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METHODS OF CALCULATING THE DYNAMICS OF SLUDGE SEDIMENTS IN WATER DELIVERY CHANNELS OF PUMPING STATIONS

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A B S T R A C T	K E Y W O R D S
In this article, the fractional composition of turbidity and the dynamics of turbid sediments in the channel that brings water to the 1st pumping station of the Karshi main channel are studied.	Amudarya, water intake without dam, Uzan, deformation, pump.

Introduction

In the world, taking into account the operating mode of the pumping stations, based on the conditions of evaluation of the processes in the water supply channel, scientific and research works aimed at improving the optimal parameters of the channel and ensuring its reliability during the period of use are being carried out. In this direction, among other things, the processes at the bottom of the water supply channel, improvement of supply to irrigation channels with the help of pumping stations, prevention of their filling with muddy sediments, selection of optimal parameters of the channel for the delivery of stagnant water to the irrigation system, One of the important tasks is to develop new designs of clarifiers, to ensure reliable operation of hydrotechnical facilities, to ensure that the water level in the vane chamber is in order to prevent the operation of pump units in cavitation mode, and to improve the technology of cleaning the impurities in the water.

The main part

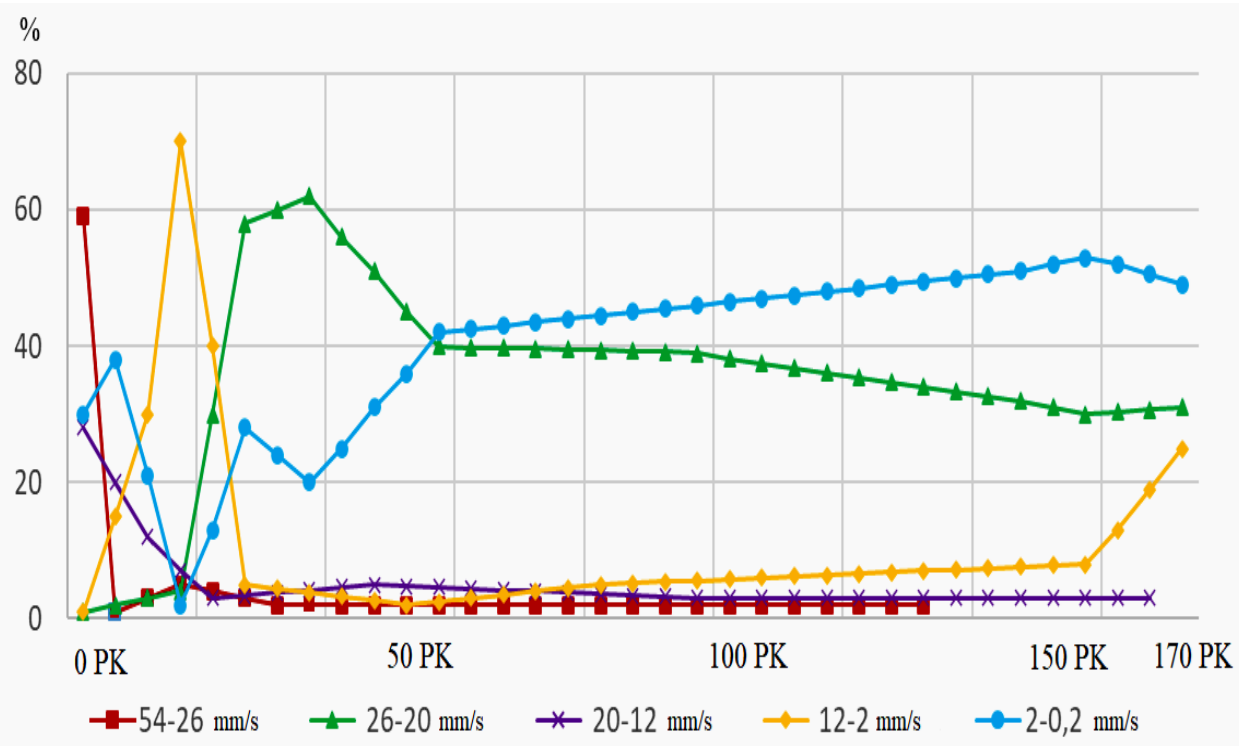
Many scientists on the irrigation systems of the Amudarya basin have done extensive work on the analysis of sediment deposition calculation methods. Having positively evaluated their methods, it can be noted that an improved option compared to other methods - methods by fractions should be widely used, the results of the calculation of this method are more accurate, the difference between the calculated blur and the measured data is 5,3 % is enough.

