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***Research Article***

# ASSESSMENT OF THE IMPACT OF THE KARAMAN RESERVOIR ON THE HYDROGEOLOGICAL CONDITIONS OF THE ADJACENT TERRITORY BY THE METHOD OF MATHEMATICAL MODELING

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## ABSTRACT
There are many published works on the technogenic impact of lowland reservoirs on the state of groundwater in adjacent areas. Currently, many countries have organized instrumental and visual monitoring of the state of the territory of possible impact of reservoir dams, space monitoring is organized, which allows for early recording of changes in objects, their assessment, and the adoption of necessary preventive and prophylactic measures. In the article, we will consider the study of these issues using the method of mathematical modeling conducted on the area of the Karaman reservoir in the Zafarobad district of the Jizzakh region.

***Keywords:*** *Hydrodynamics, Reservoir, Modeling, Three-dimensional geofiltration mathematical model, Hydrochemistry, Groundwater balance.*

## INTRODUCTION
The impact of reservoirs is associated with a rise in the groundwater level as a result of backwater from them, which is accompanied by flooding and swamping of part of the territory, as well as a change in the quality of groundwater in the backwater zone (Abdullaev et al., 2021). This leads to a change in the hydrogeodynamic regime, a change in the resources and reserves of groundwater.
Currently, many countries have organized instrumental and visual monitoring of the state of the territory of possible impact of reservoir dams, as well as space monitoring, which allows for early recording of changes in objects, their assessments, and the adoption of necessary preventive and preventive measures.
We carried out a similar assessment using the method of mathematical modeling on the area of the Karaman reservoir in the Zafarabad district of the Jizzakh region.
The surface of the study area is a gently undulating plain, hilly in places, with a general slope from the southeast to the north and northwest. In some places the flat surface is broken by dumps of the irrigation and collector network, small ravines.
The climate of the region is arid, very continental, desert-steppe character, extremely dry.The amount of evaporation significantly exceeds the amount of precipitation. Average annual evaporation fluctuates within the range of 930-1760 mm. 161-541 mm falls annually in the form of rain and snow.
The relief of the region is of the erosion-accumulative type. Within the uplands, the structural-denudation genetic type is developed, in the intermountain depression, which is a slightly hilly alluvial-proluvial plain, this is the accumulative type of relief

## MATERIALS AND METHODS
Mathematical modeling using the MODFLOW program to assess the impact of the reservoir on the hydrogeological conditions of the adjacent territory was performed for 2 different scenarios. In this case, the model reproduced the natural hydrogeological conditions and the main elements of the reservoir under construction. Boundary conditions were set in the plan, three aquifers with a maximum capacity of 40

meters in the section were identified, differing in lithological composition and filtration characteristics (Fig.1).

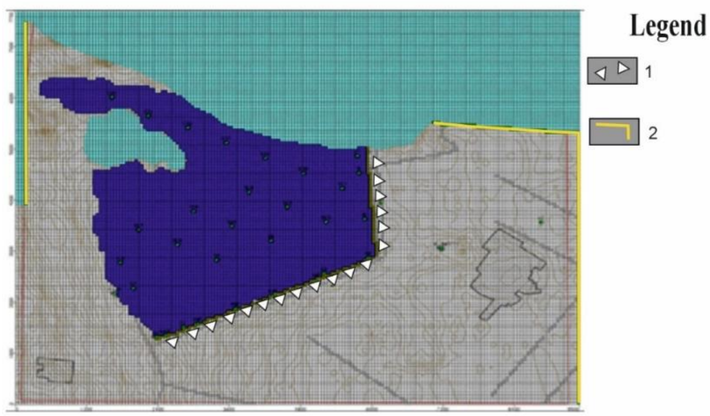
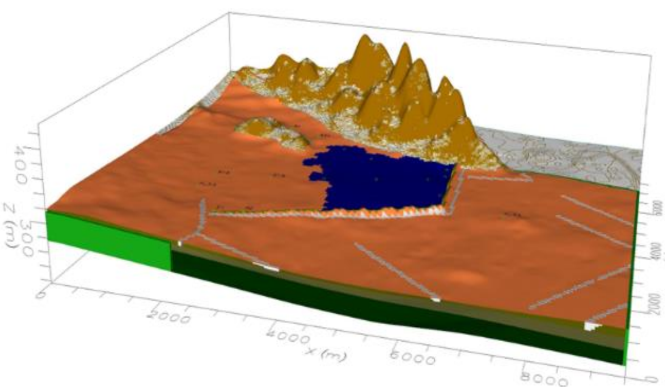



**Figure 1. Breakdown and boundary conditions of the modeling area:**
**1 – first type, 2 – third type.**

**Scenario 1.** The reservoir is filled with water for irrigation of 17 thousand hectares of land, taking into account the seasonal change in its area. In the model, filtration problems were solved for a period of five years. In this case, the reservoir is filled from the absolute water level mark of 290 m (September, minimum level) to 299 m (April, maximum level) in the context of the year (Fig. 3-5).

