Programs with programs to take water from the river without dams

Farokhiddin Uljayev[1*], *Khushnudbek* Yuldoshev[1] and Barno Abdullaeva[2]

[1]Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National Research University, Tashkent, Uzbekistan
[2]Tashkent State Pedagogical University, Tashkent, Uzbekistan

Abstract. In the arid areas of the river itself, the direction of flow is characterized by changes depending on its hydrological regime. As a result of these changes, the flow can be branched into several streams and the flow can be distributed differently in terms of quantity. As the river passes through lightly washed soils, these streams have different depths, and its hydraulic elements and river morphometry can vary at different intensities. Changes in hydraulic resistance as a result of such changes can affect the water permeability of streams. It should be noted that, depending on the form of morphometry, the roughness of the stream and the shoreline may vary at the same constant size of depth. This could be the Karshi Main and Amu Bukhara Mashina canals, which receive the most dam-free water from the Amudarya to the irrigated areas of the Republic of Uzbekistan. In these catchment areas, rapid washing of riverbeds, uneven distribution of flow velocity, and the constant distance of the stream from the dam intake facility away from the main intake facility complicate operating conditions and reduce the amount of water required to enter the canal during the growing season. **Keywords:** River, canal, dam intake, level, flow, modeling, hydrodynamics, protective dam, hydraulics.

1 Introduction

The presence of a damless water intake facility in the river area further complicates the flow dynamics due to its division. In these cases, the washing of the slopes, the distance of the streams from which the bulk of the flow flows from the water intake facility further complicates the operating conditions.

It shoul be noted that the hydraulic structures under construction in the riverbeds, changes in the hydrological regime of the river in the context of global warming complicate the operational conditions of water intake facilities. In addition, the scale, intensity and direction of deformation processes in the river change dramatically, and its dependence on many factors in time and space complicates the study of the process. In addition to the physical modeling used in the study of this, the possibilities of calculating computational hydrodynamics problems in computer modeling are expanding.

* Corresponding author: fuljayev@bk.ru

As a result of computer flow modeling, it is possible to spend very little time and money on the dynamics of hydrodynamic parameters of the flow, changes in the morphometry of the stream, the location of self-aligning structures, sufficient physical modeling of the database in the direction of flow. In computer modeling, at least a two-dimensional view of the system of Reynolds, Bussinesk, Saint-Venan equations is used to conjuction with the equation of continuity of flow in divergent form, equilibrium of nanoses, deformation equations and empirical formulas for their solubitily (flow permeability, hydrographic dynamics, etc.). Once the reliability of computer models is checked for reliability with test subjects, they are verified with the results of experimental studies and adapted for application to a specific real object. Quantitative studies have also been conducted to calculate flow expansion. A.N.Militeev, D.R.Bazarov obtained the formation of the water cycle in the abrupt expansion of the river as a result of the joint solution of the equations of motion and the equationsof continuity of hydrodynamics [1]. In this plan, R.Mayerle, S.S.Y.Wang, F.M.Toro [2] Quantitative studies by have focused on the effect of viscosity on velocity field and depth. The results obtained were consistent with the results of experimental studies conducted by experimental researchers from the United States, the Netherlands, France, and Germany [3-5].

2 Methods

As a result of the reduction of the width of the riverbed with protective control structures, the stagnation of the upper basin is formed. In this area, the level rises to the opposite distance to a certain flow direction, and the level reaches its maximum value. In this case, the flow is compressed to the maximum in width and depth. The flow after the compression section is compressed to the maximum and the level of the flow gradually rises and equalizes to the natural level. Based on these factors, the area formed as aresult of the interaction between the flow and the structure can be conditionally divided into three (Fig. 1).

1.The area of stagnation from the compression core to the end of the stagnation;

2.Compression area from the compression core to the compression section of the flow;

3.The area of propagation from the compressed section of the stream to the end section of the water cycle [6].

