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Research Article

GROUNDWATER REGIME IRRIGATION WORK EFFECT (IN THE EXAMPLE OF THE KARSHI DESERT)

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ABSTRACT
This article discusses the extent to which irrigation works affect the regime and condition of groundwater. Groundwater is formed from atmospheric precipitation, surface water systems, and groundwater infiltration from irrigation works. Groundwater in desert areas is formed mainly at the expense of water used for irrigation of gray lands developed in agriculture. New lands have been developed and irrigated in the Karshi desert for almost 50 years. Today, the study and assessment of the hydrogeological and reclamation status of the region is one of the important tasks of specialists in the field.

Keywords: *Groundwater, Infiltration, Salinization, Filtration, Mineralization, Water Level, Drainage, Collector, Evaporation, The Soil*

INTRODUCTION

The purpose of studying the groundwater regime in irrigated areas is to control the reclamation of the area, to develop measures to prevent swamping and secondary salinization, and to scientifically substantiate projects for irrigation of newly developed gray lands. The regime of groundwater is carried out by regular monitoring of changes in their level, flow rate, chemical composition and temperature, as well as a comprehensive analysis of their results, taking into account the natural and aquatic conditions (Okhunov and Miryusupov, 2020). Predicting groundwater regime in relation to irrigation is a complex task of assessing changes in level, flow rate, and chemical composition over time under the influence of natural and aquatic factors. Taking into account the dynamics of surface and groundwater and the salts dissolved in them and the interaction of this process with the salt complex of soils, it is possible to predict the regime of groundwater. Along with the practical significance of this task, its scientific significance should also be emphasized, as it is the most important part of groundwater formation (Lebedev, 1957).
The conditions of groundwater formation are influenced by factors that determine the direction of hydrogeological processes (geological structure, relief, climate, hydrographic networks) and active human activities (irrigation) and partially alter the distribution of surface water flow.

MATERIALS AND METHODS

The Karshi desert is one of the fastest growing regions in the country for many years. Specialists of the Institute of Hydrogeology and Engineering Geology and the regional hydrogeological station have conducted extensive research to monitor the hydrogeological and reclamation geological conditions of the region, to develop proposals for the protection and elimination of various negative hydrogeological and reclamation processes. First of all, the perennial data collected as a result of previous research were studied and analyzed. The main goal is to study the hydrogeological conditions of the region, including the current state of groundwater, using modern computer programs and retrospective methods, and to create an optimal monitoring system using high technology.

RESULTS AND DISCUSSION

In the Karshi desert, unfavorable conditions for the accumulation of groundwater have been created due to low rainfall, high evaporation and limited surface water resources. The formation and saturation of

groundwater in the territory of the modern Kashkadarya Valley and, in part, in the proluvial plain of the left bank, depends on the water that seeps through the well-permeable rocks. In the absence of hydrographic networks and irrigation canals, groundwater is formed mainly from mountain and foothill groundwater flows and the absorption of less atmospheric precipitation.

The area is hydrogeologically and structurally located in the Kashkadarya artesian basin. The basin is divided into two secondary basins, Kitab-Shahrisabz and Karshi. Groundwater in the region is divided into groundwater and interlayer water according to the conditions of formation and consumption in the Quaternary and Upper Neogene deposits. The salinity of groundwater varies greatly from 0,5 to 30 g/l and reaches 50,78 g/l in the area of saline lowlands. According to the mineralization of groundwater, it consists mainly of sulfate, sulfate-chloride and chloride. Interbedded (pressurized) waters are bounded by layers of sandstones, siltstones and clays belonging to the Upper Neogene period at a depth of 50-330 meters. Paleogene clay deposits serve as a regional water barrier. The degree of mineralization of interlayer waters varies from 1-3 g/l to 10-15 g/l, and the nature of mineralization varies from sodium sulfate to sodium chloride.

The study area is located in the central and south-eastern part of the Karshi Desert, including the left bank of the Kashkadarya River, and includes the Karshi, Nishan, Kasbi, Mirishkor and Mubarek districts of Kashkadarya region.

The lands of this region are irrigated mainly by fresh surface water of the Talimarjan reservoir. The area is bordered on the south and southeast by the Olovuddintov, Dultalitov, Karakir and Saxon anticline climbing groups, on the south by irrigated areas and on the north by the Kashkadarya River. Development of the gray lands of the Karshi desert began in 1970. Prior to that, the groundwater level in the area was 10-30 meters. After the start of irrigation, the groundwater level began to rise sharply. This in turn has led to a deterioration in the reclamation status of lands.

