ANALYSIS OF HYDROLOGICAL CONDITIONS IN THE SYR DARYA AND AMU DARYA RIVER BASINS FOR THE GROWING SEASON 2022

1. Syr Darya River Basin

In the growing season, the actual inflow to the upstream reservoirs in the Syr Darya River Basin (Toktogul, Andijan,Charvak) was 18.0 km^3 or 112 % of the forecast, 97 % of the norm and by 3.7 km^3 higher than during growing season 2021. Total lateral inflow to the Naryn and Syr Darya Rivers (in the reaches to the Shardara reservoir) was 8.5 km^3 (this is by 1.7 km^3 more than during the growing season 2021), including from: Karadarya River (g/s Uchtepa) - 1.59 km^3; Chirchik River (g/s Chinaz-Chirchik) - 0.57 km^3; collector drainage network (CDN) (return flow) and small rivers - 6.33 km^3.

At the beginning of the growing season, the upper reservoirs (Toktogul, Andijan,Charvak) accumulated water in the amount of 9.56 km^3. By the end of the growing season, the full volume of water amounted to 16.1 km^3 in the upstream reservoirs, i.e. water accumulation was 6.55 km^3 in the reservoirs.

Inflow to the Toktogul reservoir from the Naryn River was 10.43 km^3, which is more by 1.02 km^3 than forecasted (106% of the norm), water releases from the reservoir amounted to 4.68 km^3 or 91% of the BWO Syr Darya's schedule. The total water withdrawal from the Naryn River by the reservoir amounted to 5.75 km^3, which is 35% more than in the BWO Syr Darya's schedule.

The volume of water in the "Bakhri Tojik" reservoir amounted to 3.32 km^3 by the beginning of the growing season and 1.71 km^3 by the end of the growing season. Inflow to the "Bakhri Tojik" reservoir was 5.58 km^3 during the growing season and discharge into the river was 6.86 km^3. The analysis of the "Bakri Tojik" reservoir operation shows that more water flew into the reservoir – by 0.42 km^3 more than planned in the BWO's schedule and, accordingly, the water releases from the reservoir into the river were more by 0.89 km^3 than in the schedule.

Total water withdrawal from the Naryn and Syr Darya Rivers in the reaches up to the Shardara reservoir made up 10.17 km^3 or 86% of the established limit. For the growing season 2022, the water withdrawal was less by 1.68 km^3 than planned according to established limits by ICWC.

Water withdrawals amounted to: 0.7 km^3 – Republic of Kazakhstan (through Dustlik canal); 0.16 km^3 – Kyrgyz Republic; 1.56 $км^3$ – Republic of Tajikistan; and, 7.76 km^3 – Republic of Uzbekistan.

The volume of water made up 5.0 km^3 in the Shardara reservoir by the beginning of the growing season and 1.34 km^3 by the end of the growing season. Inflow to the Shardara reservoir was 4.5 km^3 or 115% of the forecast, discharge

from the Shardara reservoir was 6.26 km^3, including 5.69 km^3 into the river; no water from Shardara g/s into the Arnasay depression was supplied.

According to the Aral–SyrDarya Basin Water Authority, the Koksaray reservoir had 542 mln. m^3 of water by early April. The reservoir was filled with 307 mln. m^3. Drawdown of 749 mln. m^3 was carried out in in April and May.

Water supply to the Aral Sea and the Aral Sea region (Karateren g/s) was 0.34 km^3 according to the Committee for Water Resources of Kazakhstan.

Utilization of flow in the lower reaches of the Syr Darya (including water withdrawal, water loss minus lateral inflow) amounted to 6.37 km^3.