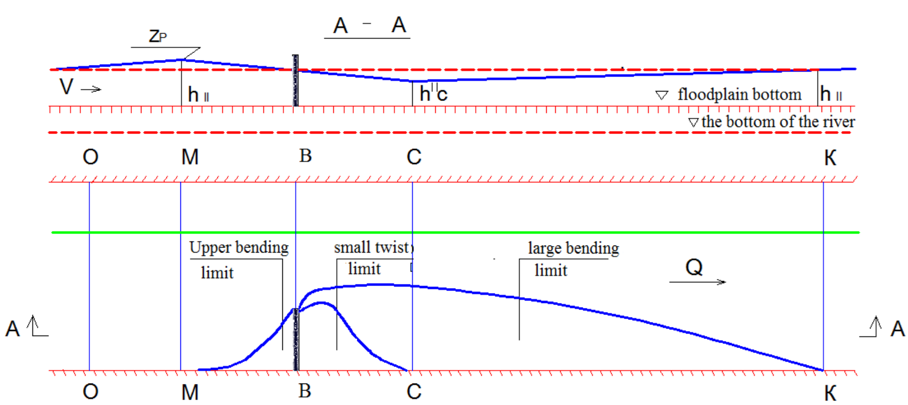

Fig. 1. The flow of the dam around the dam, O-O – is the area where the flow velocity area varies significantly; M-M – maximum stagnation rate; B-B – compression stock; C-B – compression section; K-K – is the end of the water cycle; M-B – dimming area; B-B – compression area; C-K – is the area of propagation.

In the field of dimming, it is important to determine the length of the dimming, its propagation distance, the shape of the flow movement, and the area of rotation of the current above. By identifying solutions to these issues, M.R.Bakiev [7-8], Abdul Karim, S.Shixab [9], A.M.Latyshenkov [10], I.V.Lebedev [11], Makkaveev V.M [12], M.M.Ovchinnikov [13], K.Sh.Sharapov [14] and Y.Kozeny [15], H.Y.Tracy, Carter. R.W. [16], as engaged by foreign researchers.

The coefficient of spatial compression is determined by the ratio of the magnitude of the cross-section of the flow in the compressed section to the magnitude of the cross-sectional area in the area of the riverbed where there is no construction effect.

Mathematical apparatus is also widely used in this field to determine flow parameters and dam sizes. A.V.Garzanov [17] solved the two-dimensional differential equation of potential motion:

$$\frac{\partial}{\partial x}(hvx)+\frac{\partial}{\partial y}(hvx)=0 \tag{1}$$

$$\frac{\partial vx}{\partial x}-\frac{\partial vx}{\partial y}=0 \tag{2}$$

Here, h=h(x,y) – flow depth at the x and y coordinate points;

– flow velocity projections on the coordinate axes.

The combined solution of this two-dimensional differential equation with the Bernoulli equation, which takes into account the pressure lost due to hydraulic resustance, gives the author an unequal motion equation that takes into account the change in specific potential energy along the flow length and the loss of pressure due to additional hydraulic resistance. The solution of these equations in the Kirchhoff-Chaplygin methods gave the ability to determine the depth before compression, the shape of the lines in motion near the structure, the coefficients of compression in the plan. This solution is obtained for cases where the maximum values of vertical and planar compressions are appropriate. A.V.Garzanov proposed to determine the coefficient of compression in the plan with the following expression:

$$E=b_c/a=1/\left(2\frac{\pi}{\theta}\sqrt{M_o y}_{\max}(1-\delta_{СЖ})+1\right), \tag{3}$$

$$M=(1-3\delta)/(1-\delta)^3; \quad \delta=\frac{\Delta h+\upsilon_0^2/(2g)}{Э_0(1+r)}; \quad r=\frac{m_0-m}{Э_0}, \tag{4}$$

Here, bc – the width of the stream in the compressed section;

a – the largest deflection of the flow line;

θ – the largest turning angle;

y – a coordinate without a unit of measurement corresponding to the maximum deflection of the flow line;

Mo – the average value of the function M along the line of motion of the current under consideration;

Δ h=h $_{Б}$ –h the difference in depths in the smooth and uneven motion of the flow in the selected vertical;

Эо – specific energy in the initial section;

υ_0 – approach speed;

$m_0 - m$ - the difference in the height markings of the bottom of the stream in the transverse direction relative to the flow axis.

