

Assessment of the Impact of Anthropogenic Networks on Changes in the Flow of the Zarafshan River

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Abstract:

The anthropogenic hydrographic network of the Zarafshan River Basin, ie reservoirs and canals, is to evaluate their hydromorphological parameters to the extent that they can be studied from a hydrographic perspective. The following is a brief overview of ancient water structures in the Zarafshan oasis, followed by an overview of the existing anthropogenic hydrographic networks in the region.

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I. INTRODUCTION

It is thought that Zarafshan water was poured into the Amudarya river BC. In the lower reaches of Zarafshan, archaeological research conducted in the 1950s, led by academician Y.Gulyamov, confirms this fact. These archeological excavations revealed that the Zarafshan River had been deposited in the Amu Darya after the Ice Age up to the 4th millennium BC. However, it is said that "Politimet (Zarafshan), despite its wetness, goes away" in ancient Greek sources such as Alexander the Great, historian Quint Curtius Rouge, geographer Strabon (1st century BC), historian Arians (late 2nd century BC - early 1st century BC).

However, Hafizi Abru (1362-1431, Shahabiddin Abdullah ibn Lutfulloh Al-Hawafi), in his work Zubdat at-Tavorih, wrote that, unlike the above: the Obi-Kahak (Zarafshan) flooded the Amu Darya." Therefore, Zarafshan has been deposited in the Amudarya river in the past under certain

hydrometeorological conditions. It is possible that the inflow of Zarafshan water into the Amudarya river was repeated several times later. For example, this phenomenon, as mentioned above, also occurred during the 1969 saturation period, the wateriest of the last 100 years. In the same year the water of Zarafshan reached the Amu Darya.

Indeed, in the distant past Zarafshan was one of the largest tributaries of the Amu Darya. However, in the Zarafshan oasis, it has long been separated from the Amu Darya by the emergence of irrigated agriculture and its continued development and extensive use of river water for this purpose.

Due to this, neither the Zarafshan nor the adjacent Kashkadarya river can reach the Amu Darya. Therefore, these rivers can be considered as independent hydrographic objects [2, 4].

II. THE MAIN PART

A number of reservoirs and special hydroelectric dams have been built in the area to enhance the effectiveness of irrigation water from the tributaries of the tributaries of the Zarafshan River. Currently, Karatepa, Kattakurgan, Tusinsoy, Tudakul, Kuyimozor, Akdarya, Sabirsay, Jizzakh, Qorasuv

and Korovultepa reservoirs function in the middle and lower reaches of the Zarafshan Basin. Most of them are built in rivers or streams and belong to the river basin type, while Kattakurgan, Tudakul, Kuyimozor reservoirs belong to the reservoir type (Table 1).

Table 1.
Information about water reservoirs in the middle and lower reaches

	Water reservoir	Water resource, river	Foundation year	Due to the project			Type
				Surface of water km ²	Water capacity, 10 ⁶ m ³		
					V _f	V _t	
Samarkand region							
1	Okdarya	Zarafshan	1983	12,7	98,5	100,7	outlet
2	Kattakurgan	Zarafshan	1941	84,5	810,0	900,0	influx
3	Koratepa	Koratepasoy	1982	1,9	15,75	18,0	outlet
4	Korasuv	Korasuvsoy	1988	4,14	24,1	25,4	outlet
5	Tusinsoy	Tusinsoy	1988	2,68	36,5	42,0	outlet
6	Sobirsoy	Sobirsoy	-*	3,0*	8,0	8,14	outlet
7	Muminobod	Urgutsoy	-	-	1,3	1,5	outlet
Navai region							
1	Tudakul	Amudarya	1973	162	855	1200	influx
2	Kuyimozor	Amudarya	1957	16,3	246	306	influx
Bukhara region							
1	Shurkul	Zarafshon	1983	30	35,0	160,0	influx

Note: V_f – useful water capacity; V_t – full water capacity; -* – no data; ** - data from the State Committee of Nature Protection of the Republic of Uzbekistan [3].

Kattakurgan, Tudakul and Kuyimozor reservoirs are distinguished among the reservoirs of the Zarafshan oasis by their water capacity and surface area. They have a great opportunity to develop fisheries, especially in the Tudakul and Kuyimozor reservoirs. Because, in their annual water level regime, there is no short-term change.

Historical sources indicate that the water of the Zarafshon provided, as mentioned above, along with the provinces of Samarkand, Bukhara, Karmana and the Kashkadarya (through the Old Anhor canal) and

the Jizzakh oasis (through the Old Tuyatortar canal).

