

## 27 Water use

**In Bangladesh and many other parts of Asia, water is everywhere – in lakes, in ponds, in rice fields and in rivers. Yet, across the region, even countries that might be considered water rich are becoming increasingly concerned about water security.**

Being water secure means having access to sufficient water of the right quality to meet basic needs – as well as having enough for productive purposes, including agriculture and industry. However, it is not always easy to define how much water is required for these purposes; this is not an exact science and the amount varies from place to place, depending on the nature of the economy and local livelihood needs. On average, however, when annual per capita renewable freshwater availability is less than 1,700 cubic metres countries are said to begin experiencing periodic or regular water stress. Below 1,000 cubic metres, water scarcity begins to hamper economic development and human health and well-being. Two countries in Asia and the Pacific are already facing severe water stress: Singapore, with 135 cubic metres per person per year, and Maldives with only 98 cubic metres. Other countries already experiencing periodic water stress include India, the Republic of Korea and Pakistan.

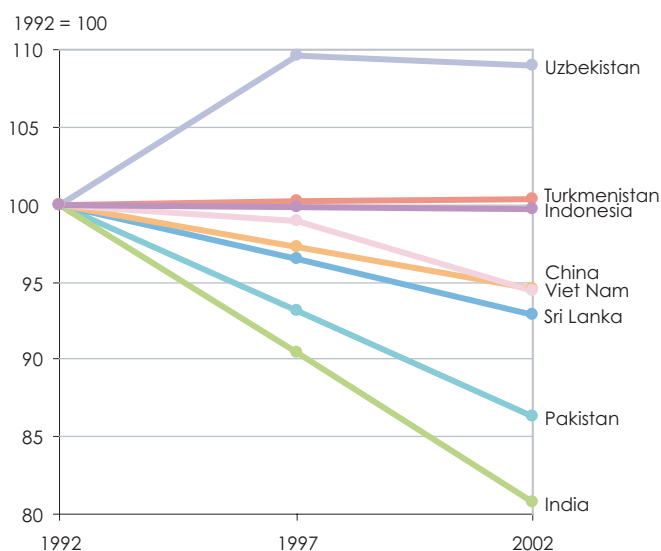
In many cases, water shortages appear to be quite localized. But it is also possible to discern wider trends. ESCAP recently led a study to establish an Index of Water Available for Development (IWAD) – defined as internal renewable water resources minus total water withdrawals for agriculture, domestic supply and industry. The conclusion is that across the region overall water available for development is declining steeply. It should be noted that this reflects only average national conditions. The situation is likely to be even more serious when considering spatial distributions of water resources within countries.

Many countries have been extracting water in an unsustainable manner. The situation is particularly serious in North and Central Asia – in

Turkmenistan, Uzbekistan and Azerbaijan. These countries are already withdrawing more water per year than is available from renewable sources. In South and South-West Asia, India, Pakistan and Sri Lanka have also seen a large surge in extraction. In North and North-East Asia high withdrawals compared with the 1988-1992 base period indicate that China in particular has also been extracting water rapidly and may reach the tipping point faster than previously anticipated. In South-East Asia and the Pacific islands, it is difficult to calculate the IWAD as there are insufficient data.

**Figure 27.1**

**Index of water available for development, selected countries, 1992-2002**

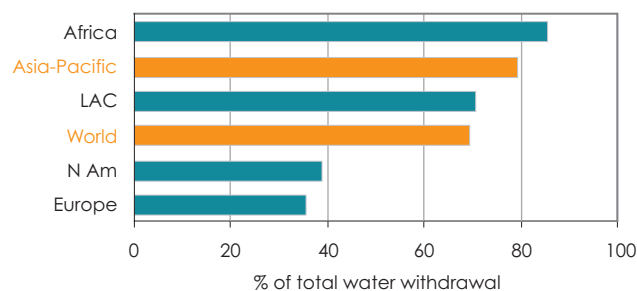


In Asia and the Pacific, most of the water is extracted for agriculture which in 2002 accounted for 79 per cent of total withdrawals. Agriculture's share has, nevertheless, fallen since 1990 in all subregions, though there has been an increase in some countries, such as the Islamic Republic of Iran, Turkey and Kazakhstan. As might be expected, it is the poorest countries that are using more water for agriculture. In 2002, in the low-income economies 90.9 per cent was extracted for this purpose,

