



SECTION 2

Situation in Water
in the Aral Sea Basin

2.1. Water in the Amu Darya and Syr Darya River Basins

Water Resources

In 2022, the total annual flow in the basins of the Amu Darya and the Syr Darya was 108.43 km³ or 92% of average long-term annual flow.

Amu Darya Basin

The annual flow in the basin (Amu Darya and Zerafshan rivers) was 68.7 km³, including 54.4 km³ at Kerki site of the Amu Darya River (upstream of diversion to the Garagumdarya Canal). The water content of the Amu Darya was estimated at 96% of the norm in the first quarter, 88% in the growing season, and 76% in October-December.

In total, 12.82 km³ of water were accumulated in Nurek and Tuyamuyun reservoirs by January 2022.

Syr Darya Basin

The annual flow in the basin, including the Naryn, Karadarya, Chirchik and small rivers, equaled 39.73 km³, of which 23.06 km³ was the total inflow into three reservoirs, such as Toktogul, Andizhan, and Charvak.

By January 2022, the total accumulation by basin's reservoirs was 17.01 km³, including 11.58 km³ in the key reservoirs (Toktogul, Andizhan, and Charvak) located in the flow formation zone.

Operation of Reservoir Hydrosystems

The annual inflow into the Nurek reservoir was 20.87 km³, including 16.4 km³ or 79% of annual inflow in the growing season. Water releases from the reservoir equaled 20.86 km³/year, of which 13.03 km³ of water were discharged during the growing season.

Because of low flow in the Panj River⁶, the annual inflow into the Tuyamuyun reservoir was 18.14 km³ only or by 5.14 km³ lower than the forecast. During the growing season the inflow was 12.82 km³. Annual water releases from the reservoir equaled 17.26 km³ or 80% of the value planned by the BWO Amu Darya. Accordingly, the discharge of water from the reservoir made up 12.97 km³ or 79% in the growing season.

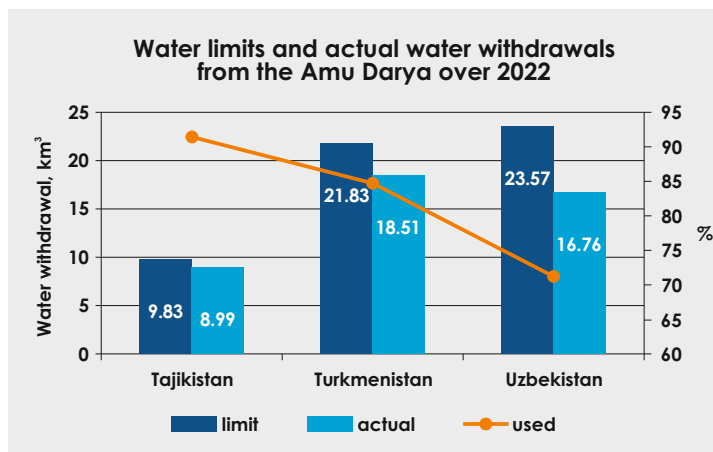
The annual inflow into the Toktogul reservoir located on the Naryn River was 13.27 km³, including 10.43 km³ (79% of annual inflow) during the growing season. Annual water releases from the reservoir amounted to 12.31 km³, including 4.68 km³ (38%) during the growing season. The Toktogul reservoir was filled by 0.96 km³ and its storage reached 11.06 km³ by the end of the year.

Water Allocation and Water Scarcity

Amu Darya Basin

In 2022, with the limit of water withdrawal from the Amu Darya Basin set at 55.23 km³, 44.26 km³ were diverted in fact (31.38 km³ during the growing season). Thus, 80% of the annual water limit was used, including 79% – in the growing season. Water was allocated between the riparian states as follows:

- **Tajikistan** – with the water limit of 9.83 km³, the actual water withdrawal was 8.99 km³ or 91.4%;
- **Turkmenistan** – with the water limit of 21.83 km³, the actual water withdrawal was 18.51 km³ or 84.8%;
- **Uzbekistan** – with the water limit of 23.57 km³, the actual water withdrawal was 16.76 km³ or 71.1%.



It was estimated in the growing season that water scarcity in the river reach from the Nurek hydropower plant to the Tuyamuyun reservoir (Darganata site) reached 5% for Tajikistan, 7% for Turkmenistan, and 17% for Uzbekistan. Turkmenistan and Uzbekistan received 36% and 41%, respectively, less water than required in the reach from Darganata site to Samanbay site. Increasing water scarcity along the river during the growing season is explained by its unequal distribution over the territory.