A.V.Garzanov did not make a logical conclusion of this solution and did not obtain quantitative values of compression coefficients. In addition, the accuracy of the solution depends on the angle of rotation of the line of motion of the flow, which has a dynamic character in terms of depth. The recognized situation does not allow for a clear opinion on this method.

I.V.Lebedev [18] conducted experimental studies to solve these problems on aerodynamic model devices. In addition to the physical modeling used in the study of this, the possibilities of calculating computational hydrodynamics problems in computer modeling are expanding. [19-23].

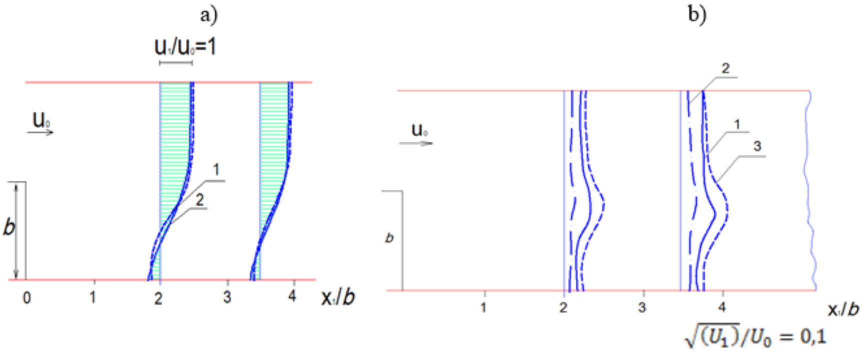

Fig. 2. a) The results of physical modeling (whole lines) for a sharply expanded state of the river; b) compare the results of numerical studies (dashed lines).

As a result of computer flow modeling, it is possible to spend very little time and money on the dynamics of hydrodynamic parameters of the flow, changes in the morphometry of the stream, the location of self-aligning structures, sufficient physical modeling of the database in the direction of flow. In computer modeling, at least a two-dimensional view of the system of Reynolds, Bussinesk, Saint-Venan equations is used in conjunction with the equation of continuity of flow in divergent form, equilibrium of nanoses, deformation equations and empirical formulas for their solubility (flow permeability, hydrographic dynamics, etc.). Once the reliability of computer models is checked for reliability with test subjects, they are verified with the results of experimental studies and adapted for application to a specific real object.

3 Results and discussion

Changes in flow velocity in the Amudarya conditions play an important role, so a reduction in velocity to a minimum was achieved by paying attention to the level of modeling. However, once the stream fully descended to the right bank, the width of the river bed in its regulated part was chosen to be approximately equal to the stable width.

The protective control dams are placed parallel to each other at an angle to the incoming flow. The length of the dams and the distance between them are assumed to be such that the width of the channel remaining at high flow velocities is equal to the regulated stable width of the river channel. The three-pass protective control dam system narrowed the channel, allowing the flow to turn to the right, towards the head of the water intake facility. The speed behind the protective control dam systems was reduced to a value not equal to zero.

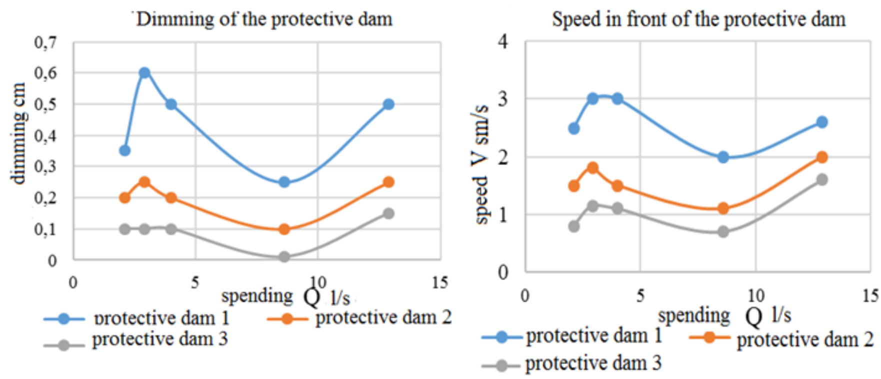

Fig. 3. Dynamics of average flow rate and flow value in the installation of protective control dam-shaped adjustment structures. Values are modeled on a 1:60 scale.