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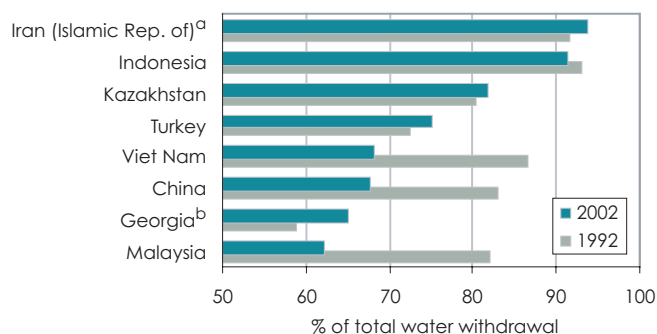
**Figure 27.2**

**Proportion of water withdrawn for agriculture, global regions, 2002**



**Figure 27.3**

**Proportion of water withdrawn for agriculture, selected Asia-Pacific countries, 1992 and 2002**

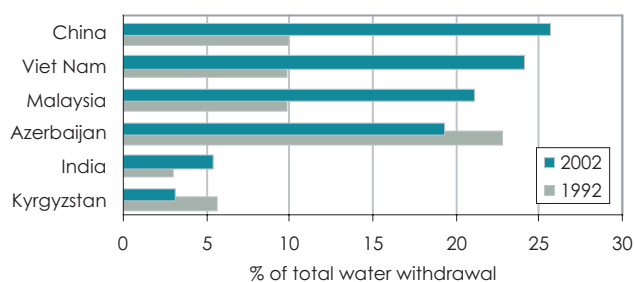


<sup>a</sup> Earliest figure is for 1997.

<sup>b</sup> Latest figure is for 2007.

**Figure 27.4**

**Proportion of water withdrawn for industry, selected Asia-Pacific countries, 1992 and 2002**



compared with 77.3 per cent in middle-income economies and only 62.4 per cent in high-income economies.

Across the region many economies are using more water for industry. China and Viet Nam, for example, between 1992 and 2002 more than tripled their industrial water use. In 2002, the average share of water withdrawal for industry reached 13.1 per cent. This proportion is rising in all subregions,

except for some countries of North and Central Asia where the share actually fell by a couple of percentage points. In the Pacific island economies data are unavailable. Recent data from the Caucasus region indicate however an increased in the proportion of water used for agriculture – by seven percentage points in Georgia, four in Azerbaijan and one in Turkey and the Islamic Republic of Iran.

The ESCAP theme study on food security, prepared for the sixty-fifth session of the Commission in April 2009 examines the links between water and food security in a greater detail.

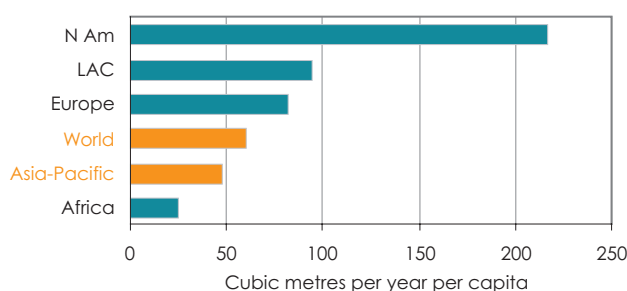
Asia and the Pacific, as the most populated global region, might be expected to have the highest domestic demand. Surprisingly, however, the region uses only 7.7 per cent of withdrawals for this purpose, compared with 10 per cent in Africa and 19 per cent in Latin America. Even in per capita terms domestic water withdrawal, at 47.5 cubic metres per year, is the second lowest in the world, after Africa. Many countries, however, have seen a rapid increase in domestic water use: in Viet Nam the volume has nearly tripled, and in Turkmenistan, India and Malaysia it has roughly doubled.

By far the highest annual per capita domestic withdrawals are in Armenia, with 288.5 cubic metres and New Zealand with 258.4 cubic metres. At the other end of the scale, the volume was only 8.8 cubic metres in Myanmar, 7.1 cubic metres in Papua New Guinea, and 4.5 cubic metres per year in Cambodia.

It is also noticeable that withdrawals for domestic use are lower in the poorest countries. Thus while the regional average was 47.5 cubic metres, in the least developed countries it was only 14.8 cubic metres – far lower than in Africa at 24.7 cubic metres. The extremely low level in these countries is a serious threat to human well-being.

