

ANALYSIS OF THE WATER MANAGEMENT SITUATION WITHIN THE AMUDARYA AND SYRDARYA RIVER BASINS FOR THE VEGETATION PERIOD OF 2012

1. Syrdarya River Basin

The actual inflow to the upstream reservoirs of the Syrdarya River Basin (Toktogul, Andijan and Charvak without considering the inflow from the Ugam river) for the vegetation period was 17.32 km³, or 83.3% of the predicted inflow (planned schedule of BWO "Syrdarya"). The upstream reservoirs took in total 5.13 km³ of water from the Naryn, Karadarya and Chirchik rivers, which was less than the planned by 2.76 km³. The actual release from those for the vegetation period came to 12.20 km³, which was less than the planned by 9.6%.

The total lateral inflow to the Naryn and Syrdarya rivers (at the river reach before the Shardara reservoir) calculated by the balance method (based on data provided by BWO "Syrdarya") came to 11.13 km³.

By the end of the vegetation period, 19.59 km³ of water, or 87.6% of the planned volume, was accumulated in the upstream reservoirs, in particular: 17.51 km³ in the Toktogul reservoir, 1.51 km³ in the Charvak reservoir, and 0.56 km³ in the Andijan reservoir.

The total volume of water withdrawal from the Naryn and Syrdarya rivers up to the Shardara reservoir came to 10.67 km³, in particular: 0.18 km³ for the Kyrgyz Republic; 1.48 km³ to the Republic of Tajikistan; 8.69 km³ to the Republic of Uzbekistan; and 0.64 km³ to the Republic of Kazakhstan (through the Dustlik canal).

The withdrawn water volume for the vegetation period 2012 was less by 0.678 km³ (5.8%) than that planned according to the BWO "Syrdarya" schedule. Water supply was unequal for the riparian countries as well for river reaches (see Table 1.1 and the data given on the website: www.cawater-info.net/analysis/water/).

Attention needs to be paid to the fact that over the past 5 years (2007-2008 ... 2011-2012) the average annual inflow to the Toktogul reservoir was 13.55 km³, including 10.27 km³ for the vegetation periods. The water inflow for the vegetation period 2012 came to 8.99 km³, which was less than the average inflow over the 5 years by 1.282 km³.

The past 5-year average volume of releases from the Toktogul reservoir for the vegetation period is estimated at 5.2 km³. During the vegetation period 2012, 4.685 km³ of water released was, which is more than the BWO "Syrdarya" scheduled release by 0.55 km³ and less the past 5-year average volume by 0.52 km³ (see Tables 1.3 and 1.4).

According to our estimates, the releases from the Toktogul reservoir for the vegetation period equaling 5.5...6.0 km³ in general meet the irrigation needs of the basin in normal water availability years and should allow (under steady operation of the Naryn HPP cascade) stable delivering water to Fergana Valley canals.

The obligations for the water delivery to the Kayrakkum reservoir were fulfilled 100%; the water inflow to the reservoir came to 6.75 km³ as compared to 6.75 km³ of the BWO "Syrdarya" scheduled water inflow.

Water availability in the Syrdarya river midstream depends on the releases from the Kayrakkum reservoir, which can limit water delivery to the midstream canals even during normal periods if it operates in the power-generation mode. During the vegetation period 2012 the lowest water availability, which was calculated using the limits for 2012, was

observed in some ten-day periods in Tajikistan in April 2012 – up to 43.1%; in Kyrgyzstan in May – up to 80.1%, in Uzbekistan in July – up to 76.5%, and in Kazakhstan in July-August – up to 43.4%). The total release from the Kayrakkum reservoir for the vegetation period 2012 was 8.0 km³, including the release into the river equal to 7.6 km³.

The release from the Kayrakkum reservoir was less than the BWO "Syrdarya" scheduled by 0.13 km³; and the total release for the vegetation period came up to 1.89 km³. Nevertheless, the total water availability of the river reach "Kayrakkum-Shardara" came to 85.4%, which is 8.8% less than the average water availability in the basin.

