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Abstract

Water situation in the Chirchik –Ahangaran – Keles subbasin of the Syrdarya River is one of the most guaranteed in the whole basin. As was introduced in the report D 24, water resources exceed water demand in all range of hydrological observations in the subbasin. But even in such water abundantsubbasin, some problems occur, especially regarding water sustainability in different districts for irrigation, environmental flow for nature protection, in fish production and others.

Sustainability of water supply in the subbasin is very important taking into account the importance of Tashkent province and Tashkent city for the Republic of Uzbekistan. As main industrial province and the metropolitan of the state, intellectual and governing Center and simultaneously as a very perspective region for development of hydropower, industry, tourism and recreation this zone requires big attention for sustainable supply of this "heart of Uzbekistan" with water, energy and food.

1. Natural and Economic Importance of the Chirchik-Akhangaran-Keles Basin

Chirchik-Akhangaran-Keles basin is the heart and the glory of Central Asia and, at the same time, it serves as a driver of development in Uzbekistan and partially in Southern Kazakhstan. Here the city of Tashkent, the capital of Uzbekistan, is located and regularly attracts people from other regions in the republic, being the political and cultural national center, with powerful industrial system (aircraft and machine-building enterprises, precision engineering and electronic industry, construction industry, etc.). The basin also accommodates specialized industrial cities, such as Chirchik, the center of chemical industry, Akhangaran and Angren, and Yangiyul. The total provincial standard residential population is more than 5 million or almost 20 % of the republican total. However, taking into account a number of foreign branch offices, regular visitors, tourists and businessmen, actual population to be served, including with water, electricity, and foodstuff is more than 6 million in Tashkent city and Tashkent province. According to unofficial sources[1], Tashkent city's population is more than 3,5 million or 1,4 times higher of the official statistics. More than 70 % of national energy generating capacities is concentrated in Chirchik-Akhangaran basin (including 70% of hydropower - 1200 MW out of 1709,6 MW).

Magnificent natural conditions – naturally drained old-irrigation area of Shash oasis, mountain landscapes with beautiful sceneries, picturesque plains and comfortable recreational places – attract many people throughout the republic and outside both in summer to soft climate of submountain plains and in winter to snow mountain slopes of sports centers Chimgan, Aksay, Beldersai and others.

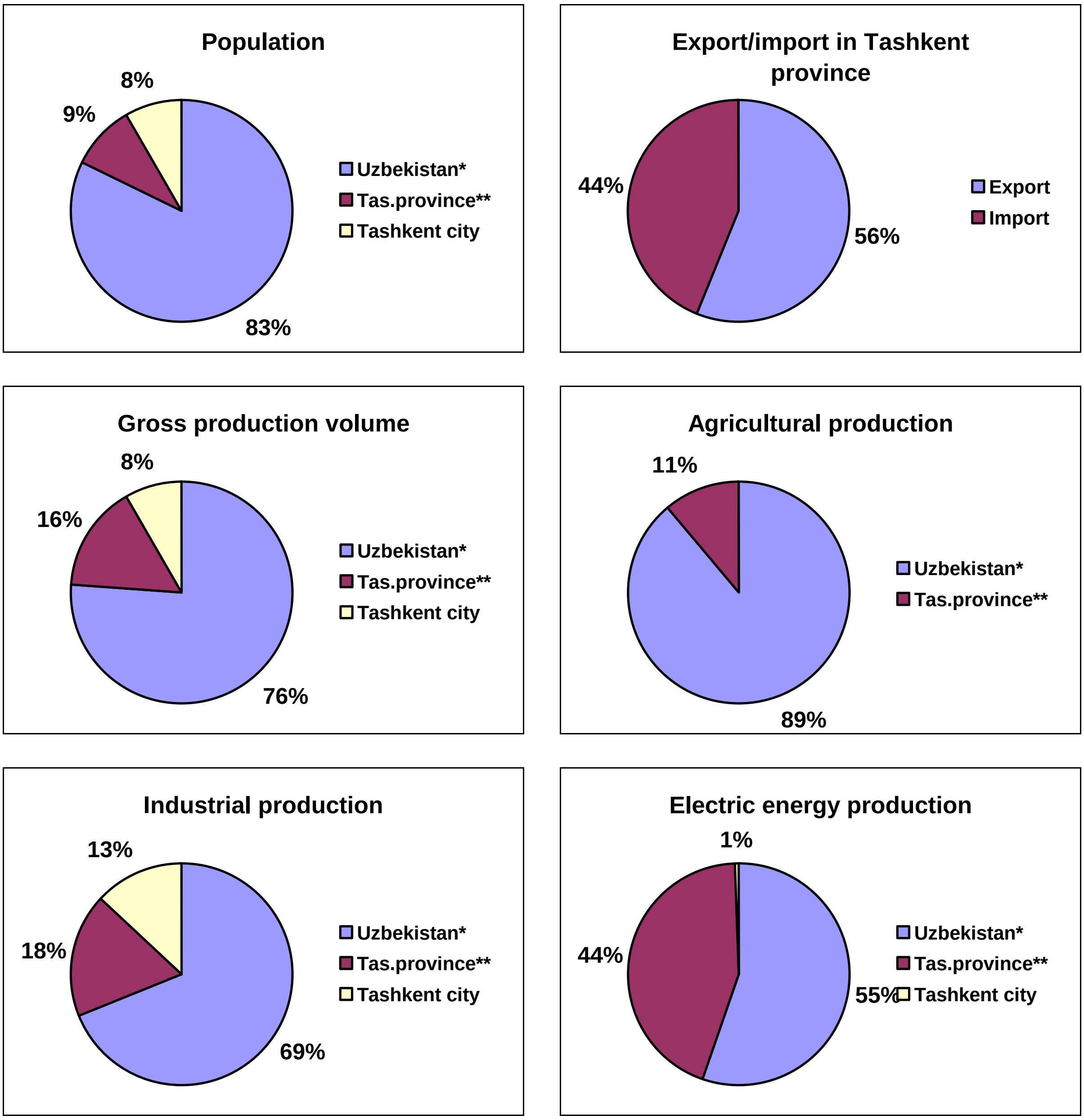
Such surroundings create favorable conditions for development of food market, especially local fruits, vegetables, grain, rice, cucurbits, and livestock products. Therefore, agriculture in the sub-basin has been always serving urban areas and regularly supplies fresh farm products to the markets in Tashkent city and Tashkent province. This is precisely why Chirchik river basin's agricultural sector plays major role in total national agricultural production. The role and importance of the Chirchik river basin in general national development becomes evident from diagrams shown in Figure 1.

Kazakh and particularly Kyrgyz parts of the basin do not play such big role as Tashkent province in life of their respective countries. However, one should note intensive rates of land privatization and site development in Keles valley along the main road Tashkent-Chirchik, which is a part of the Silk road, and particularly in frontier zone near Tashkent where main roads cross the frontier and legal and illegal large transfer and trade zones are created, with huge temporal and permanent crowds. Hypothetically, in light of Uzbekistan joining to EurAsEC and relaxation of customs and passport restrictions for unification of legislations between country-members, this development may gain additional impetus. However, by now two districts in Southern Kazakhstan province such as Saryagach and Kazygurt, located in the Keles river basin, make considerable contribution to provision of provincial center of Chimkent city with foodstuff.

Kyrgyz territory of the basin is comprised of mountain forests and pastures, with rare population but beautiful landscapes that are currently difficult of access.

[1] The World Gazetteer 2004.

Figure 1. Chirchik river basin’s contribution to Uzbekistan development. Data of 2004



* - Uzbekistan, minus Tashkent province and Tashkent city
** - including Bekabad district

The planned construction of Pskem waterworks facility which will affect reservoir zone and Kyrgyz territory may animate this semi-accessible area and give impetus to development of picturesque surroundings into mountain recreation zones and tourist complexes.

2. Economic and ecological Indicatorsaffected by water factor

World literature, unfortunately, does not offer common methodology for selection of water use indicators that impact socio-economic and ecological conditions. Thus, annually published surveys “Key indicators of developing Asian and Pacific Countries” choose the following indicators that more or less depend on water use and on development of water sector, including irrigation, hydropower production, etc. (in the order of indexing):
№ 5 – demography – percentage of population occupied in agriculture.
№ 6 – poverty – population below the poverty line.
№ 8 – health – per capita calorie consumption; losses caused by diseases, including because of water quality.
№ 9 – ecology – percentage of population having access to safe water.
№ 10 – land use – acreage per capita; irrigated acreage per capita.
№ 11 – economy – GNP per capita.
№ 12 – economic growth - % of growth per capita/year; agricultural share in GNP.
№ 16 – 20 – agricultural production:

- per capita grain production.
- per capita rice production.
- grain yields.
- rice yields.

№ 23 – energy:

- per capita electric energy production, kWh;
- per capita electricity consumption;
- access of population to electricity.

Assessments by UN per country, for example “Environmental performance reviews” for Uzbekistan, UN 2001 regarding water sector and its state-of-the-art gave the following indicators:

- water resources accessible for users (per capita);
- % of available water use;
- water use - in % for drinking water supply;
  - in % for agriculture;
  - in % for industry;
  - in % for hydropower production;
  - in % for irrigation.
- per capita wastes discharge, including treated; non-treated.
- mortality per 100000 people, including due to gastrointestinal diseases;
- spread of gastrointestinal diseases per 100000 people;

The World Bank in its “Little Green Data book” gives the following water and sanitation indicators:

- access to safe water;
- access to improved safe water in urban area;
- access to improved safe water in rural area;
- available water resources per capita/m^3;
- % of available water use;
- of which in agriculture, including irrigation;
- access to sewage system in rural area;
- the same in urban area;
- mortality of children under 5 years per 1000 born;

- per capita irrigated land;

Eventually, the European Environment Agency's (EEA) report on the "European environment outlook" № 4, 2005 addresses the following water use indicators:

- mean annual water withdrawals, total and per capita, including for agriculture, %;
  electricity production, %
  manufacturing, %
  domestic sector, %.
- water use index – ratio of total water consumption to mean annual water availability;
- mean annual water availability per person (insufficient – less than 5000 m^3, critical – less than 1000 m^3);
- number of people having access to sewerage system.

Nevertheless, in our opinion, the following major indicators are lacked among those abundant ones:

- level of water supply to sector-users, % (actual supply against demand) and its yearly dynamics, including:
  - industry;
  - domestic;
  - energy production;
  - irrigated agriculture;
- water productivity $/$m^3$, including:
  - industry;
  - energy production;
  - irrigated agriculture.

Besides, there is no indication of:

- impact of insufficient water supply on crop yields and agricultural output losses;
- impact of poor water quality on economic losses due to diseases;
- damage caused by non-satisfied environmental demand.

Below we tried to analyze indicators mentioned above, for which we could collect some data.

3. Socio-economic development indicators

3.1. Impact of water use on employment

Taking into account that 59,6 % of total basin population, excluding Tashkent city, lives in rural area, the total labor resources are 1292,7 thousand people (2003) in the province at a share of 53,2 %, while rural labor resources are 770,45 thousand people. According to official data, 171,5 thousand people are occupied in agriculture, however these statistical data do not include great number of wage earners, the so called "mardikyors", whom farmers give a work often without any contracts and accounting. Since the mean load on 1 ha of irrigated land is 0,5 person or 1 person per 2 ha.

if irrigated area is 340…350 thousand ha, number of people only occupied in irrigation should be 170…175 thousand. Considering employees in associated sectors, such as processing, machine-leasing companies, services (supply of fertilizers, chemicals, fuel, spare parts, and extension services), as well as water operator services and WUA staff, the total employment in agriculture, including irrigation and water sector, will be more than 250 thousand people or one third of all labor resources. Naturally, water use sustainability ensures that their livelihoods are stable although not sufficient. When adding family members, mainly women, elderly people and children, occupied in homestead land, 0,12…0,15 ha each, the role of water use in employment becomes greater. Research conducted by G.V.Stulina et al.[2] showed that contribution from homestead land was 36 % to the total family income, given the official earnings in the main job-place are only 28 %. This indicates once more the importance of water sector in employment and social maintenance of rural population.

3.2. Population living below the poverty line

Source: «Report on Millennium Development Goals» Uzbekistan 2006

Report was prepared jointly with the Government of Uzbekistan and the UN Representative Office in Uzbekistan.

The World Bank calculated minimum basket of goods for Uzbekistan. The basket of goods includes a combination of foodstuffs having general nutritive value of 2100 kcal/day (In estimating the cost of this basket of goods, the experts used foodstuff prices adjusted to monthly inflation and regional difference in prices).
Key data on poverty in Uzbekistan were collected during the Survey of household budgets conducted in 2001. According to the data, in 2001, 27,5 % of Uzbekistan's population (6,8 million) could be classified as needy. By 2003, this figure decreased to 26, 2 %.

Table 1

Assessment of living standards in Uzbekistan, WB, August 2002*

Region	Percentage of disadvantaged population
Urban area	22,5
Rural area	30,5
Uzbekistan	27,5
Tashkent province	16,9
Tashkent city	9,2

*) Calculations are based on the Survey of household budget conducted in 2002-2003.

[2] "Gender aspects of IWRM", G. Stulina et al., GWP, Tashkent, 2005.

Maximum concentration of low-income families is observed in southern and northern regions in Uzbekistan, while the lowest level of poverty is in Tashkent region. Level of poverty is 4 times higher in southern regions of Uzbekistan than in Tashkent region.

3.3.Food consumption per person in absolute values and calories

Comparison of food production and consumption in the basin as given in the report on position 7.3[3] showed that population in Tashkent province was fully provided with all foodstuff items, except for meat, milk and some other livestock products supplied from neighboring provinces and republics.

Table 2

Provision of population with foodstuff, kg/person/year.

Product	norm per capita	production		consumption	
		1990	2003	1990	2003
Bread and bakery	130	92,6	238	170,0	198,0
Meat and meat foods	60	23,6	21,9	32,0	32,3
Milk and dairy products	270	147,9	157,1	210,0	161,0
Vegetables and melons	45,0	138,6	127	107,0	137,0
Potato	76,0	16,4	33,0	29,0	35,0
Grapes, berries, fruits	35,0	68,5	45,6	23,0	44,0
Sugar	14,5	n.a.	9,7	24	n.a.
Vegetable oil		n.a.	8,5	12,6	9,8
Fish		n.a.	0,2	4,9	n.a.
Eggs		120	64,0	120	61,0

When calculated in calories, provision of population with foodstuff (mainly, at expense of irrigated lands) is 2230 to 2350 kcal/person/day.

3.4. Losses caused by diseases, including by water quality

Tashkent city and Tashkent province take dramatic position regarding frequency of gastrointestinal diseases in the republic, though there is considerable tendency to reduction of disease frequencies. There were 600 incidents per 100000 people in the republic in 1991, with following reduction to 195 by 2000, while this figure was 240 incidents in Tashkent city and 200 incidents per 100000 people in Tashkent province in 2000[4].

3.5. Mortality

In general, mortality level decreases, both infant mortality from 245,9 to 205 per 100000 people over 5 years and general mortality, from 718,7 to 631 people by 2003. Mortality caused by gastrointestinal and parasitic diseases is 69,2 per 100000 people or 11 %. If one considers that these diseases were caused by unsatisfactory water quality, then damage from

[3] Socio-economic analysis of Chirchik and Akhangaran river basins, executors Prikhodko V.G. and Nerozin S.A., 2005

[4] UNECE, “Environmental performance reviews, Uzbekistan”, UN, Geneva – NY, 2001, p. 155.

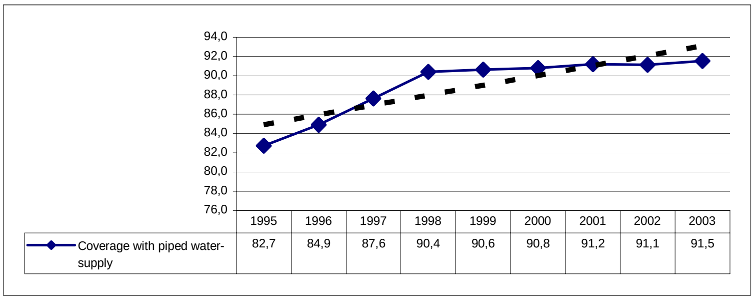
disease incidence caused by water quality would be $4.0 million out of $36.29 million of general damage due to disease incidence as estimated in the report on position 7.3[5] for a level of the year 2003.

3.6. Access to safe water and sanitation

In Tashkent province as a whole, coverage with piped water-supply was 91,5 % in 2003.

Figure 2.

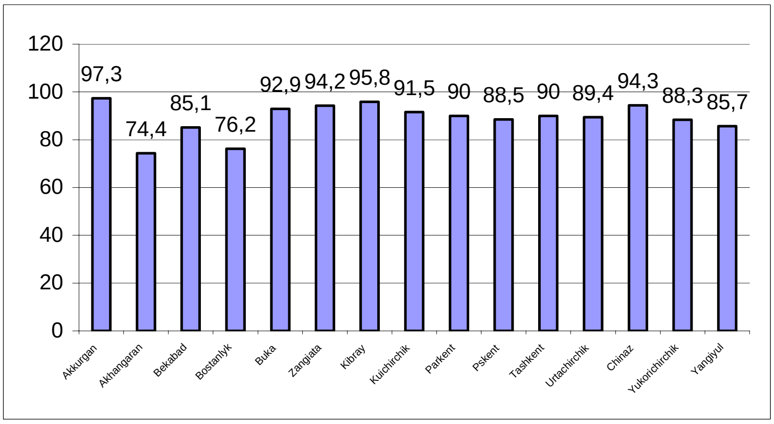
Dynamics of coverage with piped water-supply in Tashkent province, %



Practically in all towns (except for Angren – 93,7%), water-supply lines account for 98,4 to 99,2 %. Whereas in districts this figure is quite lower. The average provision with water-supply lines is 88,9 %. The more complex situation is in Akhangaran and Buka districts (74,4 % and 76,2 %, respectively).

Figure 3.

Coverage with piped water-supply per district, Tashkent province, 2003, %



Coverage with piped water-supply in Tashkent city was 98-99,2% in 2004.
According to survey results, as to provision with drinking water in the province, 59,2 % of the respondents consider it as good or fairly good and only 8,9 % of the respondents indicate poor supply with drinking water (most respondents, 22,2 %, noted poor supply in Chinaz district, which is maximally distant from catchment of Chirchik river basin).

[5] Socio-economic analysis of Chirchik and Akhangaran river basins, executors Prikhodko V.G. and Nerozin S.A., 2005

Coverage with sanitation facilities is much worse in urban area and even more so in rural area.

Table 3.

Number of citizens connected to sewerage and treatment system	Almalyk PU - 80300 Angren PU - 51600 Akhangaran PU - 26740 ПУ «Tashsuvtaminot» Keles town -2700 Kibray PU - 7200 Bekabad PU - 36400 Gazalkent PU - 11880 Parkent PU - 2960 Yangibazar PU - 620 Chirchik PU – 102000 Yangiyul PU - 23200 Zangiata PU -6400 TOTAL: - 352000
Number of citizens only connected to sewerage	Sewerage of PU Tashsuvtaminot -2700 (Keles), Kibray PU - 7200 people , Yangibazar-620 people, Parkent -2960 people connected to treatment plants of Tashkent city

So total quantity of people connected to sanitation out of Tashkent is only 15%; situation is much better in Tashkent city and this figure is approximately 77%.