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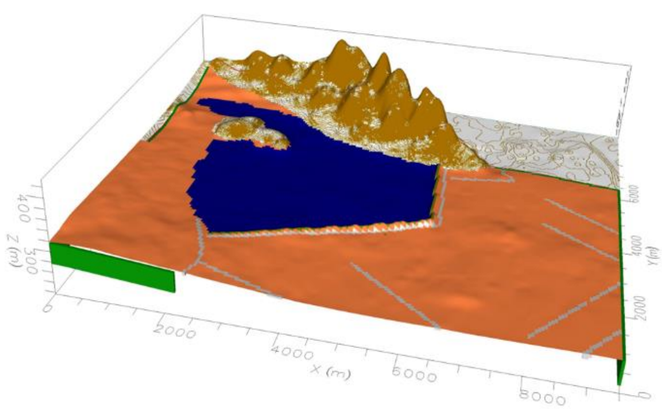
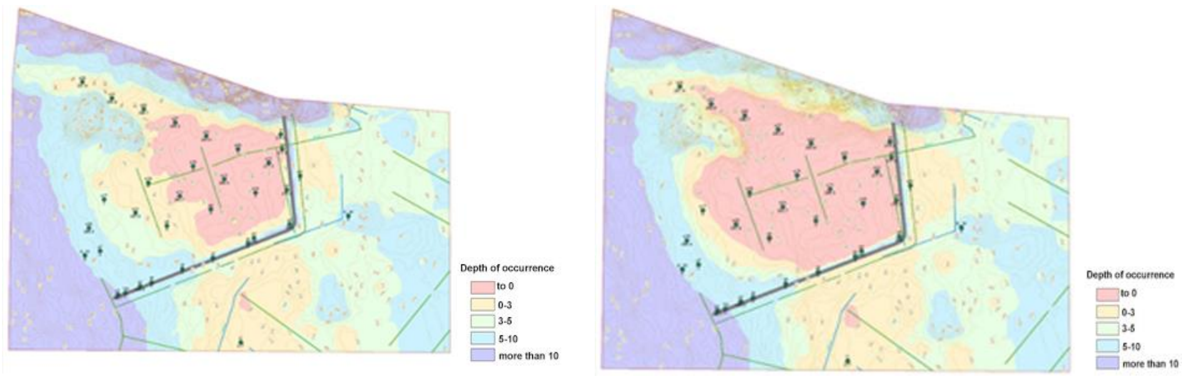



**b**

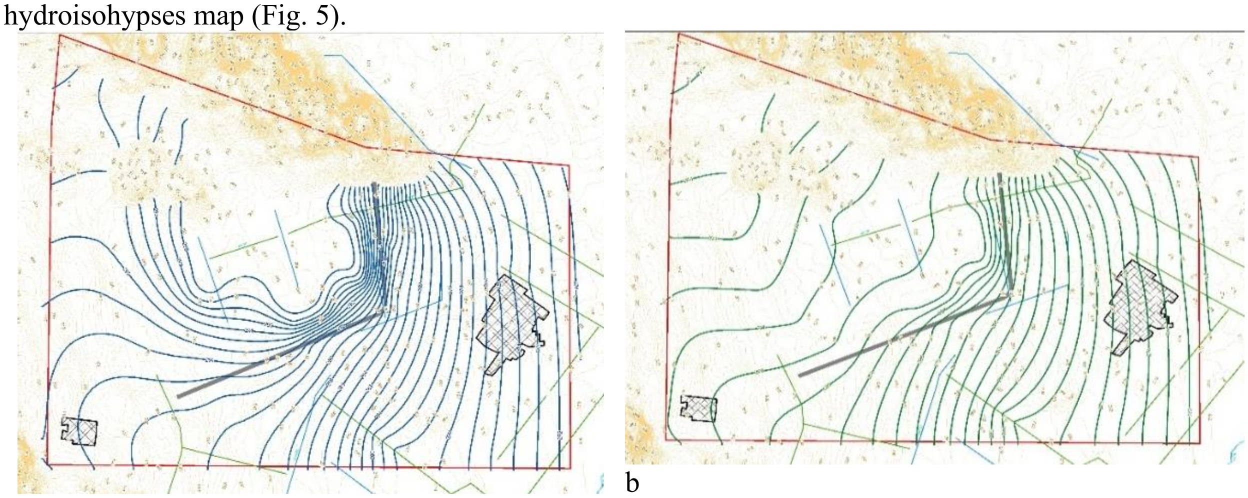
**Figure 3. The area of the reservoir depending on the water level: a – minimum (September, 290 m), b – maximum (April, 299 m).**




