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CREATING A DISPATCH SCHEDULE FOR EFFECTIVE FILLING AND EMPTYING OF A WATER TANK

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A R T I C L E I N F O.

.

Abstract

It is necessary to save water in reservoirs and use it effectively. Especially in our region, irrigation works are carried out almost all year round in fields where grain and cotton are planted. Therefore, it is necessary to establish strict control over the amount of water supplied from the reservoir. This can be achieved annually, at the beginning of the year, by drawing up a dispatching schedule of the use of the reservoir. When drawing up the graph, it is necessary to take into account the flow of water in the river supplying the reservoir, the volume of water collected in the reservoir until the beginning of the year, and the plan to deliver water to consumers in the accounting year.

First, on the basis of 15-30 years of hydrological monitoring data on the river supplying the reservoir, the change of water flow is studied, and among these years, those with a lot of water, average and low water are found. Then, the input and output of the ten-day water balance of the water reservoir of these years are considered. After all the data is collected, a dispatch schedule is created to efficiently fill and empty the reservoir.

Changes to the schedule during the accounting year can be made only due to an error that may be made in the preliminary calculation of the annual flow to the reservoir.

The dispatching graph consists of reservoir filling and water supply boundary lines.

Reservoir Filling Demarcation Line: *When filling a reservoir, a reservoir filling demarcation line should be drawn and based on this graph, the reservoir should be filled. Reservoir filling boundary line is given in tabular and graphical form. It shows the volumes of water collected in the reservoir and the signs of the water level corresponding to the last dates of the ten days of the months of the year.*

In order to determine the ordinates of the boundary line of reservoir filling, it is necessary to monitor the inflow and outflow of water for ten days, and based on this observation data, the ordinates of the boundary line of reservoir filling are determined by the following link::

$$\boldsymbol{W_j} = \boldsymbol{W_{тула}} - \boldsymbol{S_{макс}} + \sum_{i=j}^{j} (A\sum K - \sum Ч) \qquad (1)$$

here: W_j - along the boundary line of the fill j – volume of the water reservoir at the end of ten days, mln.m ^{3}; j = 1, 2, 3,…, 36 (number of ten days);

W_{full}- full volume of the reservoir, mln. m ^{3};

$S_{макс} = \sum_{i=1}^{k}(A\sum K - \sum Ч) -$ the maximum value of the aggregate during the year, that is, the maximum volume of collected water reached since the beginning of the year, mln. m ^{3};

k– the decade number at which the sum reaches its maximum value;

$A = \frac{W_б}{\bar{W}_к}$

volume of annual flow predicted for the financial year, mln. m ^{3};

$\bar{W}_к$ - long-term average flow volume, mln. m ^{3};

$\sum K$ - according to the observations of the past years, the average flow into the reservoir in ten days, mln. m ^{3};

$\sum Ч -$ according to the plan, water output during ten days, mln. m ^{3}.

Average discharge for ten days - $\sum K_j -$ can be obtained from a year with a multiyear average discharge.

If we look at the history of the Zomin reservoir, 2016 can be such a year. This year, the flow was equal to 60.23 million m3. Therefore, data based on observations made in 2016 were used to perform calculations.

In the second ten days of the sixth month = 21.61 million m3. For the year (A=1) when the average stream discharge is close to the multi-year average stream discharge, the ordinates of the break line were calculated according to the formula (1). The rising part of this line is called the boundary line of reservoir filling (Figure 2). The values of the ordinates are given in Table 1.

The proposed Zomin Reservoir recharge limit line can be used for any year. If the accounting year is predicted to be abundant, that is, A>1, the boundary line for filling the reservoir can be recalculated. In this case, it is necessary to take into account the cloudy part of the reservoir volume up to the accounting year.

Table 1. Water level marks corresponding to the ordinates of the filling boundary line of the reservoir.

Months	$W_j = W_{тула} - S_{макс} + \sum_{i=j}^{j}(A\sum K - \sum Ч)$	Water level mark, m
January	25,1	910
February	29,7	913,5
March	29,1	913,2
April	28,0	912,5
May	33,4	916
June	34,5	917
July	33,1	916,1
August	27,7	912
September	26,8	911,3
October	30,5	914,2
November	28,7	912,9
December	27,4	911,7

Limitation line of water release: *A limit line of water release is built in order to save water collected in the reservoir during the vegetation period of low water years. It makes it possible to evenly distribute the water deficit during the growing season and reduce the losses of consumers from this deficit.*

In order to release the water in the reservoir, it is necessary to draw a boundary line for the release of water, and based on this graph, it is necessary to release the water in the reservoir. The ordinates of the boundary line of water release in the reservoir are determined by the following relation..

$$W_j = W_0 - S_{мин} + \sum_{i=1}^{j} (A\sum K - \sum Ч) \quad (2)$$

here

W_j – according to the demarcation line of water release j – volume of the water reservoir at the end of ten days, mln. m ^{3}; j = 1, 2, 3,…, 36 (numbers of ten days);

W_0 - dead volume of the reservoir, mln.m ^{3};

$S_{мин} = \sum_{i=1}^{к} (A\sum K - \sum Ч)$ – the minimum value of the total, that is, the maximum decrease in the volume of the reservoir during the year;

k is the number of the decade in which the sum reached its minimum value.