3.7. GDP per capita

Dynamics of GDP per capita in Chirchik basin is determined by:

- dynamics of industrial production;
- dynamics of agricultural production;
- change in ratio of economic sectors;
- population growth.

Table 4.

Dynamics of major factors influencing GDP in Chirchik basin

Factor	1990	1995	2000	2001	2002	2003	2004	2005
Industrial production, total– $ million	7030	3090	2235	2143	1846	2022	2395	2636
of which Tashkent city	3610	1590	1181	998	871	979	992	1178
Tashkent province	3420	1500	1054	1145	975	1043	1403	1458
Agricultural production, total – $ million	3020	620	617	639	521	480	487	508
Economic structure, % of GDP								
• industry	27,4	37,9	21,9	23,3	24,8	25	26,0	26,3
• agriculture	29,2	28,9	39,7	38,6	37,8	40	39,0	38
• fisheries	0,8	0,2	0,1	0,09	0,06	0,05	0,05	0,05
construction	25,8	7,2	3,5	3,2	3	2,7	3,0	5
• transport and commun.	7,4	3,3	7,3	7,1	7,1	2,5	4,0	6

• others	9,4	22,5	27,5	27,7	27,2	29,8	28,0	24,7
GDP, total - $ billion	4,47	2,64	3,16	2,71	2,31	2,29	2,53	2,76
Tashkent province	2,95	1,03	1,34	1,24	0,95	0,98	1,12	1,25
Tashkent city	1,52	1,61	1,82	1,47	1,36	1,31	1,41	1,51
Population, total- th. people	4258,2	4371,1	4518,2	4556,1	4570,2	4585,6	4597,0	4612,0
Tashkent province	2138,2	2246,1	2370,2	2394,1	2401,2	2444,6	2451,0	2464,0
Urban area	947,6	935,3	948,7	968,8	954,8	974,3	976,9	982
Rural area	1190,6	1310,8	1403,0	1422,4	1446,4	1470,3	1474,1	1482
Tashkent city	2120	2125	2148	2162	2169	2141	2146	2148
GDP per capita, total - $/person	1050	604	699	595	505	499	550	598
Tashkent province	1380	459	565	518	396	401	457	507
Tashkent city	717.0	757.6	772.8	679.9	613.2	611.9	657.0	703.0

As the Table shows, basin GDP has continously decreased until 2001, and its minor growth leaves behind the population growth that affects both water productivity and farming efficiency and the general economic conditions. The causes include both deteriorated industrial capacities and some external factors that will be analyzed at the end of the report.

3.8. Electric energy production

Electric energy production in the basin is practically stable, though consumption has decreased slightly, mainly due to setback in industrial production.

Table 5

Electric energy production and consumption

№	Indicator	1991	1995	2000	2001	2002	2003	2004
1	Electricity generation in the basin, million kWh, total:	38441	34458	35099	35801	37268	36354	37071
1.1	of which HEPS	4277	4857	3826	4356	5576	5721	5139
1.2	TEPS	34164	29601	31273	31445	31692	30632	31931
1.3	% of generation PJSC Uzbekenergo	72,7	74,2	76,2	75,9	77,8	77,0	76,84
2	Electricity consumption, million kWh	53699	46139	48072	48422	49216	48688	49408,5
3	Electricity consumption per capita/year, kWh	2544,5	2014	1937	1921	1928	1894	1898,8
4	Cost of generated electricity, tiyin/ kWh	0.01	0.01	0.013	0.010	0.011	0.012	0.013

5	Water productivity in energy production, kWh /m^3 $/m^3	0,753 0,0075	0,759 0,0076	0,718 0,0097	0,775 0,0082	0,665 0,0077	0,706 0,0082	0,723 0,0093

The data indicated to successful performance of energy production sector and, particularly, to stability of energy production, including water productivity in the sector.

4. Agricultural development indicators

4.1. Land use

This is characterized by several indicators as set by guidelines.

Agricultural land availability is shown in Table 6.

Table 6.

Land fund and its components in the Uzbek territory of the CAB basin (thousand ha)

Year	Total area	Net irrigated area	Fallow land, hayfields, pastures	Homestead land	Agricultur. land	% agricultural land of total land area	Land use per person (ha)[6]	
							agricultur. land	irrigated land
1995	1496.0	360.0	2.5	50.0	810.4	54.2	0.171	0.076
2000	1480.4	357.1	2.8	48.5	770.6	52.0	0.158	0.073
2003	1495.1	353.6	1.8	49.2	803.8	53.7	0.163	0.071

4.2. Agricultural production in irrigated lands of Tashkent province, thousand t

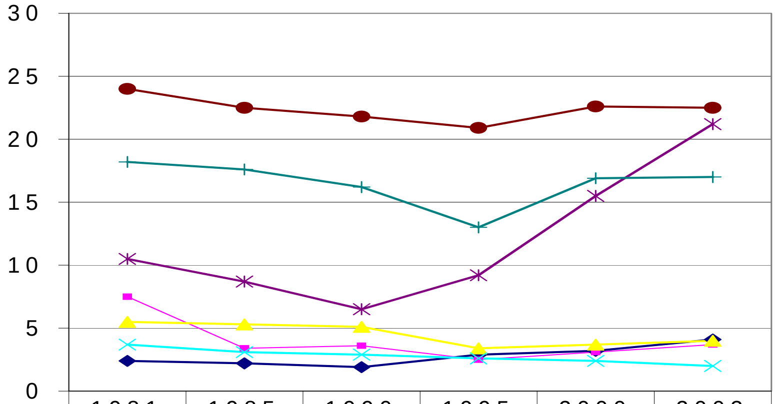
Table 7.

Year	Dry land		Irrigated land						
	Grain	Forage	Grain	Maize	Rice	Raw cotton	Potato	Vegetables	Cucurbits
1995	16.0	11.8	204.3	7.9	24.5	244.4	33.0	261.6	18.3
2000	11.6	8.7	303.7	25.9	41.1	224.5	120.7	505.5	44.7
2003	17.6	10.9	431.7	29.2	32.3	187.9	135.6	586.2	56.0

[6] Land use was calculated with account of population in Tashkent province and Tashkent city.

As Tables 6 and 7 show, the total and irrigated areas basically have not changed; cropping patterns have changed in the province and this has led to more than two-fold increase in grain and maize production, 1.5 times rise in rice production, reduction of cotton and abrupt increase in vegetables.
Dynamics of crop yields is shown in Figure 4.

Figure 4. Dynamics of main crop yields in Tashkent province, t/ha



	1981	1985	1990	1995	2000	2003
cereals	2,4	2,2	1,9	2,9	3,2	4,1
corn	7,5	3,4	3,6	2,5	3,1	3,7
rice	5,5	5,3	5,1	3,4	3,7	4
raw cotton	3,7	3,1	2,9	2,6	2,4	2
potato	10,5	8,7	6,5	9,2	15,5	21,2
vegetables	24	22,5	21,8	20,9	22,6	22,5
cucurbits	18,2	17,6	16,2	13	16,9	17

5. Indicators of water supply and use

5.1.Available water resources for use

The estimation of total water resources is given as for mean long-term and minimum year (90% probability) in Report D 24. Thereupon, water resources are estimated in Mm^3/yr:

- Surface water in year with 50% probability (1994) - 11661
- Regulated flow – 9200
- Groundwater – 555
- Return flow – 2917
- Losses in the basin – 335
- Environmental flows over 3 rivers – 870,5
- Required inflow to the Syrdarya river – 2400

Total water resources in normal year - 14798
Guaranteed regulated water resources – 9066

Available water resources per capita in the basin are as follows:

Table 8.

Year	Population (1000)	Amount
1995	4440	2041 m^3/cap
2000	4650	1940 m^3/cap
2003	4950	1813 m^3/cap

5.2.Water use in different sectors

Total water withdrawal for all needs in the basin is distributed in the following way:

Table 9.

Distribution of total water withdrawal (M m^3):

Year	Total water withdrawal	including			
		industry	domestic	energy	irrigation
1995	6530.4/100	302,4/4.6	1445/22.1	1653/25.3	3130/48
2000	6255.8/100	218,8/3.5	1390/22.2	1789/28.6	2858/45.7
2004	7045.5/100	300,6/4.3	1472/20.9	2034,9/28.9	3238/45.9

Numerator – absolute values
Denominator - %

5.3.Water consumption index as a ratio of total water consumption to average annual water availability

There is enough water availability in the basin; average value of the water consumption index varies between 35% and 50% depending on annual water availability.

5.4. Water supply per water user sector and its yearly fluctuations

In general, water supply to sectors is sustainable enough, and it is characterized by the following.

5.4.1. Water supply to irrigated farming

Irrigated farming is the main water consumer in the basin as well as in the whole region, and accounts for 85 to 95% of water withdrawal in different parts of the basin. As for Keles, it is estimated to exceed 95%.
As regards water consumption limits and design water consumption calculated in the project using the CROPWAT model, overall water supply is satisfactory enough (between 92 and 121%) (table 10).

Table 10.

Comparison of water supply to irrigated lands per district in 1995-2003[7]

Year	Area (th. ha)	Limit (M m3)	Actual (M m3)	Water supply (%)	Net limit (m3/ha)	Net actual (m3/ha)	Water supply (%)	Design data (m3/ha)	Water supply (%)
1995	**350.9**		**2075**			**5914**		**4908**	121
2000	**347.2**		**1923**			**5539**		**5114**	108
2001	**345.7**	**1544**	**1655**	107	4466	**4788**	107	**5176**	93
2002	**344.3**	**1544**	**1425**	92	4484	**4137**	92	**4469**	93
2003	**343.8**	**1544**	**1529**	99	4491	**4447**	99	**4319**	103

The analysis given in the Annex for the representative years 1995, 2000, 2001, 2002 and 2003 shows that:

- Akhangaran and Parkent districts experience a considerable chronic water shortage in the range of 30% as a result of lower water supply to this part of the sub-basin;
- In low water years, other six districts, Akkurgan, Bostanlyk, Yukori-Chirchik, Pskent, Urta-Chirchik and Yangiyul, suffer from a 20% water shortage.

During the next analysis, efforts will be made to plan measures in order to equalize water shortages in all the districts up to the mean provincial level, which practically doesn’t impact (±10 %) on crop yields.

5.4.2. Water supply to industry

This indicator for Tashkent city and Tashkent province is sufficiently stable, in absolute value it reduced from 400–425 million m^3 in the late 1980s to 220 million m^3 in 2000, and

[7] Limit is quantity of water allocated to proper area according to annual water allocation plan of Chirchik basin authority, Mm^3;
Net limit is the same per 1 ha of irrigated land;
Actual is quantity of water diverted actually to the same area, Mm^3;
Net actual is the same per 1 ha of irrigated land;
Design is quantity of water estimated by the model “Cropwat” in project per 1 ha of irrigated land.

somewhat increased to 300 million m^3 in 2003-2004. Meanwhile, beginning from 1991, the industrial production rapidly reduced, and in the 2000s it amounted to only 30% of the previous volumes that led to a sharp reduction in water productivity in the industry by 3 times. Such an occurrence is quite explainable. The investigation made by the JICA at industrial enterprises in Tashkent city showed that most part of the canalization within the enterprises was oriented on their full loading in design regimes. Though at the enterprises, from 15 to 35% of capacities are used, water is supplied to the territory with low use efficiency. No one reconstructs the outdated networks, and the production is being expanded very poorly – 3-5% a year. Such a situation seems to last until the completion of the privatization of these enterprises and their loading or mothballing (Table 11).

Table 11.

Dynamics of water withdrawal by industry

	Water withdrawal (M m3)	Output ($ billion)	Water use (m3/$)
1985	407.5	7.08	0.058
1986	426.2	7.35	0.058
1987	426.1	7.21	0.059
1988	424.7	7.14	0.060
1989	423.3	7.07	0.060
1990	423.5	7.03	0.060
1991	415.5	5.78	0.072
1992	384.5	3.55	0.108
1993	349.6	1.55	0.226
1994	327.2	1.43	0.229
1995	302.4	2.16	0.140
1996	248.7	3.06	0.081
1997	216.7	2.93	0.074
1998	202.4	2.78	0.073
1999	204.9	2.85	0.072
2000	218.8	2.22	0.099
2001	216.4	1.84	0.118
2002	192.6	1.60	0.120
2003	280.1	1.72	0.163
2004	300.6	1.92	0.157

5.4.3. Water supply to the population in Tashkent city and Tashkent province

As stated, Tashkent city (especially) and Tashkent province are characterized by the highest water supply to the population in both quality and quantity in the whole country, and perhaps in Central Asia. The normative water consumption per capita is regulated by the Construction Norms and Specifications developed for towns with moderate climate in Russia that recommended 250 liter/day/capita. In practice of designing dwelling houses and blocks in Tashkent city, such a norm was used until the recent years. By the instruction of the Mayor of Tashkent city dated 13 October 1995, the norm for the city was determined as 330 liter/day/capita, as compared to the norms in Western Europe and Japan, which are respectively 1.5-2 and more than 3 times lower[8]. Nevertheless, very high consumption in Tashkent city is reported. According to the JICA Report (2004):

[8] R.S. Khabirov, R.I. Gutnikova. Problem of drinking water supply to the population in Uzbekistan., Tashkent, 2000

- Total water withdrawal per capita in the city is 981 liter/day/capita;
  Of them, losses – 392.4 liter/day/capita;
  actual consumption – 588.6 liter/day/capita;
  including:
  - consumption by population - 168 liter/day/capita;
  - consumption by industry and budgetary organizations – 330 liter/day/capita;
  - irrigation and unaccounted entities - 90 liter/day/capita;

The planned measures should reduce water withdrawal and consumption by 2015, namely:

- losses from 40% to 29.1%;
- consumption by industry and budgetary organizations by 14% to 280 liter/day/capita;
- consumption by population to 150 liter/day.

5.4.4. Water supply to energy sector

Average water productivity in the energy production sector also remains stable and is 0,729 kWh/m^3 or 0,0084 $\$/m^3$.

Table 12.

Water consumption by the energy sector remains stable during many years and is characterized by the following indicators.

Name	Year	Water withdrawal, Mm^3/year	Outflow, Mm^3/year	Note
Tashkent combined heat power plant (CHPP)	**2000**	26,17	5,42	Only process water is returned, rest of water is used for domestic needs
	2004	25,97	5,52	
	2000	1741,38	1737,21	
Tashkent power plant	**2004**	1291,21	1287,95	
Angren power plant	**2000**	102,721	86,53	
	2004	88,624	80,06	
Novo_Angren power plant	**2000**	50,172	6,84	
	2004	42,633	4,961	
Total for CHPP and TEPS in ChAB	**2000**	1920,44	1835,99	
	2004	1448,44	1378,50	
Total for CHPP and TEPS of SJSC Uzbekenergo	**2000**	4734,7	4270,4	
	2004	4293,38	4143,34	

5.4.5. Provision of the nature with water

When planning water allocation, any water system should be considered as a single ecosystem since it represents a coherent chain of interlinked local ecosystems, including such components as sources, river channels, coastal zone, flood-plain, groundwater, wetlands and delta.

As a whole, two types of releases are identified, such as *ecological and sanitary releases*.

Ecological releases are needed to sustain natural and artificial aquatic ecosystems.

Sanitary releases along the rivers are required so that to sustain rivers as water bodies of natural (environmental) and social importance, in particular to avoid deterioration of sanitary conditions and quality of river water.

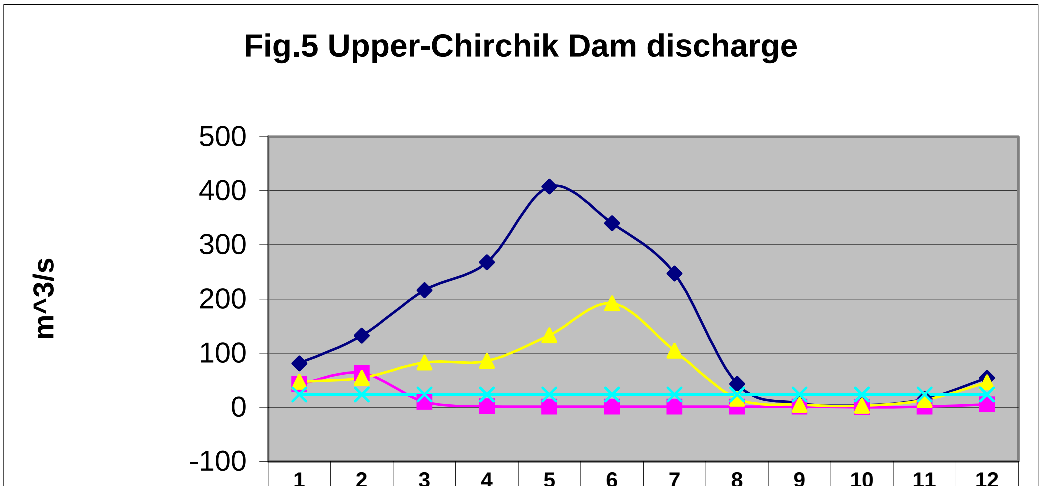
In the broad sense, hydroecosystems needs may be described as water quantity and quality that are needed for environmentally-sustainable development and use of water resources. Environmental needs may have various limit values depending on degree of potential degradation of a hydroecosystem. The lowest degree may be called as *the resource base* – this is *environmental threshold*, below which the hydroecosystem is subjected to drastic, often irreversible changes.

In estimating a value of *sanitary releases* in practice, as a rule, 95% of natural flow probability is taken as design one. It is thought that this may sustain *self-cleaning* processes.

For example, if we take annual river run-offs at 95% of flow probability as a basis, *sanitary releases* will be 23,4 m^3/s, 2,5 m^3/s and 2,0 m^3/s for rivers Chirchik, Akhangaran, and Keles respectively.