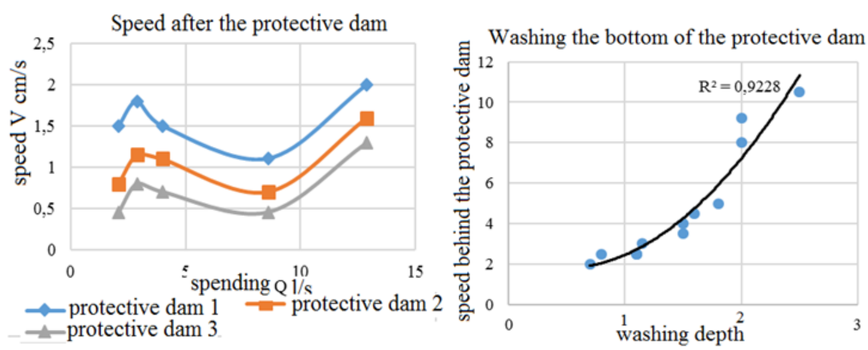

Fig. 4. In the second series of experimental studies, three hydraulic flow elements for a protective control dam system.

Experimental research work was continued and 2 series of experiments were carried out by increasing the number of protective control dams in the system. The number of protective control dams was determined by the method of I.Ya. Orlov.

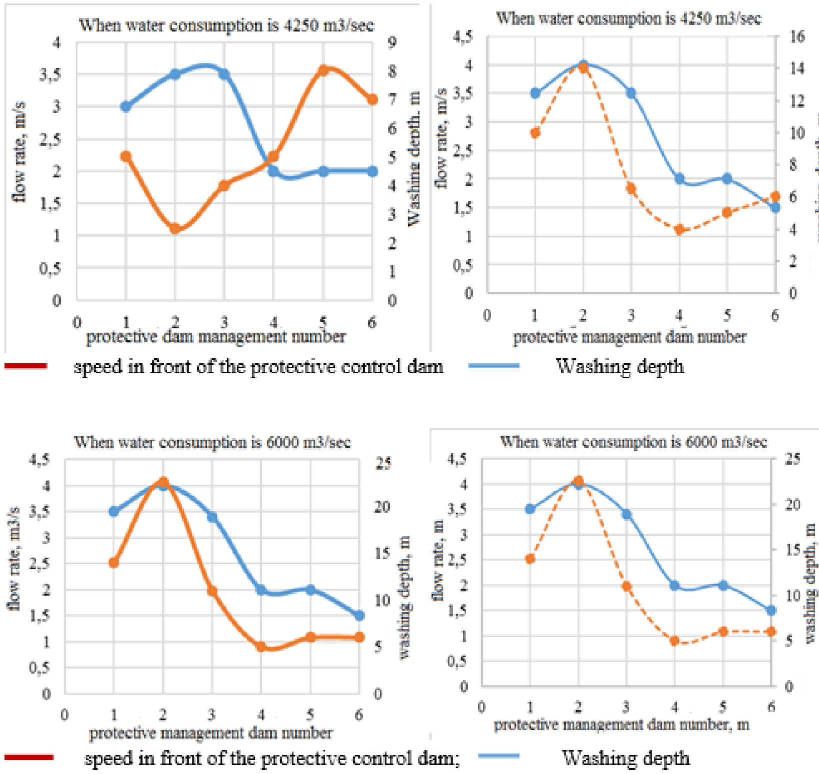

Fig. 5. In the second series of experimental studies, 6 hydraulic flow elements for a protective control dam system.

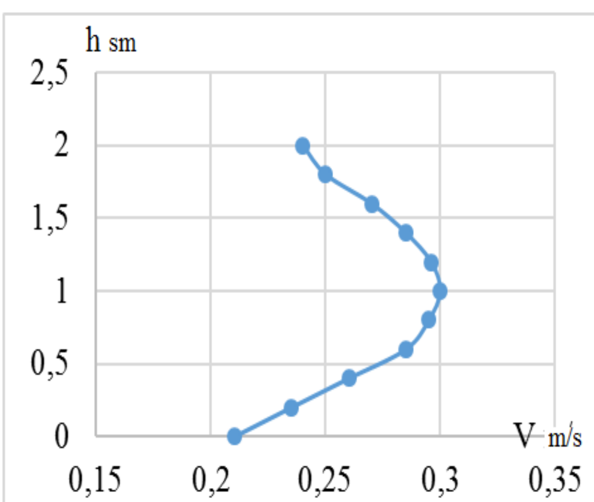

Fig. 6. Depth flow rate diagram.