If abundance is predicted for the accounting year, that is, in A 1, there is no need for a discharge boundary line for that year. If a water shortage is expected in the accounting year, then it is necessary to recalculate the water discharge limit line for the expected year.

Table 2. Water level marks corresponding to the ordinates of the water supply boundary line.

Months	$W_j = W_{ўсх} - S_{мин} + \sum_{i=j}^{j} (A\sum K - \sum Ч)$	Water level mark, m
January	3,6	880,6
February	2,5	878,9
March	1,1	873
April	2,1	877,8
May	3,1	880,2
June	2,8	879,8
July	2,2	877,7
August	1,7	876,1
September	3,8	882,2
October	3,1	880,3
November	2,1	877,6
December	3,2	880,3

Thus, the dispatching graph of the Zomin reservoir was developed in Fig. 1, where the reservoir filling limit and water supply limit lines are presented. For other years, the schedule will be modified based on the above conditions.

The operation procedure of the reservoir is carried out on the basis of this graph, that is, when filling or emptying it, the water level at the top should be between the two curves on the dispatching graph at the indicated time.

When filling and emptying the water reservoir, it is necessary that the rate of rise and fall of the water level does not exceed the standard values, following the limits given above.

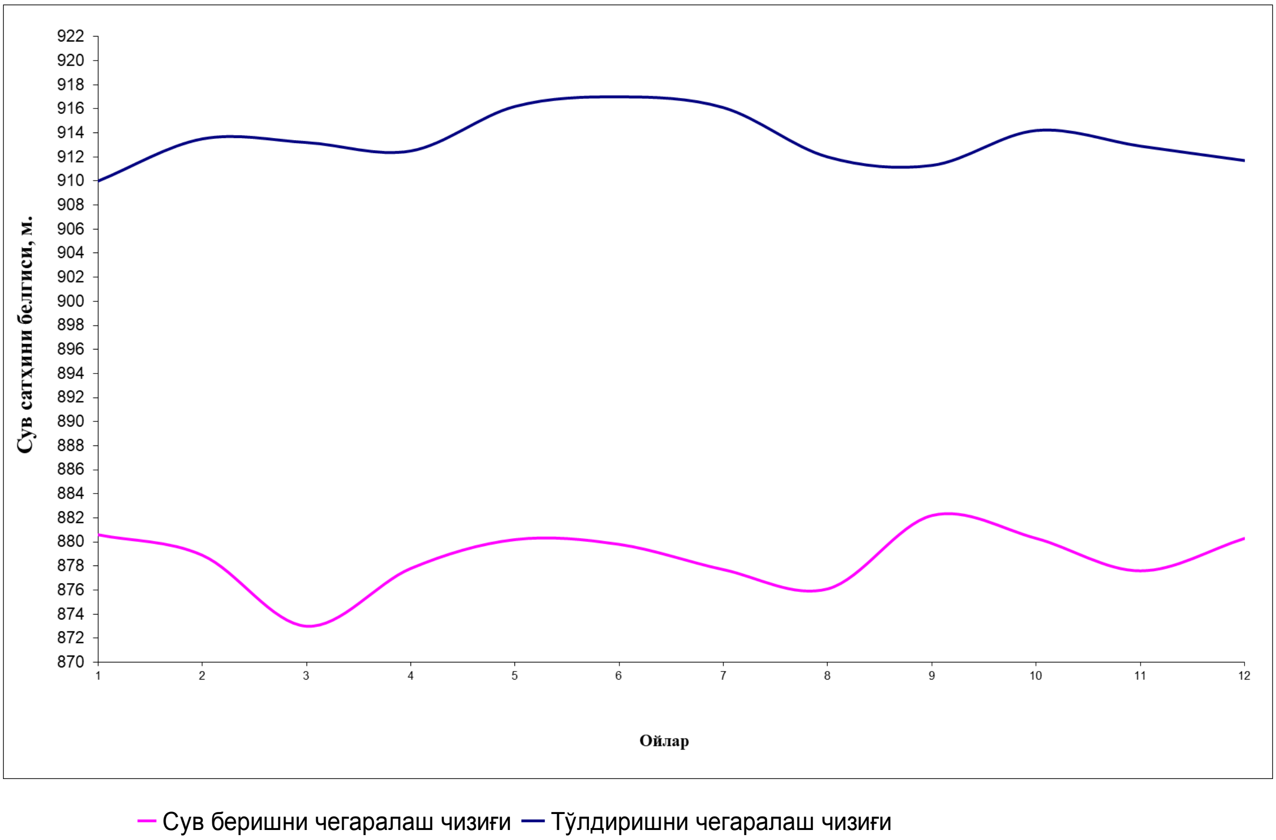

Figure 1. Zomin reservoir dispatch schedule.

At the beginning of the year, the use of a dispatching schedule, which takes into account all the changing conditions of the year, allows reliable water supply to all consumers.

In the years when water is scarce, it reduces the negative impact of limited water supply by redistributing water in such a way that the economic damage is the least.

In the years of high water, the dispatching schedule makes it possible to avoid accidents by excluding unnecessary water supply.

If the water reservoir is planned and operated on the basis of the above measures, malfunctions and accidents occurring in them will be prevented, the operation of the water reservoir will be further improved, and the water in the water reservoir will be used efficiently.

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