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"YASHIL ENERGETIKA VA UNING QISHLOQ VA SUV XO'JALIGIDAGI O'RNI" MAVZUSIDAGI XALQARO ILMIY VA ILMIY-TEXNIKAVIY ANJUMANI

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RECOMMENDATIONS FOR SAFE PASSAGE OF FLOOD WATERS THROUGH THE AMUDARYA RIVER IN THE ZONE OF BRIDGE CROSSINGS

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Abstract. This article presents the results of a study conducted in order to develop recommendations for the safe transfer of flood waters from the areas where transport bridges have been built in the lower reaches of the Amudarya. In the course of the research, the hydraulic parameters of the riverbed and stream were obtained and their changes at different water consumptions (2000-6000 m^3/sec) were analyzed. Based on the results of the analysis, recommendations were developed on the transfer of maximum water consumption from the zones where the transport bridges of the Amudarya were built.

Key words: riverbed formation, hydromorphological parameters, hydrotechnical structure, maximum water consumption.

Аннотация. В данной статье представлены результаты исследования, проведенного с целью разработки рекомендаций по безопасному пропуску паводковых вод из зон их влияния в результате строительства транспортных мостов в нижнем течении Амударьи. В ходе исследований были получены гидравлические параметры русла и потока и проанализированы их изменения при различных расходах воды (2000-6000 $м^3$/сек). По результатам анализа были разработаны рекомендации по переносу максимального расхода воды из зон Амударьи, где построены транспортные мосты.

Ключевые слова: переформирование русла, гидроморфологические параметры, гидротехнические сооружения, максимальный расход воды.

Annotatsiya. Ushbu maqolada Amudaryoning quyi oqimidagi transport ko‘priklari barpo etilgan natijasida ularning ta`sir zonalaridan toshqin suvlarini xavfsiz o‘tkazish uchun tavsiyalar ishlab chiqish maqsadida o‘tkazilgan tadqiqot natijalari keltirilgan. Tadqiqot jarayonida o‘zan va oqimning gidravlik parametrlari olingan va turli suv sarflarida (2000-6000 m^3/sek) ularning o‘zgarishi tahlil qilingan. Tahlil natijalariga ko‘ra Amudaryoning transport ko‘priglari qurilgan zonalaridan maksimal suv sarfini o‘tkazish bo‘yicha tavsiyalar ishlab chiqildi.

Kalit so‘zlar: o‘zan shakllanishi, gidromorfologik parametrlar, gidrotexnik inshootlar, maksimal suv sarfi.

Introduction. The study of riverbed formation, i.e., hydromorphological parameters of riverbeds and flows in rivers, provides computational dependencies for establishing riverbed parameters when designing hydraulic structures in river channels. Existing computational dependencies on riverbed formation characterize the natural state of riverbeds. Issues of riverbed formation are addressed in the works of Avakyan A.B. [1], Altunin S.T. [2], Berkovich K.M. [3], Mukhamedov A.M. [4], Irmukhamedov Kh.A. [5], Buzunov I.A. [6], Lapshenkov V.S. [7], Ismagilov Kh.A. [8], and others.

Under regulated river flow conditions influenced by hydraulic structures, riverbed reformation occurs with new hydraulic flow parameters, necessitating the development of scientific principles for riverbed regulation considering these changing factors. The new hydraulic parameters require adjustments to existing computational dependencies for regulated river flow conditions. This research aims to address the aforementioned tasks.

In the Amudarya section from the Tyuyamuyun Reservoir to the Tahiatash Hydro Unit, there are three pontoon bridges in the regions of Turtkul, Beruni, and the Kipchak settlement (Fig. 1). The pontoon bridges have a width of 300 m instead of the natural riverbed width of 600 m. The riverbed near the pontoon bridges is narrowed by half compared to its natural state. To assess the impact of pontoon bridges on the river's flow capacity, we calculated the average depth and flow velocity for various water discharges under riverbed widths of 600 m and 300 m.

Water discharge Q = ω*V*B = 600 m – channel width (1)

B_c= 300 m – pontoon bridge length

Flow velocity $V = C\sqrt{Hi} = \frac{H^{1/6}}{n}\sqrt{Hi} = \frac{H^{2/3}i^{1/2}}{n}$ – Chezy formula (2)

Substituting (1) into (2) and transforming, we obtain

$$H_{cp} = \left(\frac{Q \cdot n}{B \cdot i^{1/2}}\right)^{0.6} \quad (3)$$

Here: Q – water flow in m³/s;

ω = B·H – typical cross-section area, m²;

B – channel width, m;

H – average flow depth, m;

n – channel roughness coefficient;

i – water surface slope;

V – flow velocity, m/s;

C = $\frac{H^{1/6}}{n}$ – Chezy coefficient.