**Figure 27.5**

**Domestic water withdrawal per capita, global regions, 2002**



**Total renewable water (billion cubic metres per year, cubic metres per capita)**

The sum of internal renewable water resources and natural incoming flow originating from outside the country, taking into consideration the quantity of flows reserved to upstream and downstream countries through formal or informal agreements or treaties. This gives the maximum theoretical amount of water actually available for a country.

**Aggregates:** For total renewable water (billion cubic metres per year): Sum of individual country values. For total renewable per capita (cubic metres per year): Averages are calculated using total population as weight. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008), and World Population Prospects: The 2006 Revision Population Database (online database, accessed in July 2008).

**Total internal renewable water (billion cubic metres per year)**

Average annual flow of rivers and recharge of groundwater generated from endogenous precipitation. **Aggregates:** Sum of individual country values. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database accessed in November 2008).

**Domestic water withdrawal per capita (cubic metres per year)**

Drinking water plus water withdrawn for homes, municipalities, commercial establishments, and public services, divided by population. **Aggregates:** Averages are calculated using total population as weight. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008), and World Population Prospects: The 2006 Revision Population Database (online database, accessed in July 2008).

**Annual withdrawals of ground and surface water (% of total renewable water)**

The gross amount of water extracted in a day from any source either permanently or temporarily. Water sources can be either withdrawn from surface water, groundwater or produced (non-conventional water sources), such as reused treated wastewater and desalinated water. **Aggregates:** Averages are calculated using total

renewable water as weight. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008).

**Total water withdrawal (billion cubic metres per year)**

The gross quantity of water withdrawn for agricultural, industrial and domestic purposes in a given country. Does not include other categories of water use, such as for cooling of power plants, mining, recreation, navigation, or fisheries. **Aggregates:** Sum of individual country values. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008).

**Domestic water withdrawal (% of total water withdrawal)**

The total water withdrawn by the public distribution network. It can include industries which are connected to the network. **Aggregates:** Averages are calculated as the sum of individual country values within each group divided by total water withdrawal of each group. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008).

**Water withdrawal for agriculture (% of total water withdrawal)**

Quantity of water used for agricultural purposes, including irrigation and for livestock. Methods for computing agricultural water withdrawal vary from country to country. **Aggregates:** Averages are calculated as the sum of individual country values within each group divided by total water withdrawal of each group. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008).

**Water withdrawal for industry (% of total water withdrawal)**

Quantity of water used for industrial purposes. Usually, this sector refers to self-supplied industries not connected to any distribution network divided by the total water withdrawal. **Aggregates:** Averages are calculated as the sum of individual country values within each group divided by total water withdrawal of each group. **Source:** Food and Agriculture Organization of the United Nations, FAO Information system on Water and Agriculture (online database, accessed in November 2008).

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### 27.1 Water resources and domestic use