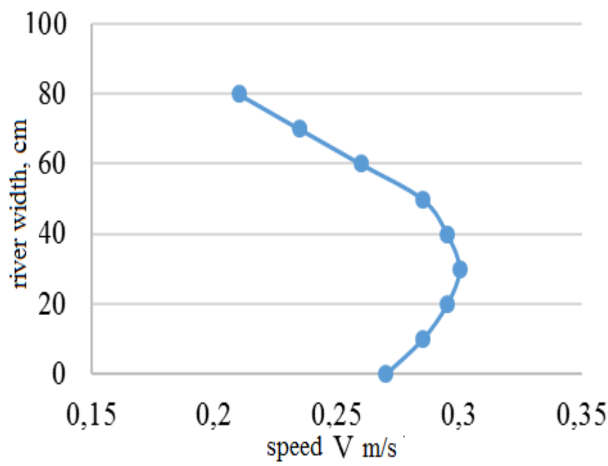

Fig 7. Flow rate in smooth water intake for smooth surfaces.

Methodological experimental data show that adherence to boundary conditions (establishing a balance between sediments removed and retained at the end of the main channel) to form a channel of the modeled section of water flow was performed after approximately 205 minutes of experimental experiments. The time of morphological and hydraulic processes was 11.2 hours. After the formation of the local canal was completed, the gate at the beginning of the section was gradually closed and inspected. Experimental experiments show that the installation of protective dams allows guaranteed water intake to the dam-free water intake facility [24].

Since the Mejen period is considered to be the most difficult period in the intake of water without a dam, for the Mejen period in the Amudarya as well as in the object of this study Q=500 m^3/s and 300 m^3/s and 100 m^3/s and 30 m^3/s water intake cycles, respectively, were also studied.

Since the distance from the entrance section of the calculated fragment section length to the entrance section of the Karshi Main Channel is small, the functional dependence Z = f (Q) in the exit area of the calculated fragment was taken as the boundary condition. [23-24].

Several types of calculations have been identified and constructed as the basis for numerical modeling. The upper part of the main section of the Amudarya without dams is based on topographic data [108; 606-610-p], the flow area in this area is DX = 36.8 m in the direction of movement, except for 4 stvors in the entrance section (step DX - 22 m, 24 m, 28 m and 33 m) and the direction of transverse flow DY = 20 m. was accepted. The calculated fragment length was 3 km above the flow intake facility and 2 km below the facility. (Fig. 8).

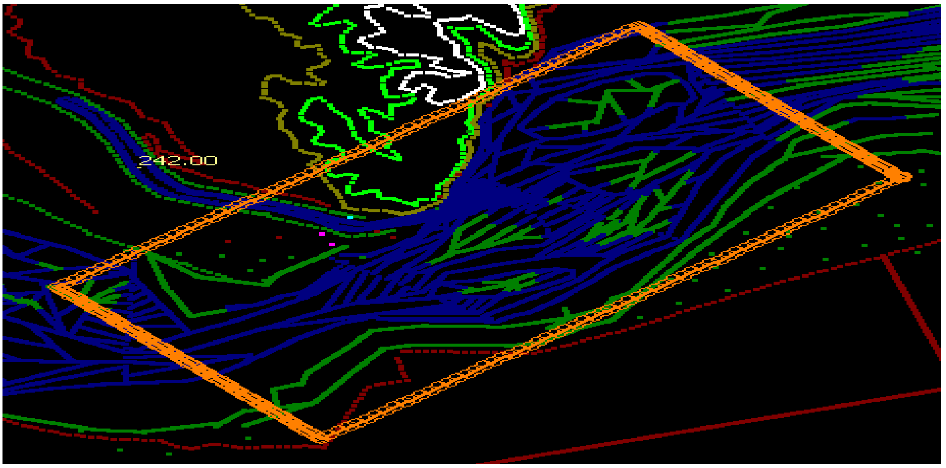

Fig. 8. Computed fragment type.