a b

**Figure 4. Map of groundwater depths depending on the water level in the reservoir: a – minimum (September, 290 m), b – maximum (April, 299 m).**

Based on the modeling results, the following were obtained: distribution of groundwater levels across the study area, graphs of changes in the level in observation wells, and income and expenditure balance items. As can be seen from the presented materials, after filling the reservoir, the direction of the groundwater flow is disrupted as a result of infiltration and the backwater process, which is confirmed by the hydroisohypses map (Fig. 5).



b

a

**Figure 5. Hydroisohypses in the exploitation area of the Karaman reservoir. Position of the water level in the reservoir: a – maximum (April, 299 m), b – minimum (September, 290 m).**

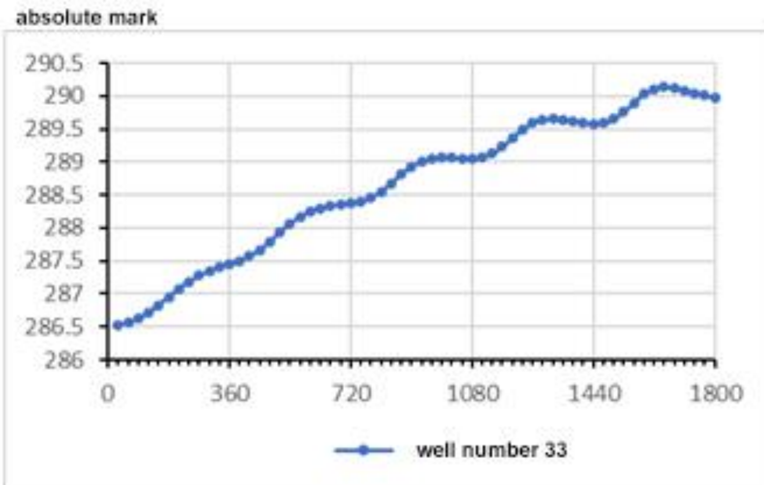
To study the process of reducing filtration losses, the construction project provided for laying geotextiles 300 m wide and 6 km long in the front part of the dam.
In addition, to fully account for the balance of groundwater, we took into account evaporation from the surface. The evaporation value, based on work experience, is taken to be 0.002-0.004 m / day.

**Scenario 2.** In this case, all the parameters of Scenario 1 are preserved; on the model along the dam, that is, on the area with geotextile, a section with a filtration coefficient of Kf=0.01 m/day was specified.
Based on the modeling results, the values of the balance sheet receipt and expenditure items were obtained, as well as graphs of the level change at observation points.

Analysis of the balance structure in different variants shows that with the installation of geotextiles, filtration losses are reduced from 0.262 to 0.210 m3/s, i.e. by 20%.

The influence of the reservoir is also reflected in the hydrodynamic regime of groundwater.

Almost after filling the reservoir, after 3-4 months, the groundwater level begins to rise, and depending on the location of the well, the drainage of part of the reservoir as a result of operation and the initial level, the rise is from 5-7 to 8-10 m. It is important to note that in wells located before the water line in the reservoir, a gradual rise in level is observed, in wells k33 and s1 the level increases by 5-6 m and stabilizes 5 years after the start of operation (Fig. 6).