	Renewable water						Domestic water withdrawal per capita			Annual withdrawals of ground and surface water		
	Total	Internal	Per capita				Cubic metres per year			% of total renewable water		
	Billion cubic metres per year		Cubic metres per year				Cubic metres per year					
	2007	2007	1992	1997	2002	2007	1992	1997	2002	1992	1997	2002
<b>East and North-East Asia</b>	<b>3 441</b>	<b>3 409</b>	<b>2 503</b>	<b>2 388</b>	<b>2 300</b>	<b>2 236</b>			<b>45.0</b>			<b>21.7</b>
China	2 829	2 812	2 404	2 286	2 196	2 129	29.7	20.3	32.2	17.7	18.6	22.3
DPR Korea	77	67	3 713	3 464	3 315	3 242			76.9			11.7
Hong Kong, China												
Japan	430	430	3 457	3 409	3 373	3 360	136.7		136.5	21.3		20.6
Macao, China												
Mongolia	35	35	15 110	14 347	13 868	13 238		35.0	35.9		1.2	1.3
Republic of Korea	70	65	1 594	1 522	1 474	1 445		135.6	140.0			26.7
<b>South-East Asia</b>	<b>7 063</b>	<b>5 674</b>	<b>15 453</b>	<b>14 211</b>	<b>13 197</b>	<b>12 336</b>			<b>39.6</b>			<b>4.5</b>
Brunei Darussalam	9	9	31 261	27 395	24 324	21 792				0.9	1.1	
Cambodia	476	121	45 834	39 712	35 909	32 963			4.5			0.9
Indonesia	2 838	2 838	15 035	13 972	13 050	12 252	25.1		30.4	2.6		2.9
Lao PDR	334	190	77 126	67 812	61 741	56 926			24.1			0.9
Malaysia	580	580	30 387	26 768	23 909	21 828	42.9	61.9	62.7	1.7		1.6
Myanmar	1 046	881	25 269	23 609	22 357	21 427			8.8			3.2
Philippines	479	479	7 469	6 692	6 026	5 446		59.6	59.5		5.8	6.0
Singapore	1	1	189	162	144	135						
Thailand	410	210	7 374	6 968	6 647	6 417	26.9		35.2			21.2
Timor-Leste												
Viet Nam	891	367	12 893	11 767	10 943	10 200	28.9		68.0	6.1		8.0
<b>South and South-West Asia</b>	<b>4 104</b>	<b>2 174</b>	<b>3 141</b>	<b>2 835</b>	<b>2 594</b>	<b>2 395</b>			<b>44.2</b>			<b>26.1</b>
Afghanistan	65	55	4 425	3 337	2 926	2 395						35.8
Bangladesh	1 211	105	10 233	9 205	8 353	7 630	14.4	30.5	17.5			6.6
Bhutan	95	95	177 580	183 859	160 776	144 271						0.4
India	1 897	1 261	2 113	1 913	1 753	1 622	27.9		48.3	26.4		34.1
Iran (Islamic Rep. of)	138	129	2 323	2 151	2 041	1 931		93.9	66.8		60.4	64.4
Maldives	0	0	131	116	106	98						
Nepal	210	198	10 462	9 233	8 246	7 455		10.8	11.8			4.8
Pakistan	225	55	1 892	1 676	1 501	1 374	21.0		21.8	69.1		75.2
Sri Lanka	50	50	2 852	2 721	2 647	2 591	11.1		15.9	19.5		25.2
Turkey	214	227	3 591	3 288	3 045	2 852	87.4		91.3	14.8		19.7
<b>North and Central Asia</b>	<b>4 833</b>	<b>4 594</b>	<b>22 232</b>	<b>22 086</b>	<b>22 123</b>	<b>22 150</b>			<b>92.9</b>			<b>4.8</b>
Armenia	11	9	3 051	3 350	3 452	3 507	280.5	275.2	288.5	33.3	27.8	28.0