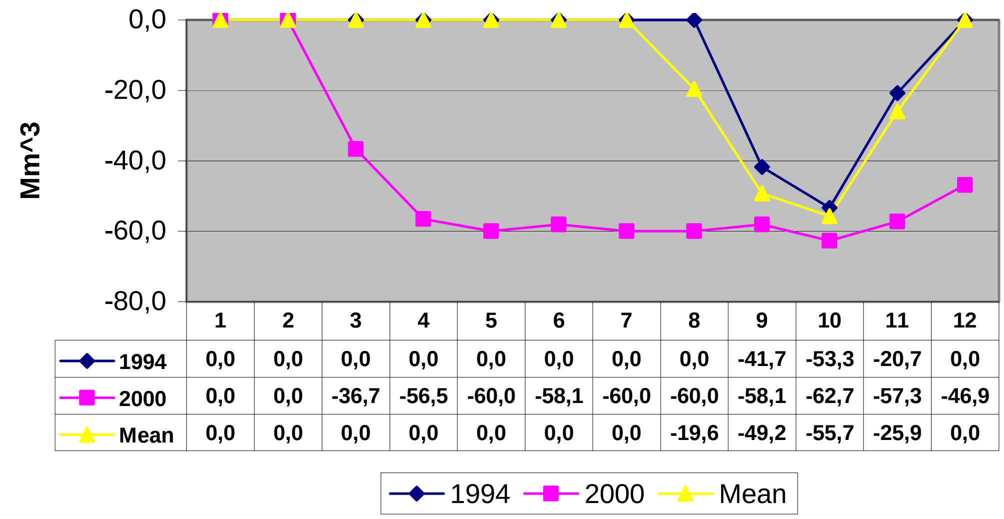
Analysis of hydrographic data on these rivers shows that, besides the Keles river, the approved volume of sanitary-ecological releases is not observed in the Chirchik river and the Akhangaran river. From August till December, discharge is not more than 7-8 m^3/s in the Chirchik river (Fig. 5), and less than 1,5 m^3/s in the Akhangaran river. Figure 6 shows mean monthly deficit values for provision of sanitary-ecological releases in the Chirchik river (Fig. 6). As a result of insufficient water quantity in the river, bloom of green algae and fish productivity reduction due to low water quality and decreased water level and volume (1,5-2,0 m) in fish ponds are observed.

All such conditions were proved by us during agroeconomic and ecological survey conducted together with representatives of nature conservation agencies in Chirchik and Akhangaran basins.



	1	2	3	4	5	6	7	8	9	10	11	12
1994	80,8	132,5	216,1	267,4	407,8	339,9	246,9	43	7,3	3,5	15,4	54,4
2000	43,1	63,2	9,7	1,6	1	1	1	1	1	0	1,3	5,3
Mean	47	54,3	82,5	85,6	133,1	192,3	104,5	16,1	4,4	2,6	13,4	46,1
San-ekolog/	23,4	23,4	23,4	23,4	23,4	23,4	23,4	23,4	23,4	23,4	23,4	23,4

Fig.6 Mean monthly deficit values for provision of sanitary releases in the Chirchik river



	1	2	3	4	5	6	7	8	9	10	11	12
1994	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-41,7	-53,3	-20,7	0,0
2000	0,0	0,0	-36,7	-56,5	-60,0	-58,1	-60,0	-60,0	-58,1	-62,7	-57,3	-46,9
Mean	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-19,6	-49,2	-55,7	-25,9	0,0

The evaluation shows that sanitary-ecological releases should account to 150 to 556 Mm^3 in the Akhangaran river. Taking into account Keles river and preservation of tributaries and small ponds as natural entities, this value should be 870,5 Mm^3 per year.

6. Impact of insufficient water availability

We tried to evaluate agricultural production shortage due to this reason by using dynamics of water productivity in irrigated farming. The analysis was made for the years 1995, 2000, 2001, 2002 and 2003. Two of the analyzed years are sufficiently high water years, other two ones are low water years. The analysis (Annex 2) shows the absence of a direct relationship between water availability and economic indicators of agricultural production in money terms, since such factors as domestic currency conversion, inflation and changes in prices for agricultural products have a much more strong impact upon these indicators. It seems expedient to make a factor analysis, which can make the situation clear. In general, it can be seen from a summary table of this analysis (Table 13) that in the low-water years 2001 and 2002 irrigated farming was higher than in the high-water years 2003 and 2004 (in US dollars), though in the low-water years the absolute yields of grain and vegetables were smaller, with those of cotton being larger. It seems expedient to make a more detailed analysis and present it as a supplement. Nevertheless, (quantitative) problems with irrigation water supply reduce the productivity of irrigated lands by 5-10% that results from improper water resources management and high rates of growth in prices for electric energy (in upstream areas where pumping irrigation is practiced). The annual damage amounts to US$12.5 million (average for the years 2000-2004).

Table 13. Dynamics of water productivity in irrigated agriculture (Tashkent province)[9]

	Actual water withdrawal for irrigation at the border of districts (M m3) (A1)	Flow from collector-drainage network (M m3) (A2)	Irrevocable water consumption (M m3) (A=A1-A2)	Irrigated area (th. ha) (B)	Gross crop production ($ M) (C)	Water use productivity – version 1 ($/m3) (C/A)	Water use productivity – version 2 ($/m3) (C/A1)	Land use productivity ($/ha) (C/B)
1995	***3191,0***	***1657,5***	***1533,5***	***350,9***	***215,7***	***0,14***	***0,07***	***614,7***
2000	***2958,5***	***1278,5***	***1680,0***	***347,2***	***335,5***	***0,20***	***0,11***	***966,3***
2001	***2547,0***	***1261,6***	***1285,4***	***345,7***	***302,8***	***0,24***	***0,12***	***875,9***
2002	***2191,4***	***1196,2***	***995,2***	***344,3***	***220,6***	***0,22***	***0,10***	***640,7***
2003	***2351,8***	***1320,7***	***1031,1***	***343,8***	***197,2***	***0,19***	***0,08***	***573,6***

[9] Table showing these indicators per district is given in Annex 2

7. Water factor's impact on environmental conditions in the basin

7.1. Ecological indicators for assessment of surface water

Monitoring and assessment of surface water quality is one of the challenges of environmentally sound water resources management and protection. Currently there are standards and methods of water quality assessment for economic purposes (domestic use, fisheries, irrigation, recreation). However, from ecological point of view, the system of economic water quality assessment, which is based on comparison of certain hazardous substance concentrations with maximum permissible concentrations (MPC), is ineffective since it does not describes the ecological status of water bodies. At the same time, available methods for biological evaluation of aquatic ecosystems based on priority indicator biocenoses (periphyton, zoobenthos, phytoplankton) are more acceptable for analysis and identification of the ecological status of aquatic environment. The recommended assessment methods for the ecological status of aquatic entities are based on establishment of control parameters of water quality, which include indicator physical, chemical, and biological parameters.

When establishing water quality parameters, we took into account current surface water quality, regional characteristics of their formation, importance of water bodies for economic use and for certain habitats of biocenoses.

According to set of water quality criteria on the basis of European Union's[1] water policy, we have developed classifications of ecological status (environmental conditions) and levels of environmental sustainability of aquatic entities («Recommendations for environmental assessment of surface water in Uzbekistan», Nikolayenko V.A., Ruziev I.B., Matsura M., Tashkent, 2005)[2] separately for water salinity (mineralization) and for ecological and sanitary parameters.

The following water quality indicators are proposed for assessment of ecological status of surface (river) water:

Biological:

- Phytoplankton;
- Other aquatic flora;
- Macro-invertebrates;
- Fish fauna

Hydromorphological:

- Continuity;
- Hydrology;
- Morphology

Chemical-physical:

- Temperature conditions;
- Oxygenation;
- Salinity;
- Nutrient content;
- Biochemical oxygen demand;
- Other pollutants;
- Priority substances

Proceeding from the above-mentioned classification (2) and indicators (1) of surface water quality, we assessed environmental conditions in the Chirchik river basin.

7.2. Assessment of river's environmental conditions in terms of chemical, physical, and biological indicators

Assessment of water quality in the Chatkal river has shown that for household water use (HWU) reservoirs, all parameters related to general sanitary and sanitary-toxicological LHI did not exceed MPC, while among organoleptic LHI, phenols exceeded MPC in some months. For fish-husbandry reservoirs (FHR), river water did not meet standards regarding zinc, phenols and pesticides that mainly come from large quantity of private landholders located along tributaries and around Charvak reservoir.

In terms of hydrobiological parameters, water quality in the Chatkal river is classified as clean and very clean.

Water in the Pskem river for HWU reservoirs is of good quality. Excess of MPC is observed for phenols in certain periods of time. As to FHR, river water did not meet standards on a range of elements: zinc, phenols, oil products and pesticides.

In general, environmental conditions in tributaries vary from good to satisfactory level. Trophicity level varies from oligotrophic to mesotrophic one.

Water quality in Charvak reservoir is characterized by the same indicators as its inflows.

The third environmental zone is located downstream of Charvak reservoir up to Chirchik city and is subjected to moderate anthropogenic load through discharge of domestic sewage and small manufacturing water from Charvak and Gazalkent towns and Iskander and Tavaksay villages into the Chirchik river. The fourth environmental zone, which is subjected to great anthropogenic load is located downstream of Chirchik city up to the Syrdarya river. This zone accommodates large cities and industrial plants, such as PE Electrokhimprom, UzKTJM, Uzbekhimmash, meat-packing plants, bread-baking plants, construction materials industry, building industry, etc. Under-treated wastes containing biogenic elements, organic matters and heavy metals that are discharged from these plants have negative impacts on ecological status of the Chirchik river. This is confirmed by our assessment of river water quality in the section, 130 km long, from upstream to river outlet.

Water quality parameters deteriorate from upstream cross-section to river outlet. In the first cross-section, at present level (2000 – 2003) water salinity ranged from 132 to 272 mg/l and mean annual values varied from 181 to 195 mg/l, whereas in the 10^{th} cross-section it increased to 273 – 1526 mg/l, with mean annual values growing to 449 – 763 mg/l. Accordingly, main ions, especially sulphates, chlorides and sodium ions increased. Among nitrogen compounds, maximum concentrations are observed for nitrates amounting to 5 – 6 mg/l in river midstream. Microgram concentrations of heavy metals were also found, including copper, zinc, chrome, nickel, mercury, lead, and cadmium (toxicological indicators). Pollutants are represented mainly by phenols that are found from thousandths to hundredths fractions of mg/l along the whole length of the river. Oil products, synthetic surfactants, pesticides (alpha and gamma hexachlorocyclohexane) were also found.

Results of economic water quality assessment made in different cross-sections of the Chirchik river in 1980, 1985, 1900, 1995, 2000-2003 are show in Tables 14, 15.

Table14 – Chirchik river's water quality parameters approaching and exceeding MPC for household water use reservoirs

Para-meter	Unit	MPC /year	C/MPC and date of detection							
			1980	1985	1990	1995	2000	2001	2002	2003
1	2	3	4	5	6	7	8	9	10	11
1. Upstream of Gazalkent town										
1.Phenol	mg/l	0,001	3 - 32	1 - 19	1 - 8	I - 6	I - 3	1,0	1,0	9 - 10
MONTH detection			(I - XII)	(I,III,VIII)	(I,III-VIII)	(III-XII)	(II-V,VII, VIII,XI)	(I-III,VI, VIII,XI)	(V)	(I,VII,)
2. Oil	mg/l	0,1	1,0 - 35,6	1,3 - 12,8	1,0	1,7	1,0	0	0	1,1 - 1,4
			(II,VII-IX, XII)	(III,VI, VIII,IX)	(XII)	(XII)	(IX)			(X-XI)
3. Hg	mg/l	0,0005	2,0 - 25,2	1,6	0	0	0	0	0	0
			(I-III,VII VIII,XI, XII)	(XI)						
2. Downstream of Chirchik town										
1. ultimate BOD	mg/l	3,0	1,4 - 1,6	0	1,4 - 2,8	0	1,4 - 1,8	1,0 - 1,1	1,6	1,4 - 2,2
			(III,VIII- IX)		(I -VI, IX - XII)		(I,III,VI, VII)	(V,VI)	(I)	(VIII-XI)
2. COD	mg/l	15	0	1,1 - 1,2	1,0	0	2,0	0	1,1	0
				(X-XII)	(V)		(X)		(II)	
3. Phenol	mg/l	0,001	1 - 210	3 - 16	2 - 30	1 - 14	1 - 8	1 - 3	1 - 7	1 - 4
			(I-XII)	(I-XII)	(I,III-XII)	(I-II,IV, VII-XII)	(I,VI,VIII, X,XII)	(I,IX-XI)	(II,V,VI, XI,XII)	(I,III)
4. Oil	mg/l	0,1	1,1 - 3,7	1,4 - 4,2	1,0 - 1,1	0	0	1,2 - 1,8	0	1,0 - 1,2
			(I,III,VII- IX,XI- XII)	(I,V,VI, XI,XII)	(IV-XII)			VIII,X)		II,IX,XI)
5. Hg	mg/l	0,0005	1,0 - 50,2	1,2	0	0	0	0	0	0
			(I-VI, VIII-IX)	(I)						
3. Downstream of Tashkent city										
1. ultimate BOD	mg/l	3,0	-	1,1	1,0 - 2,4	0	1,1 - 1,5	2,2	1,0 - 1,5	1,2 - 2,0
				(XI)	(I-VII, IX-XII)		(VI-VIII)	(VIII)	(II,VI, VII,XI)	(I,III,VII I)
2. COD	mg/l	15	-	1,0 - 2,3	1,0	0	2,3	0	1,1	0
				I,III,V, IX-XII)	(V,X)		(V)		(II)	

3. Phenol	mg/l	0,001	-	1 - 9	1 - 5	1 - 9	1 - 4	1 - 7	1 - 3	2 - 4
				(I-XII)	(I-VII, IX-XII)	(II,III,V-X,XII)	(I,IV-VII, XII)	(I-III,VI-VIII,XII)	(I,III, V,XI)	(II,VII)
4. Oil	mg/l	0,1	-	3,0 - 9,1	1,1	0	1,4	1,3 - 2,2	1,4 - 3,0	1,2
				II,III,V-VII,XI)	(V)		(VIII)	(V,VII,IX , X,XII)	(II-V)	(XI)
5. Hg	mg/l	0,0005	-	1,0 - 2,8	0	0	0	0	0	0
				III,VII, IX)						
4. Downstream of Novomikhailovka village										
1. ultimate BOD	mg/l	3,0	1,2 - 3,1	1,2	1,0 - 2,2	1,1 - 1,8	1,1 - 1,5	1,3 - 2,0	1,4 - 1,6	1,0 - 1,3
			(I,IV,V,VI I, IX,XII)	(I)	(II-VI,XI)	(VI,VII, XII)	(I,III,VI, VII)	(I,V-IX)	(III,IX)	(III,VIII, IX)
2. COD	mg/l	15	2,2	1,1 - 1,2	0	0	0	0	1,1	0
			(XII)	(I,X,XI)					(I)	
3. Phenol	mg/l	0,001	6 - 117	3 - 11	1 - 4	1 - 8	1 - 6	2 - 6	2 - 7	1 - 5
			(I-XII)	(I-XII)	(I-VII, IX,XI)	(II-V,VII, X,XII)	(I,II,V-VIII,X,XII)	(I-II,VIII, XI-XII)	(I,VII,IX, XI,XII)	(III,X)
4. Oil	mg/l	0,1	1,0 - 43,7	1,8 - 11,7	0	0	0	1,2 - 1,5	1,3 - 4,4	0
			I-III,V, IX,X,XII)	(I-III,VII, VIII,XII)				(II-XII)	(I,IV,XII)	
5. Hg	mg/l	0,0005	1,2 - 39,8	-	0	0	0	0	0	0
			(I-X,XII)							
5. Cninaz, river outlet										
1. ∑ion	mg/l	1000	0	0	0	0	1,4 - 1,5	0	0	0
							(VIII-IX)			
2. total hardness	mmole	7,0	1,0 - 1,1	1,0 - 1,1	1,0 - 1,3	1,0	1,0 - 2,0	1,0 - 1,4	1,0	1,0 - 1,1
			(IX-XII)	(II,V,VI, X,XI)	(I,III,VII-X,XII)	(V,IX, XII)	(VI-IX, XI)	(II,III, V-XI)	(VIII-IX)	(VIII-IX)
3. ultimate BOD	mg/l	3,0	1,0 - 1,7	1,0 - 1,4	1,0 - 1,7	1,1 - 2,3	0	0	0	0
			(I-III, V,VIII)	(I-III)	(II.IV.VI, VIII,XII)	(II,III, V,XI)				
4. COD	mg/l	15	1,2	0	1,1	0	0	1,3 - 1,9	1,1 - 1,2	0
			(X,XII)		(I)			(VI-IX)	(IX-XI)	
5. Phenol	mg/l	0,001	11 - 70	4 - 13	1 - 8	1 - 7	1 - 2	1 - 2	1 - 9	4 - 11
			(I-XII)	(I-VI,VIII, X,XI)	(II-IV, VI-XII)	(I-VII, IX-XII)	(VI,VII,XI I)	(I,II,IV,V , VII.IX,XI ,	(II-IV, VI-VIII,	(III,IX, XI)

								XII)	X-XII)	
6. Oil	mg/l	0,1	1,4 - 1,9	1,3 - 8,9	0	0	0	0	0	2,4
			(II,VI, IX,XII)	(II,VII, XI)						(V)
7. Hg	mg/l	0,0005	6,2 - 21,4	0	0	0	0	0	0	0
			(II,V,VII, VIII,X)							

Table 15 - Chirchik river’s water quality parameters approaching and exceeding MPC for fish-husbandry reservoirs

Para-meter	Unit	MPC /year	C/MPC and date of detection							
			1980	1985	1990	1995	2000	2001	2002	2003
1	2	3	4	5	6	7	8	9	10	11
1. Upstream of Gazalkent town										
1. Cu	mg/l	0,01	0	1,1 - 5,5	1,3	0	0	0	0	0
				(I,V,VI, X)	(V)					
2. Zn	mg/l	0,01	1,8 - 2,2	1,2 - 4,6	1,0 - 4,0	1,0 - 2,6	0	1,0	0	1,0 - 1,7
			(II,IV,VIII, IX)	(IV,VI,X)	(I,III,V,VI, IX-XII)	(I-XI)		(IX)		(V-VII)
3. Phenol	mg/l	0,001	3 - 32	1 - 19	1 - 8	I - 6	I - 3	1,0	1,0	9 - 10
			(I - XII)	(I,III,VIII)	(I,III-VIII)	(III-XII)	(II-V,VII, VIII,XI)	(I-III,VI, VIII,XI)	(V)	(I,VII,)
4. Oil	mg/l	0,05	2,0 - 71,2	2,6 - 25,6	2,0	3,4	2,0	0	0	2,2 - 2,8
			(II,VII-IX, XII)	(III,VI, VIII,IX)	(XII)	(XII)	(IX)			(X-XI)
5. Ni	mg/l	0,01	1,1 - 1,3	-	0	0	0	0	0	0
			(II-XI)							
6.N-NH_4	mg/l	0,39	2,3	0	0	0	1,5	0	0	0
			(II)				(VII)			
7.N-NO_2	mg/l	0,024	2,0	0	1,3	1,3	0	1,0 - 8,9	5,4	0
			(II)		(XII)	(VII)		(I-III,VI-VII,X,XII)	(V)	
8. Hg	mg/l	0,00001	100 - 990	10 - 350	1,0 - 16	1,0 - 10	1,0 - 6,0	1,0 - 2,0	1,0	0
			I-III,VII-VIII,X-XII)	(I,II,V, X)	(I-VI, VIII-XII)	(II-III, V-XII)	(III-VI)	(VII,IX, XI)	(IV,VII, XI,XII)	
9. Cr^{6+}	mg/l	0,001	2,5 - 5,2	1,0 - 32	1,0 - 7,6	2,0 - 2,4	1,0	1,7 - 5,0	1,2 - 1,3	1,1 - 10
			(II,III,VII, X,XI)	(I-V,VII-IX,XI,XII)	(I-VII, X,XII)	(IX,XI)	(V,VII)	(IV,X-XII)	(IX,XI)	(I,IV-VI, VIII,IX)
2. Downstream of Chirchik town										