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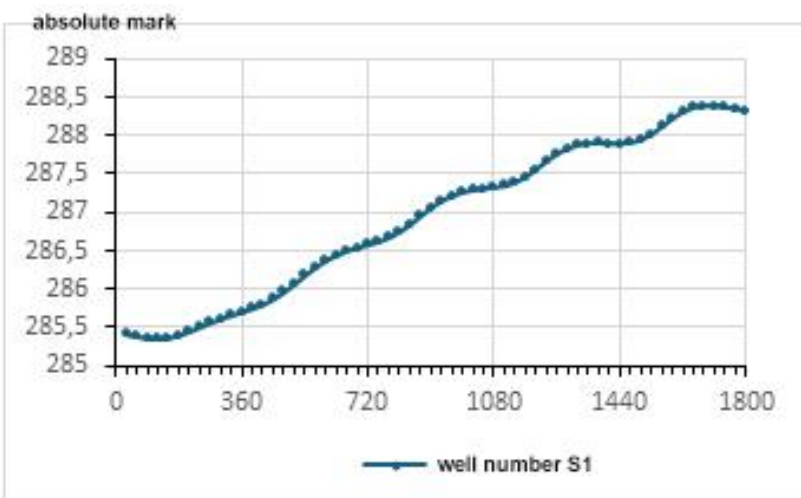


**b**

**Figure 6. Hydrodynamic regime of groundwater in the eastern boundary of the reservoir: a – well No. 33, b – well No. S1**

Another situation with the hydrodynamic regime is observed in the wells located below the reservoir dam. In this case, the groundwater regime in wells s11, k34 is completely determined by the reservoir operating regime (Fig. 7).

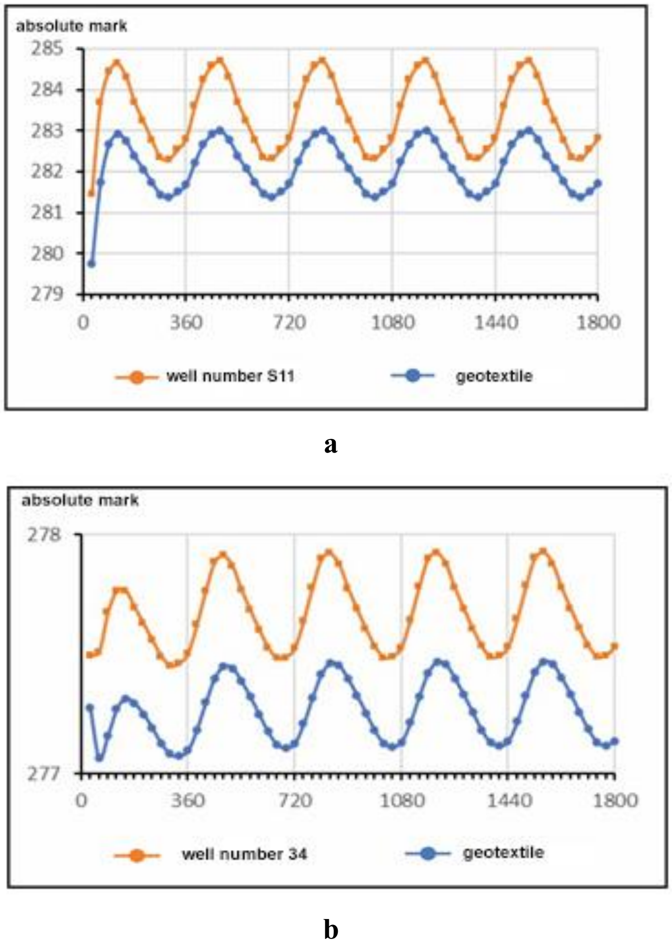


**Figure 7. Hydrodynamic regime of groundwater west of the dam.**
**a – well No. S11, b – well No. 34**

As can be seen from the graphs, as the distance from the object increases, the fluctuations in the groundwater level during the year stabilize and after 2-3 years become stationary. The amplitude of the fluctuation in the level over the year is 2-3 m, depending on the operation of the reservoir

**CONCLUSION**

1. A filtration model based on the MODFLOW program has been created, allowing to assess the interaction of the reservoir and groundwater aquifers.
2. In the zone of influence of the Karaman reservoir, after its filling for 6 months, a backed filtration regime is observed, after which a free filtration regime occurs, and filtration losses change from 0.262 to 0.210 m3/s.
3. The creation of a 300-meter anti-filtration barrier made of geotextiles in the dam zone leads to a decrease in filtration in this area, and the amount of filtration losses decreases by 20%.
4. Below the dam, at a distance of 1.5 km, the level rises by 2 m and after five years of reservoir operation, the hydrogeodynamic regime of groundwater becomes stationary.

## REFERENCES

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