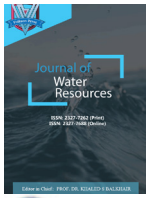
Journal of Water Resources (JWR)

DOI: *http://doi.org/10.7508/jwr.01.2020.06.08*

ISSN: 2327-7262 (Print)
ISSN: 2327-7688 (Online)
CODEN : JWROB9



ARTICLE

DISCUSSION ON THE GUARANTEE OF GROUNDWATER RESOURCES FOR SUSTAINABLE ECONOMIC AND SOCIAL DEVELOPMENT OF BAICHENG CITY

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ARTICLE DETAILS

Article History:

Received 30 April 2020
Accepted 18 July 2020
Available online 26 July 2020

ABSTRACT

Groundwater is not only an indispensable water resource, but also an important ecological and environmental supporting element. The protection and rational development and utilization of groundwater resources are the basic guarantee conditions for sustainable economic and social development. At present, the situation of groundwater resources in our city is very serious: the over-exploitation of groundwater in some areas is serious, causing the groundwater level to continue to decline; the continuous drought has caused groundwater to not be effectively replenished, which has become an important reason for the deterioration of the ecological environment; groundwater pollution is becoming more and more serious, endangering the water supply safety etc. Aiming at the characteristics, situation and problems existing in the development and utilization of groundwater resources in our city, this paper proposes a strategy for groundwater resources in the new period, that is, to focus on quantitative investigation and evaluation, to pay equal attention to both quantitative and quality investigation, evaluation and monitoring, and from redevelopment. The transition from light protection to equal emphasis on protection and development and utilization. Within this strategic framework, specific countermeasures are proposed.

KEYWORDS

Groundwater resources, sustainable development, strategic countermeasures

1. THE IMPORTANT ROLE OF GROUNDWATER IN THE COMPREHENSIVE, COORDINATED AND SUSTAINABLE DEVELOPMENT OF OUR CITY'S ECONOMY AND SOCIETY IS MAINLY REFLECTED IN THREE ASPECTS

Groundwater is an important part of water resources, and it plays an indispensable role in ensuring residents' domestic water use, economic and social development, and ecological environment balance, especially in semi-arid areas like our city.

Resource support: From 2000 to 2004, the total water supply in Baicheng City was about 1.5 billion m3 per year, and the groundwater supply was more than 1.25 billion m3, accounting for more than 85% of the total water supply [1]. These figures illustrate the importance of groundwater in the city's water supply, but the significance of its resource support is not limited to these figures [2].

The resource attributes of surface water and groundwater complement each other. The time distribution of precipitation in our city is seriously uneven. Within a year, the four consecutive months of precipitation in most areas accounted for 70% to 90% of the annual precipitation. That is to say, most of the surface water resources in our city are river floods and passenger water runoff, and there are often consecutive dry years. Coupled with the lack of water conservancy projects, surface water has not been developed and utilized in large quantities [2-4]. The characteristics of groundwater with wide distribution, large storage capacity, strong regulation and storage capacity, and high water supply guarantee just make up for the limited distribution of surface water and large dynamic changes, and become an indispensable and important water supply source for our city. The river base flow formed by the discharge of groundwater into the river course is the fundamental guarantee for the continuous flow of many rivers [5]. Due to the large-scale exploitation of groundwater in the areas along the river, the underground recharge source of the river is determined, which is one of the reasons for the river to stop flowing.

Groundwater is of good quality, generally rich in various trace elements and minerals needed by the human body, and can be directly consumed without any treatment. In developed countries, even if there is clean surface water, groundwater is the preferred source of drinking water. For example, in countries and regions such as the United States and Western Europe, the proportion of groundwater supply for domestic water is above 50%.

The development and utilization of groundwater is an inevitable choice when surface water is insufficient. During the continuous drought from 1999 to 2004, the Taoer River, Jiaoliu River and Huolin River were cut off one after another, and groundwater became the only choice for water supply.

Ecological support: In semi-arid areas like our city, groundwater is the basic support for wetland ecology such as natural lakes and swamps, and groundwater and water in these natural wetlands can be transformed into each other.

Environmental support: Groundwater is not only an important resource,

but also an important environmental factor. Once groundwater is polluted, the damage to the environment and human health is long-term and difficult to eliminate. Surface water pollution control is already quite difficult. Compared with surface water pollution control, groundwater pollution control is even more difficult, expensive, and even impossible to cure. Most of our city is a plain area, and the crustal surface is mostly the Quaternary large-thickness loose strata. The key to the reason why they can provide a solid foundation for human habitation and various economic and social activities lies in the supporting role of groundwater. Once the groundwater support is lost, disasters such as land subsidence and ground fissures will follow.