In addition, due to the nature of the species, 8200 m and 4200 m size species were also adopted (Figures 4-7). The longitudinal step in this case is 209 m, and the width of the stream is 190 m. water intake from the main structure from 37.5 m. changed to. Crushed DX = 15 m DY = 10 m, which completely covers the calculated fragment in the damless water intake facility. dimensional step types were adopted.

Recognizing the complexity of the above-mentioned problem, a number of studies have been conducted to ensure guaranteed water intake in the Mejen period in the area of the main dam intake facility from the Amudarya. It was acknowledged that the width of the stream was reduced by blocking with protective dams, reducing the width of the stream flowing into the MMC. In this case, the increase in depth and velocity of the flow was based on numerical studies. This has increased the ease of obtaining dam-free water from the Amudarya to the Karshi main canal (Fig. 9).

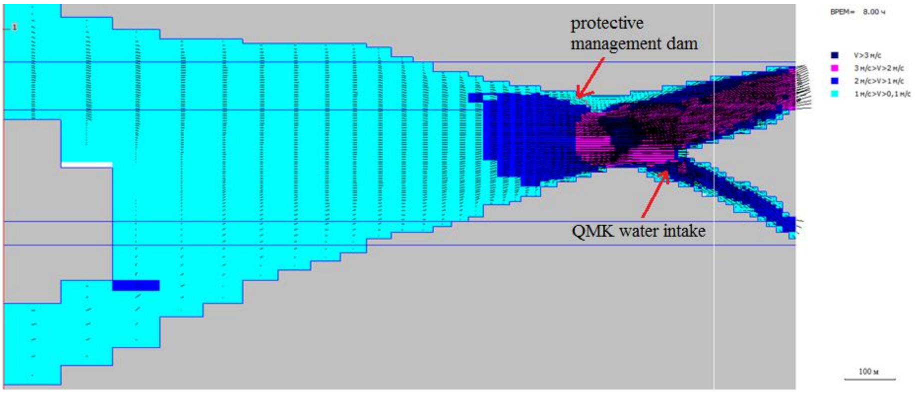

Fig. 9. The result of a numerical study of the flow rate mejen Q = 500 m^3/s in the area of the dam directing the digital flow. In this case, Qm = 100 m^3/s was applied to the MMC, and the roughness in this area was assumed to be n = 0.021. m^3/s.

Table 1.

№	Options	The width of the stream occupied by the MMC. m
1	Dam №1 length 50 m	28.6
2	Dam №1 length 70 m	24.3

3	Dam №2 length 65 m	32.9
4	Dam №2 length 120 m	28.9

The following table presents the results of a numerical study conducted to determine the effect of flow-protecting dams on the flow width for the mejen period. The flow rate in the Amudarya is assumed to be 500 m^3/s and the flow to the MMC is assumed to be 100 m^3/s.

The flow diver is 150 m above the water intake point from dams of the dimensions given in the table. Compared to the above, the results of numerical studies have shown that the Karshi main canal provides efficient water intake. Length 65 m. ta'siri 2 dams were found to have no effect on water intake. However, when the dam length is increased to 120 m, the water intake efficiency №1 total length is 50 m. found to have the same efficiency as the №2 dam.

4 Conclusion

The change of water flow is achieved by building protective dams made of local materials at an angle of a = 600 every 100 meters at a distance of 2000-3000 m from the dam-free catchment area on the left bank of the river and in the form of a base. Numerical studies and experimental studies have confirmed that they increase the amount of water flow coming into the inlet channel by directing the water flow to the right using them.

It has been proved that we will build the first temporary measures to prevent deformation processes in the riverbed, ie a system of embankments. Given the high cost of production and transportation of reinforced concrete products, it is necessary to build and strengthen the protective dams of local dams with reinforced concrete structures in the future. The need to install protective dams on the left bank of the river and in the Kayir area will be determined. As a result, it provides guaranteed water access to the counter-main canal. At the same time, the demand for water in the country creates opportunities to solve problems in agriculture.