Water inflow to the Shardara reservoir amounted to 4.52 km³, or 33.1% less than the BWO "Syrdarya" scheduled volume. Based on the water balance method, water losses at the river reach "Kayrakkum-Shardara" were estimated as equal to 1.32 km³, at that the lateral inflow was 11.13 km³.

Water release from the Shardara reservoir came to 7.85 km³, including 7.1 km³ into the river and 0.059 km³ to the Arnasay reservoir.

Analysis of reservoirs' water balances (Table 1.3) has revealed the non-registered inflow to the Andijan reservoir, which was 0.02 km³. The total water losses in the Toktogul, Andijan, Kayrakkum and Shardara reservoirs came to 1.8 km³.

According to the Kazakhstan hydrometeorological station (Karateren gauging station), water delivery to the Aral Sea and Priaralie came to 2.8 km³. The actual water balance of the Syrdarya lower reaches is given in Table 1.5.

Table 1.1

Water availability in the Syrdarya River basin countries for the vegetation period 2012

Water user	Water volume, km ³		Water availability, %		Deficit (-), surplus (+) km ³	
	limit/schedule*	actual	season	min value for ten-day period**	season	total of ten-day period***
1. Total water withdrawal	11.67	10.99	94.2	76.76	-0.68	-1.26
2. By countries:						
Kyrgyz Republic	0.183	0.178	97.4	80.05	0.00	-0.01
Republic of Uzbekistan	8.80	8.69	98.8	76.49	-0.11	-0.88
Republic of Tajikistan	1.90	1.48	77.7	43.09	-0.43	-0.43
Republic of Kazakhstan	0.78	0.64	82.0	43.4	-0.14	-0.20
3. By river reaches						
3.1 Toktogul reservoir-Uchkurgan hydroscheme	3.90	4.08	104.7	83.36	0.18	-0.16
<i>In particular:</i>						
<i>Kyrgyz Republic</i>	0.11	0.13	111.7	82.56	0.01	0.00
<i>Republic of Tajikistan</i>	0.24	0.07	29.1	5.71	-0.17	-0.17
<i>Republic of Uzbekistan</i>	3.55	3.89	109.5	85.09	0.34	-0.10
3.2 Uchkurgan hydroscheme – Kayrakkum hydroscheme	1.06	1.18	111.3	82.3	0.12	-0.04
<i>In particular:</i>						

Water user	Water volume, km ³		Water availability, %		Deficit (-), surplus (+) km ³	
	limit/schedule*	actual	season	min value for ten-day period**	season	total of ten-day period***
<i>Kyrgyz Republic</i>	0.07	0.05	74.0	63.31	-0.02	-0.02
<i>Republic of Tajikistan</i>	0.45	0.54	120.4	91.88	0.09	-0.01
<i>Republic of Uzbekistan</i>	0.54	0.59	108.6	70.56	0.05	0.05
3.3 Kayrakkum hydroscheme – Shardara reservoir	6.71	5.73	85.4	62.75	-0.98	-1.23
<i>In particular:</i>						
<i>Republic of Kazakhstan</i>	0.78	0.64	82.0	43.40	-0.14	-0.20
<i>Republic of Tajikistan</i>	1.22	0.87	71.4	2.0	-0.35	-0.35
<i>Republic of Uzbekistan</i>	4.71	4.22	89.6	63.08	-0.49	-0.88
4. In addition:						
Inflow to the Shardara reservoir	6.77	4.53	66.9	31.5	-2.24	-2.46
Discharge to Arnasay	0.00	0.06	0.00	0.00	0.00	0.00
Water supply to the Aral Sea and Priaralie	2.89	2.05	71.0			