Using formulas (1) and (3), we determined the average velocity and depth for various discharges under riverbed widths of 600 m and 300 m. Table 1 presents the calculation results.

Table 1 – Calculation results of average depth and flow velocity near pontoon bridges under varying water discharges.

Q, m³/s	2000		3000		4000		5000		6000	
B, m	600	300	600	300	600	300	600	300	600	300
H, m	3.2	4.7	4.0	6.0	4.7	7.2	5.5	8.1	6.0	9.1
V, m/s	1.07	1.42	1.25	1.67	1.44	1.86	1.52	2.05	1.67	2.20

The calculations show that narrowing the riverbed by half at the pontoon bridge cross-section leads to a 1.5-fold increase in average depth and flow velocity compared to natural conditions (Table 1). Increased depth raises water levels in the river. For example, at a discharge of 2000 m³/s, the average depth was 3.2 m, increasing to 4.7 m at the bridge cross-section. At 4000 m³/s, the depth reached 7.2 m (2.4 m higher than in free-flowing sections).

At 6000 m³/s, the average depth at the bridge cross-section may reach 9.1 m, exceeding the critical level by 3 m. Such a rise could lead to catastrophic overtopping of embankments, flooding of coastal lands, and nearby settlements.

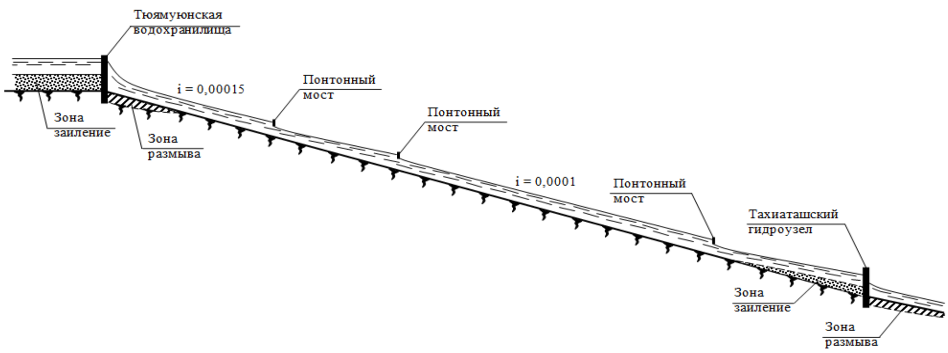

Figure 1. Longitudinal profile of the Amudarya River between the Tyuyamuyun and Tahiatash Hydro Units. Length: 250 km.

The maximum permissible discharge through the Kipchak cross-section is calculated using:

$$Q = \frac{B \cdot H^{5/3} \cdot i^{1/2}}{n} \quad (4)$$

Assuming an embankment height of 5 m, a safety margin of 0.5 m, and riverbed scouring lowering the bed by 1.5 m:

Here: $H = H_д – H_з + H_р$ = 5 - 0.5 + 1.6 = 6.0 m

где: $H_д$ =5 m – dam height;

$H_з$=0.5 m – dam reserve above maximum water level;

$H_р$=1.5 m – channel bottom lowering due to erosion;

B=300 m – channel width in section;

i = 0.0001 – water surface slope;

n = 0.02 – roughness coefficient.

$$Q = \frac{300 \quad 6.0^{5/3} \quad (0.0001)^{1/2}}{0.02} = 3500 \text{ m}^3/\text{s}.$$

Conclusion. The maximum permissible discharge through the Kipchak cross-section is 3500 m³/s. Exceeding this value leads to embankment overtopping, flooding, and erosion of coastal areas, which is unacceptable. This must be considered when releasing discharge from the Tyuyamuyun Reservoir.

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CHORTOQ SUV OMBORINI TEXNIK HOLATI VA BEXATAR ISHLASHINI NAZORAT QILISH

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Annotatsiya: Ushbu maqola “Chortoq suv ombori” Namangan viloyatining Chortoq tumani Chortok posyolkasidan 20 km janub tomonda joylashgan.CHortoq suv ombori texnik holati va bexatar ishlashini nazorat qilish boyicha o‘rganishlar hamda kuzatishlar olib borildi,suv omboridagi qurilishdagi va ishlatishdagi kamchiliklar yo‘l qo‘yilgan xatolar o‘rganilib chiqildi hamda kerakli tavsiyalar berildi.