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Nature and Experimental Research Conducted on the Great Fergana Trunk Canal

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INTRODUCTION

In 2023, in-kind and experimental measurement-researches were carried out in order to study the efficiency of water resources, the processes and morphology of the channel bed of the Great Fergana Main Canal. In particular, in the section of the Big Fergana main channel from PK1949+00 to 2042+00, in 22 tributaries, along the cross section of the channel, studies were conducted to study the water consumption, speed, depth and bed morphology of each tributary using the SONTEK S5 acoustic doppler profilograph with GPS device. .

The working principle of the profilograph SONTEK S5 acoustic doppler device is as follows.

Figure 1. SONTEK S5 hardware and software complex.

This state-of-the-art scientific apparatus consists of a SONTEK S5 ADP M9 velocity measuring instrument with acoustic doppler and Sontek River Surveyor Live software for instrument control, data collection and analysis (Figure 1).

The device floats along observation walls in dynamic mode and performs quick measurement of speed distribution along the cross section of the flow, flow direction and change of flow depth along the wall with an accuracy of 0.1-0.4 m, as well as automatic calculation of water consumption.

The horizontal distance between the points measured along the cut line of the channel is 1-2 meters, depending on the speed of the device. The device's inertial system and high-precision GPS receiver, magnetic compass, linear and angular acceleration sensor determine the spatial position and speed of water particles in the water environment.

Table 2.1 below shows the results of experimental measurements and studies of water consumption, speed, depth and bed morphology of each stream.

Table 2.1.

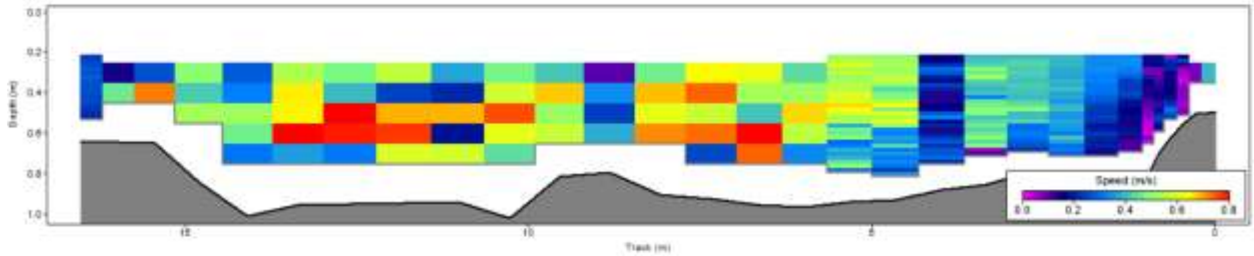
The results of experimental measurements and studies on the study of water consumption, speed, depth and morphology of the channel in the walls

Wall number	Picket number	Live shear surface, (m^2)	average speed, (m/c)	spend, (m^3)	Maximum depth, (m)
1	1949+00	14,55	0,42	6,4	1,0
2	1954+00	14,0	0,41	6,35	1,02
3	1959+00	14,9	0,4	6,28	1,18
4	1964+00	14,3	0,4	6,21	1,03
5	1969+00	15,1	0,38	6,1	1,07
6	1974+00	17,0	0,35	6,0	1,28
7	1979+00	13,64	0,35	5,93	0,97
8	1984+00	15,08	0,36	5,8	0,91
9	1989+00	15,22	0,34	5,74	1,07
10	1994+00	15,22	0,33	5,65	1,07
11	1994+50	13,7	0,33	5,58	1,28
12	1995+50	14,71	0,31	5,63	1,27
13	1997+00	19,76	0,51	10,1	1,83
14	2002+00	16,13	0,58	9,41	1,31
15	2007+00	15,15	0,62	9,4	1,28
16	2012+00	18,34	0,44	8,04	1,26
17	2017+00	18,57	0,43	8,0	1,14
18	2022+00	7,86	0,16	1,36	0,77
19	2027+00	6,05	0,22	1,32	0,91
20	2032+00	6,92	0,18	1,3	0,61
21	2037+00	6,44	0,16	1,28	0,55
22	2042+00	5,64	0,15	1,26	0,55

Below, we will describe in detail the experimental studies and their results.

Building 1. Measurement studies were carried out along the cross-section of the channel at PK1949+00 using a SONTEK S5 doppler profilograph with a GPS device (Fig. 2.8). It was determined that the water consumption in the channel 1 is 6.4 m3/s, the cross-sectional area (live shear surface) is 14.55 m2, the average water speed is 0.42 m/s, and the maximum depth is 1.0 m (Fig. 2.9).

Figure 1. Clips from measurement studies carried out in the 1 stvor



Section 1 cross-sectional surface and profile of the Big Fergana main channel PK 1949+00. The maximum depth from the water level is 1.0m, the maximum speed of water flow is 0.42m/s, water consumption is 6.4m3/s

(taken from SONTEK S5 doppler profilograph)

Figure 2.9. The results of measurement-research in Figure 1

Building 2. It was determined that the water consumption in the channel 2 is 6.35 m3/s, the cross-sectional area (live shear surface) is 14.0 m2, the average water speed is 0.41 m/s, and the maximum depth is 1.02 m (Fig. 2.9).

Building 3. In channel 3, water consumption in the channel is 6.28 m3/s, the cross-sectional area (live shear surface) is 14.9 m2, the average water speed is 0.4 m/s, and the maximum depth is 1.18 m (Fig. 2.10).

