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ABOUT THE ONE PROBLEM OF INCREASING EFFICIENCY USE OF WATER RESOURCES IN ARMENIA

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Abstract.

The growing demand for fresh water and the continued reduction of water resources are creating new and serious problems around the world, which also entails various manifestations of the destructive effects of water. The territory of Armenia was constantly exposed to various types of natural disasters. flood, earthquake, hail, drought, landslides, strong winds, etc., which cause significant damage Water has already become an important geopolitical factor determining the development opportunities of individual countries. In this regard, a discussion is needed to assess the structure of water resources use in Armenia and develop mechanisms aimed at conserving water resources.

Keywords: surface and fluorinated groundwater, water intake, aquatic ecosystem, drought, pumping station.

Introduction

The main causes of natural disasters in the republic are:

- anthropogenic impact on the environment,
- insufficient forecasting system, development and use of simulation models, mechanisms for preventing the consequences of natural disasters, etc.

The proportions of areas affected by various types of natural disasters (percentage of the total area of the country) are shown below [1]:

- areas of active collapse – 1.16%,
- areas of inactive collapses – 1.015%,
- areas where there is shedding (collapse) stones – 0.5%,
- areas of increased risk of torrent streaming – 0.17%,
- areas with low torrent risk – 20-30%,
- arable lands subject to drought – 15%,
- arable land subject to hail – 15-17%,
- areas with high humidity / super moist soils – 20%,

- soils subject to erosion – 50%.

The development and implementation of a plan for the prevention and mitigation of natural disasters related to water exposure is a complex process that largely depends on the technical capabilities of the country. The experience of using water systems shows that in order to meet the requirements of environmental protection, it is necessary to eliminate or minimize the negative factors associated with their construction and operation.

During the design process, the location of the hydroelectric plant, the operating scheme and the main parameters (channel area, normal bottom surface mark, dead tank volume, hydroelectric power plant capacity, operating mode, etc.) are determined. A set of environmental protection, protective, rehabilitation and compensatory measures provided for in the lower reaches as a result of the reservoir's impact on the environment is being developed. Measures should provide for a mechanism to compensate for damage caused to any element of the biosphere that has been adversely affected, which will preserve the ecological balance. They are fixed [2]:

- to preparation of the reservoir basin and security (including sanitary) and water supply zones,
- for engineering conservation of structures,
- to prevention of pool pollution,
- to prevention of possible damages related to the construction of the waterworks,
- to conservation and enrichment of the species diversity of aquatic and terrestrial biocenoses of ecosystems, to ensure regulatory requirements for water quality characteristics, ecotoxicological and radioecological standards, to create the necessary conditions for the rational use and conservation of water and biological resources,
- to prevention of possible accidents,
- for the ensuring favorable socio-economic conditions for the population.

It is necessary to constantly monitor the environment during the operation of the hydroelectric power plant.

About 75% of the territory of Armenia is located at an altitude of 1,500 m or more. 60 percent of districts receive up to 600 mm of precipitation per year, and 20 percent receive up to 400 mm of precipitation per year [3]. Effective water resources management plays a key role in Armenia's socio-economic development. Until the 21st century, Armenia was considered to have sufficient water resources of about 3,100 m^3 per capita per year, which significantly exceeds the “Falkenmark” water stress index of 1,700 m^3 per year. Water scarcity is measured as the amount of renewable water available per person per year, as follows: when the amount of renewable fresh water in a country is less than 1,700 cubic meters per person per year, the region is considered to be experiencing water scarcity; when this indicator falls below 1,000 m^3, the region is considered to be experiencing average water scarcity; and when the amount of renewable water it drops to less than 500 m^3 per person per year, the region is considered to be experiencing an absolute water shortage [4].

The Falkenmark water stress indicator method for Armenia, as for other countries of the South Caucasus, should be applied with a number of reservations, since it does not take into account the huge differences in water availability in different regions of the country and their seasonal fluctuations.

The criticality coefficient, also known as the fence-to-accessibility ratio, offers an alternative approach. Instead of working on the assumption that countries use the same amount of water per person, this method determines water scarcity according to the region's demand compared to the water supply. It measures water scarcity as a proportion of the total volume of water withdrawn annually, relative to the total volume of available water.

