RESEARCH ON POLLUTION OF THE GROUNDWATER CAPTURE

CERCETĂRI PRIVIND POLAREA CAPTĂRILOR DE APĂ SUBTERANĂ

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Abstract*. The research was conducted on groundwater catchments located in the hilly and mountainous area of Moldova. One of the catchments presents a complex of negative factors in the site, of which the pollutants are predominant. The interference of economic activities in the protection zone has led to changes in the quality parameters of the captured water. The activities are represented by forestry, car transport, car parks etc. Emissions from the catchment site polluted the water with biological material. The biological analyzes performed revealed the improper quality of the water captured for domestic consumption.*
Key words: protection area, quality parameters, technical expertise

Rezumat. *Cercetările au fost efectuate la captări de apă subterană amplasate în zona de deal şi montană a Moldovei. Una din captări prezintă un complex de factori negativi în amplasament, dintre care cei poluanți sunt predominanți. Interferența activităților economice în zona de protecție a dus la modificarea parametrilor de calitate ai apei captate. Activitățile sunt reprezentate de exploatarea forestieră, transportul auto, realizarea de parcuri auto, clădiri de serviciu cu grupuri sanitare etc. Noxele din amplasamentul captării au poluat apa cu material biologic. Analizele biologice efectuate au evidențiat calitatea improprie a apei captate pentru consum menajer.*
Cuvinte cheie: expertiză tehnică, parametri de calitate, zonă de protecție

INTRODUCTION

Human health parameters are primary conditions in the operation of the water supply system and implicitly of water intakes. Failure to comply with the requirements of the law causes pollution of water sources (Bica, 2000; NP 133, 2013). Environmental protection in groundwater catchment areas for water supply systems is required by law (Law 37-1995). Ensuring the sanitary quality of the captured water is a primary condition in the operation of the water supply system. Failure to comply with the requirements of current legislation will result in pollution of water sources. The presence of pollution sources requires the shutdown of the water supply system. The absence of coherent legislation in the field of environmental protection, as well as its firm application determines the pollution of water sources used to supply the population.

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The environment is negatively influenced by natural factors since its formation. Over time, anthropogenic factors have also emerged. From the beginning of the 20th century, anthropogenic factors began to be more influential than natural ones (Avram, 2020). A number of these factors present a high risk due to objective but also subjective causes of human society (Avram and Luca, 2017). In the last period of time, there is a coupling of natural risk factors with anthropogenic ones, a situation that determines catastrophic phenomena.

The paper aims to present the results of research on environmental degradation in the area of groundwater abstraction through the brutal intervention of anthropogenic risk factors.

MATERIAL AND METHOD

The research was carried out in the area of the water system that serves the localities of Oituz and Marginea within Oituz commune, Bacău county. Oituz locality is located in the southwest of Bacău county, on the border with Covasna county, in the area of the upper course of the Oituz river. The capture of water for domestic consumption is made from an underground source located outside the village of Oituz at the edge of a slope. The catchment is located near the confluence between the streams Leşunțul Mic and Leşunțul Mare (fig. 1) (Luca, 2020).