* Limits for the vegetation period 2010

** Minimum value recorded for the ten-day period

*** Total water deficit recorded in ten-day periods

Table 1.2

Syrdarya River channel water balance for the vegetation period 2012

Item	Water volume, km ³		Deviation (actual-planned)
	predicted/planned	actual	
1. Inflow to the Toktogul reservoir	11.57	8.99	-2.58
2. Lateral inflow at the river reach Toktogul reservoir-Shardara reservoir (+)	9.75	11.13	1.38
<i>In particular:</i>			
<i>Release to the Karadarya river</i>	0.88	1.82	0.94
<i>Release to the Chirchik river</i>	0.73	1.41	0.68
<i>Lateral inflow by CDF¹ and small rivers</i>	8.14	7.90	-0.24
3. Flow control in the reservoirs: water addition (+) or withdrawal (-)	-5.12	-3.28	1.84
<i>In particular:</i>			
<i>Toktogul reservoir</i>	-6.33	-4.31	2.03
<i>Kayrakkum reservoir</i>	1.21	1.03	-0.19
4. Regulated flow (1+2+3)	16.20	16.84	0.64
5. Water withdrawal at the Toktogul-Shardara (-) site	-11.67	-10.99	0.68
6. Water losses (-) or unrecorded inflow to the channel (+) at the Toktogul-Shardara site	2.23	-1.32	-3.56
<i>Including % of the regulated flow</i>	13.78	-7.86	-21.64

¹ CDF stands for collector & drainage network.

Item	Water volume, km ³		Deviation (actual-planned)
	predicted/ planned	actual	
7. Inflow to the Shardara reservoir	6.77	4.53	-2.24
8. Flow regulation in the Shardara reservoir: water addition (+) or withdrawal (-)	3.04	3.32	0.28
9. Water release from the Shardara reservoir to the river	8.60	7.10	-0.15
10. Diversion to the Kyzylkum canal (-)	-1.21	-0.80	0.41
11. Discharge to Arnasay (-)	0.00	-0.06	-0.06
12. Water supply to the Aral Sea and Priaralie	2.89	2.85	-0.04

Table 1.3

Water balance of the Syrdarya River basin reservoirs for the vegetation period 2012

Item	Water volume, km ³		Deviation (actual-planned)
	predicted/ planned	actual	
1. Toktogul reservoir			
1.1 Inflow to the reservoir	11.57	8.99	-2.58
1.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	13.22	13.22	0.00
- at the end of the season (October 1, 2012)	19.50	17.51	-1.99
1.3 Release from the reservoir	5.24	4.68	-0.55
1.4 Unaccounted water inflow (+) or losses (-)	-0.05	-0.01	0.04
<i>% of the inflow to the reservoir</i>	-0.45	-0.16	0.29
1.5 Flow regulation: water addition (+) or withdrawal (-)	-6.33	-4.31	2.03
2. Andijan reservoir			
2.1 Inflow to the reservoir	3.25	2.71	-0.54
2.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	0.74	0.74	0.00
- at the end of the season (October 1, 2012)	1.22	0.56	-0.66
2.3 Release from the reservoir	2.76	2.89	0.13
2.4 Unaccounted water inflow (+) or losses (-)	-0.01	-0.01	0.00
<i>% of the inflow to the reservoir</i>	-0.37	-0.22	0.15
2.5 Flow regulation: water addition (+) or withdrawal (-)	-0.49	0.17	0.66
3. Charvak reservoir			
3.1 Inflow to the reservoir	5.97	5.62	-0.35
3.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	0.50	0.50	0.00
- at the end of the season (October 1, 2012)	1.63	1.51	-0.12
3.3 Release from the reservoir	5.50	4.63	-0.87
3.4 Unaccounted water inflow (+) or losses (-)	0.66	0.02	-0.64
<i>% of the inflow to the reservoir</i>	11.06	0.43	-10.64
3.5 Flow regulation: water addition (+) or withdrawal (-)	-0.47	-0.99	-0.52
4. Kayrakkum reservoir			
4.1 Inflow to the reservoir	6.75	6.75	0.00
4.2 Lateral inflow	0.25	0.23	-0.02