According to this method, a region is considered water-scarce when the annual intake is from 20% to 40% of the available supply, and severely water-scarce when the intake exceeds 40% of the available water resources. Although this method takes into account regional differences in supply and demand, it also has limitations. It does not take into account human contributions to the water supply, such as desalination or recycling and reuse of water. It also does not take into account human efforts to reduce consumption, for example, through behavioral change or water-saving technologies [4].

Analyzing the quantitative indicators of water resources in Armenia, we see that in 2012-2023, the Falkenmark water stress index turned out to be lower than the average annual values (7 billion 769 million m^3) [5, 6].

Conflict setting

The task is to analyze the structure of water use in Armenia and present proposals for improving the efficiency of water resources use.

Research Results

The most serious reason for concern is the share of underground sources in the total volume of water intake. Over the years to 2021, it has increased significantly, and since then, despite the restrictions imposed in the fishing industry and the intensive process of eliminating deep wells, it has hardly decreased (Fig.1), although the Armenian government has decided that fish farmers should work in a closed water cycle.

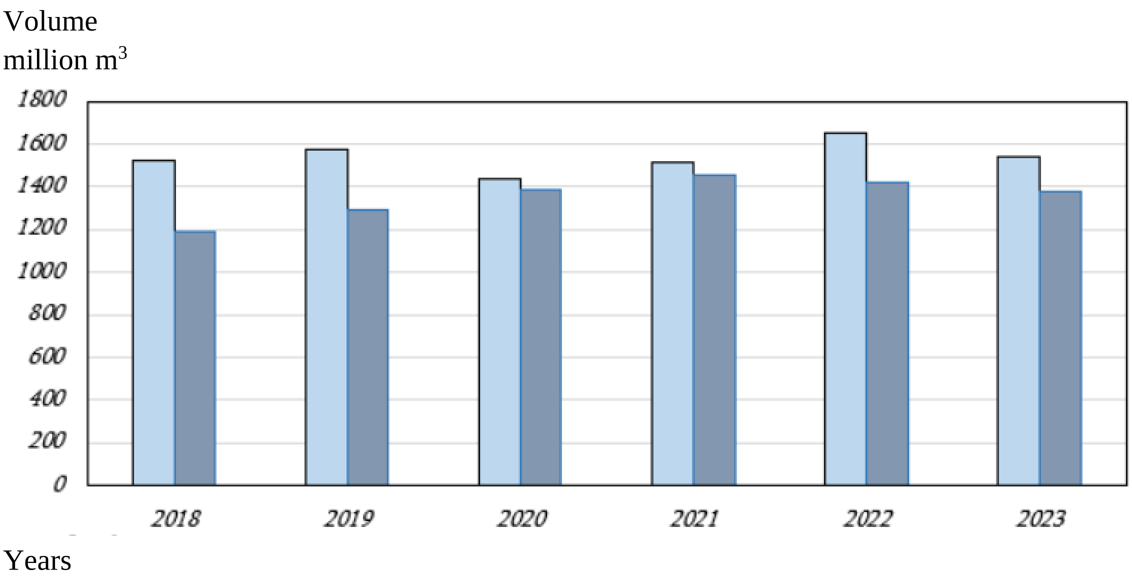

Fig. 1 Water intake in Armenia in 2018-2023 (million m^3)
(Left: surface water intake, right: underground water intake) [7].

This means that water taken from a natural source will not drain back into nature after being fed to a fish hatchery, but will remain and be reused after passing through filters.

It is worth noting that the use of this technology is quite expensive for entrepreneurs. And some complain that it is not available to them, and the price of fish produced may increase 2-3 times [8]. It should definitely be noted that in this case, the increase in fish prices is an insignificant factor and cannot be discussed in the context of waste of water resources.

As shown in Fig. 2, Armenia's groundwater is mainly used for the fishing industry. In particular, in 2022, about 680 million m^3 of groundwater was used for fishing purposes, which, mainly after a single use, were discharged into a transboundary river and left the republic.