Currently, the Zarafshan River is supplied through these canals to Samarkand, Navoi, Bukhara, Jizzakh and Kashkadarya regions. In the middle of the twentieth century, new channels, such as New Right Channel, New Dargom, Mionkul-Khatirchi, Central Miyankul, were repaired and renovated. In the lower reaches of Zarafshan, the Amu Darya water is also supplied through the Amu-Bukhara and Amu-Karakul car canals.

Distribution of water among consumers through all existing hydraulic structures and canals in Zarafshan oasis is assigned to **Zarafshan Irrigation Systems Basin Committee (ZISBC)**. It also provides and monitors the timely delivery of river water to water users and users at a set limit [5].

ZISBC, owned by the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, provides services to four regions of the country - Samarkand, Navoi, Jizzakh and Kashkadarya.

Its main task, as mentioned above, is to ensure the correct and expeditious implementation of water resources distribution in the Zarafshan Basin between the provinces and their respective districts, using existing natural and anthropogenic hydrographic networks in the basin. For this purpose, the Upper Zarafshan Water Supply Department, Zarafshan Main Canal Department and 8 Irrigation Systems Department (ISD) have been established under the ZISBC.

The main task of the Upper Zarafshan Water Service is to distribute the water of the Zarafshan River into the Dargam and Old Tuyatorta canals, and to ensure the efficient and efficient operation of all water distribution facilities (Table 2).

Table 2
Data about canals under the jurisdiction of Upper Zarafshan Water Service

№	Canals	location, region	Main indicators	
			L, km	Q_{max} , m^3/s
1	New Dargom	Urgut	5,2	125
2	New Dargom, filling	Urgut	3,5	40
3	Old Dargom	Urgut	3,7	60
4	Zarafshan river	Urgut		750
5	New Dargom	Toyloq	5,1	60
6	Old Dargom	Toyloq	5	58
7	Right shore	Bulungur	2,2	125
8	Right shore, filling	Bulungur	0,8	10

9	Old Tuyatortar	Bulungur	1,5	45
Total			27,0	

Note: L is the length of the channel; Q_{max} is the largest water consumption that can be channeled.

The main task of the Zarafshan Main Canal Office is to ensure that Zarafshan River transports water resources through its own rivers and canals and transmits them to relevant channels on request. The management of these canals also has a responsibility to ensure the efficient use of eight reservoirs in the region. According to the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, there are six major canals in Zarafshan (Table 3).

Table 3
Information about canals under the jurisdiction of Zarafshan trunk canal management

№	Canals	location, region	main indicators	
			L, km	Q_{max} , m^3/s
1	Dargom rotation	Urgut	20,5	70
2	Dargom	Toyloq, Samarkand, Pastdargom	92,1	180
3	Old Anhor	Pastdargom	25	80
4	Old Tuyatortar	Bulungur, Бахмал	69,1	45
5	Lower Bulungur	Payarik	35,8	60
6	Lower Zeravshan (Narpay)	Kattakurgon	5	200
Total			247,5	-

Note: indications are given in the table above

The main task of IDU is to provide Zarafshan water to Jizzakh city, Jizzakh, Bakhmal and Gallaorol districts of Jizzakh region. The largest water losses that can be attributed to these IDB channels are $10\div 600 m^3 / s$ and their length varies between 1.8 and 23.9 km (Table 4).

Table 4
Main indicators of the available channels Tuyatortar-Kiyli
Irrigation Systems Department

№	Canals	location, region	main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Sangzar river	Jizzakh	14,4	600	2,385
2	Right shore	Jizzakh	3,4	60	2,076
3	Saroyli bosh	Jizzakh	1,8	15	2,680
4	Eroni bosh	Jizzakh	19,2	10	2,380
5	Old Tuyatortar	Gallaorol	12,1	45	6,683
6	Sangzar, concrete	Gallaorol	23,9	30	0,715
7	Sangzar river	Jizzakh	11,0	600	0,055
8	Right shore	Jizzakh	2,0	60	0,004
9	JSO, to exit	Jizzakh	12,8	15	4,984
10	JSO, access	Jizzakh	8,4	50	0,910
11	QSO, to exit	Gallaorol	4,7	50	1,520
Total			113,7		24,392

Note: F is the area under canal irrigation; JWR - Jizzakh Water Reservoir; KWR - Korovultepa Water Reservoir.

The Mirza-Pay IDB provides Zarafshan water to Bulungur, Jambay and Payarik districts of Samarkand region. The length of these canals falling within the IDB are 1.7-73.5 km, and their largest water consumption ranges between 10÷46 m³/s and provides water for more than 51500 ha of land (Table 5).