1. Cu	mg/l	0,01	0	1,0 - 1,3	0	0	0	0	0	0
				(IV,VI-VIII,X)						
2. Zn	mg/l	0,01	1,5 - 2,6	1,1 - 1,8	1,1 - 2,0	1,0 - 3,1	0	1,1	0	1,0 - 1,5
			(I-III,V-VI, VIII,IX,XII)	(II-IV,VI, VII,XI)	(II-III, V-XII)	(I-IX)		(II)		(VI,XI)
3. Phenol	mg/l	0,001	1 - 210	3 - 16	2 - 30	1 - 14	1 - 8	1 - 3	1 - 7	1 - 4
			(I-XII)	(I-XII)	(I,III-XII)	(I-II,IV, VII-XII)	(I,VI,VIII, X,XII)	(I,IX-XI)	(II,V,VI, XI,XII)	(I,III)
4. Oil	mg/l	0,05	2,2 - 7,4	2,8 - 8,4	2,0 - 2,2	0	0	2,4 - 3,6	0	2,0 - 2,4
			(I,III,VII-IX,XI-XII)	(I,V,VI, XI,XII)	(IV-XII)			VIII,X)		II,IX,XI)
5. Ni	mg/l	0,01	1,5	-	1,1 - 2,2	1,3	0	0	0	0
			(X)		(VII-X)	(XI)				
6.N-NH_4	mg/l	0,39	1,6 - 16	2,8 - 16,9	1,2 - 4,1	1,2	1,7 - 1,9	1,8	0	0
			I,III-IV, VI-XII)	(I-IV, VI-XII)	(I-V,VIII, IX-XII)	(XI)	(VI, XI)	(II)		
7.N-NO_2	mg/l	0,024	2,0 - 18,3	1,8 - 7,5	1,0 - 9,1	1,0 - 6,3	1,1 - 9,5	1,1 - 6,7	1,1 - 3,3	2,8 - 4,6
			(I-XII)	(I-VII, IX-XII)	(I-XII)	(II,III,VI, IX,XI,XII)	(V-XII)	(I-IV,VI, VIII)	(I-III,V-VI,IX,XI)	(VIII-X)
8. Hg	mg/l	0,00001	50 - 1180	20 - 60	1,0 - 17	1,0 - 11	1,0 - 8,0	3,0 - 23	1,0 - 8,0	0
			(I-VI,VIII-IX,XI,XII)	(I-IX)	(I-III,V-VI,VIII-XII)	(I,III,IV, VI,IX-XI)	(I-II, IV-XII)	(I-XII)	(I-VIII, X-XII)	
9. Cr^{6+}	mg/l	0,001	1,1 - 13,5	1,9 - 10	1,3 - 5,9	2,2 - 3,6	1,0 - 2,0	1,0 - 9,0	1,0 - 2,3	1,8 - 7,6
			I-IV,VI-VII, X-XII)	(I-V,VIII- X,XII)	(I-V,VIII- X,XII)	(I,IV,VII, XII)	(II,IV,V, VII,VIII,X)	(II,VI,VII, IX,XI)	(I,II,IV, VIII,X,XI)	(IV,VI, VIII-XI)
3. Downstream of Tashkent city										
1. Cu	mg/l	0,01	-	1,0 - 19,5	0	0	0	0	0	0
				(I-II,V-XI)						
2. Zn	mg/l	0,01	-	1,0 - 4,0	1,2 - 2,2	1,3 - 3,6	2,5	1,4 - 2,2	1,1 - 2,7	1,3 - 4,0
				(I-IV,VI, VIII-XI)	(I-III,VI, X)	(I-III, V-X)	(XI)	(VIII,IX, XI)	(I-XII)	(IV,V, IX,XI)
3. Phenol	mg/l	0,001	-	1 - 9	1 - 5	1 - 9	1 - 4	1 - 7	1 - 3	2 - 4
				(I-XII)	(I-VII, IX-XII)	(II,III,V-X,XII)	(I,IV-VII, XII)	(I-III,VI-VIII,XII)	(I,III, V,XI)	(II,VII)
4. Oil	mg/l	0,05	-	6,0 - 18,2	2,2	0	2,8	2,6 - 4,4	2,8 - 6,0	2,4
				II,III,V-	(V)		(VIII)	(V,VII,IX	(II-V)	(XI)

				VII,XI)				, X,XII)		
5. Ni	mg/l	0,01	-	0	1,0	0	0	0	0	0
					(IV)					
6.N-NH_4	mg/l	0,39	-	1,1 - 3,7	1,2 - 4,4	0	1,1	0	0	0
				(I-IV)	(I,II,XII)		(VII)			
7.N-NO_2	mg/l	0,024	-	2,5 - 5,3	1,0 - 7,7	1,1 - 3,8	1,5 - 14,9	1,0 - 10	1,3 - 13,5	1,1 - 1,7
				(I-VI)	(III-XII)	(II,III,IV, V,VII,XI)	(I,VII-XII)	(I-III,VII, XII)	(I,II,IV, VI,VIII,XI)	(I,V,VIII)
8. Hg	mg/l	0,00001	-	10 - 140	3,0 - 18	2,0 - 13	2,0 - 6,0	2,0 - 6,0	1,0 - 6,0	0
				(II-V,VII-X,XII)	(I-IX, XI,XII)	(III,VI,IX, XI,XII)	(I-XII)	(I-III-VIII, XI,XII)	(I-VIII, X,XI)	
9. Cr^{6+}	mg/l	0,001	-	1,5 - 6,9	2,1 - 4,6	1,2 - 2,7	3,0	1,3 - 5,0	1,8 - 3,0	1,0 - 4,4
				(I-XII)	(I-IV)	(III,V,VII, IX,X)	(IV)	(I,II,VI, X,XII)	(II,X)	(IV,VI, VIII,X,XI)
4. Downstream of Novomikhailovka village										
1. Cu	mg/l	0,01	1,4	1,1 - 2,2	0	0	0	0	0	0
			(I)	(II,V-XI)						
2. Zn	mg/l	0,01	1,2 - 23,7	1,0 - 4,4	1,0 - 2,9	1,2 - 4,9	0	1,1 - 1,4	1,3	1,0 - 3,0
			(I,II,XI,XII)	(II-IX, XI,XII)	(I-III,VI, VIII,IX)	(I-X)		(X-XI)	(XII)	(II,IX, XI,XII)
3. Phenol	mg/l	0,001	6 - 117	3 - 11	1 - 4	1 - 8	1 - 6	2 - 6	2 - 7	1 – 5
			(I-XII)	(I-XII)	(I-VII, IX,XI)	(II-V,VII, X,XII)	(I,II,V-VIII,X,XII)	(I-II,VIII, XI-XII)	(I,VII,IX, XI,XII)	(III,X)
4. Oil	mg/l	0,05	2,0 - 88,4	3,6 - 23,4	0	0	0	2,4 - 3,0	2,6 - 8,8	0
			I-III,V, IX,X,XII)	(I-III,VII, VIII,XII)				(II-XII)	(I,IV,XII)	
5. Ni	mg/l	0,01	0	-	1,7(X)	0	0	0	0	0
6.N-NH_4	mg/l	0,39	1,5 - 12,4	1,4 - 2,5	1,2	1,9	0	0	0	2,6
			(II,III,XI, XII)	(II,IV,X, XI)	(II)	(I)				(I)
7.N-NO_2	mg/l	0,024	1,3 - 24,2	1,5 - 5,0	1,5 - 6,1	1,2 - 2,6	1,3	1,4 - 8,3	1,3 - 3,8	1,0 - 13,9
			(I-XII)	(I-VII,X)	(I-VII, IX,XII)	(I,III,V-VII,XI,XII)	(IX-XII)	(I-VII,IX, X,XII)	(I-III,V, VI,VIII)	(II,III X,XI)
8. Hg	mg/l	0,00001	60 - 1990	-	-	1,0 - 10	3,0 - 6,0	2,0 - 14	1,0 - 5,0	1,0
			(I-X,XII)			(I-XII)	(I,II, VI-XII)	(I-XII)	(I-VIII, X-XII)	(I)
9. Cr^{6+}	mg/l	0,001	1,6 - 13,5	1,4 - 11,6	1,0 - 5,0	1,0 - 2,4	1,0 - 1,3	1,1 - 1,5	1,1 - 1,2	0

			(I-III, VII-XII)	(I,II,V-VIII, X-XII)	(I-VI, VIII-XII)	(III,VII,X)	(I,II,IV, VII)	(VI-XII)	(IV,XII)	
5. Cninaz, river outlet										
1. Cu	mg/l	0,01	2,4	1,0 - 2,3	0	0	0	0	0	0
			(XI)	III,V-VIII, X)						
2. Zn	mg/l	0,01	1,2 - 2,6	1,3 - 2,4	1,0 - 2,0	1,1 -4,0	1,1 - 1,9	0	2,6 - 3,1	1,4 - 2,6
			(II-VII, IX-XII)	(IV,X)	(I,VIII,IX, XI,XII)	(I,II,IV-X)	(V,X,XI)		(X-XI)	(VIII-XI)
3. Phenol	mg/l	0,001	11 - 70	4 - 13	1 - 8	1 - 7	1 - 2	1 - 2	1 - 9	4 – 11
			(I-XII)	(I-VI,VIII, X,XI)	(II-IV, VI-XII)	(I-VII, IX-XII)	(VI,VII,XII)	(I,II,IV,V, VII.IX,XI, XII)	(II-IV, VI-VIII, X-XII)	(III,IX, XI)
4. Oil	mg/l	0,05	2,8 - 3,8	2,6 - 17,8	0	0	0	0	0	4,8
			(II,VI, IX,XII)	(II,VII, XI)						(V)
5. Ni	mg/l	0,01	0	0	1,0 (XII)	0	0	0	0	0
6.N-NH_4	mg/l	0,39	1,5 - 12,4	1,4 - 2,5	1,2	1,9	0	0	0	2,6
			(II,III,XI, XII)	(II,IV,X, XI)	(II)	(I)				(I)
7.N-NO_2	mg/l	0,024	1,5 - 3,5	1,3 - 11	1,0 - 7,8	1,2 - 7,4	1,1 - 7,3	1,2 - 7,6	7,2 - 8,0	1,0 - 9,7
			(I-XII)	(I-IV,VIII, IX)	(I-V,XI)	(I,II,IV-VI, VIII)	(IV,V, VII-IX)	(II,IV,VIII)	(III-VIII)	(II,IV,X, XII)
8. Hg	mg/l	0,00001	310 - 1070	10 - 30	2,0 - 20	2,0 - 33	1,0 - 15	1,0 - 5,0	2,0 - 5,0	1,0
			(II,V,VII, VIII,X)	(I-III, V-IX)	(I,IV-VII, X,XI)	(I,II,IV-VI, VIII,XII)	(I-III, V-XII)	(I-V,VII, IX-XII)	(I-VII)	(II)
9. Cr^{6+}	mg/l	0,001	1,7 - 18,2	1,5 - 5,5	1,0 - 3,1	1,0 - 1,2	1,2	3,6	1,1 - 1,2	1,3 - 3,1
			(I,V-IX)	(I-V,VII-XII)	(I-V,VII-XII)	(I,VII,IX)	(I)	(III)	(IX,XII)	(III,VII, VIII,XI)

As the Table shows, in the river section located upstream of Gazalkent town, three water quality parameters exceeded MPC for HWU reservoirs such as phenols (to 32 times), oil products (35,6 times), and mercury (25,2 times). At present level, concentration of oil products has decreased, and mercury has not been found in concentrations exceeding MPC for HWU reservoirs. At the same section, 9 water quality parameters exceeded MPC for FHR, including: copper, zinc, phenols, oil products, nickel, ammonium nitrogen, nitrite nitrogen, mercury and hexavalent chrome. Moreover, recently, concentrations of copper, nickel, and ammonium did not exceed MPC. At the same time, phenols approached 10 MPC, zinc 1.7 MPC, oil products 2.8 MPC, nitrite nitrogen 5.4 MPC, mercury 2 MPC, and chrome 10 MPC.

In 2003, pesticides of alpha and gamma hexachlorocyclohexane were found, whereas their presence in water was inadmissible for FHR reservoirs.
At the river section located downstream of Chirchik town, 5 water quality parameters exceeded MPC for HWU reservoirs: BOD (to 2,2 times), COD (2), phenols (210), oil products (4,2), and mercury (50,2). However, in recent years (2000-2003), mercury has not exceeded MPC, phenols – 7 MPC, and oil products – 1.8 MPC for HWU reservoirs. Water quality for FHR reservoirs is much worse in this section. 9 parameters exceeding MPC were found: copper (1,3 times), zinc (3,1), phenols (210), oil products (8,4), nickel (2,2), ammonium nitrogen (16,9), nitrite nitrogen (18,3), mercury (1180), and hexavalent chrome (13,5). Recently, in this section, copper and nickel have not exceeded MPC, while concentrations of other parameters have decreased: mercury and phenols - 8 MPC; zinc - 1,5 MPC; chrome - 9 MPC; ammonium nitrogen - 1,9 MPC; nitrite nitrogen - 6,7 MPC. Pesticides of alpha and gamma hexachlorocyclohexane were also found in water.
In the river section located downstream of Tashkent city, 5 water quality parameters exceeded MPC for HWU reservoirs: ultimate BOD (2б4 times); COD (2,3); phenols (9); oil products (9,1); mercury (2,8). In recent years, exceeding of mercury MPC was not observed, while concentrations of oil products and phenols decreased to 3 MPC and 7 MPC, respectively. 9 water quality parameters exceeded MPC for FHR reservoirs: copper (19,5 times); zinc (4); phenols (9); oil products (18б2); nickel (1); ammonium nitrogen (4,4); nitrite nitrogen (14,9); mercury (140); and, hexavalent chrome (6,9). Recently, concentration of some parameters in this river section has decreased and, as a result, copper, nickel, and ammonium nitrogen have not exceeded MPC, phenols have dropped to 7 MPC, oil products and mercury to 6 MPC, and chrome to 5 MPC for FHR reservoirs. However, pesticides of alpha and gamma hexachlorocyclohexane were found in water.
At the river section located downstream of Novomikhailovka village, 5 parameters exceeded MPC for HWU reservoirs: ultimate BOD (3,1 times); COD (2,2); phenols (117); oil products (43,7); mercury (39,8). In recent years, mercury has not exceeded MPC for HWU reservoirs, concentration of phenols has decreased to 7 MPC, ultimate BOD to 2 MPC, COD to 1,1 MPC, and oil products to 4,4 MPC. As for FHR reservoirs, this river section showed exceeding of MPC by 9 water quality parameters: copper (2,2 times); zinc (23,7); phenols (117); oil products (88,4); nickel (1,7); ammonium nitrogen (12,4); nitrite nitrogen (24,2); mercury (1990); and hexavalent chrome (13,5). Such high concentrations were mainly registered in the past. At present, concentrations of most elements have decreased and therefore copper and nickel have not exceeded MPC. Concentration of zinc has decreased greatly – to 3 MPC, phenols to 7 MPC, oil products to 8,8 MPC, ammonium nitrogen to 2,6 MPC, nitrite nitrogen to 13,9 MPC, mercury to 14 MPC, and chrome to 1,5 MPC. Here, like in other river sections, pesticides of alpha and gamma hexachlorocyclohexane were found.
In the Chirchik river outlet, 7 water quality parameters exceeded MPC for HWU reservoirs: mineralization (1,5 times); general hardness (1,4); ultimate BOD (2,3); COD (1,9); phenols (70); oil products (8,9); and, mercury (21,4). Recently, concentrations of elements have also decreased in this river section. Exceeding of mercury and ultimate BOD MPCs was not observed. In recent 3 years, water mineralization was below MPC, while phenols did not exceed 11 MPC. As for FHR reservoirs, 9 parameters exceeded MPC in this river section: copper (2,4 times); zinc (3,1); phenols (70); oil products (17,8); nickel (1); ammonium nitrogen (12,4); nitrite nitrogen (9,7); mercury (1070); and hexavalent chrome (18,2). In last years, concentrations of a number of elements have decreased, and, particularly, copper and nickel did not exceed MPC. There was considerable decrease in mercury concentration – to 15 MPC, chrome – to 3,6 MPC, phenols – to 11 MPC, ammonium nitrogen – to 2,6 MPC, and oil products - to 4,8 MPC. However, pesticides of alpha and gamma hexachlorocyclohexane are found both in the past and at present.

Hydrobiological analysis of the Chirchik river indicated to poor or moderate development of aquatic biota along the whole length of the river. The ecological status of the river is characterized as satisfactory, and trophicity level varies from oligotrophic to mesotrophic one from the upstream to the river outlet.

It should be noted that water in the Chirchik river is diverted through multiple canals (Parkent, Left-bank and Right-bank Karasu, Yangi, Karabai, Khanym, Bozsu, Salar, etc.) for irrigation. These canals are additionally polluted with domestic wastes and outflow from irrigation fields. In this context, irrigation waters incur a certain risk to the environment and to quality of produced crops, mainly grains, fruits and vegetables. The main risk parameters are heavy metals, phenols, and oil products.

Thus, despite some improvement of water quality over recent 20 years, one should note that toxicological risk parameters are still present and pose hazard to environmental sustainability of this waterway. This causes huge annual damage amounting to $3 299 666 (Report on environmental development in the basin, I.Ruziev).

Water factor (shortage and poor quality) affects the following economic activities:

1. Fishery. Capacity of fish industry is the main indicator of fish-breeding in the basin. In 1970-1980, fish capacity of water bodies in ChAB averaged 35 centner/ha. Under average capacity of 10-20 centner/ha and in case of water quality deterioration and water quantity reduction, fish capacity may drop to 9-16 centner/ha, i.e half compared to eighties. The annual damage due to fish capacity losses would be more than $1050 thousand.
2. Morbidity (especially in rural area). Sickness rate keeps growing, and the highest rate is observed in industrial centers of the province. 20-30 % of disease incidence is caused by unsatisfactory water quality (colon bacillus, dysbacteriosis, etc.). Every missing workday has negative effect on Tashkent province's economy. Given the mean disease duration of 5-7 days and the medical treatment costs of 5-10 $/day, the total damage is $98,1 million over the period from 1995 to 2003 or on average $10 million per year.

Conclusions

1. The Chirchik-Akhangaran-Keles basin has high water availability as compared to other zones in Central Asia. This allows quite successful water supply to Tashkent agglomeration, which is the major national zone regarding industrial, agricultural, and energy development, let alone its cultural and political importance.
2. Water factor ensures sustainable supply of energy generation, industrial and social sectors and, thus, results in high level of food security in the region. Water-use sectors contribute to creation of job places and improvement of employment, thus providing more than 50 % of this indicator in rural area.
3. Water use has great reserves for improvement of efficiency and for higher water productivity. In this context, there is a possibility to release additional water quantities to solve economic problems.
4. While underlining socio-economic importance of water in the basin, we should pay attention to present environmental problems that cause losses and damages exceeding in total $26,85 million a year, including:
    - toxicological risk – $3,3 million;
    - fish capacity losses – $1,05 million;
    - health losses – $10,0 million;
    - agricultural losses – $12,5 million.