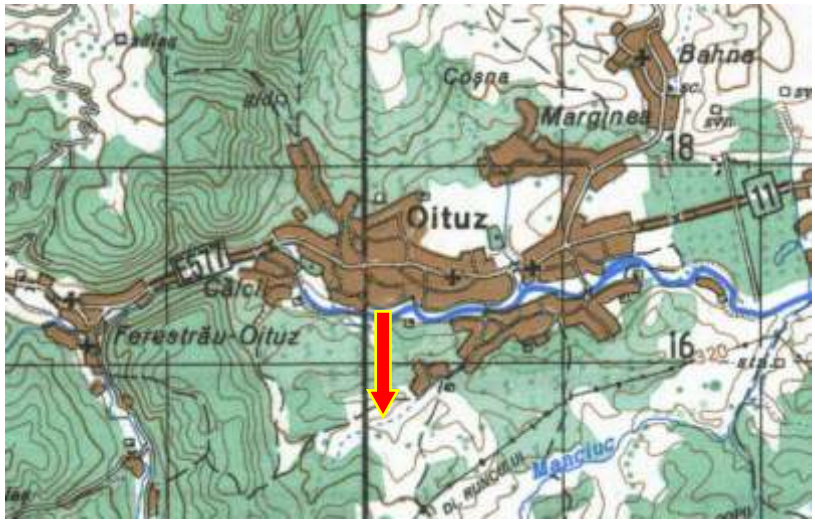


Fig. 1 Location of the research objective in the suburbs of Oituz, Bacău County

Theoretical and experimental research was conducted in the following areas:

1. Studies and research on the integration of groundwater capture in the issue of the evolution of environmental parameters in the location area in the context of land ownership changes in the last period of time.

2. Studies and experimental research on the state of quality of the environment in the area of groundwater abstraction.

3. Research of current natural and anthropogenic risk factors with influence on the evolution of the quality parameters of the captured water.

For the analysis of the situation in the field, a technical expertise was performed which highlighted the change in the structural and functional state of the catchment in the last period of time. The data collection from the field was performed through topographic measurements, specialized analyzes by fields, material samples, photo and video surveys.

The primary data were processed using statistical, hydrogeological and hydraulic calculation programs applicable to the case study.

RESULTS AND DISCUSSIONS

The location of the researched works is in the hydrographic basin of the Oituz River, the main collector of surface and groundwater in this area. Oituzul is a tributary on the right of the Trotuş River. The tributaries of the Oituz collect surface and groundwater from the mountain and hill area. The main tributaries in the studied area are Pârâul Leşunţul Mic and Pârâul Leşunţul Mare fed by a series of torrential formations.

The groundwater catchment is located at about 300 m from the confluence of the streams Leşunţul Mic and Leşunţul Mare. The captured flow is 4.8 l/s at a hydrostatic level of 1.40 - 1.70 m. The capture consists of the following components (fig. 2):

1. Two catch drains (D1, D2) located on an area at the base of a slope. The drains are 75 m long, are made of stone and gravel and are mounted at a depth of 3.50 m.

2. Two visiting homes (Cd1, Cd2) provided in the upstream section of each drain. The visiting home have an inner diameter of 1.50 m, a depth of 3.50 m. The visiting home are made of reinforced concrete.

3. A collecting visiting home (CC) to which the two catchment drains are connected. The collecting visiting home has an inner diameter of 1.50 m, a depth of 4.50 m and is made of reinforced concrete. In the collecting chamber is located the suction of the supply pipe that transports the captured water to the storage tank and the treatment station.

4. A channel located perimeter of the catchment surface with the role of supplementing the volume of water in the underground layer. The canal is fed by a diversion from a mountain stream located near the catchment front.

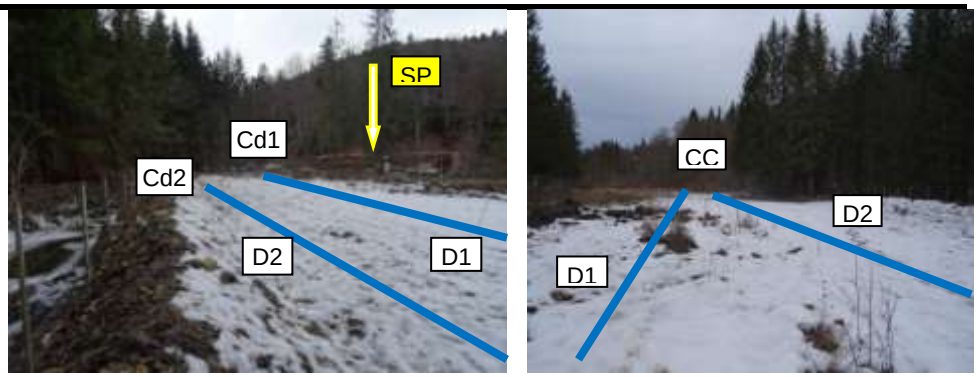
5. Sanitary protection works for groundwater abstraction consisting of: 1 - "severe sanitary protection area" protected by fencing, protection distance 72.0 m, about 2.0 ha; 2 - "restricted health protection area", protection distance 180 m, about 6.0 ha.