Table 5
Main indicators of the available channels of the Department of
Irrigation Systems of Mirza Pay

№	Canals	location, region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Right shore	Jizzakh	8	46	6,666
2	Mirza-Pay	Jizzakh	42,8	30	8,595
3	Right shore	Bulungur	13,4	46	2,989
4	Oqtapa	Bulungur	27	10	6,315
5	Bulungur	Bulungur	53,5	25	2,352
6	Obolin	Payarik	16,99	10	1,846
7	Tuqqiz	Jizzakh	1,7	10	0,855
8	Middle Bulungur	Jizzakh	19,9	10	1,303
9	Pay	Payarik	43	20	20,632
Total			226,29		51,553

Note: the descriptions are given in the tables above.

The Dargom IDB supplies water to Zarafshan, Urgut, Taylak, Samarkand, Pastdargom, Nurabad, Kattakurgan districts and Samarkand city. The length of canals in this system varies between 1.14 and 51.6 km (Table 6).

Table 6
Main indicators of the available channels of Department of
Irrigation Systems

№	Canals	location, region	main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Nev Urgut	Urgut	36,4	25	18,396
2	Nev Urgut	Samarkand	27,6	15	7,747
3	Urgutsay	Urgut	10	15,48	
4	Kamangaron soy	Urgut	5	14,3	
5	Ogaliqsay	Urgut	8		
6	Nev water supply pump	Urgut	51,6		

station					
7	Gijduvonsoy	Urgut	5,8		
8	Muminobodsoy	Urgut	4,6		
9	Shaudar	Toyloq	7	10	3,796
10	Kavarzor, small	Samarkand	2,77		
11	Ankhar	Pastdargom	41,95	25	14,200
12	Jagalboyli	Pastdargom	3,22		
13	Eshburiyev	Pastdargom	1,14		
14	Ankhar, trunk	Pastdargom	13		1,420
15	Progress	Pastdargom	3,6		
16	Honchorbog, trunk	Pastdargom	10,75	24	1,439
17	KPS	Pastdargom	46,3	20	13,274
18	Videl-2	Pastdargom	2,5		
19	MP-1	Pastdargom	17,5		
20	MP-2	Pastdargom	2,61		
21	Yangi yer	Pastdargom	10,5		
Total			311,84		60,272

Note: the descriptions are given in the tables above.

Old Anhor IDB supplies Zarafshan water to Pastdargom, Nurabad, Chirakchi districts of Kashkadarya region and partly to Kamashi and Shakhribabz districts of Samarkand province. The system includes the Old Anhor Canal itself and the Sandal, Sanddarya, Daur, and Arabbandi canals (Table 7).

Table 7

Main indicators of the available channels of Department Old Anhor Irrigation Systems

№	canals	location, region	main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Old Ankhor	Pastdargom	15,1	60	2,199
2	Old Ankhor	Nurobod	16,0	57	3,123
3	Old Ankhor	Nurobod	17,6	60	-
4	Old Ankhor	Chiroqchi	48,3	50	8,868
5	Sandal	Chiroqchi	5,1	30	3,190
6	Qumdarya	Chiroqchi	17,9	40	0,754
7	Dovur	Chiroqchi	16	10	3,576
8	Arabbandi	Chiroqchi	27,0	10	5,820
Total			163		27,530

The main task of the Ak-Karadarya IDB is to provide the Zarafshan River with Jomboy, Samarkand, Akdarya, Payarik, Ishtyhan and Kushrabad districts of Samarkand region. In this system, the Miyonkol main canal (MMC) is the largest and holds 70 m³ / s of water (Table 8).

Table 8

Main indicators of the available channels of Department of Irrigation Systems Ak-Karadarya

№	Canals	Location, region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	MMK	Akdarya	10,3	70	2,945
2	Joy Devona	Akdarya	15,5	28,7	8,679
3	Ahakob	Akdarya	7,2	45	1,122
4	Qiyat	Akdarya	6,5	30	1,554
5	Narkiskent	Akdarya	15	15	6,923
6	Kurbanobod	Jomboy	5,8	12	1,969
7	Kurbanobod	Payarik	21,2	12	7,039
8	Tusinsoy	Payarik	0,8		0,101
9	Jamalak	Ishtixon	14,8	12	7,676
10	Yangikent	Ishtixon	29,6	20	7,985

0					
Total		126, 7	244, 7	45,99 3	

Miyonkol-Tos IDB supplies water to the Zarafshan River in Khatirchi, Navoi region, Ishtihan and Kattakurgan districts of Samarkand region. Miyonkul-Khatirchi canal is the largest canal in this system, with a maximum water consumption of 50 m³ / s (Table 9).