Syr Darya Basin

The total water withdrawal in the Syr Darya Basin (up to entry point to the Shardara reservoir) amounted to 13.83 km³, including 10.17 km³ during the growing season or 86% of the established limit of water withdrawal into canals. No water was discharged from the Syr Darya into Arnasay.

⁶ Lower flow along the Panj River can be explained by the increased water diversion by Afghanistan, improper accounting of water along the main course of the Amu Darya or inaccurate estimation of river flow losses. Thus, thorough examination is needed to find the exact causes of such lowering

86% of the water allocation plan set by the BWO Syr Darya was fulfilled. The water scarcity in the reach from the Toktogul reservoir to the Chardara reservoir was estimated at 8% for Tajikistan, 36% for Kyrgyzstan, and 22% and 12% for Kazakhstan and Uzbekistan, respectively. Higher water scarcity observed in Kyrgyzstan is because of its water needs exceeding the allocated water limit.

Inflow into the Aral Sea Region

According to the Kazakhstan's Committee for Water Resources, in 2022, inflow into the Northern Aral Sea from the Syr Darya was 0.82 km³. No water was discharged from the Northern Sea into the Large Aral Sea (Eastern body).

Based on SIC's estimates, the South Aral region is supposed to get 8 km³ from the Amu Darya River in average and wet years and 3.5 km³ in dry years. In fact, 2.06 km³ of water was delivered to the South Aral region in 2022.

Meeting the Demands

The table below shows how water demands were met for the CA countries during the growing season.

CA countries	Meeting water demands in growing season, %	
	Amu Darya	Syr Darya
Kazakhstan	–	78
Kyrgyzstan	–	64
Tajikistan	95	82
Turkmenistan	83	–
Uzbekistan	69	88

Source: SIC ICWC using the data from BWO Amu Darya and the BWO Syr Darya

2.2. Large Aral Sea and the Amu Darya Delta

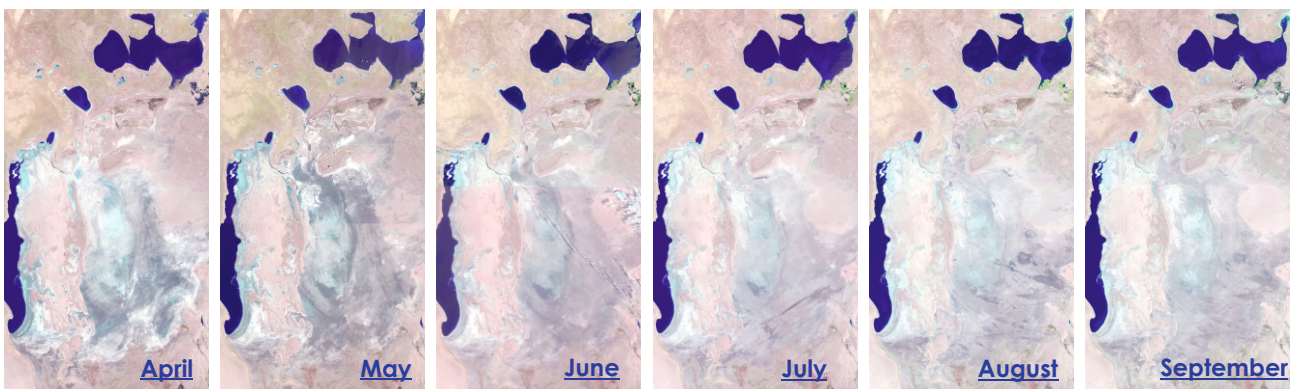
This Section was prepared using the data of the BWO Amu Darya, the Aral Sea Region Delta Authority, and the Uzbek Hydrometeorological Service (UzHydromet) and based on RS-monitoring of Eastern and Western bodies of the Large Aral Sea (LAS) and the lake systems in the Amu Darya River delta using Landsat 8 OLI images (http://cawater-info.net/aral/data/monitoring_amu.htm).

Since 2022, NDVI with the refined threshold values has been used for satellite imagery analysis to identify three surface categories: (1) open water surface, (2)

wetland, (3) dryland. Until 2022, the total area of a water body has been determined as the sum of open water surface and wetland areas. However, the problem of detecting wetlands, i.e. the possibility to distinguish them from dry, degraded land, remained open.