Improper development and utilization of groundwater will cause various environmental problems and geological disasters, hindering the comprehensive, coordinated and sustainable development of the economy and society.

2. MAIN PROBLEMS FACED BY GROUNDWATER RESOURCES

The plain area of our city is roughly equivalent to the central and southern part of the Songnen sedimentary basin that has developed in succession since the Neogene, and it forms a water storage structural basin opening to the east with Changling, Qian'an and Qianguo in Songyuan City. Most of the impermeable floor of the basin is Cretaceous mud shale. The weakly cemented sandstone and glutenite of the Upper Tertiary and the sand and gravel layers of the Quaternary are good aquifers, providing conditions for the collection and storage of groundwater. Groundwater resources are richer than surface water resources. The main source of groundwater recharge is atmospheric precipitation, and the main discharge methods are phreatic evaporation and artificial mining. The city's annual average precipitation is 398mm. 70% of them are concentrated in June, July and August. The average annual evaporation is 1839mm, and the evaporation is strong from April to May. Therefore, the problem of drought and water shortage is prominent, which is caused by natural conditions. Due to insufficient understanding of the relationship between surface water and groundwater and the supporting role of groundwater resources, ecology and environment, emphasis is placed on development over protection, resulting in a series of problems.

2.1 Serious Over-Exploitation of Groundwater in Some Areas

The current groundwater exploitation degree in our city reaches 81.9%, and the groundwater exploitation degree in the municipal government reaches 168.72%. Due to continuous large-scale exploitation, the shallow groundwater level in our city continues to drop. According to the analysis of monitoring data, from 1998 to 2003, the groundwater level in the Taoer River alluvial fan area dropped by 3-5m on average. At the same time, a large number of shallow wells that have been in use for decades have been scrapped. Excessive exploitation is the consumption of groundwater storage. Research data show that the groundwater storage consumed in the plain area is almost equal to the volume of land subsidence, that is to say, the consumption of groundwater storage is at the expense of land subsidence.

2.2 Random Exploitation of Deep Groundwater

The buried depth of deep groundwater in our city is generally more than 80m, which has the characteristics of good water quality and high water head. The upper part has a thick cohesive soil layer, which cannot be replenished by precipitation, and the lateral replenishment is also very small, and the water in this layer can hardly be replenished. Due to funding problems, a systematic evaluation of the groundwater in this layer has not been done so far. Deep groundwater is the only backup source of groundwater in our city. Agricultural and industrial water also uses deep groundwater, which will inevitably lead to the depletion of this layer of groundwater, and will also destroy the disease prevention and water improvement work implemented using this layer of water. Many villages have to return to drinking alkaline water and high fluoride The state of water, people's health is difficult to be guaranteed. Although many experts and leaders of water conservancy departments have strongly called for prohibiting the use of groundwater in this layer of agricultural and industrial water, the momentum of drilling deep wells has continued unabated. Some well-sinking construction units, in order to increase the water output of a single well, adopt the method of mixed exploitation of medium and deep groundwater and deep groundwater, which has caused deep groundwater pollution in local areas. If it is allowed to develop, the consequences will be disastrous.

2.3 Shallow Groundwater Pollution is Becoming More and More Serious

In recent years, with the development of industrial and agricultural production and urban (town) construction, the discharge of industrial wastewater and domestic sewage and the application of pesticides and fertilizers have increased year by year. Pollution has caused some shallow waters with poor water quality to further deteriorate. Some of the water quality was good in the past, and now the content of some ions exceeds the sanitary standards for drinking water.

2.4 Serious Deterioration of Ecological Environment

According to the survey, the wetland area of our city was 3986.03 km^2 in the early 1950s, and by 2000 the wetland area of our city was 1192.57 km^2. In the past 50 years, the wetland area of our city has decreased by 2793.45 km^2, with an average annual decrease of 55.87 km^2; In the 1950s, there were many ponds in our city, almost with water in the ponds and fish in the ponds. Now, except for 3 ponds with water, all the other ponds have dried up; from 1980 to 2000, the Tao'er River and the Huolin River were the largest ones. The flow lengths are 100 km and 210 km, accounting for 13.7% and 59.7% of the total length of the respective rivers, respectively. The cumulative occurrence times from 1980 to 2000 were 18 and 30, respectively, and the cumulative occurrence days from 1980 to 2000 were 1335 and 3391, respectively. Especially in recent years, Taoer River and Huolin River have been without continuous flow for more than 1,700 days. In the 1950s, the land desertification area in our city was 659.67km^2, of which the salinization area was 650.03km^2 and the desertification area was 9.64km^2. By 2000, the desertification area of our city reached 6984.78 km^2, of which the salinization area was 6940.22 km^2, the desertification area was 44.56 km^2, and the expansion rate of land desertification was 126.50 km^2/a, of which the salinization rate was 125.80 km^2 /a, the desertification speed is 0.62km^2/a.

