



Development of Filters with Minimal Hydraulic Resistance for Underground Water Intakes

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Abstract

The development of modern structures of water wells filtering equipment with enhanced performance characteristics is a vital task. The purpose of this work was to create filters for taking water from underground sources that have high performance, long service life, quickly and economically replace or repair in case of performance loss. The selection of the filter device must be made taking into account all the geological features of the aquifers, the performance characteristics of the filter devices and the size of the future structure. Filter equipment designs for water intake wells have been developed in this study. These filters have low hydraulic resistance, high performance and are easy to repair. This article presents the dependency of flow inside the receiving part of the well, the dependence of filter resistance at various forms of the cross section of the filter wire and the selected optimal section. The paper proposes a method for selecting the optimal cross-section of the filter wire used in the manufacture of a water well filter. The proposed structures of easy-to-remove well filters with increased productivity allow replacing the sealed well filter with a new one easily, reducing capital and operating costs, and increasing the inter-repair periods of their operation. Based on the presented method, examples are given for selecting the parameters of the filter wire cross-section. The above calculations showed that the use of the hydraulic resistance criterion at the design stage of underground water intakes can significantly reduce the cost of well construction. Studies have found that the minimum hydraulic resistance to ensure maximum filter performance is achieved when using filter wire teardrop and elliptical shapes.

Keywords: Hydraulic Resistance; Filter; Water Well; Resistance; Filter Wire; Capacity.

1. Introduction

Groundwater use is 70% of the total water consumption in some European countries with the best rates in quality of life for the public. These countries are Germany, Austria, Denmark, Belgium, Switzerland, and several others. More than 300 million groundwater intake structures have been drilled around the world over the past 25-30 years [1-2].

The use of groundwater for water supply of the population has many significant advantages. High water quality in the water supply source helps to avoid the necessity for preparation equipment using due to protection from external contamination and seasonal changes of indicators. The capacity of a water well depends on hydrogeological characteristics of soil and groundwater, as well as the structure of intake portion of a well and pumping equipment. Therefore, the development of modern structures of water wells filtering equipment with enhanced performance characteristics is a vital task.

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