The information for 2021 and 2022 on <http://cawater-info.net/aral/data/index.htm> was updated using the improved methodology. Thus, some differences can be found when making comparison with the data in the past years.

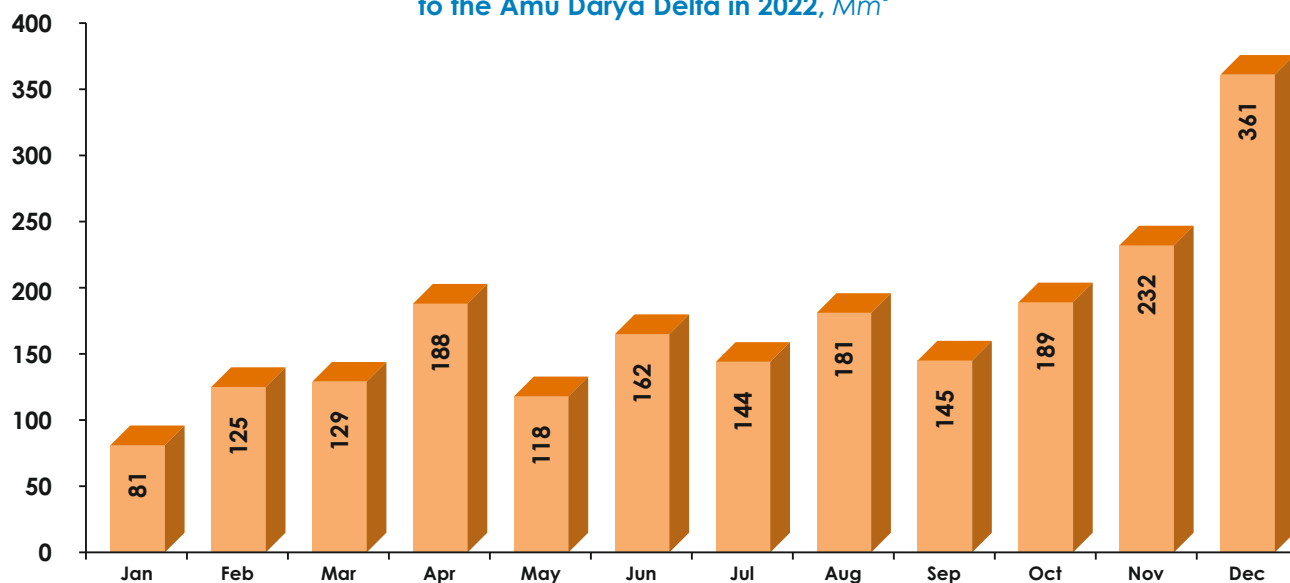
Figure 1. Satellite images of Western and Eastern bodies of the Large Aral Sea, Landsat 8 OLI (2022)



2.2.1. Water Supply to the Amu Darya Delta and the Large Aral Sea

Water Supply to the Amu Darya Delta

According to BWO Amu Darya, in 2022, 2,055 Mm³ of water (flow from the river and water discharged from canals and collecting drains) reached the Amu Darya delta. This is by 451 Mm³ more than in 2021.

Figure 2. Dynamics of total water supply to the Amu Darya Delta in 2022, Mm³

Source: BWO Amu Darya

Flow from the Main South-Karakalpak collecting drain to the exposed bed of the Large Aral Sea

Bypassing the Amu Darya Delta, 503.5 Mm³ of collector-drainage water flowed towards the exposed bed of the Large Aral Sea from the Main South-Karakalpak (Right-bank) collecting drain (Table 1). This is by 36.15 Mm³ more than in 2021 (467.35 Mm³).

Table 1. Flow from the Main South-Karakalpak collecting drain to the exposed bed of the Large Aral Sea in 2022, Mm³

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2022
23	25	31	51.5	54.5	52.5	43.5	42.5	48.5	50.5	45	36	503.5

Source: Aral Sea Region Delta Administration at the Ministry of Water Management of Karakalpakstan

Total inflow into the Large Aral Sea

In 2022, the total inflow into the Large Aral Sea (LAS) decreased from 650.35 Mm³ (2021) to 503.5 Mm³. The LAS got water from the Main South Karakalpak collecting drain (SKCD) only. No water was discharged from the Amu Darya River Delta and the Northern Aral Sea (NAS) (Table 2).