Analyzing the correlations determined for calculating the saturation of the current with sediments during washing of bottom sediments, it should be noted that these correlations reflect the influence of factors that sufficiently clarify the process. An example of this is the failure to take into account the fractional composition of bottom sediments, the re-formation of bottom sediments into the washing process, i.e. the reverse effect of the bottom sediments (protective cover) on the speed of formation and washing process.

The beginning of the movement of particles in the bottom sediments, which are not homogeneous in terms of size, is determined by the speed of vertical pulsation in the bottom area and the flow velocity. With the help of these values, the minimum diameter of the sediments, which remain at the bottom of the stream during washing and form a protective layer consisting of large particles - scum, is determined.

Table 1 Fractional composition of suspended solids in the water supply channel to the 1st pumping station of KMK

The day the sample was taken	**Sampling location**	**Fractional composition of turbidity, %**			
		Muddy <0,005 mm	**Dusty 0,005-0,05 mm**	**Sandy 0,05-0,25 mm**	**>0,25 mm**
15.08.2021	Enter PK 0+00	21,57	41,20	34,52	1,31
15.08.2021	PK 7+64	24,30	50,00	25,45	0,35
16.08.2021	PK13+80	33,06	51,43	15,33	0,18
1.09.2021	PK 200	30,41	66,00	3,44	0,15



Picture 1. The dynamics of changes in the fractional composition of turbid sediments along the length of the KMK.


Picture 2. Zemsnaryad is in progress.

The phenomenon of otmostka (protective covering) has been thoroughly studied for many years. The reason for the study is that this protective coating has positive effect. For example, the formation of a protective cover on the lower part of the hydrotechnical structure provides an opportunity to increase the upper limit of the non – washable speed, which in turn allows to prevent significant deformation of the core and increase the flow rate of water.

Although the protective coating has been deeply and continuously studied, the following basic questions have not yet been answered, for example, how many layers of the protective coating form on the surface of the bottom, how much is the accumulated layer strength of the protective coating, and what criteria are used to determine the beginning and end of the protective coating formation possible identifying these factors determines the direction of the analytical description of the protective coating process.

It can be considered that K.I.Rossinsky was the first to take into account the effect of the protective coating on the size of the bed washout, according to him, this process is as follows: after the bottom washout is complete, the full depth of the flow is h_p, the washout horizon the depth of the water under h is equal to the sum of the accumulated layer thickness h_n of the protective coating:

Here:

$$h = \sqrt[12]{\frac{q}{V_n}} \quad (1)$$

$$h_n = \frac{\delta}{n} \quad (2)$$

V_n – non-washable flow rate determined by the sizes included in the protective cover;

δ – layer thickness of the protective coating;

n – the relative amount of large contents by volume.

The need for practical calculations of clarifiers creates the task of simultaneously calculating both the turbidity of the bottom and the hydraulic washing of bottom sediments in the clarifier. The analysis of the methods used for this showed that there is no sufficiently complete semi-empirical method for calculating the dynamics of turbidity in clarifiers. This situation makes it possible to formulate the real goal of these studies: to develop a method for calculating turbidity dynamics in a clarifier that simultaneously takes into account sediment settling and washing of bottom sediments, taking into account the effect of protective coating.

Taking into account that the turbidity and bottom sediments moving with the current in field conditions have different fractional compositions, it is very difficult and almost impossible to express them in the same analytical form, therefore, in the development of a new method, according to the size corresponding to the given composition of sediments it is necessary to take into account the possibility of using sediment distribution curves.

The solution of these problems is very complex and difficult, so it is necessary to involve new computational tools and methods in solving it.

Numerical modeling of turbidity dynamics in turbulent flows can be used as such a method. The basis of this modeling method is the mathematical model of the studied process, which consists of a set of ratios, equations, and formulas that determine its state depending on the parameters and initial conditions of the flow leading to the flow. In digital modeling, numerical expressions of these parameters are used if there are no analytical relationships to determine one or another system parameter. Storing and processing large digital data, which is necessary for high-precision calculation of fuzzy dynamics, is almost impossible without modern computing, which is a tool for implementing digital models.

The purpose of developing a numerical model of the sediment transport flow comes from the development and improvement of the above-mentioned methods for calculating sediment transport and requires the use of their main achievements.

Conclusion

It is possible to increase the efficiency of using the pump station aggregates of the opposite main channel by changing the parameters of the channel. By developing improved parameters of the KMK softener, the efficiency of pump units is increased by 12 %. According to field studies, when analyzing the dynamics of changes in the hydraulic parameters of the flow in the channel, it was found that large riverbed processes occur in the field in a short time. This shows that the hydraulic regime of the channel significantly redistributes the speed, depth and width of the flow. That is, an increase in the flow of turbid sediments into the riverbed causes a decrease in the depth of the water flow and an increase in the width of the riverbed.

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