Item	Water volume, km ³		Deviation (actual-planned)
	predicted/ planned	actual	
4.3 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	3.39	3.39	0.00
- at the end of the season (October 1, 2012)	1.76	1.50	-0.26
4.4 Release from the reservoir	8.22	8.00	-0.22
<i>In particular:</i>			
- release to the river	7.73	7.60	-0.13
-water withdrawal from the reservoir	0.48	0.40	-0.08
4.5 Unaccounted water inflow (+) or losses (-)	-0.41	-0.87	-0.45
<i>% of the inflow to the reservoir</i>	-6.14	-12.84	-6.70
4.6 Flow regulation: water addition (+) or withdrawal (-)	1.21	1.03	-0.19
5. Shardara reservoir			
5.1 Inflow to the reservoir	6.77	4.53	-2.24
5.2 Lateral inflow	-	-	-
5.3 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	5.13	5.13	0.00
- at the end of the season (October 1, 2012)	1.57	0.91	-0.66
5.4 Release from the reservoir	9.80	7.85	-1.96
<i>In particular:</i>			
- discharge to Arnasay	0.00	-0.06	-0.06
- release to the river	8.60	7.10	-1.50
- water withdrawal from the reservoir	1.21	0.80	-0.40
5.5 Unaccounted water inflow (+) or losses (-)	-0.53	-0.91	0.38
<i>% of the inflow to the reservoir</i>	-7.78	-20.01	-12.23
5.6 Runoff regulation by the reservoirs: water addition (+) or withdrawal (-)	3.04	3.32	0.28
TOTAL flow regulation: water addition (+) or withdrawal (-)	-3.04	-0.78	2.26
TOTAL losses (-), unaccounted inflow (+)	-0.34	-1.77	-1.42

Table 1.4

Inflow to and release from the Toktogul reservoir during the period of 2007-2012

Hydrologic year	Inflow, million m ³			Release, million m ³		
	Non-vegetation period	Vegetation period	Annual	Non-vegetation period	Vegetation period	Annual
2007-2008	2505	7371	9876	9726	4408	14134
2008-2009	2672	9876	12548	5884	5748	11632
2009-2010	3898	15244	19142	6965	5445	12410
2010-2011	3896	9888	13783	8000	5714	13714
2011-2012	3408	8992	12401	9730	4685	14415
Average for the five years	3276	10274	13550	8061	5200	13261

Table 1.5

**Water resources and flow consumption in the lower reaches of the Syrdarya river
for the vegetation period 2012**

Item	Water volume, km ³	
	predicted/planned	actual
1. Release from the Shardara reservoir to the river and Koksaray reservoir	8.6	7.1
2. Release to the Arys river	-	0.5
3. Drawdown (+) or filling (-) of the Koksaray reservoir	-	2.4
Total water resources (1+2+3)	-	10.0
4. Water withdrawal (-)	-	-5.7
5. Losses (-)	-	-1.5
6. Release to the Aral Sea (Karateren gauging station) (-)	-2.89	-2.80
Total consumption (4+5+6)	-	-10.0
Balance	-	0.0

In the Syrdarya river reach from the Toktogul reservoir to the Kayrakkum reservoir, water deficit took place in most ten-day periods of the vegetation period: in Kyrgyzstan, slight water deficit in April-July (5-20%); in Tajikistan, in May-August (up to 25-31% in June); in Uzbekistan, in July (8-17%).

In the middle reach, deficit in water withdrawal was much higher: in Tajikistan it was observed during all ten-day period of the vegetation period with peak values in April and early May (90-60%); in Kyrgyzstan, in April-early May, late July, August-September; and in Uzbekistan, in April-July and early August.

In April to August, deficit in water withdrawal was mainly due to insufficient water release from the Toktogul reservoir (12-15% in April and 36-41% in August) and insufficient release from the Kayrakkum reservoir (see Table 1.6.).

Table 1.6

**Release from the Kayrakkum reservoir during water deficit
for the vegetation period 2012**

Item	Unit	April	August		
		III	I	II	III
Predicted	m ³ /s	517	584	584	584
Actual	m ³ /s	451	327	331	307
Deficit in water release	m ³ /s	66	257	253	277
	%	13	44	43	47
Deficit in water withdrawal at the Kayrakkum-Shardara section:	%	37	23	11	-
In particular:					
- Kazakhstan	%	56	56	57	15
- Tajikistan	%	83	17	24	28
- Uzbekistan	%	20	16	-	-

2 Amudarya River Basin

The actual water content of the Amudarya river at the reference gauging station Atamyrat (upstream to the water intake into Garagumdarya) was 32.3 km^3 , which was less the expected one (according to the BWO "Amudarya" schedule) by 7.45 km^3 (Table 2.2). At the same time, water inflow to the Nurek HPP was more by 2.95 km^3 than the predicted one! Therefore, the release from the reservoir came to 12.4 km^3 , or more than the planned one by 2.91 km^3 .