Azerbaijan	30	8	4 062	3 803	3 679	3 576	98.9	27.9	61.1	51.4	41.3	33.3
Georgia	63	58	11 878	12 960	13 727	14 408			136.5			5.5
Kazakhstan	110	75	6 672	7 084	7 340	7 107	38.5	37.7	39.5	33.4	30.7	31.9
Kyrgyzstan	21	46	4 596	4 356	4 069	3 871	61.4	63.7	63.3	53.4	49.0	49.0
Russian Federation	4 507	4 313	30 185	30 318	30 838	31 630	98.1	96.2	98.4	1.8	1.7	1.7
Tajikistan	16	66	2 896	2 692	2 529	2 372	87.9	69.4	69.6	75.2	74.3	74.8
Turkmenistan	25	1	6 363	5 703	5 339	4 979	49.2	80.5	90.7	100.1	96.2	99.7
Uzbekistan	50	16	2 344	2 128	1 981	1 842	95.4	109.0	108.8	124.0	115.2	115.7
<b>Pacific</b>	<b>1 693</b>	<b>1 703</b>	<b>61 309</b>	<b>56 773</b>	<b>52 904</b>	<b>49 437</b>			<b>143.4</b>			<b>1.5</b>
Australia	492	492	28 334	26 592	25 097	23 719			179.6			4.9
American Samoa												
Cook Islands												
Fiji	29	29	38 653	36 455	35 132	34 041			12.3			0.2
French Polynesia		10										
Guam												
Kiribati												
Marshall Islands												
Micronesia (F.S.)												
Nauru												
New Caledonia												
New Zealand	327	327	93 070	87 209	82 824	78 257			258.4			0.6
Niue												
Northern Mariana Is.												
Palau												
Papua New Guinea	801	801	184 122	161 183	141 535	126 520			7.1			0.0
Samoa												
Solomon Islands	45	45	134 620	116 799	102 068	90 183						
Tonga												
Tuvalu												
Vanuatu												
<b>Asia and the Pacific</b>	<b>21 133</b>	<b>17 555</b>	<b>6 247</b>	<b>5 815</b>	<b>5 470</b>	<b>5 183</b>			<b>47.5</b>			<b>11.3</b>
LLDC	1 001	796	9 560	8 674	8 078	7 370			55.6			19.0
LDC	3 481	1 690	16 459	14 663	13 349	12 161			14.8			4.4
ASEAN	7 063	5 674	15 480	14 235	13 219	12 361			39.6			4.5
ECO	893	679	2 865	2 589	2 385	2 202			52.4			53.0
SAARC	3 753	1 819	3 159	2 846	2 598	2 395			40.9			25.1
Central Asia	325	281	4 782	4 639	4 502	4 300			81.9			47.0
Pacific island dev. econ.	874	884	129 705	115 440	103 413	93 716			5.9			0.0
Low-income	5 467	3 013	12 034	10 782	9 838	9 046			32.4			8.8
Middle-income	14 338	13 209	5 253	4 908	4 629	4 400			44.2			12.4
High-income	1 328	1 333	6 663	6 456	6 299	6 193			135.5			10.0
<b>Other world regions</b>												
Africa	5 641	3 936	8 200	7 389	6 556	5 846			24.7			3.8
Europe	3 285	2 291	5 594	5 663	5 633	5 580			81.7			10.1
Latin America & Carib.	18 525	13 570	40 263	37 063	34 478	32 375			94.0			1.4
North America	6 556	6 253	22 595	21 423	20 343	19 349			216.7			8.0
Other countries/areas	115	55	1 349	1 159	1 010	893			68.7			59.6
<b>World</b>	<b>55 256</b>	<b>43 659</b>	<b>10 072</b>	<b>9 392</b>	<b>8 797</b>	<b>8 283</b>			<b>60.6</b>			<b>6.9</b>