3. STRATEGIC COUNTERMEASURES FOR GROUNDWATER RESOURCES

The sustainable utilization of water resources is the basic support condition for the comprehensive, coordinated and sustainable development of the economy and society. Establishing a scientific view of water resources, fully understanding the interdependence and complementary relationship between surface water and groundwater, coordinating the development and utilization of surface water and groundwater, coordinating the development of water resources and ecological and environmental protection, and coordinating the proportion of water use in the upper, middle and lower reaches are the basic strategic countermeasures to realize the rational development and utilization of water resources, alleviate the contradiction of water shortage in our country, and ensure the safety of water supply. Within the framework of the above-mentioned basic strategic countermeasures, the following countermeasures should be taken according to the characteristics of the city's groundwater resources, the situation it faces, and the problems existing in its development and utilization.

1) To formulate scientific and rational development and utilization planning

To achieve scientific and rational development and utilization of water resources, first formulate comprehensive water resources planning, clarify the initial water rights, and then optimize the water resources carrying capacity and water environment carrying capacity on the basis of careful analysis. Allocate water resources and formulate scientific and rational water resource development and utilization plans. Strictly follow the approved plans to develop and utilize water resources, take sustainable utilization of water resources as the goal, improve water use efficiency as the core, put water resources conservation, protection and allocation in a prominent position, and coordinate the use of water for life, production and ecology.

2) Prioritize the use of surface water resources

According to the actual situation of our city, we should increase the development of surface water resources. On the one hand, the existing reservoirs are expanded and reconstructed to increase the storage

capacity of surface water; On the other hand, the project of diverting Nen into Bai and Da'an Irrigation Area should be implemented as soon as possible to divert water from the Nen River to reduce the exploitation of groundwater.

3) According to the occurrence and distribution law of groundwater resources, implement regional groundwater resource development and protection: for areas with abundant shallow groundwater, groundwater should be actively exploited to prevent the occurrence of soil salinization; for areas with poor shallow groundwater, the exploitation and use of groundwater should be restricted, and the rainwater during the flood season should be fully intercepted to replenish the groundwater, and it can also be used for abundant dry use; since the deep groundwater has not been systematically evaluated, the storage, replenishment and discharge conditions of the deep water are still unclear. Industrial and agricultural production and exploitation should be prohibited to be reserved as a backup water source; the exploitation of groundwater in over-exploited areas should be strictly controlled to gradually achieve a balance between extraction and compensation and restore the water ecological environment.

4) Establish groundwater resource protection zone to effectively prevent groundwater pollution: The problem of groundwater pollution has also become a major problem affecting the water supply security of many cities and regions in our country. Due to the concealment of underground water-bearing media and the complexity of buried distribution, the treatment of groundwater pollution is much more difficult and costly than that of surface water, and some of them are even impossible to completely treat. To prevent and control groundwater pollution, we should adhere to the policy of "prevention first, combination of prevention and control, and emphasis on prevention over cure". The establishment of groundwater protection zone is an important measure to prevent groundwater pollution. According to the hydrogeological conditions and the layout of industrial and agricultural production, on the basis of identifying the groundwater quality and pollution status, scientifically divide the scope and protective layer of the groundwater protection zone, and take strict measures to ensure that the water quality within the groundwater source and recharge area is not contaminated.

5) Improve the groundwater environment monitoring network: Groundwater environment monitoring data is an important basis for groundwater resource evaluation, rational development, utilization and protection, groundwater pollution and geological disaster prevention and control. At present, the control level of the groundwater environment monitoring network in our city is very low, which is not suitable for the severe situation and existing problems of groundwater resources. It is necessary to gradually improve and establish a systematic groundwater environment monitoring network, basically control the areas with high degree of groundwater development and utilization and important ecological and environmental functions, and realize effective monitoring of groundwater excessive exploitation and pollution.

6) Establishment of groundwater artificial regulation and storage project: The Taoer River alluvial fan, distributed in the Taobei District of Baicheng City and the central part of Taonan City, is a natural underground reservoir with thick aquifers and good water permeability. At present, the water storage capacity of the reservoir is about 1.5 billion m^3, and the minimum water storage capacity is also about 350 million m^3. If the Taoer River flood can be diverted to the ground, the groundwater can be replenished in large quantities, the availability of groundwater resources can be increased, and the environmental geological problems caused by the decline of groundwater levels can be alleviated.

7) Strengthen the reserve of urban groundwater sources: Continuous droughts frequently occur in our city, and groundwater is the main source of urban emergency water supply. The exploration of urban backup groundwater sources should be strengthened to prepare for emergencies and realize the transition from disorderly emergency water supply to orderly emergency water supply.

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