Table 1.1

Available water supply of riparian countries in the Syr Darya River basin, growing season 2022

Water user	Water volume, km^3	
	BWO schedule/Limit	Actual
1 Total water withdrawal up to Shardara reservoir	11.85	10.17
2 by state:		
– *Kyrgyz Republic*	0.25	0.16
– *Republic of Uzbekistan*	8.80	7.76
– *Republic of Tajikistan*	1.91	1.56
– *Republic of Kazakhstan*	0.90	0.70
3 by river reaches		
3.1 Toktogul reservoir – Uchkurgan hydroscheme	3.95	3.55
Including:		
– *Kyrgyz Republic*	0.16	0.08
– *Republic of Tajikistan*	0.24	0.08
– *Republic of Uzbekistan*	3.55	3.38
3.2 Uchkurgan hydroscheme – Bakhri Tojik reservoir	1.08	1.22
Including:		
– *Kyrgyz Republic*	0.08	0.07
– *Republic of Tajikistan*	0.45	0.53
– *Republic of Uzbekistan*	0.54	0.61
3.3 Bakhri Tojik – Shardara reservoir.	6.83	5.41
Including:		
– *Republic of Kazakhstan*	0.90	0.70
– *Republic of Tajikistan*	1.22	0.95
– *Republic of Uzbekistan*	4.71	3.76
4 Additionally :		
– Inflow to the Shardara reservoir	3.90	4.50
– Discharge into Arnasay	0.00	0.00
– Water supply to the Aral Sea and Aral Sea region[1]	0.82	0.34

[1] Committee for Water Resources of the Republic of Kazakhstan

Table 1.2

Water balance of the Syr Darya River for the growing season 2022

Balance item	Water volume, km^3		Deviation (actual-plan)	
	Forecast/ plan	Actual	km^3	%
1 Inflow to Toktogul reservoir	9.41	10.43	1.02	11
2 Lateral inflow (LI) in the Toktogul reservoir – Shardara reservoir reach (+)	8.30	8.49	0.19	2
Including:				
-Discharge from the Karadarya River (Uchtepa g/s)	1.43	1.59	0.16	11
-Discharge from the Chirchik (Chinaz-Chirchik g/s)	0.44	0.57	0.13	29
- Lateral inflow from CDN and small rivers	6.43	6.33	-0.10	2
3 Flow regulation by reservoirs: recharge (+) or diversion of flow (-)	-3.44	-4.47	-1.03	30
Including:				
– *Toktogul reservoir*	-4.25	-5.75	-1.50	35
– *Bakhri Tojik reservoir*	0.81	1.28	0.47	58
4 Regulated flow (1+2+3)	14.26	14.44	0.18	1
5 Water intake in the Toktogul– Shardara reach (-)	-11.85	-10.17	1.68	14
6 Inflow to Shardara reservoir	3.90	4.50	0.60	15
7 Water releases from Shardara reservoir (into the river and water intake)	7.38	6.26	-1.12	15
8 Flow regulation in Koksaray reservoir: recharge (+) or diversion of flow (-)	0.50	0.44	-0.06	12
9 Water use (-) downstream of the Shardara reservoir (water withdrawal –lateral inflow + water losses)	-7.07	-6.37	0.70	10
10 Water supply to the Aral Sea and Aral Sea region	0.82	0.34	-0.48	58

Table 1.3

Reservoir water balance in the Syr Darya River basin for the growing season 2022

Balance item	Water volume, km^3		Deviation (actual-plan)	
	Forecast/ plan	Actual	km^3	%
1.Toktogul reservoir				
1.1 Inflow to the reservoir	9.41	10.43	1.02	11
1.2 Water volume in reservoir:				
– beginning of the season (April 1, 2022)	7.85	7.85	0.00	0
– end of the season (October 1, 2022)	12.11	13.62	1.51	12
1.3 Water releases from the reservoir	5.15	4.68	-0.48	9
1.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-4.25	-5.75	-1.50	35
2. Andijan reservoir				
2.1 Inflow to the reservoir	2.13	3.01	0.88	41
2.2 Water volume in the reservoir:				
– beginning of the season (April 1, 2022)	1.06	1.06	0.00	0
– end of the season (October 1, 2022)	0.80	0.91	0.11	13
2.3 Water releases from the reservoir	2.39	3.15	0.76	32
2.4 **Flow regulation:** recharge (+) or diversion of flow (-)	0.26	0.14	-0.12	
3. Charvak reservoir				
3.1 Inflow to the reservoir	4.56	4.57	0.01	0
3.2 Water volume in the reservoir:				
– beginning of the season (April 1, 2022)	0.64	0.64	0.00	0
– end of the season (October 1, 2022)	1.46	1.57	0.11	7
3.3 Water releases from the reservoir	3.81	4.28	0.48	13
3.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-0.75	-0.29	0.46	62
4 Bakhri Tojik reservoir				
4.1 Inflow to the reservoir	5.16	5.58	0.42	8
4.2 Lateral inflow	0.30	0.17	-0.13	43
4.3 Water volume in the reservoir:				
– beginning of the season (April 1, 2022)	3.32	3.32	0.00	0
– end of the season (October 1, 2022)	1.70	1.71	0.01	1