Fig. 2 Orthophotoplan with the location of groundwater abstraction: Cd1, Cd2 – visiting home 1, CC - collector visiting home, D1, D2 - drain, Cal - supply channel, CA - adduction pipe (Luca 2020).

The catchment was located on a land covered with large forests specific to the mountain and hill area. The phenomenon of forest retreat, but especially the intensification of wood cutting has caused a pollution of the catchment area. The field analysis highlighted the following aspects:

A. Sources of pollution:

- construction of transport roads for forestry exploitation on the sanitary protection areas (fig. 2, fig. 3);
- forest material warehouses equipped with processing and loading equipment (fig. 2, fig. 3);
- parking areas for forestry transport trucks;
- the construction of constructions for the exploitation services of the forestry activities equipped with sanitary groups.



a b

Fig. **3** General view of the groundwater emplacement site: a - view from CC to Cd1; b - view from Cd1 to CC; SP - source of pollution, noe. 2019 (Luca 2020).

B. The research carried out highlighted a number of types of pollutants:

- hydrocarbs resulting from the activity of forest transport, from the maintenance of trucks in the parking lot, from the parking of trucks during periods of inactivity;
- biological material from the sewerage installation of the constructions that serve the forest exploitation;
- biological pollutants from forest waste as a result of cutting and shaping trees;
- dust and dust from heavy traffic;
- aerosols and gases from the movement, parking and technological process of forestry equipment.

The research carried out in the field highlighted the degradation of the sanitary protection area by pollution phenomena that affected the quality of groundwater. Logging is carried out right on the "severe protection zone". Pollution is rapid, because the hydrostatic level of groundwater is only at a depth of 1.40 - 1.70 m (Luca 2020). The drains are located at a depth of 3.50 m, in which case they can be easily polluted.

The severe sanitary protection zone involves a distance of 72.0 m (Luca 2020) . Field measurements indicated a distance of 15.0 m to the road and 40-60 m to the wood depot, parking lot and buildings. The restricted sanitary protection area is about 180 m. It is not respected by the forestry activity. The perimeter of hydrogeological protection is respected due to the performance of forestry works, transport of timber, etc. The situation analyzed in the field highlights the state of environmental degradation in the area where the groundwater catchment is located.

Water quality parameters at the time of setting up the water supply system were within acceptable limits according to the standards in force. The analysis of water quality parameters performed by DSP Bacău in November 2019 highlighted the presence of biological material in water distributed to consumers. The sanitary

report indicates the presence of biological pollutants in domestic drinking water distributed in two localities.

The microbiological analysis performed revealed the following situation (Luca 2020): coliform bacteria (100/100 mL), enterococci (20/100 mL) and escherichia coli (19/100 mL). The presence of biological pollutants determined the stopping of the water distribution and the disinfection works of the system. At the same time, we started to detect the sources of pollution, analyze them and determine the remedial measures. The analyzes performed also indicated an increased turbidity above the limits of the drinking water distributed to consumers.

CONCLUSIONS

1. Anthropogenic risk factors particularly influence the state of the natural environment in the last period of time and cause disastrous situations on human society.

2. Anthropogenic risk factors have an important contribution to the degradation of drinking water sources used in the supply of the population and activities involving water with quality parameters accepted by the rules in force.

3. The partial and total degradation of the drinking water sources on the Romanian territory has recently become a permanent action and not sanctioned by the legislation in force.

4. Drinking water sources restrict their usable volume in the last period of time under the pressure of anthropogenic pollution factors, a situation that makes it difficult to supply human society with quality water.

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