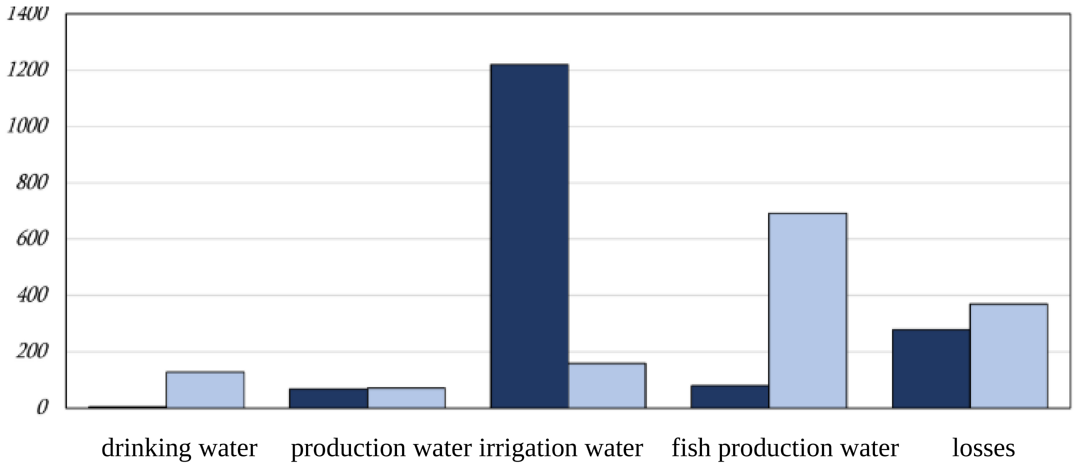

Fig. 2 Water use in Armenia in 2022 (million m^3)
(To the left of the surface water, to the right of the groundwater).

Please note that in 2021, about 630 million m^3 of groundwater was used for fishing purposes (Fig. 3). That is, despite the fact that in the context of the implementation of the policy of limiting groundwater abstraction in the republic, this indicator has increased significantly instead of decreasing - by 8%.

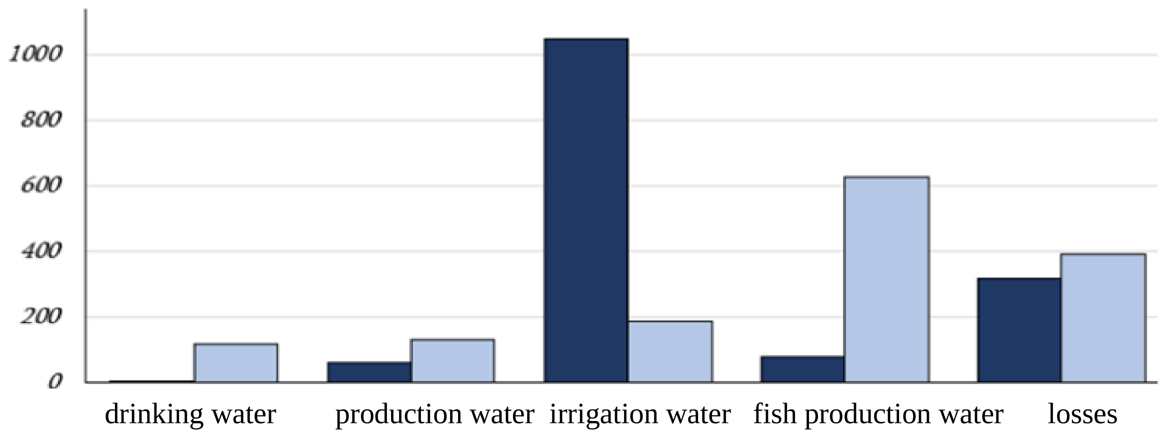

Fig. 3 Water use in Armenia in 2021 (million m^3)
(To the left of the surface water, to the right of the groundwater)

About 16-17 thousand tons of fish are produced annually in Armenia, most of which - 14 thousand tons -are produced in the Ararat Valley. According to hydrologist B. Zakaryan, fish farms cause great damage to the underground basin of Ararat. The economic benefits they bring to the state are much less than the damage they cause to Armenia's water resources. The fish farmings are private and fish mainly is shipped abroad. Private companies receive income, and damage is done to the national water resources of the Republic of Armenia. According to B. Zakaryan, the transition of fish farms to a closed cycle will not fundamentally solve the problem of irrational use of water, since this technology will reduce water consumption by 40% [8].

