Planning

³ Estimates based on 10% of domestic demand, this sector included in Domestic for total

⁴ All 25 local small desalination plants at Al Wagan, Al Quaa and Um Al Zamool were shut down on 1st March 2003 (AADC)

إجمالي استهلاك المياه لعام ٢٠٠٣

التغيير منذ عام ٢٠٠٢	الإجمالي		المنطقة الغربية		المنطقة الشرقية		القطاع المستهلك
	%	مليون متر مكعب	%	مليون متر مكعب	%	مليون متر مكعب	
%١٨+	١٥,٤٤	٥٢٢,٠٠	٢٠,٤١	٣٨٥,١٣	٩,١٦	١٣٦,٨٧	المنزلي
صفر	١,٧٢	٥٨,٠٠	٢,٢٧	٤٢,٧٩	١,٠٢	١٥,٢١	الصناعي
%١-	٥٧,٦٤	١٩٤٩,٣٦	٤٤,٤٥	٨٤٠,٢٩	٧٤,١٩	١١٠٩,٠٧	الزراعي
%١٨+	١٧,٩٦	٦٠٧,٣٠	٢٥,٦٨	٤٨٤,٤٥	٨,٢٢	١٢٢,٨٥	الغابات
%٥-	٧,٢٥	٢٤٥,٠٤	٧,١٠	١٣٤,٠٤	٧,٤٢	١١١,٠٠	المتنزهات
%٥+	١٠٠,٠٠	٣٣٨١,٧٠	١٠٠,٠٠	١٨٨٦,٧٠	١٠٠,٠٠	١٤٩٥,٠٠	الإجمالي

وبمقارنة هذه النتائج مع إحصاءات موارد المياه المستغلة بإمارة أبوظبي في عام ٢٠٠٢ فإنه يتضح أن هناك زيادة في استهلاك الموارد المائية بنسبة ٤,٦% من إجمالي كمية الموارد المستغلة بالإمارة. وقد زاد الاستهلاك في القطاع المنزلي من ٤٤١ إلى ٥٢٢ مليون متر مكعب وفي قطاع الغابات زاد الاستهلاك من ٥١٢ إلى ٦٠٧ مليون متر مكعب. بينما يوجد انخفاض بسيط جدا في الاستهلاك بنسبة تقدر بحوالي ١% في القطاع الزراعي وبنسبة تقدر بحوالي ٩% في قطاع الحدائق والمتنزهات. ويأتي النقص في استهلاك المياه في القطاع الزراعي كنتيجة لتقليل مساحات مزارع الأعلاف التابعة للإمارة من ٢٤٠٠٠ هكتار في عام ٢٠٠٢ إلى ١٧٠٠٠ هكتار في عام ٢٠٠٣.