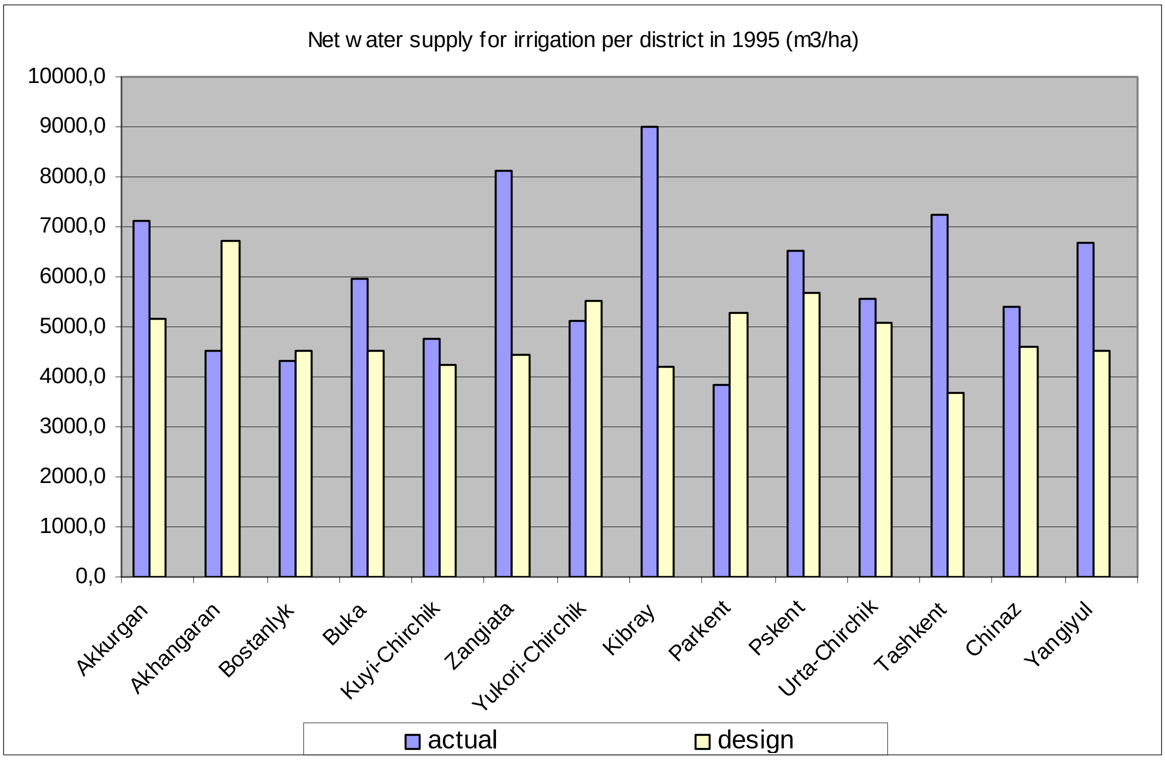
Annex 1

Report
on comparison of design data with actual data on water withdrawal per district in Tashkent province in 1995-2003

Water supply for irrigation per district in 1995

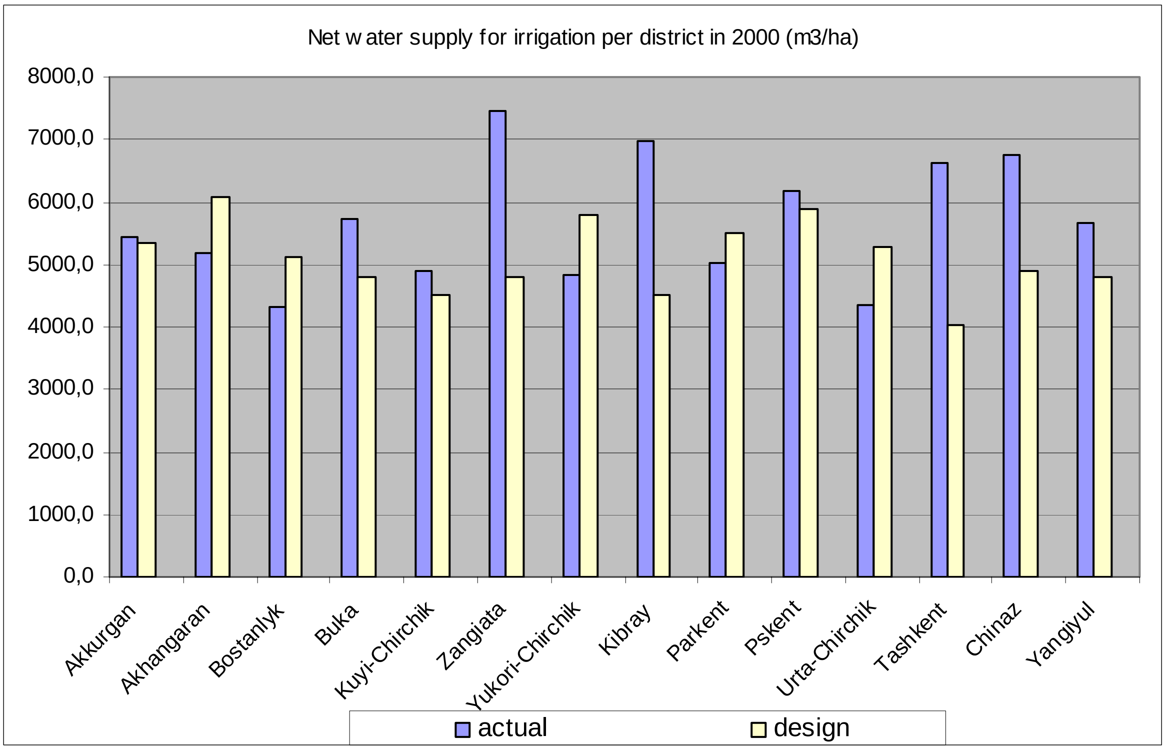
District	1995				
	Area (th. ha)	Actual* (M m3)	Net actual (m3/ha)	Net design data ** (m3/ha)	Level of water supply (%)
Akkurgan	29,40	209,3	7120	5148	138
Akhangaran	26,00	117,6	4521	6736	67
Bostanlyk	15,30	65,9	4308	4505	96
Buka	39,70	236,9	5968	4502	133
Kuyi-Chirchik	39,60	188,6	4764	4250	112
Zangiata	14,30	116,0	8114	4446	183
Yukori-Chirchik	26,20	133,9	5112	5506	93
Kibray	18,80	169,3	9008	4187	215
Parkent	17,00	65,5	3855	5280	73
Pskent	25,30	164,9	6519	5671	115
Urta-Chirchik	33,00	183,0	5546	5070	109
Tashkent	16,00	115,9	7247	3682	197
Chinaz	21,80	117,6	5392	4598	117
Yangiyul	28,50	190,6	6688	4504	148
Total:	**350,90**	**2075,3**	**5914**	**4908**	**121**

Note: * - water withdrawal in field, derived from water withdrawal at the border of a district, the efficiency factor of an inter-farm network in each district is individual; taken from the 2003 Technical Report of the Chirchik-Akhangaran Basin Irrigation Systems Management Organization (ChABISMO)
**- design data of G.F. Solodkiy by the CROPWAT model



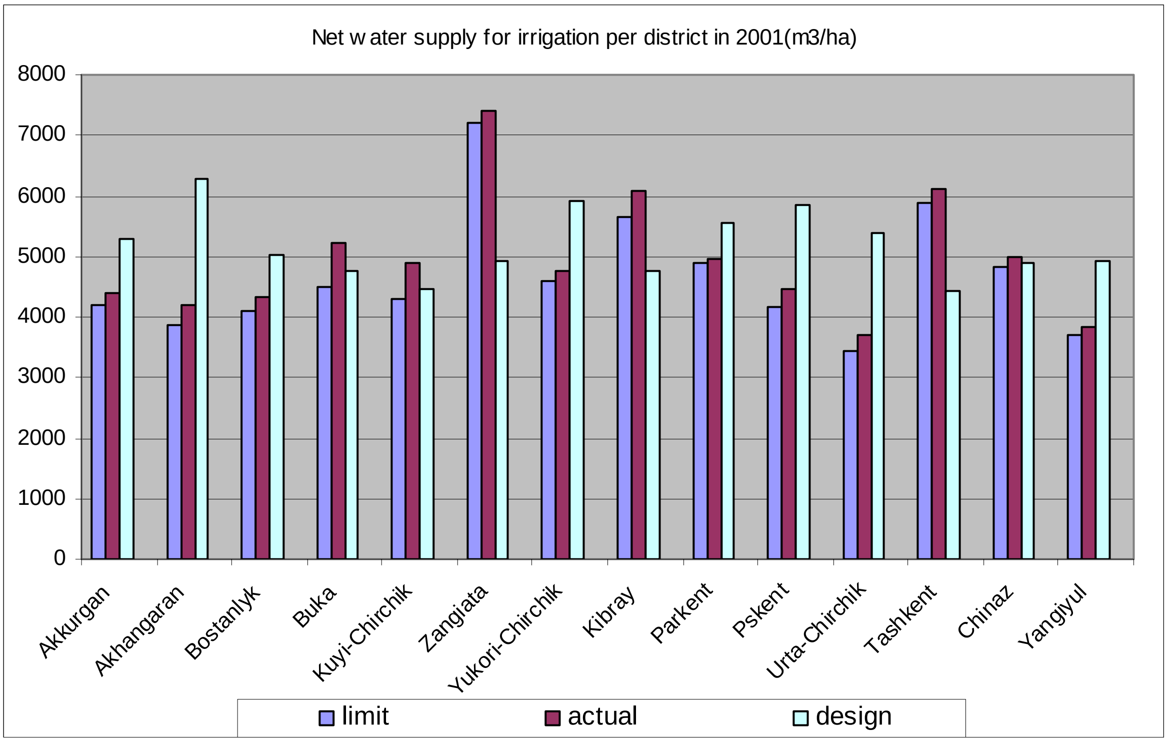
Water supply for irrigation per district in 2000

District	2000				
	Area (th. ha)	Actual (M m3)	Net actual (m3/ha)	Net design data (m3/ha)	Level of water supply (%)
Akkurgan	29,4	160,4	5455,1	5334	102
Akhangaran	25,6	133,1	5197,5	6079	86
Bostanlyk	15,5	66,8	4311,9	5104	84
Buka	39,7	227,0	5717,9	4784	120
Kuyi-Chirchik	39,4	192,4	4883,8	4498	109
Zangiata	12,9	96,3	7465,2	4807	155
Yukori-Chirchik	26,2	126,4	4822,6	5794	83
Kibray	19,3	134,4	6962,6	4524	154
Parkent	15,2	76,4	5028,5	5512	91
Pskent	24,9	153,6	6170,2	5874	105
Urta-Chirchik	33,3	144,6	4342,2	5280	82
Tashkent	15,5	102,8	6630,2	4022	165
Chinaz	21,8	147,1	6749,3	4892	138
Yangiyul	28,5	161,8	5678,3	4795	118
Total:	**347,2**	**1923,1**	**5539,0**	**5114**	**108**



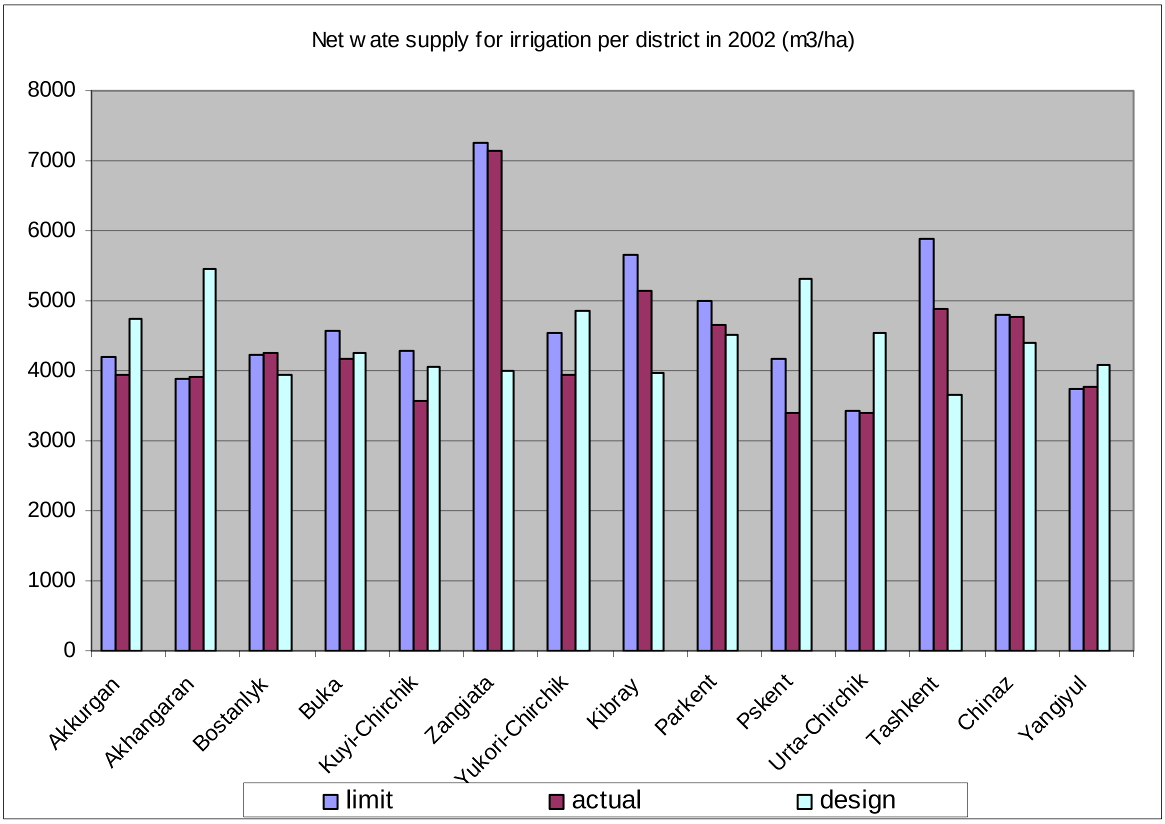
Water supply for irrigation per district in 2001

District	2001								
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Level of water supply (%)
Akkurgan	29,4	123,5	129,6	**104,9**	4202	4408	**104,9**	5285	83
Akhangaran	25,9	100,2	108,4	**108,2**	3868	4184	**108,2**	6267	67
Bostanlyk	15,5	63,5	67,0	**116,2**	4094	4321	**105,6**	5033	86
Buka	39,1	175,5	203,9	**113,5**	4488	5214	**116,2**	4775	109
Kuyi-Chirchik	39,4	169,7	192,5	**102,7**	4306	4885	**113,5**	4459	110
Zangiata	12,7	91,5	94,0	**102,7**	7205	7401	**102,7**	4910	151
Yukori-Chirchik	26,1	119,9	124,3	**103,7**	4592	4763	**103,7**	5910	81
Kibray	19,2	108,4	116,6	**107,6**	5644	6070	**107,6**	4744	128
Parkent	15,2	74,2	75,5	**101,7**	4880	4965	**101,7**	5553	89
Pskent	24,9	103,8	110,9	**106,8**	4170	4455	**106,8**	5847	76
Urta-Chirchik	32,6	112,2	120,7	**107,6**	3443	3703	**107,6**	5378	69
Tashkent	15,5	91,4	94,6	**103,6**	5894	6104	**103,6**	4441	137
Chinaz	21,7	104,6	108,4	**103,7**	4818	4994	**103,7**	4882	102
Yangiyul	28,5	105,8	109,0	**103,0**	3712	3825	**103,0**	4923	78
Total:	**345,7**	**1543,9**	**1655,2**	**107,2**	**4466**	**4788**	**107,2**	**5176**	93



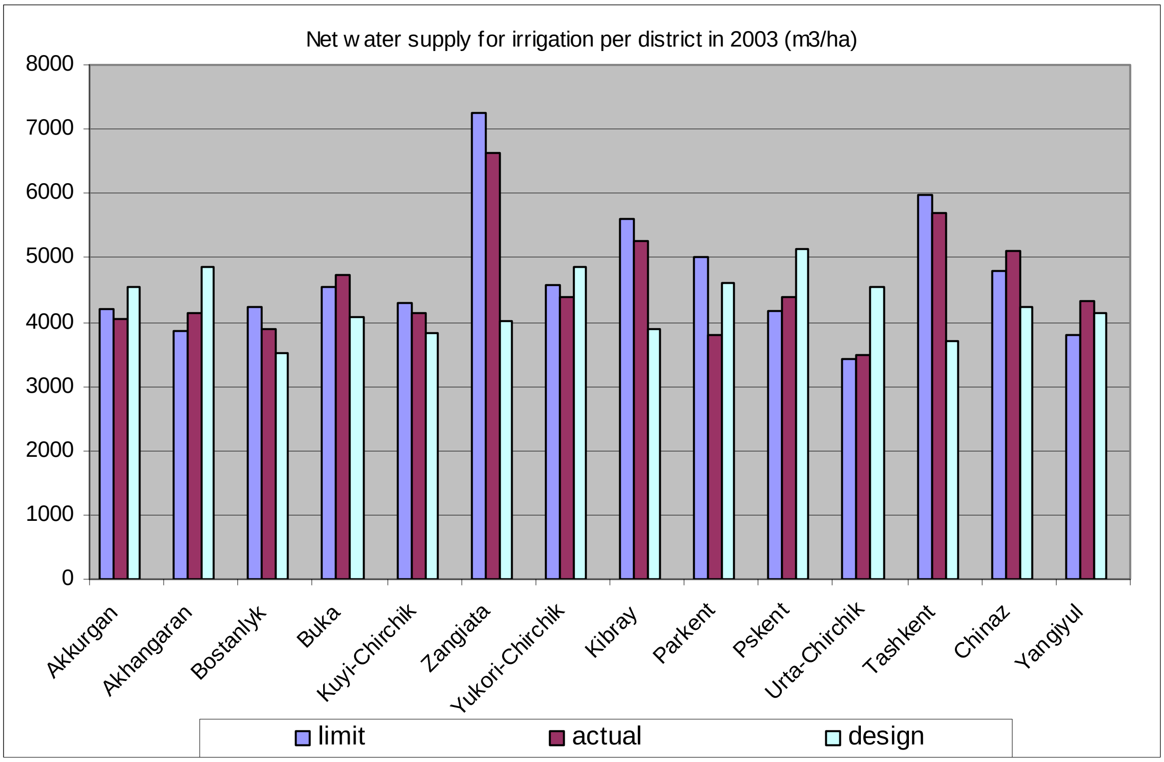
Net water supply for irrigation per district in 2002