Thus, it becomes obvious that this problem is not solved by administrative methods. As an alternative, we propose to apply mechanisms for the repeated use of groundwater for the extraction of groundwater for the purposes of the fishing industry, after which, using pumping stations, they are sent to nearby reservoirs for irrigation. In particular, water from fishing basins located on the Ararat plain can be directed to the Azat reservoirs and the newly built Vedi.

Conclusion

1. Despite the fact that water resources management, especially in agriculture, is still subject to various inefficiencies (this includes the widespread use of irrigation systems with high-lift pumps built during the Soviet era, but now unprofitable due to high energy costs) with a steady decline in renewable water resources and due the complex mountainous relief of the country, it is not possible to abandon the mechanical supply of water.
2. Proposes to apply multiple water use mechanisms to underground water intakes for the purposes of the fishing industry, and then send them through pumping stations to nearby reservoirs for irrigation.

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ՀԱՅԱՍՏԱՆՈՒՄ ՋՐԱՅԻՆ ՌԵՍՈՒՐՍՆԵՐԻ ՕԳՏԱԳՈՐԾՄԱՆ ԱՐԴՅՈՒՆԱՎԵՏՈՒԹՅԱՆ ԲԱՐՁՐԱՑՄԱՆՆ ՈՒՂՂՎԱԾ ՄԻ ԽՆԴՐԻ ՄԱՍԻՆ

Դ.Վ. Մադոյան
Ակադեմիկոս Ի.Վ. Եղիազարովի անվան ջրային հիմնահարցերի և հիդրոտեխնիկայի ինստիտուտ

Քաղցրահամ ջրի աճող պահանջարկը և ջրային ռեսուրսների շարունակական նվազումը, նոր խնդիրներ է ստեղծում ամբողջ աշխարհում, իր հետ բերելով նաև ջրի կործանարար ազդեցության բազմապիսի դրսևորումներ: Ջուրն արդեն դարձել է առանձին երկրների զարգացման հնարավորությունները պայմանավորող կարևոր աշխարհաքաղաքական գործոն:

Հայաստանի տարածքը մշտապես ենթարկվել է տարբեր տեսակի բնական աղետների. սելավ, հեղեղ, երկրաշարժ, կարկտախառն անձրև, երաշտ, փլուզումներ, ուժգին քամիներ և այլն, որոնք հանգեցնում են զգալի վնասների: Այս առումով քննարկման անհրաժեշտություն է առաջացել գնահատելու Հայաստանում ջրօգտագործման կառուցվածքը և մեխանիզմներ մշակել ուղղված ջրային ռեսուրսների պահպանմանը:

Բանալի բառեր: մակերևութային և ստորերկրյա ջրեր, ջրառ, ջրաէկոհամակարգ, երաշտ, պոմպակայան:

ОБ ОДНОЙ ПРОБЛЕМЕ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ВОДНЫХ РЕСУРСОВ АРМЕНИИ

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Растущий спрос на пресную воду и продолжающееся сокращение водных ресурсов создают новые и серьезные проблемы во всем мире, что также влечет за собой различные проявления разрушительного воздействия воды. Вода уже стала важным геополитическим фактором, определяющим возможности развития отдельных стран.

Территория Армении постоянно подвергалась различным видам стихийных бедствий, наводнениям, землетрясениям, граду с дождем, засухе, обрушениям, сильным ветрам и т. д., которые приводят к значительному ущербу. В связи с этим возникла необходимость обсуждения структуры водопользования в Армении и разработки механизмов, направленных на сохранение водных ресурсов.

Ключевые слова: поверхностные и грунтовые воды, водозабор, водноэкосистема, засуха, насосная станция.

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