Table 2. Total inflow into LAS, Mm³

Year	Northern Aral Sea*		South Aral Region		Total discharge into LAS
	Total inflow into NAS from the Syr Darya, Karateren site	Discharge from NAS into LAS	Total inflow into the Amu Darya Delta	Discharge from the Amu Darya Delta into LAS, including flow from Main South Karakalpak coll.drain**	
2021	1196.88	183	1604	467.35	650.35
2022	816	0	2055	503.5	503.5

* Committee for Water Resources of the Republic of Karakalpakstan;

** Aral Sea Region Delta Administration at the Ministry of Water Management of Karakalpakstan

2.2.2. Open Water Surface and Wetlands in Eastern and Western Parts of the Large Aral Sea

As monitoring and GIS data for 2022 shows, (1) the water surface area in Western part of LAS slightly decreased from 220.0 to 211.8 thousand ha, while the wetland area shrank dramatically (from 284.6 to 9.8 thousand ha), and the dryland area extended 6 fold (from 56.6 to 339.6 thousand ha); (2) the water sur-

face area in Eastern part of LAS decreased from 1.6 to 0.046 thousand ha, dropping to 0.025 thousand ha in July and increasing to 0.145 thousand ha in August. Wetlands shrank a lot from 1,292.38 to 6.1 thousand ha (Table 3).

Table 3. The area of wetlands and open water surface in the Western and Eastern parts of LAS, 2022

Date	Feb 16	Apr 29	May 23	Jun 8	Jul 18	Aug 27	Sep 20	Oct 6
Western part of the Large Aral Sea, ha								
Total area	561350**							
Wetland	clouds	284,687	5,877	15,446	8,659	4,644	9,834	clouds
Water surface	clouds	220,020	219,193	218,914	216,255	214,563	211,891	clouds
Dryland*	clouds	56,643	336,280	326,990	336,436	342,143	339,625	clouds
Eastern part of the Large Aral Sea, ha								
Total area	1496824**							
Wetland	clouds	1,292,357	clouds	clouds	5,173	3,845	6,108	clouds
Water surface	clouds	1,624	clouds	clouds	25.38	145	46	clouds
Dryland*	clouds	202,841	clouds	clouds	1,491,626	1,492,834	1,490,670	clouds

* bare soil, rare or dense vegetation

** taken as control as of 2016 (Monograph "Aral Sea and the Aral Sea Region". UNESCO, "Complex Print", Tashkent, 2020, <http://cawater-info.net/library/rus/aral-sic-icwc-2020.pdf>)

Source: SIC ICWC using the GIS data derived from Landsat 8 OLI images, http://cawater-info.net/aral/data/monitoring_amu.htm

2.2.3. Lake Systems in the Amu Darya Delta

Lake systems in the Amu Darya delta are comprised of small local water bodies in the South Aral region. Overall, as compared to 2021, the hydrological situation deteriorated in 2022.

The actual water area of the lake systems accounted for 5 (February) to 1.5% (October) of the design area (353,644 ha). In the period from February to October, the open water surface area of the lake systems shrank from 23.6 to 6.2 thousand ha, while the area of

wetlands, from 101.2 to 45.1 ha (Table 4). The supply of 2,055 Mm³ of water to the Amu Darya delta did not create favorable environment for fishery and ecosystem in such lakes as Sudoche, Rybache, Muynak and Djiltirbas.

The decreased inflow of water from collecting drains into local lakes in the South Aral region was caused by reduced supply of water to the delta of the Amu Darya (Figure 2) during the growing season (Table 5).

⁷ According to SIC's research, the South Aral region should receive 8 km³ of water from the Amu Darya in average and wet years and 3.5 km³ in dry years (like in 2020), <http://cawater-info.net/biblio/Publicationview.php?KodItem=1179>

Table 4. The area of open water surface, wetlands and dryland* within the lake systems in South Aral region in 2022⁸, ha