Over the past 50 years, the water management conditions in the region have changed significantly, the area of irrigated lands has expanded (i.e. from the initial period of irrigation to 50 thousand to 250 thousand hectares) and the amount of water allocated to them has increased from 400 to 2100 million m3. The development of non-irrigated areas in Nishan, Mirishkor and Mubarek districts has led to further expansion of such areas. As a result of the expansion of irrigated areas, the groundwater level has risen steadily to a sharp level (3 meters). This, in turn, necessitated the rapid construction of a collector-drainage system in the area. According to the data known to us from 1990 to 2009, the amount of collector-drainage water is closely related to the amount of water used for general irrigation (Figure 1).

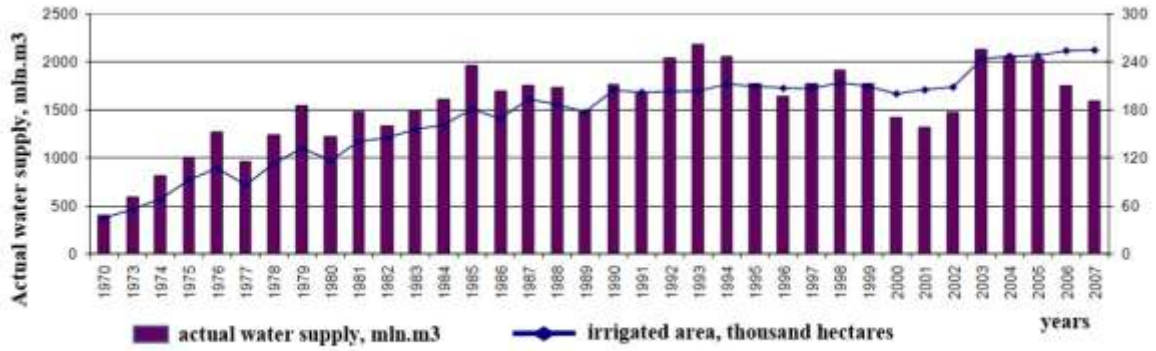


Figure 1. Actual water supply and irrigated area by districts of Kashkadarya region

During the same period (1990-2009) the leaching of salt from the groundwater was observed in all parts of the region due to the implementation of water-salt balance, efficient operation of drainage systems and fresh water from the Talimarjan reservoir used for irrigation (Figure 2).

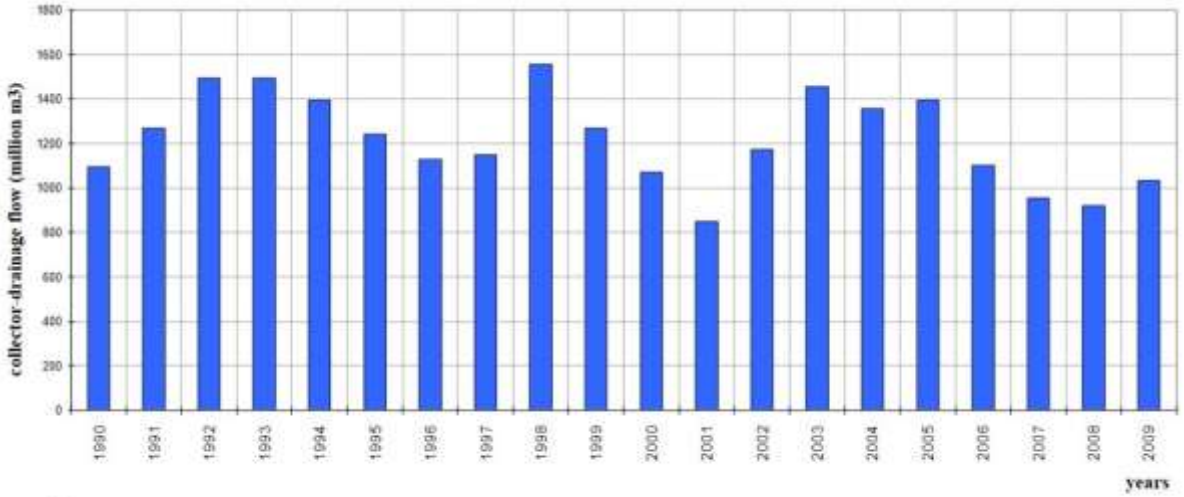


Figure 2. Collector-drainage flow (million m3) in the districts of the Kashkadarya region for 1990-2009.

The maximum level of leaching of salts from the underground layers of irrigated areas was up to 2009 and reached 6,000 thousand tons, after which a decrease was observed. Over the last 4 years, the leaching of salts has decreased to 1,000,000 tons, while the mineralization of drainage and groundwater has declined (Figure 3).