In the existing water management situation, 93.0% of the water withdrawal limit for the canals in the Amudarya river basin was used; the total water withdrawal came to 36.83 km^3 , including 30.32 km^3 downstream the Atamyrat GS (starting from the water intake into Garagumdarya). Water supplying differed from one country to another and from one river reach to another (see Table 2.1 as well as data on the website: www.cawater-info.net/analysis/water/).

At the end of the season, up to 10.54 km^3 of water were accumulated in the Nurek reservoir and up to 5.74 km^3 in the Tuyamuyun Hydroscheme (TMHS) reservoir (Table 2.3). River water withdrawal for filling in the Nurek and Tuyamuyun reservoirs came to 8.86 km^3 .

Water losses from the Amudarya river assessed by using the water balance method for the river section from the Atamyrat GS (reference) to the TMHS inflow point came to 4.92 km^3 , or 9.2% of the flow at the Atamyrat GS (reference). Water losses at the river section from TMHS inflow point up to the boundary of water delivery to the Aral Sea and Priaralie was 2.77 km^3 , or 9.1% of the inflow to TMHS.

There are no water losses in the Nurek reservoir; while in the Tyuyamuyun reservoir the made up 2.84 km^3 .

In general, water losses in the Amudarya river basin came to 9.6 km^3 , or 18% of water content (Atamyrat GS), which is less by 7.75 km^3 (10.54%) than the estimated (planned by BWO "Amudarya"). By the beginning of the non-vegetation period 2012-2013, the both reservoirs have been filled up to the optimal water volume.

The flow at the Samanbay GS came to 5.45 km^3 ; given the water releases from the collector and drainage network, the Aral Sea and Priaralie received 7.19 km^3 of water.

Table 2.1

Water availability in the Amudarya river basin countries for the vegetation period 2012

Water user	Water volume, km ³		Water availability, %		Deficit (-), surplus (+) km ³	
	limit/schedule	actual	season	Min ten-day period*	season	Total for ten-day period**
1. Total water withdrawal	39.60	36.83	93.00	86.75	-2.77	-2.87
2. By countries:						
Kyrgyz Republic	-	-	-	-	-	-
Republic of Tajikistan	6.88	5.82	84.53	62.71	-1.06	-1.06
Turkmenistan	15.50	14.48	93.45	80.09	-1.02	-1.18
Republic of Uzbekistan	17.22	16.53	95.98	84.73	-0.69	-1.18
3. Downstream Atamyrat GS***	31.52	30.32	96.20	88.95	-1.20	-1.51
<i>In particular:</i>						
<i>Turkmenistan</i>	15.50	14.48	93.45	80.09	-1.02	-1.18
<i>Republic of Uzbekistan</i>	16.02	15.84	98.85	87.78	-0.18	-0.80
4. By river reaches:						
Upstream	8.02	6.51	80.54	67.32	-1.57	-1.58
<i>In particular:</i>						
<i>Kyrgyz Republic</i>	-	-	-	-	-	-
<i>Republic of Tajikistan</i>	6.88	5.82	84.53	62.71	-1.06	-1.06
<i>Surkhandarya province, Uzbekistan</i>	1.20	0.69	57.68	37.30	-0.51	-0.52
Middle reach	16.21	15.15	93.45	82.79	-1.06	-1.12
<i>In particular:</i>						
<i>Turkmenistan</i>	10.47	9.37	89.48	70.46	-1.10	-1.14
<i>Republic of Uzbekistan</i>	5.73	5.78	100.70	78.10	0.04	-0.29
Downstream	15.31	15.18	99.10	87.21	-0.14	-0.77
<i>In particular:</i>						
<i>Turkmenistan</i>	5.03	5.11	101.73	85.36	0.09	-0.22
<i>Republic of Uzbekistan</i>	10.28	10.06	97.82	84.44	-0.22	-0.67
5. In addition:						
Emergency and environmental releases to downstream canals	0.0	0.79				
<i>In particular:</i>						
<i>Turkmenistan</i>	0.00	0.00				
<i>Republic of Uzbekistan</i>	0.00	0.79				
Water supply to the Aral Sea and Priaralie	7.00	7.19	102.7			