District	2002								
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Level of water supply (%)
Akkurgan	29,4	123,5	115,8	**93,8**	4202	3940	**93,8**	4756	83
Akhangaran	25,8	100,2	100,9	**100,7**	3883	3909	**100,7**	5470	71
Bostanlyk	15	63,5	63,9	**100,8**	4230	4263	**100,8**	3949	108
Buka	38,5	175,5	160,9	**91,7**	4558	4180	**91,7**	4259	98
Kuyi-Chirchik	39,6	169,7	140,9	**83,1**	4284	3559	**83,1**	4059	88
Zangiata	12,6	91,5	89,8	**98,2**	7263	7129	**98,2**	3989	179
Yukori-Chirchik	26,4	119,9	103,8	**86,6**	4540	3931	**86,6**	4844	81
Kibray	19,2	108,4	98,6	**91,0**	5644	5135	**91,0**	3970	129
Parkent	14,8	74,2	68,9	**92,9**	5012	4654	**92,9**	4507	103
Pskent	24,9	103,8	84,5	**81,4**	4170	3393	**81,4**	5327	64
Urta-Chirchik	32,6	112,2	110,4	**98,4**	3443	3387	**98,4**	4543	75
Tashkent	15,5	91,4	75,7	**82,9**	5894	4883	**82,9**	3662	133
Chinaz	21,8	104,6	104,1	**99,6**	4796	4775	**99,6**	4412	108
Yangiyul	28,2	105,8	106,2	**100,4**	3751	3767	**100,4**	4097	92
Total:	**344,3**	**1543,9**	**1424,5**	**92,3**	**4484**	**4137**	**92,3**	**4469**	93



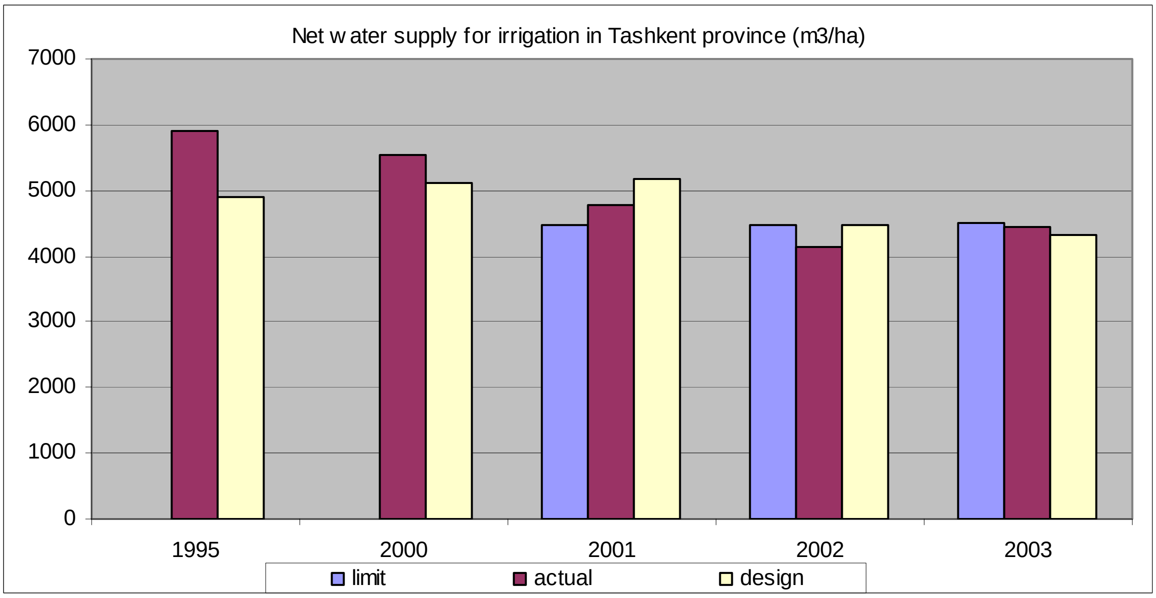
Water supply for irrigation per district in 2003

District	2003								
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Level of water supply (%)
Akkurgan	29,5	123,5	119,6	**96,8**	4187	4055	**96,8**	4533	89
Akhangaran	25,9	100,2	107,6	**107,4**	3868	4155	**107,4**	4871	85
Bostanlyk	15	63,5	58,3	**91,9**	4230	3887	**91,9**	3522	110
Buka	38,6	175,5	182,4	**103,9**	4547	4725	**103,9**	4080	116
Kuyi-Chirchik	39,4	169,7	163,0	**96,1**	4306	4137	**96,1**	3834	108
Zangiata	12,6	91,5	83,4	**91,2**	7263	6620	**91,2**	4003	165
Yukori-Chirchik	26,2	119,9	115,3	**96,2**	4574	4402	**96,2**	4857	91
Kibray	19,3	108,4	101,3	**93,5**	5615	5249	**93,5**	3878	135
Parkent	14,8	74,2	56,1	**75,7**	5012	3792	**75,7**	4603	82
Pskent	24,9	103,8	109,2	**105,2**	4170	4385	**105,2**	5135	85
Urta-Chirchik	32,7	112,2	113,6	**101,2**	3432	3474	**101,2**	4547	76
Tashkent	15,3	91,4	87,4	**95,6**	5971	5710	**95,6**	3699	154
Chinaz	21,8	104,6	111,6	**106,8**	4796	5120	**106,8**	4225	121
Yangiyul	27,8	105,8	120,0	**113,4**	3805	4315	**113,4**	4141	104
Total:	**343,8**	**1543,9**	**1528,8**	**99,0**	**4491**	**4447**	**99,0**	**4319**	**103**

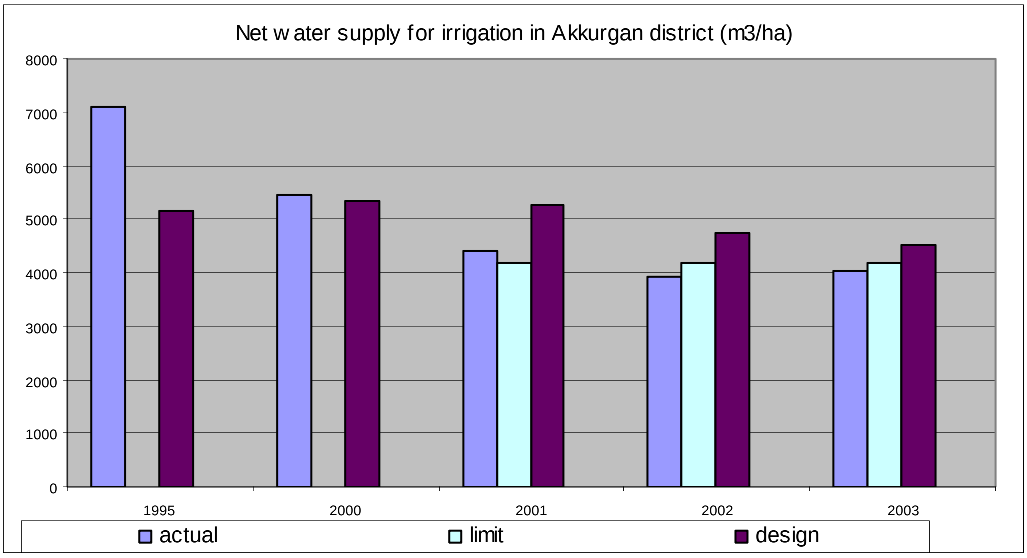


Water supply for irrigation in Tashkent province

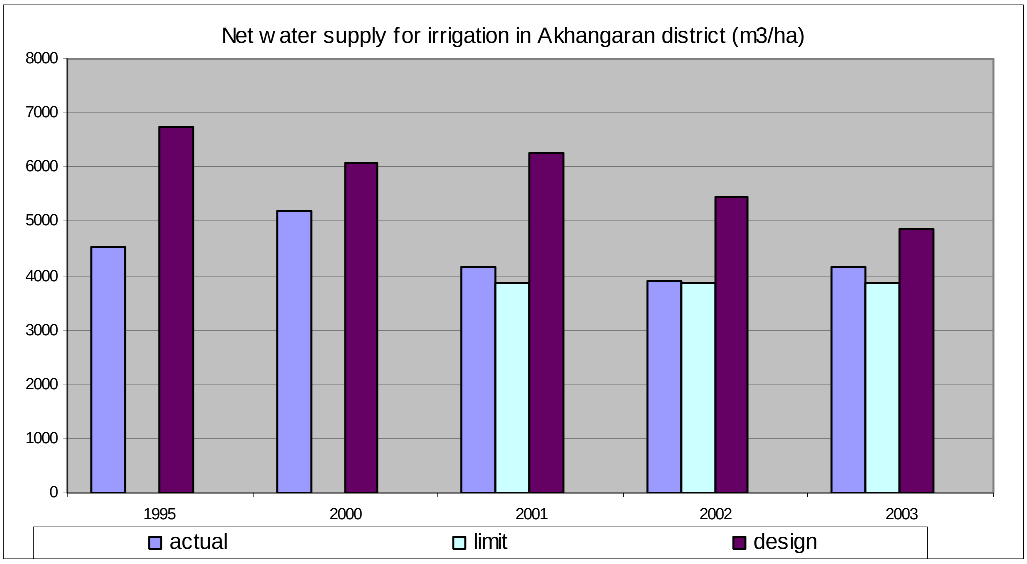
District	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Level of water supply (%)
1995	**350,9**		**2075**			**5914**		4908	121
2000	**347,2**		**1923**			**5539**		5114	108
2001	**345,7**	**1544**	**1655**	107	4466	**4788**	107	5176	93
2002	**344,3**	**1544**	**1425**	92	4484	**4137**	92	4469	93
2003	**343,8**	**1544**	**1529**	99	4491	**4447**	99	4319	103



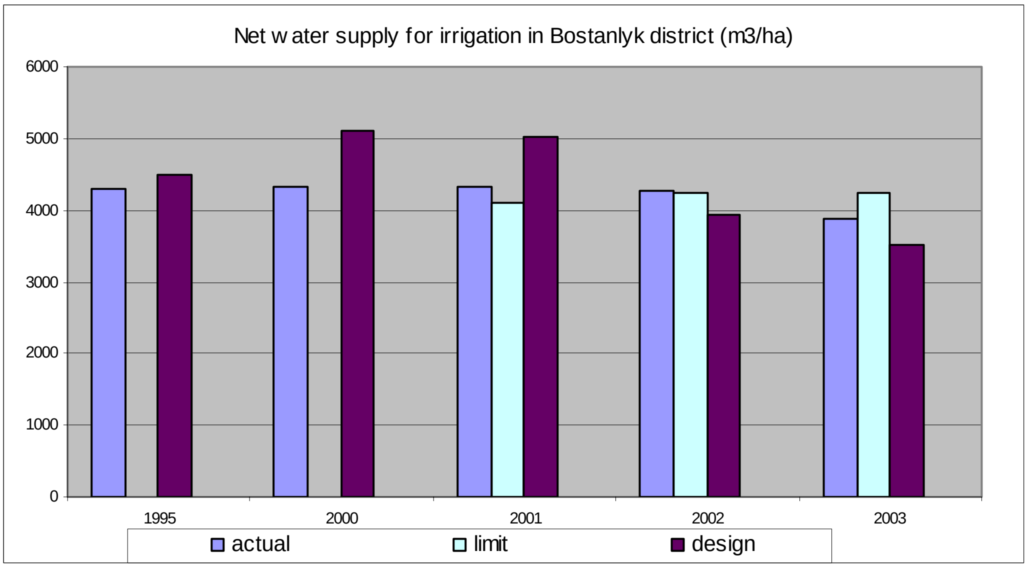
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
29,4	1995	Akkurgan	7120		5148
29,4	2000		5455		5334
29,4	2001		4408	4202	5285
29,4	2002		3940	4202	4756
29,5	2003		4055	4187	4533



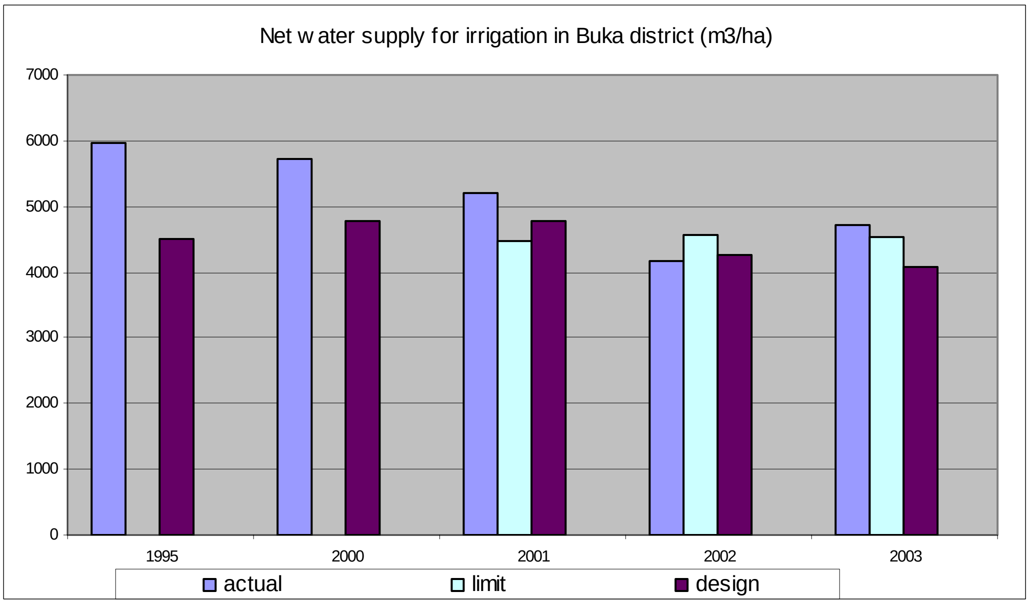
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
26	1995	Akhangaran	4521		6736
25,6	2000		5198		6079
25,9	2001		4184	3868	6267
25,8	2002		3909	3883	5470
25,9	2003		4155	3868	4871



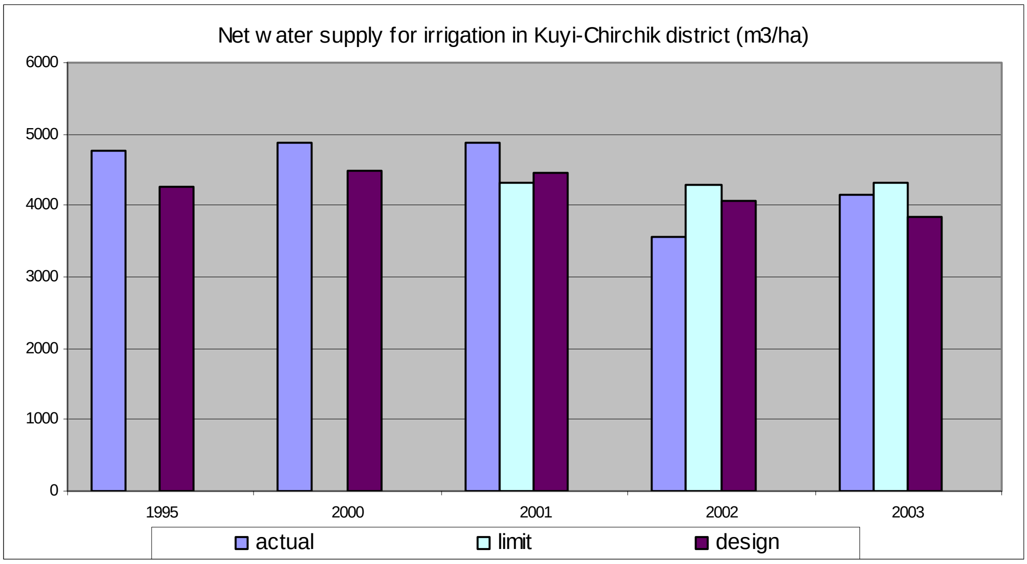
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
15,3	1995	Bostanlyk	4308		4505
15,5	2000		4312		5104
15,5	2001		4321	4094	5033
15	2002		4263	4230	3949
15	2003		3887	4230	3522



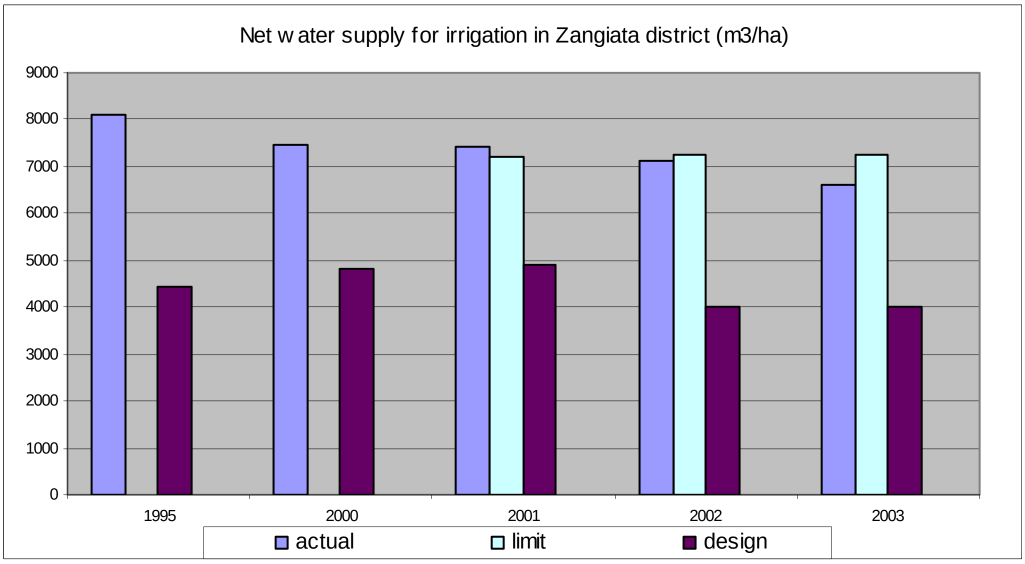
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
39,7	1995	Buka	5968		4502
39,7	2000		5718		4784
39,1	2001		5214	4488	4775
38,5	2002		4180	4558	4259
38,6	2003		4725	4547	4080



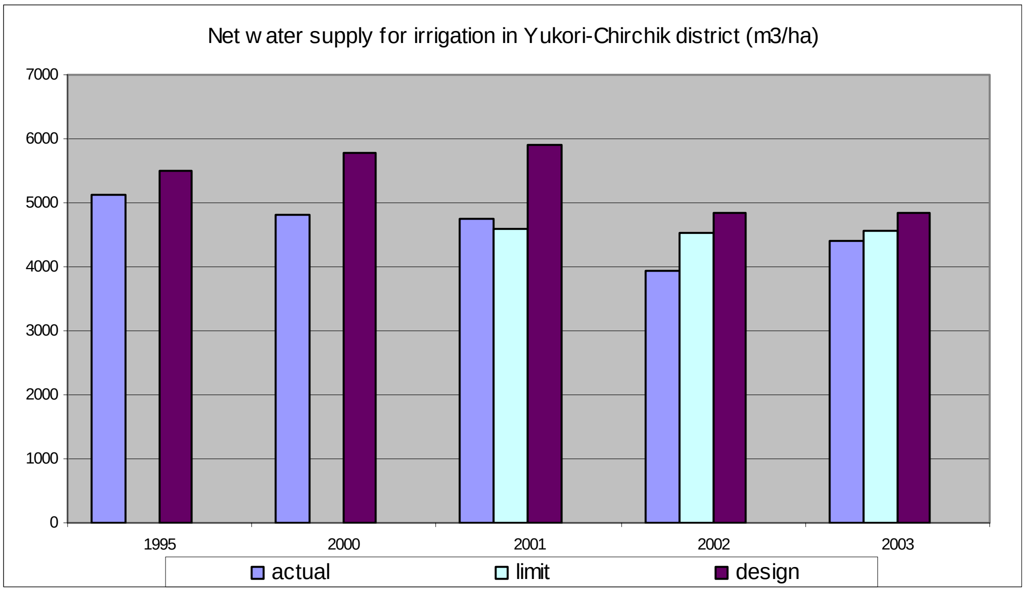
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
39,6	1995	Kuyi-Chirchik	4764		4250
39,4	2000		4884		4498
39,4	2001		4885	4306	4459
39,6	2002		3559	4284	4059
39,4	2003		4137	4306	3834