Building 4. It was determined that the water consumption in the channel 4 is 6.21 m3/s, the cross-sectional surface (live shear surface) is 14.3 m2, the average water speed is 0.4 m/s, and the maximum depth is 1.03 m (Fig. 2.11).

Building 5. In the 5th channel, the water consumption in the channel is 6.1 m3/s, the cross-sectional area (live shear surface) is 15.1 m2, the average water speed is 0.38 m/s, and the maximum depth is 1.07 m. It was found that (Fig. 2.12).

Building 6. It was determined that the water consumption in the channel 6, 6.0 m3/s, cross-sectional surface (live shear surface) is 17.0 m2, average water speed is 0.35 m/s, and the maximum depth is 1.28 m (Fig. 2.13).

Figure 2.12. Measurement studies carried out in the 4th century

Figure 2.13. Measurement studies carried out in the 5th century

Figure 2.14. Measurement studies carried out in the 7th century

Building 7. In the 7th channel, the water consumption in the channel is 5.93 m3/s, the cross-sectional area (live shear surface) is 13.64 m2, the average water speed is 0.35 m/s, and the maximum depth is 0.97 m. it was found to be (Fig. 2.14).

Building 8. It was determined that the water consumption in the channel 8 is 5.8 m3/s, the cross-sectional area (live shear surface) is 15.08 m2, the average water speed is 0.36 m/s, and the maximum depth is 0.91 m.

Building 9. It was determined that the water consumption in the channel 9 is 5.74 m3/s, the cross-sectional area (live shear surface) is 15.22 m2, the average water speed is 0.34 m/s, and the maximum depth is 1.07 m.

Building 10. In the 10th channel, it was determined that the water consumption in the channel is 5.65 m3/s, the cross-sectional area (live shear surface) is 15.22 m2, the average water speed is 0.33 m/s, and the maximum depth is 1.07 m.

Building 11. In Figure 11, it was determined that the water consumption in the channel is 5.58 m3/s, the cross-sectional area (live shear surface) is 13.7 m2, the average water speed is 0.33 m/s, and the maximum depth is 1.28 m.

12th building. In the 12th channel, it was determined that the water consumption in the channel is 5.63 m3/s, the cross-sectional area (live shear surface) is 14.71 m2, the average water speed is 0.31 m/s, and the maximum depth is 1.27 m.

Building 13. In the 13th channel, it was determined that the water consumption in the channel is 10.1 m3/s, the cross-sectional area (live shear surface) is 19.76 m2, the average water speed is 0.51 m/s, and the maximum depth is 1.83 m.

Building 14. In the 14th channel, it was determined that the water consumption in the channel is 9.41 m3/s, the cross-sectional surface (live shear surface) is 16.13 m2, the average water speed is 0.58 m/s, and the maximum depth is 1.31 m.

Building 15. In channel 15, water consumption in the channel is 9.4 m3/s, the cross-sectional area (live shear surface) is 15.15 m2, the average water speed is 0.62 m/s, and the maximum depth is 1.28 m.

Building 16. In the 16th channel, it was determined that the water consumption in the channel is 8.04 m3/s, the cross-sectional area (live shear surface) is 18.34 m2, the average water speed is 0.44 m/s, and the maximum depth is 1.26 m.

Building 17. In the 17th channel, it was determined that the water consumption in the channel is 8.0 m3/s, the cross-sectional surface (live shear surface) is 18.57 m2, the average water speed is 0.43 m/s, and the maximum depth is 1.14 m.

Building 18. In the 18th channel, it was determined that the water consumption in the channel is 1.36 m3/s, the cross-sectional area (live shear surface) is 7.86 m2, the average water speed is 0.16 m/s, and the maximum depth is 0.77 m.

Building 19. In Figure 19, it was determined that the water consumption in the channel is 1.32 m3/s, the cross-sectional area (live shear surface) is 6.05 m2, the average water speed is 0.22 m/s, and the maximum depth is 0.91 m.

Building 20. In the 20th channel, it was determined that the water consumption in the channel is 1.3 m3/s, the cross-sectional area (live shear surface) is 6.92 m2, the average water speed is 0.18 m/s, and the maximum depth is 0.61 m.

Building 21. In the 21st channel, it was determined that the water consumption in the channel is 1.28 m3/s, the cross-sectional area (live shear surface) is 6.44 m2, the average water speed is 0.16 m/s, and the maximum depth is 0.55 m.

Building 22. In the 22nd channel, it was determined that the water consumption in the channel is 1.26 m3/s, the cross-sectional area (live shear surface) is 5.64 m2, the average water speed is 0.15 m/s, and the maximum depth is 0.55 m.

Conclusion: the results of the research made it possible to obtain the necessary information about the main hydraulic parameters of the Greater Fergana Canal and to make practical conclusions about the effects of processes in the basin of 22 dams in the section of the Greater Fergana Main Canal from PK1949+00 to 2024+00.

By keeping the flow parameters constant over time in laboratory conditions, it is possible to study the spatial uneven distribution of the velocity field in the flow. But there is no possibility to ensure such stationarity in field conditions. Nevertheless, according to the results of the experiment conducted with the help of a modern profilograph, the water level has changed significantly: in the section of the Big Fergana main canal from PK1949+00 to 2024+00 in 22 stvers (December 2023), this indicator is a maximum of 128 cm (29%) reached It should be noted that the values of the water level at the measurement sites differ sharply. This difference can be explained by the corresponding change of channel width in certain walls.

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