Balance item	Water volume, km^3		Deviation (actual-plan)	
	Forecast/ plan	Actual	km^3	%
4.4 Water releases from the reservoir	6.57	7.556	0.99	15
Including*:*				
– *water releases into the river*	5.97	6.86	0.89	15
– *water intake from the reservoir*	0.60	0.70	0.10	16
4.5 **Flow regulation:** recharge (+) or diversion of flow (-)	0.81	1.28	0.47	58
5 Shardara reservoir				
5.1 Inflow to the reservoir	3.90	4.50	0.60	15
5.2 Lateral inflow	0.00	0.00	0.00	
5.3 Water volume in the reservoir:				
– beginning of the season (April 1, 2022)	5.00	5.00	0.00	0
– end of the season (October 1, 2022)	1.04	1.34	0.30	29
5.4 Water releases from the reservoir	7.38	6.26	-1.12	15
Including:				
– *discharge into Arnasay*	0.00	0.00	0.00	
– *water releases into the river*	6.57	5.69	-0.88	13
– *water intake from the reservoir*	0.81	0.57	-0.24	29
5.5 **Flow regulation:** recharge (+) or diversion of flow (-)	3.48	1.19	-2.29	66
TOTAL volume of flow regulation by reservoirs: recharge (+) or diversion of flow (-)	-0.46	-3.44	-2.98	

2. Amu Darya River Basin

Actual water content in the Amu Darya River at nominal Kerki g/s (upstream of the water intake to Garagumdarya) amounted to 41.23 km^3, which is less by 0.24 km^3 than expected and estimated value according to the schedule of BWO Amu Darya (Table 2.2). For comparison: actual water content of the river for the growing season 2021 amounted to 41.16 km^3.

Inflow to the Nurek reservoir was 16.4 km^3, i.e. more by 1.13 km^3 than forecasted inflow, while water releases from the reservoir were 13.03 km^3 (more by 0.9 km^3 than in BWO Amu Darya's schedule). Diversion of river flow through filling of the Nurek reservoir amounted to 3.37 km^3 (Table 2.3.)

According to the data on Darganata g/s, inflow to the Tuyamuyun hydroscheme (TMHS) was 22.55 km^3, which is more by 1.74 km^3 than expected; despite this, the plan for accumulation of 3.45 km^3 during the growing season was not fulfilled in the reservoirs of Tuyamuyun hydroscheme (TMHS). The actual volume of water was 2.32 km^3 by the end of the growing season in the TMHS reservoirs and water releases from TMHS amounted to 12.97 km^3.

In the current water-related situation, the established water withdrawal limit for the canals in the Amu Darya Basin was met by 79% (Table 2.1). Total water withdrawal was 31.38 km^3, including downstream of Kerki g/s (starting from the water intake to Garagumdarya) – 23.93 km^3. During the growing season, the average available water supply was 95% for the Republic of Tajikistan, 83% for Turkmenistan, and 69% for Uzbekistan; in the lower reaches, the available water supply was 64% for Turkmenistan, 59% for Uzbekistan, and 67% for the Syrkhandarya province.

0.94 km^3 reached the Aral Sea region and the Aral Sea (Amu Darya river flow at Samanbay g/s plus discharges from CDN) or 45% of BWO's schedule during the growing season.