* Minimum value recorded in the ten-day period

** Total water deficit by ten-day periods; covered by surplus water during the season

*** Atamyrat gauging station (reference) – Amudarya river section upstream of Garagumdarya

Table 2.2

The Amudarya River channel water balance for the vegetation period 2012

Items	Water volume, km ³		Deviation (actual-planned)
	predicted/ planned	actual	
1. Water content in the Amudarya river: unregulated flow at the section of Atamyrat GS (reference)	60.73	53.28	-7.45
2. Flow regulation in the Nurek reservoir: water addition (+) or withdrawal (-)	-4.44	-4.48	-0.04
3. Water withdrawal in the middle reach (-)	-16.21	-15.15	1.06
4. Return CDF in the middle reach (+)	1.85	1.57	-0.28
5. Water losses (-) or unrecorded inflow to the channel (+)	-9.01	-4.92	4.09
<i>% of the flow at the section of Atamyrat GS (reference)</i>	-14.8	-9.2	5.61
6. Inflow to the Tuyamuyun Hydroscheme (Bir-Ata GS)	32.92	30.30	-2.62
7. Flow regulation at TMHS: water addition (+) or withdrawal (-)	-2.27	-4.38	-2.11
8. Losses in (-) and lateral inflow (+) to the TMHS reservoirs	0.00	-1.92	-1.92
<i>% of inflow</i>	0.00	-6.33	-6.33
9. Releases from TMHS (including water withdrawal from the reservoir)	30.65	25.92	-4.73
10. Lower reach water withdrawal, including withdrawal from TMHS (-)	-15.31	-15.18	0.14
11. Return CDF in the lower reach (+)	0.00	0.00	0.00
12. Emergency and environmental water releases to downstream canals (-)	-0.00	-0.79	0.79
13. Water losses (-) or unrecorded inflow to the channel (+)	-8.34	-2.77	5.57
<i>% of the flow at the section of Tuyamuyun GS</i>	-27.2	-10.7	16.52
14. Water supply to the Aral Sea and Priaralie	7.00	7.19	0.19
TOTAL losses:	-17.35	-9.60	7.75
<i>% of water content in the river</i>	-28.56	-18.0	10.54

* after deduction of the upper reach water withdrawal (Tajikistan and Surkhandarya province of Uzbekistan)

Table 2.3

Water balance of the Amudarya river basin's reservoirs for the vegetation period 2012

Items	Water volume, km ³		Deviation (actual-planned)
	predicted/ planned	actual	
1. Nurek reservoir			
1.1 Inflow to the reservoir	17.05	20.00	2.95
1.2 Water volume in the reservoir:			
- at the beginning of the season (April 1, 2012)	6.06	6.06	0.00
- at the end of the season (October 1, 2012)	10.50	10.54	0.04
1.3 Release from the reservoir	12.61	15.52	2.91
1.4 Lateral inflow (+) or water losses (-)	0.00	0.00	0.00
<i>% of inflow to the reservoir</i>	0.00	0.00	0.00
1.5 Flow regulation: water addition (+) or withdrawal (-)	-4.44	-4.48	-0.04
2. TMHS reservoirs			
2.1 Inflow to TMHS	32.92	30.30	-2.62
2.2 Water volume in the reservoirs:			
- at the beginning of the season (April 1, 2012)	3.28	3.28	0.00
- at the end of the season (October 1, 2012)	5.55	5.74	0.19
2.3 Release from TMHS	30.65	25.92	-4.73
in particular:			
- release to the river	25.04	20.67	-4.36
- water withdrawal	5.61	5.25	-0.37
2.4 Lateral inflow (+) or water losses (-)	0.00	-1.92	-1.92
<i>% of inflow to the reservoir</i>	0.0	-6.3	-6.3
2.5 Flow regulation: water addition (+) or withdrawal (-)	-2.27	-4.38	-2.11
TOTAL flow regulation by the reservoirs: water addition (+) or withdrawal (-)	-6.71	-8.86	-2.15
TOTAL losses (-), unaccounted inflow (+)	0.00	-1.92	-1.92