## 27.2 Water use by sector

	Total water withdrawal			Domestic use			Use for agriculture			Use for industry		
	Billion cubic metres per year						% of total water withdrawal					
	1992	1997	2002	1992	1997	2002	1992	1997	2002	1992	1997	2002
<b>East and North-East Asia</b>			<b>746.8</b>			<b>9.0</b>			<b>66.4</b>			<b>24.5</b>
China	500.0	525.5	630.3	7.0	4.8	6.6	83.0	77.6	67.7	10.0	17.6	25.7
DPR Korea			9.0			19.8			55.0			25.2
Hong Kong, zChina												
Japan	91.4		88.4	18.6		19.7	64.1		62.5	17.3		17.9
Macao, China												
Mongolia		0.4	0.4		19.9	20.5		53.0	52.3		27.1	27.3
Republic of Korea			18.6			35.6			48.0			16.4
<b>South-East Asia</b>			<b>319.1</b>			<b>6.6</b>			<b>85.6</b>			<b>7.8</b>
Brunei Darussalam	0.1	0.1										
Cambodia			4.1			1.5			98.0			0.5
Indonesia	74.3		82.8	6.4		8.0	93.1		91.3	0.5		0.7
Lao PDR			3.0			4.3			90.0			5.7
Malaysia	10.1		9.0	8.1		16.9	82.0		62.1	9.9		21.1
Myanmar			33.2			1.2			98.2			0.5
Philippines		27.7	28.5		15.4	16.6		76.3	74.0		8.3	9.4
Singapore												
Thailand			87.1			2.5			95.0			2.5
Timor-Leste												
Viet Nam	54.3		71.4	3.7		7.8	86.5		68.1	9.8		24.1
<b>South and South-West Asia</b>			<b>1 071.6</b>			<b>6.5</b>			<b>89.3</b>			<b>4.2</b>
Afghanistan			23.3			1.8			98.2			
Bangladesh			79.4			3.2			96.2			0.7
Bhutan			0.4			4.7			94.1			1.2
India	500.0		645.8	5.0		8.1	92.0		86.5	3.0		5.5
Iran (Islamic Rep. of)		83.0	93.3 <sup>1</sup>		7.2	6.6 <sup>1</sup>		91.6	92.2 <sup>1</sup>		1.2	1.2 <sup>1</sup>
Maldives												
Nepal			10.2			2.9			96.5			0.6
Pakistan	155.6		169.4	1.6		1.9	96.8		96.0	1.6		2.0
Sri Lanka	9.8		12.6	2.0		2.4	96.0		95.2	2.0		2.5
Turkey	31.6		40.1 <sup>2</sup>	16.5		15.5 <sup>2</sup>	72.5		73.8 <sup>2</sup>	11.1		10.7 <sup>2</sup>
<b>North and Central Asia</b>			<b>229.7</b>			<b>8.8</b>			<b>65.6</b>			<b>25.6</b>
Armenia	3.5	2.9	3.0	27.6	29.6	29.8	67.4	66.3	65.8	5.0	4.1	4.4
Azerbaijan	15.6	12.5	12.2 <sup>3</sup>	4.7	1.8	4.3 <sup>3</sup>	72.5	81.2	76.4 <sup>3</sup>	22.8	17.0	19.3 <sup>3</sup>
Georgia	3.5		1.6 <sup>4</sup>	21.0		22.1 <sup>4</sup>	58.9		65.1 <sup>4</sup>	20.1		12.8 <sup>4</sup>
Kazakhstan	36.6	33.7	35.0	1.7	1.7	1.7	80.3	81.4	81.8	18.0	16.9	16.5
Kyrgyzstan	11.0	10.1	10.1	2.5	3.0	3.2	91.9	94.2	93.8	5.6	2.9	3.1
Russian Federation	82.6	77.1	76.7	17.7	18.5	18.8	23.5	19.8	17.8	58.7	61.6	63.5
Tajikistan	12.0	11.9	12.0	4.0	3.5	3.7	91.0	92.3	91.6	4.9	4.2	4.7
Turkmenistan	24.7	23.8	24.7	0.8	1.5	1.7	98.7	97.9	97.5	0.5	0.6	0.8
Uzbekistan	62.5	58.1	58.3	3.3	4.4	4.7	94.7	93.7	93.2	2.0	1.9	2.1
<b>Pacific</b>			<b>26.2</b>			<b>17.5</b>			<b>72.4</b>			<b>10.1</b>
Australia			23.9			14.7			75.3			10.0
American Samoa												
Cook Islands												
Fiji			0.1			14.3			71.4			14.3
French Polynesia												
Guam												
Kiribati												
Marshall Islands												
Micronesia (F.S.)												
Nauru												
New Caledonia												
New Zealand			2.1			48.3			42.2			9.5
Niue												
Northern Mariana Is.												
Palau												
Papua New Guinea			0.1			56.3			1.4			42.3
Samoa												
Solomon Islands												
Tonga												
Tuvalu												
Vanuatu												
<b>Asia and the Pacific</b>			<b>2 393.4</b>			<b>7.7</b>			<b>79.2</b>			<b>13.1</b>
LLDC			190.4			3.6			90.9			5.5
LDC			153.6			2.5			96.9			0.6
ASEAN			319.1			6.6			85.6			7.8
ECO			473.3			4.1			91.9			3.9
SAARC			941.1			6.3			89.5			4.2
Central Asia			153.1			3.9			89.5			6.6
Pacific island dev. econ.			0.1			35.5			36.2			28.4
Low-income			483.4			3.7			90.9			5.4
Middle-income			1 776.9			7.7			77.3			15.0
High-income			133.1			21.5			62.4			16.1
<b>Other world regions</b>												
Africa			213.3			10.0			85.5			4.2
Europe			332.6			14.3			35.6			50.1
Latin America & Carib.			265.3			19.0			70.6			10.3
North America			525.3			13.3			38.7			48.0
Other countries/areas			92.1			8.5			80.0			11.5
<b>World</b>			<b>3 821.9</b>			<b>10.0</b>			<b>69.6</b>			<b>20.4</b>

<sup>1</sup> Date refers to the period 2003-2007. For the period 1998-2002: total water withdrawal = 88.5 billion cubic metres per year, and with % share in domestic, agriculture and industry = 5.1, 93.8, and 1.1, respectively. <sup>2</sup> Date refers to the period 2003-2007. For the period 1998-2002: total water withdrawal = 42.0 billion cubic metres per year, and with % share in domestic, agriculture and industry = 15.2, 75.0, and 9.8, respectively. <sup>3</sup> Date refers to the period 2003-2007. For the period 1998-2002: total water withdrawal = 10.1 billion cubic metres per year, and with % share in domestic, agriculture and industry = 5.0, 75.4, and 19.6, respectively. <sup>4</sup> Date refers to the period 2003-2007.