References

1. Abdul Karim, S. Shihab, *Patterns of flow spreading behind a transverse dam on rivers with a wide floodplain* (Abstract diss. Ph.D., M., 1991)
2. G.N. Abramovich, *Theory of turbulent jets* (Fizmatgiz, Moscow, 1960)
3. F. Atykbekova, F. Uljaev, G. Jumaboeva, et al., IOP Publishing Materials Science and Engineering **883**, 012003 (2020) DOI: 10.1088/1757-899X/ 883/1/012003
4. S.N. Andreev, L.M. Apasheva, M.K. Ashurov, N.A. Lukina, B. Sapaev, I.B. Sapaev, K.F. Sergeichev, I.A. Shcherbakov, Physics of Wave Phenomena **27(2)**, 145-148 (2019)
5. I.B. Sapaev, G.E. Eshchanova, U.A. Nullaev, et al., IOP Conference Series: Earth and Environmental Sciencethis link is disabled **614(1)**, 012148 (2020)
6. T.F. Avrova, *Planned expansion of a calm stream constrained by a cofferdam in a rough channel. Channel processes and methods of their modeling. Proceedings of VNIIG* (Energy, L., 1977)
7. T.F. Avrova, *Velocity field in the area of spreading of a calm flow in a prismatic channel. Channel processes and hydraulics of structures* (Saratov. Polytech. Inst, Saratov, 1980)
8. I.I. Agroskin, G.T. Dmitriev, F.I. Pikalov, *Hydraulics. Ed.* (Energy, L., 1964)

9. D.R. Bazarov, *Dissertation for the degree of Doctor of Technical Sciences. Scientific substantiation of new numerical methods for calculating the channel deformations of rivers, the channels of which are composed of easily eroded soils, Specialty 05.23.16 - hydraulics and engineering hydrology* (M., 2000)
10. D.R. Bazarov, F.B. Ulzhaev, S.Kh. Pulatov, et al., Web of Scholar **4(22)**, 51-56 (2018)
11. D.R. Bazarov, A.N. Krutov, V.V. Belikov, *Prospects for the use of numerical modeling of channel processes, Proceedings of the Republican scientific-practical conference "Actual problems of water management and reclamation of irrigated lands"* (2011)
12. M.R. Bakiev, O. Kodirov, K.T. Yakubov, *The hydraulics of the compressed flow with a variable spur coefficient of water permeability through the body. Irrigation and reclamation* (2019)
13. M.R. Bakiev, M.R. Ikramova, N. Raxmatov, *Rekomendatsii po gidravlicheskomu raschetu popirechnyx damb s uchetom chastichnogo zaileniya (osvoeniya) mejdambnogo prostranstva* (Kartfabrika NII EOS, Tashkent, 1991)
14. A.V. Garzanov, Hydraulics of the Saratov Polytechnic Institute **24**, 222-226 (1965)
15. A.M. Latyshenkov, *Voprosy gidravliki iskusstvenno sjatyx rusel* (Gosstroyizdat, M., I960)
16. I.V. Lebedev, Proceedings of MPEI **33**, 82 (1960)
17. V.M. Makkaveev, Proceedings of LIIVT **1**, 28-34 (1932)
18. M.M. Ovchinnikov, Hydrotechnical construction **1**, 62 (1966)
19. Kh.Zh. Khayitov, *Improvement of methods of calculation substantiation of transverse dams on rivers with one-sided floodplain. The dissertation for the degree of Doctor of Philosophy in technical sciences in the specialty. 05.09.06. Hydrotechnical and reclamation construction* (2018)
20. K.Sh. Sharapov, *Investigation of the hydraulics of massive spurs* (Abstract diss. cand. tech. Sciences, Tashkent, 1968)
21. V. Kozeny, *Hydralik, ihre Grandlagan and praktische. Anwen- dung* (1953)
22. A.S. Sharma, Lodhi, R.K. Jain, Journal of Hydraulic Engineering **138(10)**, 897-901 (2012)
23. H.V. Tracy, R.W. Carter, Proc. am. soc. of Civil Engineers **80**(413), 34-38 (1954)
24. S.S. Wang, R.Y. Mayerle, F.M. Toro, Journal of Hydraulic Research **33(2)**, 243-256 (1995)