Table 9
Main indicators of the available channels of Department of irrigation systems of Miyonkul-Tos

№	Canals	Location. Region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	MXK	Ishtixon	13,6	50	5,351
2	MXK	Kattakurgan	20,3	36	
3	Tuyintiruvchi	Kattakurgan	3,2	60	
4	Oqchiroksoy	Kattakurgan	31	16	8,675
5	Shavot	Kattakurgan	11,9	13	3,100
6	Tos	Xatirchi	40,4	21	12,984
7	Shavot	Xatirchi	17,5	13	7,019
Total			137, 9		37,12 9

The Narpay-Navoi IDB provides water delivery to the Zarafshan River to the Narpay, Pakhtachi and Kattakurgan districts of the Samarkand Province, as well as Navoi city and Karmana district of Navoi region.

The Narpay Canal plays a major role in supplying this system, the Narpay-Navoi irrigation system with Zarafshan water.

All arteries in this irrigation system receive water from this canal. The canals under the Narpay-Navoi Irrigation Systems Department irrigate over 50,000 hectares of arable land in Samarkand and Navoi regions (Table 10).

Table 10
Main indicators of the available channels of Department of irrigation systems of Narpay-Navai

№	Canals	Location, region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Narpay-Navoiy	Kattakurgan	20,6	90	3,086
2	Chigatory	Kattakurgan	9,0	20	0,903
3	Narpay	Narpay	33,2	70	16,811
4	Mashina	Narpay	15,19	12	4,213
5	Hamza rotation	Narpay	4,02	20	
6	Narpay	Paxtachi	43,2	50	22,456
7	LB-1 (left shore)	Paxtachi	33,5	20	1,495
8	Narpay	Karmana	9,7	10	4,970
Total			168,4 1		53,93 4

The Karmana-Konimekh IDB supplies water from the Zarafshan River to Khatirchi, Navbahor, Konimekh districts and Navoi region. The length of canals in this Karmana-Konimekh irrigation system varies between 1.8 and 50 km. Among them, the right coastline of the Konimekh Canal Navbahor district is 42.5 km long and the largest water consumption is 45 m³ / s. The Karmana-Konimekh irrigation canals irrigate over 30,000 hectares of land around Navoi region and Navoi (Table 11).

Table 11
Main indicators of the available channels of Department of irrigation systems of Karmana-Konimekh

№	Canals	Location, region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Chavli	Xatirchi	19,9	14	2,55
2	Right shore	Navbahor	42,5	45	8,455
3	Right shore	Konimex	7,4	12	0,455
4	Konimex	Navbahor	28,8	16	10,335
5	Left shore	Karmana	25,7	18	7,820
6	Uzatma-1	Karmana	1,8	24	
7	Uzatma-2	Karmana	3		
8	Slektrakt	Karmana	50		
9	Mavlon	Karmana	5,6		0,391
10	Kasaba Durma	Navbahor	2,8		
Total			187,5		30,006

III. DISCUSSIONS

There are many canals in the Zarafshan Basin area as well. However, because of limited water resources in the Zarafshan Basin, the Amu Darya has been used in the downstream of the river, namely in the Bukhara region, since the 1970s. For this purpose, the Amu-Bukhara and Amu-Karakul canals were constructed to get water from the Amudarya River. The Amu-Bukhara canal is the largest channel in the region (Table 12).