Table 2.1

Indicators of available water supply of the countries in the Amu Darya River Basin, growing season 2022

Water user	Water volume, km^3		Water availability %	Shortage (-) Surplus (+) km^3
	Limit/ Schedule	Actual	Season	Season
1. Total water withdrawal	39.68	31.38	79	-8.3
2. Water intake by states:				
Kyrgyz Republic	-	-	-	-
Republic of Tajikistan	7.0	6.6	95	-0.3
Turkmenistan	15.5	12.9	83	-2.6
Republic of Uzbekistan	17.2	11.8	69	-5.4
3. Downstream of nominal Kerki g/s*	31.520	23.93	76	-7.6
Including:				
Turkmenistan	15.5	12.9	83	-2.6
Republic of Uzbekistan	16.0	11.0	69	-5.0
4. By river reach:				
Upper reaches	8.163	7.45	91	-0.7
Including:				
Kyrgyz Republic	-	-	-	-
Republic of Tajikistan	6.96	6.64	95	-0.3
Syrkhandarya, Uzbekistan	1.20	0.81	67	-0.4
Middle reaches	16.207	14.66	90	-1.5
Including:				
Turkmenistan	10.47	9.71	93	-0.8
Republic of Uzbekistan	5.73	4.95	86	-0.8
Lower reaches	15.313	9.27	61	-6.0
Including:				
Turkmenistan	5.03	3.20	64	-1.8
Republic of Uzbekistan	10.285	6.07	59	-4.2
5. Additionally:				
Emergency and environmental discharge into canals in the lower reaches	0	0		

Water user	Water volume, km^3		Water availability %	Shortage (-) Surplus (+) km^3
	Limit/ Schedule	Actual	Season	Season
Including:				
Turkmenistan	0	0		
Republic of Uzbekistan	0	0		
Water supply to the Aral Sea region and the Aral Sea**	2.10	0.94	45	-1.2

***)** nominal Kerki section- in the Amu Darya River (upstream of the water intake to Garagumdarya)

**) including discharges from CDN

Table 2.2

Water balance of the Amu Darya River, growing season 2022

Balance item	Water volume, km^3		Deviation (actual-plan)	
	Forecast/ plan	Actual	km^3	%
1. Water content in the Amu Darya River – unregulated flow in nominal Kerki section*	41.47	41.23	-0.24	1
2. Flow regulation by the Nurek reservoir: recharge (+) or diversion of flow (-)	-3.15	-3.37	-0.22	7
3. Water withdrawal in the middle reaches (-)	-16.21	-14.66	1.55	10
4. Return flow in the middle reaches (+)	1.60	1.03	-0.57	36
6. River flow at Darganata g/s	20.80	22.55	1.74	8
7. Water releases from TMHS (including water withdrawal from the reservoir)	16.35	12.97	-3.38	21
8. Water withdrawal in the lower reaches, including water withdrawal from TMHS (-)	-15.31	-9.27	6.04	39
9 Return flow in the lower reaches (+)	0.00	0.00	0.00	
10 Emergency-environmental water releases to canals (-)	0.00	0.00	0.00	
11 Supply to the Aral Sea region and the Aral Sea (Samanbay g/s)	0.46	0.44	-0.02	5

***** Amu Darya River flow (upstream of the water intake to Garagumdarya) at the non-regulated flow rate of Nurek HPS (excluding flow regulation of the Vakhsh River).

Table 2.3

Reservoir water balance in Amu Darya River basin, growing season 2022

Balance item	Water volume, km^3		Deviation (actual-plan)	
	Forecast/ plan	Actual	km^3	%
1 Nurek reservoir				
1.1. Water inflow to the reservoir	15.28	16.40	1.13	7
1.2. Water volume in the reservoir:				
– beginning of the season (April 1, 2022)	6.62	6.62	0.00	0
– end of the season (October 1, 2022)	10.56	10.57	0.00	0
1.3. Water releases from the reservoir	12.13	13.03	0.90	7
1.4. **Flow regulation:** recharge (+) or diversion of flow (-)	-3.15	-3.37	-0.22	7
2 Reservoirs of TMHS				
2.1 River flow at Darganata g/s	20.80	22.55	1.74	8
2.2 Water volume in the reservoirs:				
– beginning of the season (April 1, 2022)	2.46	2.46	0.00	0
– end of the season (October 1, 2022)	3.45	2.32	-1.13	33
2.3 Water releases from the hydroscheme	16.35	12.97	-3.38	21
Including:				
– water releases into the river	11.41	9.48	-1.93	17
– water withdrawal	4.94	3.49	-1.45	29
2.4 **Flow regulation:** recharge (+) or diversion of flow (-)	-9.39	-13.07	-3.68	39
TOTAL flow regulation by reservoirs: recharge (+), diversion of flow (-)	-12.54	-16.44	-3.90	31