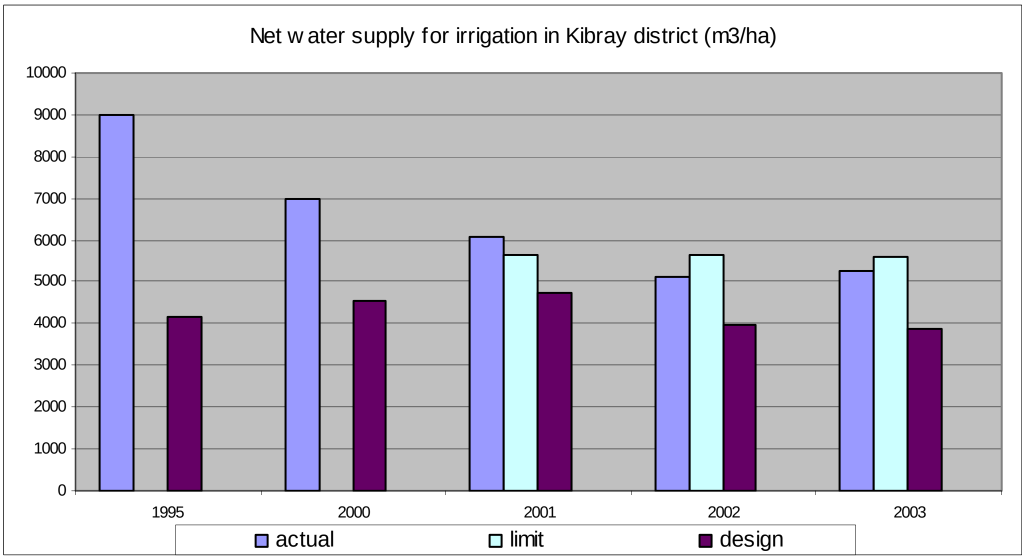
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
14,3	1995	Zangiata	8114		4446
12,9	2000		7465		4807
12,7	2001		7401	7205	4910
12,6	2002		7129	7263	3989
12,6	2003		6620	7263	4003



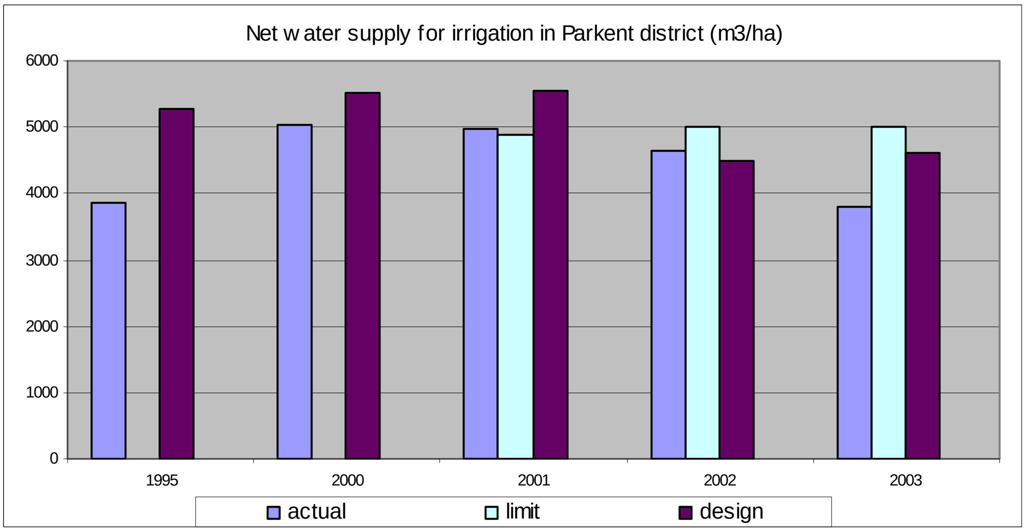
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
26,2	1995	Yukori-Chirchik	5112		5506
26,2	2000		4823		5794
26,1	2001		4763	4592	5910
26,4	2002		3931	4540	4844
26,2	2003		4402	4574	4857



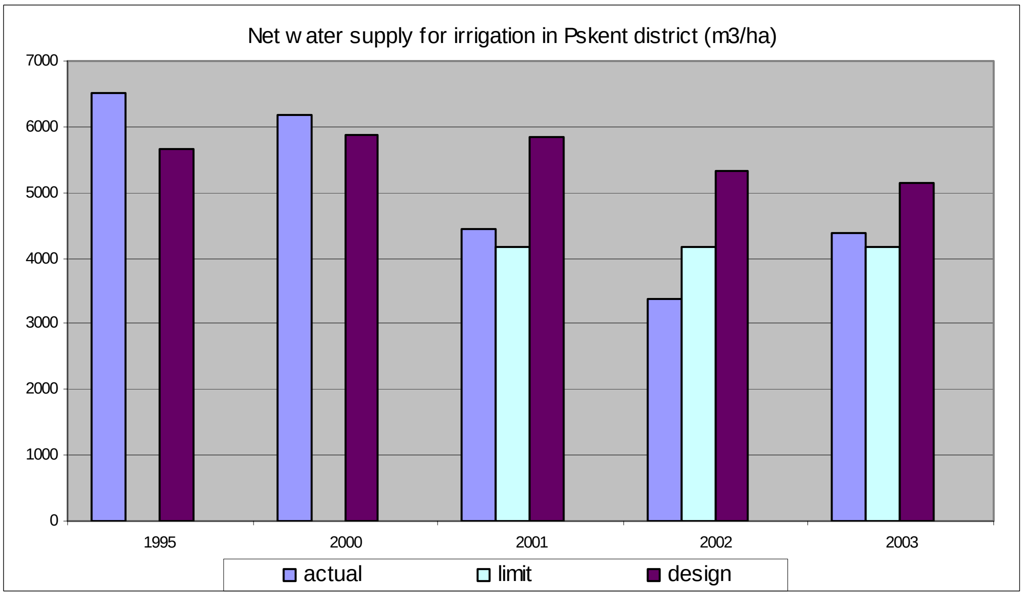
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
18,8	1995	Kibray	9008		4187
19,3	2000		6963		4524
19,2	2001		6070	5644	4744
19,2	2002		5135	5644	3970
19,3	2003		5249	5615	3878



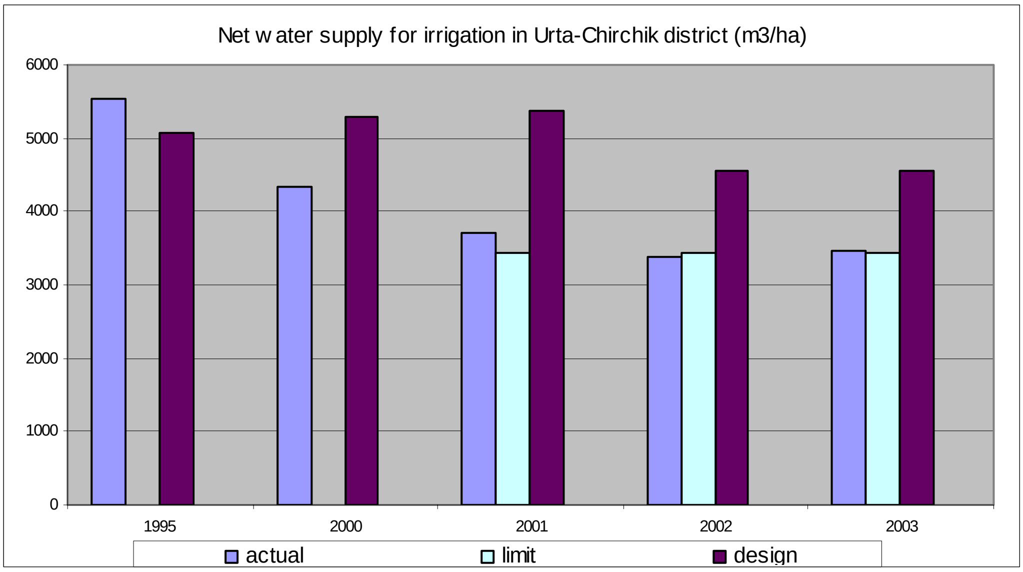
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
17	1995	Parkent	3855		5280
15,2	2000		5028		5512
15,2	2001		4965	4880	5553
14,8	2002		4654	5012	4507
14,8	2003		3792	5012	4603



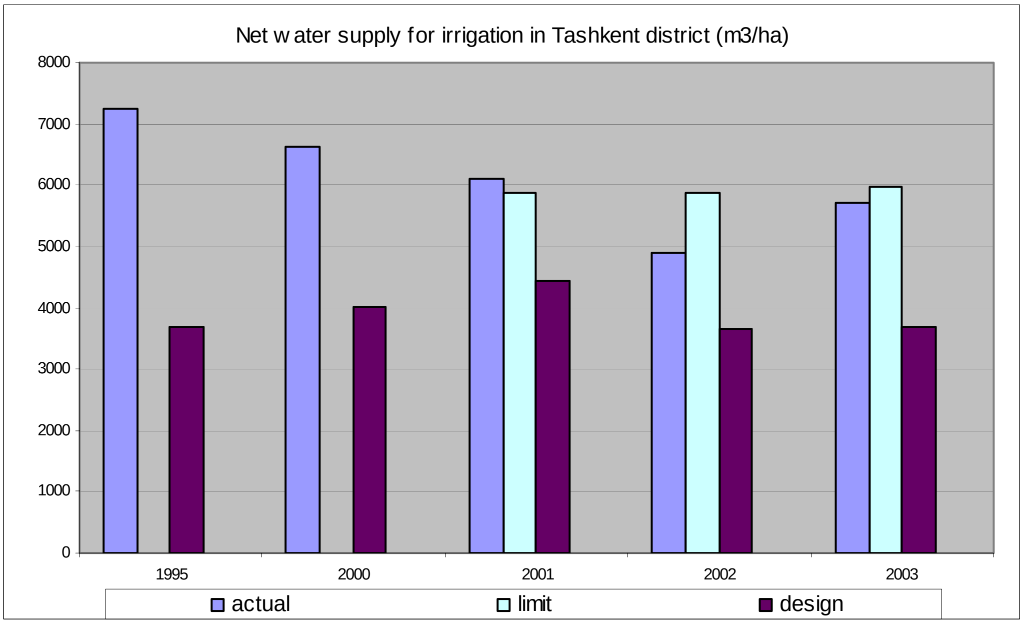
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
25,3	1995	Pskent	6519		5671
24,9	2000		6170		5874
24,9	2001		4455	4170	5847
24,9	2002		3393	4170	5327
24,9	2003		4385	4170	5135



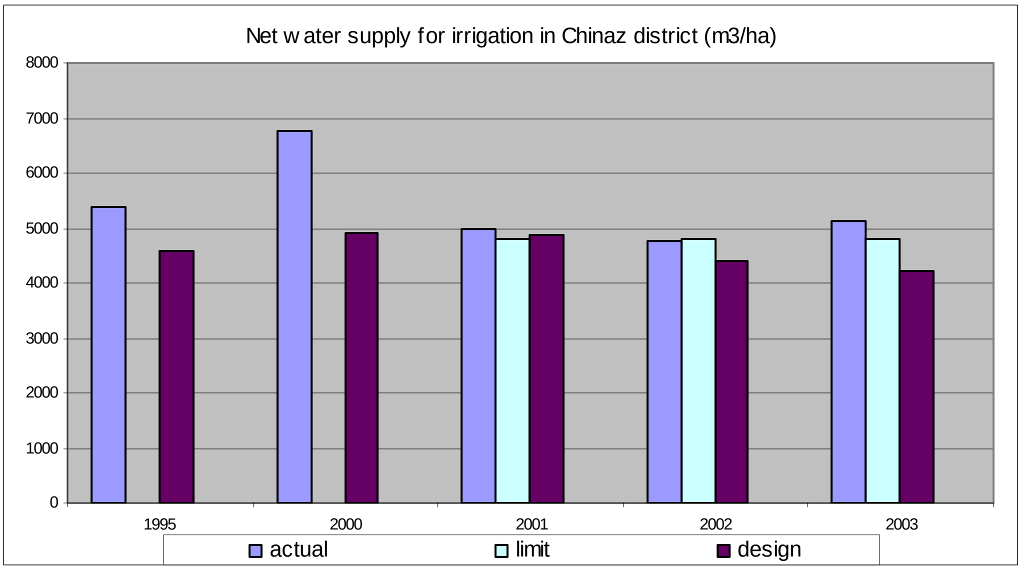
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
33	1995	Urta-Chirchik	5546		5070
33,3	2000		4342		5280
32,6	2001		3703	3443	5378
32,6	2002		3387	3443	4543
32,7	2003		3474	3432	4547



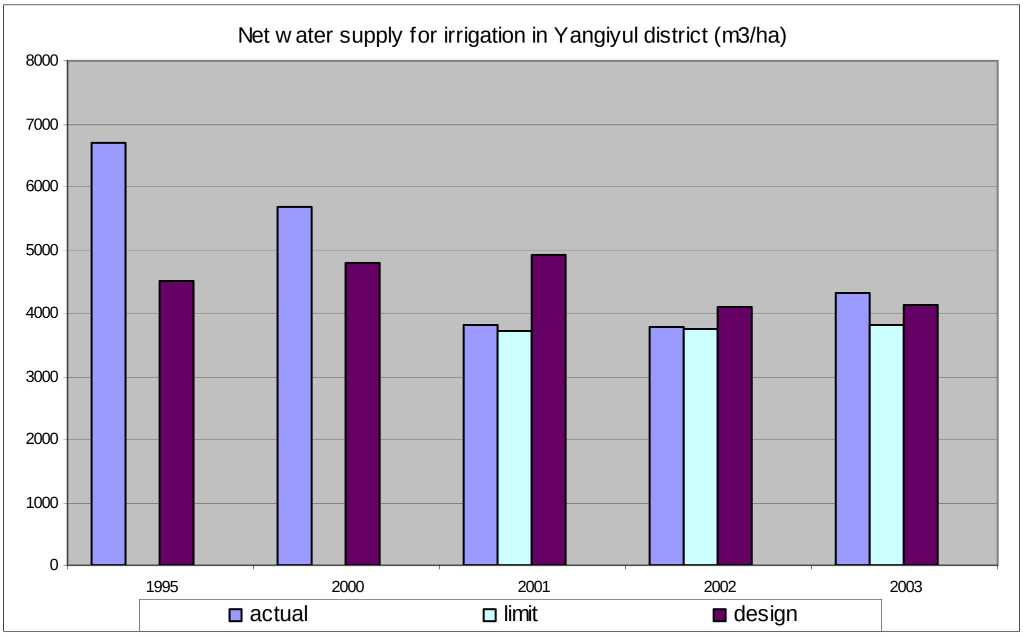
Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
16	1995	Tashkent	7247		3682
15,5	2000		6630		4022
15,5	2001		6104	5894	4441
15,5	2002		4883	5894	3662
15,3	2003		5710	5971	3699



Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
21,8	1995	Chinaz	5392		4598
21,8	2000		6749		4892
21,7	2001		4994	4818	4882
21,8	2002		4775	4796	4412
21,8	2003		5120	4796	4225



Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
28,5	1995	Yangiyul	6688		4504
28,5	2000		5678		4795
28,5	2001		3825	3712	4923
28,2	2002		3767	3751	4097
27,8	2003		4315	3805	4141



Area	Year	District	Net actual irrigation (m3/ha)	Net limit on irrigation (m3/ha)	Net design (m3/ha)
350,9	1995	Tashkent province	**5914**		**4908**
347,2	2000		**5539**		**5114**
345,7	2001		**4788**	**4466**	**5176**
344,3	2002		**4137**	**4484**	**4469**

343,8	2003		**4447**	**4491**	**4319**

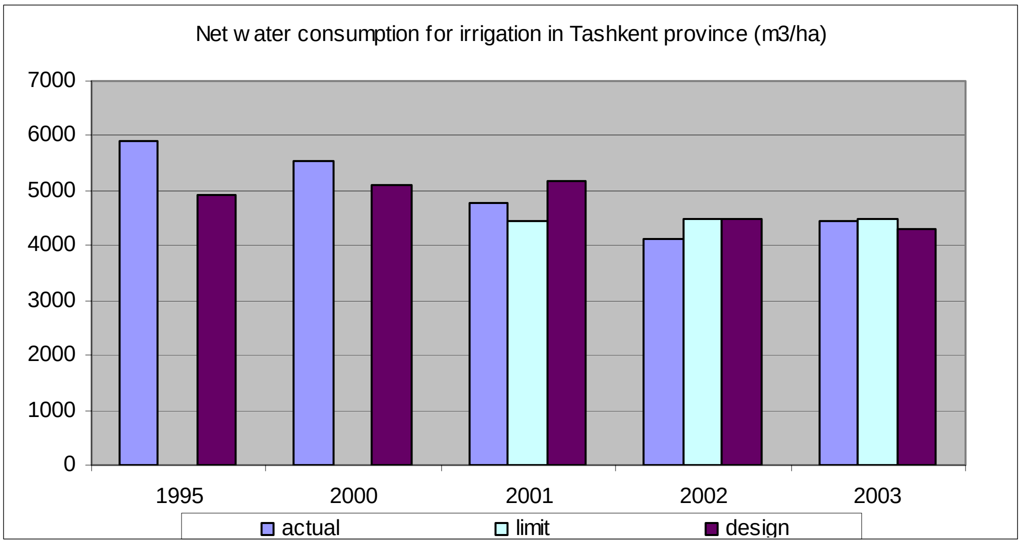


Table of comparison between design and actual water consumption

Year	Design water withdrawal (m3/ha)	Actual water withdrawal (m3/ha)	Surplus (+), shortage (-): %	Irrigation area (net) (th. ha)
1995	**4908**	**5914**	**17**	**350,9**
2000	**5114**	**5539**	**8**	**347,2**
2001	**5176**	**4788**	**-8**	**345,7**
2002	**4469**	**4137**	**-8**	**344,3**
2003	**4319**	**4447**	**3**	**343,8**

Annex 2

Water use productivity in irrigated farming per year and per district in Tashkent province.