Table 12
Key indicators of the largest channels in the Bukhara region

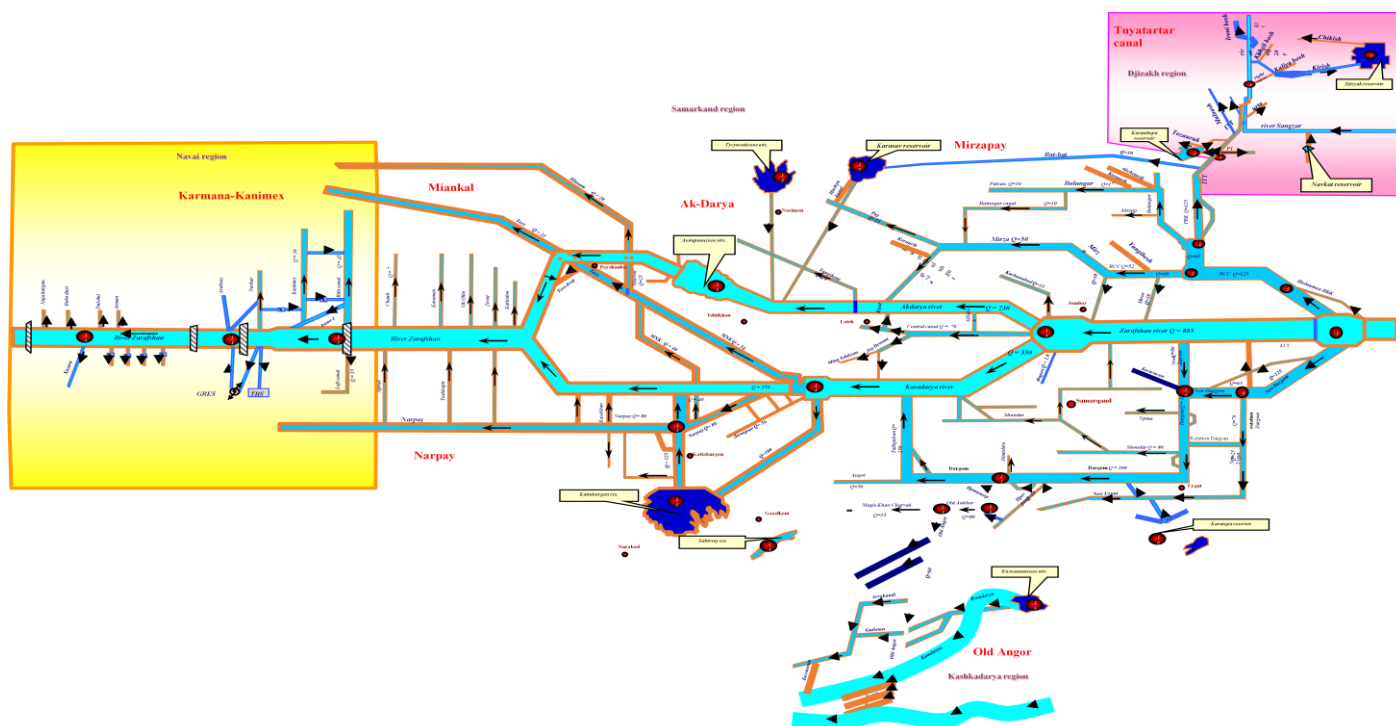
№	Canals	Location, region	Main indicators		
			L, km	Q _{max} , m ³ /s	F, 10 ³ ha
1	Amu-	Buxoro	378,	350	552,8

	Buxoro		6		
2	Amu-Qorakul	Olot,	39,7	56	40,43
3	Yomonjar	Olot	32,5	14	8,37
4	Koryakin	Olot	64,0	48	34,39 2
5	Ovgir	Jondor	13,2	20	12,31 7
6	Vobkentdar ya	Vobkent	34,6	82	35,58 3
7	Romitan	Romitan	5,8	30	1,03
8	Shahrud	Kogon,	33,6	122	56,87
9	Kabdun	Kogon	7,79	35,1 5	20,94 1
10	Juyzar	Buxoro	21,1 8	16	12,89 7
11	Katta Jilbon	Shofirkon	20,6	30	28,26 1
12	Kuhna Rud	Shofirkon	12,6	12	18,4
13	Kolong Rud	Gijduvon	10,1	35	23,84 6
14	Qorovulbozor	Qorovulbozor	34	22	16,96
15	Quyimozor (jan.)	Jondor	78	10	2,8
16	Qorakuldar ya	Qorakul	25,3 5	10	3
17	Gazli	Peshku	6	0,75	1,2

IV. CONCLUSION

From the foregoing, we can conclude that anthropogenic hydrographic networks have been formed in the Uzbekistan part of the Zarafshan Basin long ago. The remains of ancient reservoirs, discovered by archeologists in the territory of our country, canals, which were built thousands of years ago and are still a vivid evidence of our opinion.

Zarafshan irrigation system



Since the middle of the 20th century, the construction of canals and reservoirs has expanded to expand irrigated land in the Middle and Lower Zarafshan. Currently, the distribution of Zarafshan water through these canals and reservoirs by regions and districts is under the responsibility of the Zarafshan Irrigation Systems Basin Department (ZITHB).

The Upper Zarafshan Water Management, Zarafshan Main Canals and 8 Department of Irrigation Systems were established under the Ministry of Water Resources of the Republic of Uzbekistan. At the same time, water supply sources for the canals have also changed. In particular, the canals in Lower Zarafshan, that is, Bukhara region, provide the Amu Darya water, not Zarafshan water, to the cultivated area.

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