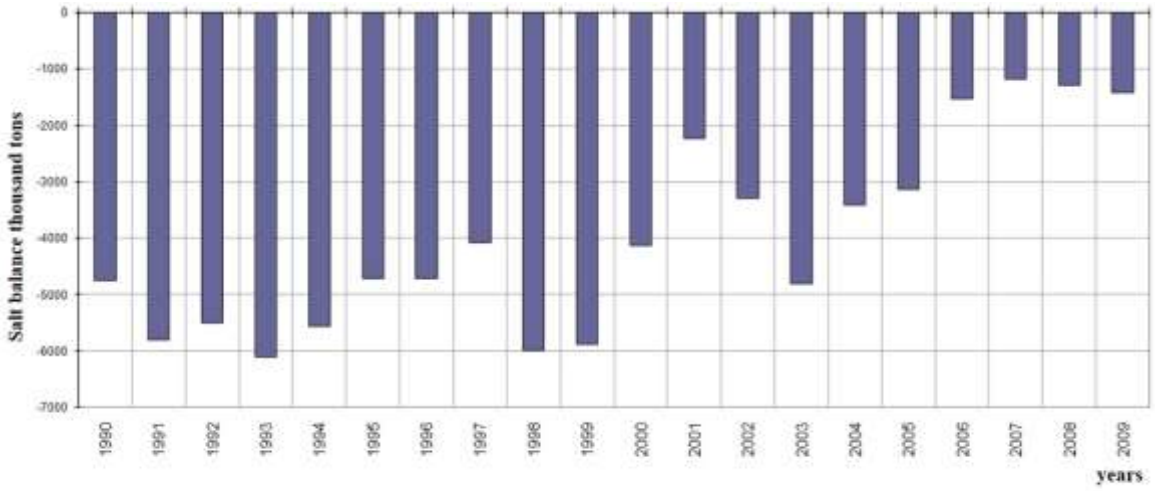
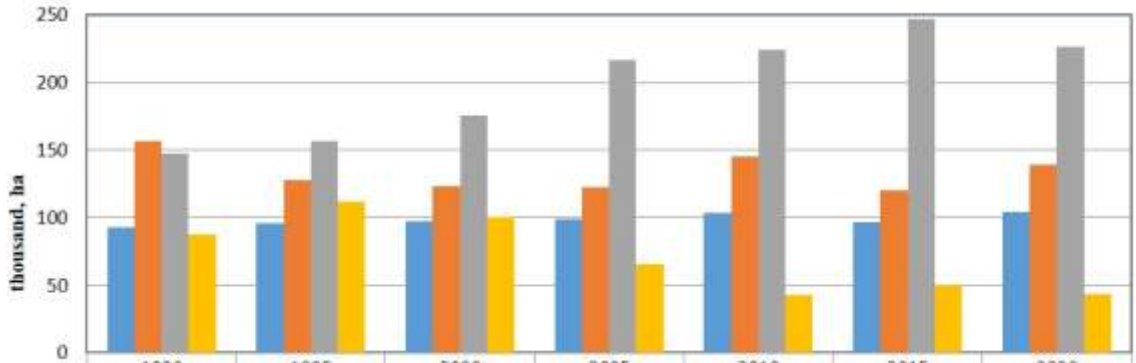


Figure 3. Water-salt balance in the districts of the Kashkadarya region for 1990-2009.

Analysis of data collected and processed on the results of previous and current research, as well as data on the depth and salinity of irrigated lands in Kashkadarya region in 1990-2020, shows that the process of salt leaching continues in the region (Figure 4).



	1990	1995	2000	2005	2010	2015	2020
0-1 g/l	92,95	95,7	97,52	99,25	103,32	96,78	104,22
1-3 g/l	157,1	127,54	123,68	122,83	145,16	120,47	139,52
3-5 g/l	147,84	156,43	175,65	216,83	224,34	247,51	226,31
> 5 g/l	87,91	111,77	100,87	65,81	43,02	50,68	43,92

Figure 4. Diagram of salinity of irrigated lands of Kashkadarya region for 2010-2020, thousand ha

In the Karshi desert region, we can observe that irrigation works have been carried out intensively for almost half a century, the groundwater level has risen, resulting in the formation of a hydrodynamic barrier blocking the flow of saline groundwater entering the area from the side. The construction of reservoirs, canals and collectors, open and closed drainage systems and their efficient operation, improved land reclamation, increased the artificial fertility of irrigated soils. These processes significantly contribute to the improvement of hydrogeological and reclamation conditions of the region, as well as the state of groundwater.

At the same time, we can observe an increase in the mineralization of groundwater in the lower reaches and the middle reaches of the Kashkadarya River as a result of water discharged from the desert using leachate and collector-drainage systems. Specialists of relevant ministries and agencies should develop the necessary measures to prevent this situation.

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