District	1995					
	Area (th. ha)	Actual (M m3)	Net actual (m3/ha)	Net design data (m3/ha)	Crop production ($ million)	Water use productivity ($/m3)
Akkurgan	29.4	209.3	7119.6	5148	16.9	0.08
Akhangaran	26	117.6	4521.5	6736	14.7	0.13
Bostanlyk	15.3	65.9	4308.3	4505	14.8	0.23
Buka	39.7	236.9	5967.9	4502	17.1	0.07
Kuyi-Chirchik	39.6	188.6	4763.6	4250	15.4	0.08
Zangiata	14.3	116.0	8114.3	4446	16.9	0.15
Yukori-Chirchik	26.2	133.9	5112.2	5506	15.1	0.11
Kibray	18.8	169.3	9007.7	4187	17.6	0.10
Parkent	17	65.5	3854.8	5280	14.1	0.22
Pskent	25.3	164.9	6518.8	5671	14.8	0.09
Urta-Chirchik	33	183.0	5546.3	5070	15.0	0.08
Tashkent	16	115.9	7246.8	3682	10.5	0.09
Chinaz	21.8	117.6	5392.4	4598	16.9	0.14
Yangiyul	28.5	190.6	6687.6	4504	15.9	0.08
Total:	**350.9**	**2075.3**	**5914.1**	**4908**	**216**	**0.12**

District	2000					
	Area (th. ha)	Actual (M m3)	Net actual (m3/ha)	Net design data (m3/ha)	Crop production ($ million)	Water use productivity ($/m3)
Akkurgan	29.4	160.4	5455.1	5334	22.9448	0.14
Akhangaran	25.6	133.1	5197.5	6079	20.64354	0.16
Bostanlyk	15.5	66.8	4311.9	5104	21.12317	0.32
Buka	39.7	227.0	5717.9	4784	27.48919	0.12
Kuyi-Chirchik	39.4	192.4	4883.8	4498	22.86728	0.12
Zangiata	12.9	96.3	7465.2	4807	19.77148	0.21
Yukori-Chirchik	26.2	126.4	4822.6	5794	24.57749	0.19
Kibray	19.3	134.4	6962.6	4524	24.17537	0.18
Parkent	15.2	76.4	5028.5	5512	26.38943	0.35
Pskent	24.9	153.6	6170.2	5874	24.16568	0.16
Urta-Chirchik	33.3	144.6	4342.2	5280	28.49206	0.20
Tashkent	15.5	102.8	6630.2	4022	18.01768	0.18

Chinaz	21.8	147.1	6749.3	4892	28.681	0.19
Yangiyul	28.5	161.8	5678.3	4795	26.14234	0.16
Total:	**347.2**	**1923.1**	5539.0	**5114**	**335.5**	**0.19**

District	2001									
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Crop produc-tion ($ M)	Water use product ivity ($/m3)
Akkurgan	29.4	123.53	129.6	**104.9**	4202	4408	**104.9**	5285	23.7	0.18
Akhangaran	25.9	100.17	108.4	**108.2**	3868	4184	**108.2**	6267	20.6	0.19
Bostanlyk	15.5	63.45	67.0	**116.2**	4094	4321	**105.6**	5033	20.8	0.31
Buka	39.1	175.50	203.9	**113.5**	4488	5214	**116.2**	4775	24.0	0.12
Kuyi-Chirchik	39.4	169.65	192.5	**102.7**	4306	4885	**113.5**	4459	21.5	0.11
Zangiata	12.7	91.51	94.0	**102.7**	7205	7401	**102.7**	4910	23.7	0.25
Yukori-Chirchik	26.1	119.85	124.3	**103.7**	4592	4763	**103.7**	5910	21.2	0.17
Kibray	19.2	108.36	116.6	**107.6**	5644	6070	**107.6**	4744	24.7	0.21
Parkent	15.2	74.18	75.5	**101.7**	4880	4965	**101.7**	5553	19.8	0.26
Pskent	24.9	103.85	110.9	**106.8**	4170	4455	**106.8**	5847	20.8	0.19
Urta-Chirchik	32.6	112.23	120.7	**107.6**	3443	3703	**107.6**	5378	21.1	0.17
Tashkent	15.5	91.35	94.6	**103.6**	5894	6104	**103.6**	4441	14.7	0.16
Chinaz	21.7	104.55	108.4	**103.7**	4818	4994	**103.7**	4882	23.8	0.22
Yangiyul	28.5	105.78	109.0	**103.0**	3712	3825	**103.0**	4923	22.4	0.21
Total:	**345.7**	1543.94	**1655.2**	**107.2**	**4466**	**4788**	**107.2**	**5176**	**302.7**	**0.20**

District	2002									
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Crop produc-tion ($ M)	Water use produc tivity ($/m3)
Akkurgan	29.4	123.5	115.8	**93.8**	4202	3940	**93.8**	4756	16.6	0.14
Akhangaran	25.8	100.2	100.9	**100.7**	3883	3909	**100.7**	5470	12.9	0.13
Bostanlyk	15	63.5	63.9	**100.8**	4230	4263	**100.8**	3949	13.8	0.22
Buka	38.5	175.5	160.9	**91.7**	4558	4180	**91.7**	4259	17.6	0.11
Kuyi-Chirchik	39.6	169.7	140.9	**83.1**	4284	3559	**83.1**	4059	14.6	0.10
Zangiata	12.6	91.5	89.8	**98.2**	7263	7129	**98.2**	3989	15.7	0.17
Yukori-Chirchik	26.4	119.9	103.8	**86.6**	4540	3931	**86.6**	4844	16.9	0.16
Kibray	19.2	108.4	98.6	**91.0**	5644	5135	**91.0**	3970	18.8	0.19
Parkent	14.8	74.2	68.9	**92.9**	5012	4654	**92.9**	4507	15.7	0.23
Pskent	24.9	103.8	84.5	**81.4**	4170	3393	**81.4**	5327	15.5	0.18
Urta-Chirchik	32.6	112.2	110.4	**98.4**	3443	3387	**98.4**	4543	18.6	0.17
Tashkent	15.5	91.4	75.7	**82.9**	5894	4883	**82.9**	3662	9.8	0.13
Chinaz	21.8	104.6	104.1	**99.6**	4796	4775	**99.6**	4412	15.7	0.15
Yangiyul	28.2	105.8	106.2	**100.4**	3751	3767	**100.4**	4097	18.4	0.17
Total:	**344.3**	1543.9	1424.5	**92.3**	**4484**	**4137**	**92.3**	**4469**	**220.5**	**0.16**

District	2003									
	Area (th. ha)	Limit (M m3)	Actual (M m3)	%	Net limit (m3/ha)	Net actual (m3/ha)	%	Net design data (m3/ha)	Crop produc-tion ($ M)	Water use productivity ($/m3)
Akkurgan	29.5	123.5	119.6	96.8	4187	4055	96.8	4533	15.3	0.13
Akhangaran	25.9	100.2	107.6	107.4	3868	4155	107.4	4871	11.5	0.11
Bostanlyk	15	63.5	58.3	91.9	4230	3887	91.9	3522	12.4	0.21
Buka	38.6	175.5	182.4	103.9	4547	4725	103.9	4080	14.8	0.08
Kuyi-Chirchik	39.4	169.7	163.0	96.1	4306	4137	96.1	3834	13.6	0.08
Zangiata	12.6	91.5	83.4	91.2	7263	6620	91.2	4003	12.7	0.15
Yukori-Chirchik	26.2	119.9	115.3	96.2	4574	4402	96.2	4857	15.3	0.13
Kibray	19.3	108.4	101.3	93.5	5615	5249	93.5	3878	16.9	0.17
Parkent	14.8	74.2	56.1	75.7	5012	3792	75.7	4603	13.7	0.24
Pskent	24.9	103.8	109.2	105.2	4170	4385	105.2	5135	13.6	0.12
Urta-Chirchik	32.7	112.2	113.6	101.2	3432	3474	101.2	4547	17.2	0.15
Tashkent	15.3	91.4	87.4	95.6	5971	5710	95.6	3699	9.0	0.10
Chinaz	21.8	104.6	111.6	106.8	4796	5120	106.8	4225	15.1	0.14
Yangiyul	27.8	105.8	120.0	113.4	3805	4315	113.4	4141	16.1	0.13
Total:	**343.8**	1543.9	1528.8	99.0	**4491**	**4447**	99.0	**4319**	**197.3**	**0.14**

Dynamics of water productivity in irrigated agriculture

	Districts*	Actual water withdrawal for irrigation at the border of districts (M m3) (A1)	Flow from collector-drainage network (M m3) (A2)	Irrevocable water consumption (M m3) (A=A1-A2)	Irrigated area (th. ha) (B)	Gross crop production ($ M) (C)	Water use productivity – version 1 ($/m3) (C/A)	Water use productivity – version 2 ($/m3) (C/A1)	Land use productivity ($/ha) (C/B)
1995	Akkurgan	*310,1*	*267,5*	*42,6*	*29,4*	*16,9*	*0,40*	*0,05*	*574,8*
	Akhangaran	*186,6*	*4,8*	*181,8*	*26,0*	*14,7*	*0,08*	*0,08*	*565,4*
	Bostanlyk	*93,5*	*29,7*	*63,8*	*15,3*	*14,8*	*0,23*	*0,16*	*967,3*
	Buka	*351,0*	*282,2*	*68,8*	*39,7*	*17,1*	*0,25*	*0,05*	*430,7*
	Kuyi-Chirchik	*289,1*	*165,6*	*123,5*	*39,6*	*15,4*	*0,12*	*0,05*	*388,9*
	Zangiata	*186,4*	*144,7*	*41,7*	*14,3*	*16,9*	*0,41*	*0,09*	*1181,8*
	Yukori-Chirchik	*210,1*	*91,3*	*118,8*	*26,2*	*15,1*	*0,13*	*0,07*	*576,3*
	Kibray	*268,8*	*78,5*	*190,3*	*18,8*	*17,6*	*0,09*	*0,07*	*936,2*
	Parkent	*101,6*	*74,9*	*26,7*	*17,0*	*14,1*	*0,53*	*0,14*	*829,4*
	Pskent	*255,7*	*108,9*	*146,8*	*25,3*	*14,8*	*0,10*	*0,06*	*585,0*
	Urta-Chirchik	*280,5*	*134,5*	*146,0*	*33,0*	*15,0*	*0,10*	*0,05*	*454,5*
	Tashkent	*177,7*	*95,2*	*82,5*	*16,0*	*10,5*	*0,13*	*0,06*	*656,3*
	Chinaz	*184,4*	*76,8*	*107,6*	*21,8*	*16,9*	*0,16*	*0,09*	*775,2*
	Yangiyul	*295,5*	*102,9*	*192,6*	*28,5*	*15,9*	*0,08*	*0,05*	*557,9*
	Total	***3191,0***	***1657,5***	***1533,5***	***350,9***	***215,7***	***0,14***	***0,07***	***614,7***

2000	Akkurgan	*237,6*	*134,6*	*103,0*	*29,4*	*22,9*	*0,22*	*0,10*	*778,9*
	Akhangaran	*211,2*	*8,5*	*202,7*	*25,6*	*20,6*	*0,10*	*0,10*	*804,7*
	Bostanlyk	*94,8*	*34,4*	*60,4*	*15,5*	*21,1*	*0,35*	*0,22*	*1361,3*
	Buka	*336,3*	*269,1*	*67,2*	*39,7*	*27,5*	*0,41*	*0,08*	*692,7*
	Kuyi-Chirchik	*294,9*	*71,9*	*223,0*	*39,4*	*22,9*	*0,10*	*0,08*	*581,2*
	Zangiata	*154,7*	*110,2*	*44,5*	*12,9*	*19,8*	*0,44*	*0,13*	*1534,9*
	Yukori-Chirchik	*198,2*	*81,9*	*116,3*	*26,2*	*24,6*	*0,21*	*0,12*	*938,9*
	Kibray	*213,3*	*67,9*	*145,4*	*19,3*	*24,2*	*0,17*	*0,11*	*1253,9*
	Parkent	*118,5*	*54,0*	*64,5*	*15,2*	*26,4*	*0,41*	*0,22*	*1736,8*
	Pskent	*238,2*	*76,2*	*162,0*	*24,9*	*24,2*	*0,15*	*0,10*	*971,9*
	Urta-Chirchik	*221,6*	*74,4*	*147,2*	*33,3*	*28,5*	*0,19*	*0,13*	*855,9*
	Tashkent	*157,5*	*58,2*	*99,3*	*15,5*	*18,0*	*0,18*	*0,11*	*1161,3*
	Chinaz	*230,8*	*86,5*	*144,3*	*21,8*	*28,7*	*0,20*	*0,12*	*1316,5*
	Yangiyul	*250,9*	*150,7*	*100,2*	*28,5*	*26,1*	*0,26*	*0,10*	*915,8*
	Total	***2958,5***	***1278,5***	***1680,0***	***347,2***	***335,5***	***0,20***	***0,11***	***966,3***
2001	Akkurgan	*192,0*	*126,0*	*66,0*	*29,4*	*23,7*	*0,36*	*0,12*	*806,1*
	Akhangaran	*174,0*	*8,5*	*165,5*	*25,9*	*20,6*	*0,12*	*0,12*	*795,4*
	Bostanlyk	*95,0*	*36,0*	*59,0*	*15,5*	*20,8*	*0,35*	*0,22*	*1341,9*
	Buka	*302,0*	*254,0*	*48,0*	*39,1*	*24,0*	*0,50*	*0,08*	*613,8*
	Kuyi-Chirchik	*295,0*	*82,2*	*212,8*	*39,4*	*21,5*	*0,10*	*0,07*	*545,7*
	Zangiata	*151,0*	*110,2*	*40,8*	*12,7*	*23,7*	*0,58*	*0,16*	*1866,1*
	Yukori-Chirchik	*195,0*	*50,9*	*144,1*	*26,1*	*21,2*	*0,15*	*0,11*	*812,3*
	Kibray	*185,0*	*71,6*	*113,4*	*19,2*	*24,7*	*0,22*	*0,13*	*1286,5*
	Parkent	*117,0*	*50,3*	*66,7*	*15,2*	*19,8*	*0,30*	*0,17*	*1302,6*
	Pskent	*172,0*	*99,7*	*72,3*	*24,9*	*20,8*	*0,29*	*0,12*	*835,3*
	Urta-Chirchik	*185,0*	*97,9*	*87,1*	*32,6*	*21,1*	*0,24*	*0,11*	*647,2*
	Tashkent	*145,0*	*59,3*	*85,7*	*15,5*	*14,7*	*0,17*	*0,10*	*948,4*
	Chinaz	*170,0*	*96,7*	*73,3*	*21,7*	*23,8*	*0,32*	*0,14*	*1096,8*
	Yangiyul	*169,0*	*118,3*	*50,7*	*28,5*	*22,4*	*0,44*	*0,13*	*786,0*
	Total	***2547,0***	***1261,6***	***1285,4***	***345,7***	***302,8***	***0,24***	***0,12***	***875,9***
2002	Akkurgan	*171,6*	*134,3*	*37,3*	*29,4*	*16,6*	*0,45*	*0,10*	*564,6*
	Akhangaran	*160,1*	*7,4*	*152,7*	*25,8*	*12,9*	*0,08*	*0,08*	*500,0*
	Bostanlyk	*90,7*	*42,3*	*48,4*	*15,0*	*13,8*	*0,29*	*0,15*	*920,0*
	Buka	*238,4*	*202,6*	*35,8*	*38,5*	*17,6*	*0,49*	*0,07*	*457,1*
	Kuyi-Chirchik	*216,0*	*70,0*	*146,0*	*39,6*	*14,6*	*0,10*	*0,07*	*368,7*
	Zangiata	*144,3*	*113,2*	*31,1*	*12,6*	*15,7*	*0,50*	*0,11*	*1246,0*
	Yukori-Chirchik	*162,8*	*64,4*	*98,4*	*26,4*	*16,9*	*0,17*	*0,10*	*640,2*
	Kibray	*156,5*	*48,3*	*108,2*	*19,2*	*18,8*	*0,17*	*0,12*	*979,2*
	Parkent	*106,8*	*51,1*	*55,7*	*14,8*	*15,7*	*0,28*	*0,15*	*1060,8*
	Pskent	*131,0*	*88,7*	*42,3*	*24,9*	*15,5*	*0,37*	*0,12*	*622,5*
	Urta-Chirchik	*169,2*	*93,2*	*76,0*	*32,6*	*18,6*	*0,24*	*0,11*	*570,6*
	Tashkent	*116,0*	*59,2*	*56,8*	*15,5*	*9,8*	*0,17*	*0,08*	*632,3*
	Chinaz	*163,3*	*102,9*	*60,4*	*21,8*	*15,7*	*0,26*	*0,10*	*720,2*
	Yangiyul	*164,7*	*118,6*	*46,1*	*28,2*	*18,4*	*0,40*	*0,11*	*652,5*
	Total	***2191,4***	***1196,2***	***995,2***	***344,3***	***220,6***	***0,22***	***0,10***	***640,7***
2003	Akkurgan	*177,2*	*160,7*	*16,5*	*29,5*	*15,3*	*0,93*	*0,09*	*518,6*
	Akhangaran	*170,8*	*9,2*	*161,6*	*25,9*	*11,5*	*0,07*	*0,07*	*444,0*
	Bostanlyk	*82,7*	*37,3*	*45,4*	*15,0*	*12,4*	*0,27*	*0,15*	*826,7*
	Buka	*270,2*	*248,5*	*21,7*	*38,6*	*14,8*	*0,68*	*0,05*	*383,4*
	Kuyi-Chirchik	*249,8*	*75,8*	*174,0*	*39,4*	*13,6*	*0,08*	*0,05*	*345,2*
	Zangiata	*134,0*	*98,9*	*35,1*	*12,6*	*12,7*	*0,36*	*0,09*	*1007,9*
	Yukori-Chirchik	*180,9*	*79,0*	*101,9*	*26,2*	*15,3*	*0,15*	*0,08*	*584,0*

	Kibray	*160,8*	*61,5*	*99,3*	*19,3*	*16,9*	*0,17*	*0,11*	*875,6*
	Parkent	*87,0*	*49,4*	*37,6*	*14,8*	*13,7*	*0,36*	*0,16*	*925,7*
	Pskent	*169,3*	*98,8*	*70,5*	*24,9*	*13,6*	*0,19*	*0,08*	*546,2*
	Urta-Chirchik	*174,1*	*101,0*	*73,1*	*32,7*	*17,2*	*0,24*	*0,10*	*526,0*
	Tashkent	*133,9*	*52,7*	*81,2*	*15,3*	*9,0*	*0,11*	*0,07*	*588,2*
	Chinaz	*175,1*	*108,4*	*66,7*	*21,8*	*15,1*	*0,23*	*0,09*	*692,7*
	Yangiyul	*186,0*	*139,5*	*46,5*	*27,8*	*16,1*	*0,35*	*0,09*	*579,1*
	Total	***2351,8***	***1320,7***	***1031,1***	***343,8***	***197,2***	***0,19***	***0,08***	***573,6***

* - Information is given per district in Tashkent province, except for district centers and Bekabad district