Water body	Feb 16			Mar 20			Apr 29			May 23			Jun 24			Jul 18			Aug 27			Sep 20			Oct 6			
	WS	WL	DL**	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	WS	WL	DL	
Sudoche	8,652	29,296	34,750	9,182	24,280	39,235	9,581	2,105	61,011	9,010	229	63,458	6,375.6	17,801	48,521	4,271	706.3	67,720	1,757	335	70,605	3,239	866	68,592	4,325.5	20,858	47,513	
Mejdureche	3,598	8,374	25,812	2,825	4,638	30,322	1,789	2,769	33,227	1,389	30	36,365	899	331	36,554	597	22	37,165	1,501	22	36,261	1,785	48	35,952	1,528	2,100	34,156	
Rybacha	903	2,130	8,460	1,007	803	9,683	790	509	10,195	629	1	10,863	44	631	10,818	0	0.2	11,493	0	0	11,493	0.4	0	11,493	0.2	1,275	10,217	
Muynak	16,164	324	3,212	12,629	259	2,733	13,172	36	1,514	14,613	24	3	16,137	7	102	16,055	3	1	16,160	3	0.5	16,161	5.3	3	16,156	5.3	729	15,430
Djilyrbas, dam-terminated	47,472	7,341	13,575	26,556	7,739	11,425	28,309	5,948	7,184	34,340	4,813	402	42,258	1,618	6,049	39,806	1,286	103	46,083	845	32	46,596	322.2	21.7	47,128	213	5,517	41,743
Djilyrbas (together with former right and left streams)	98,951	66	30,675	68,210	149	20,224	78,578	196	1,715	97,039	94	6	98,851	0	0	98,951	8	2.5	98,940	7	26.5	98,918	7.4	95	98,848	15	12,242	86,693
Dumalak	16,050	22	5,033	10,995	1	2,881	13,068	0.1	2,012	14,038	0	0	16,050	0	64	15,986	0	0	16,050	0	0	16,050	0	0	16,050	0	481	15,569
Makpalkul	8,684	2,195	1,429	5,059	1,576	5,596	815	1,157	6,712	402	35	8,248	0	189	8,495	573	126	7,985	0	0	8,684	0.1	0	8,684	0	168	8,518	
Mashon Karađar	27,201	308	4,808	22,085	294	3,557	23,350	181	1,988	25,032	34	17	27,150	0.4	499	26,702	8	3	27,190	63	24	27,114	152.6	20	27,028	210	1,207	25,784
Water surface southward of Muynak	9,605	0.5	2,463	7,141	0	420	9,185	0.1	302	9,303	0	9,605	0	48	9,557	0	0	9,605	0	0	9,605	0	0.3	9,605	0	475	9,130	
Water surface along Kazakhdaya river course	4,752	0	4,752	0	522	4,229	0	193	4,559	0	4,752	0	0	0	4,752	0	0	4,752	0	0	4,752	0	0	4,752	0	96	4,655	
Zakirkol Lake	2,791	208.5	274	2,309	179	133	2,479	57.8	36	2,697	1	2,790	1	0	2,791	0	0	2,791	0	0	2,791	0	0	2,791	0	19	2,772	
Total:	353,644	23,618	101,269	228,758	23,211	73,228	257,206	19,394	21,484	312,766	16,396	17,870	319,381	8,944	25,714	318,988	6,746	964	345,934	4,176	440	349,030	5,512	1,054	347,079	6,297	45,167	302,180

* OTAWB – Total area of water body within the boundaries of water surface (WS) and wetlands (WL) of 2016 as mentioned in the “Aral Sea and the Aral Region” monograph

** DL – dryland

⁸ Source: SIC ICWC using the GIS data derived from Landsat 8 OLI images, http://cawater-info.net/arak/data/monitoring_amu.htm

Table 5. Inflow into local lakes in South Aral region during 2022, Mm³

Water body	Inflow by month												Total over 2022
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Sudoche	13.85	14.61	22.61	29.59	27.09	30.62	26.02	31.13	34.96	30.88	21.23	19,95	302.54
Mejdureche	28.04	46.19	60.87	25.36	12.49	22.16	10.42	45.42	24.34	25.84	98.08	122.1	521.31
Djiltirbas	5.32	8.53	10.25	14.90	16.10	22.69	26.46	22.48	28.18	38.27	22.93	27.20	243.31

Source: Aral Sea Region Delta Administration at the Ministry of Water Management of Karakalpakstan

Conclusion

Despite the increased supply of water to the Amu Darya delta and discharge from SKCD as compared to 2021, inflow into LAS decreased in 2022. The areas of water surface and wetlands in Eastern and Western parts of LAS also shrank. Local lakes in the South Aral Region continue suffering from unstable water supply.

