NEW STRATEGY FOR WATER SUPPLY IN VOJVODINA

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Abstract:

The great intensity of groundwater exploitation for water supply in Vojvodina Province (northern part of Serbia) has been provided from deep aquifers. More than 6,5 m^3/s comes from those aquifers, which belong to a subartesian and artesian type, and from depths varying from 60 m to more than 250 m. Due to intensive long-term groundwater production, the actual pumping levels at numerous deep wells, used for supplying cities, have declined more than 30m in. The new strategy of water supply will be contributed by radical restriction of groundwater exploitation of deep aquifers and by saving the available reserves for future generations.

Keywords:

Water, supply, well, aquifer, alluvium, GIS.

1. EXISTING STATE OF WATER SUPPLYING IN VOJVODINA

Water from basic water-bearing complex, mostly from deep aquifers is, even today, the most significant resource of potable water supply in Vojvodina.

Exploitation of underground water in Backa and Banat intensively started in 1960's. Today, ground water is tapped from the formed sources in water-bearing areas of BWC (basic water-bearing complex), water-bearings from younger Quaternary in coastal belt of the Danube and locally, from deep water-bearings from Pliocene. The deeps of underground water tapping are different and depend on position of the water-bearing systems. Generally, from the water-bearings of BWC and younger quarter, water is tapped on the deep of 25 m in coastal belt of the Danube and in South Banat. According to middle and northeast Backa the tapping deeps are from 75 to 190 m, but in northeast Banat (Kikinda-Mokrin) water is tapped even from 230 m. Water-bearing of Pliocene is available on 140-230 m, locally and in the deeper areas (from 255-272 in Novi Knezevac, from 306-395 m in Opovo).

Today's average underground water consumption from some sources of city centres in Backa, Banat and Srem is from 10-50 l/s to 0.5 m3/s. Most of the sources daily exploit less than 100 l/s (33 springs). There are no precise information for spring exploitation in rural areas. It is believed that there are over 250, from which is tapped 2-10 l/s, mostly less than 5 l/s.

Total amount of collected water for public water supply for inhabitants and industry, or total average daily exploitation of underground water in Vojvodina is: in area of Backa Q=3870 l/s, Banat Q=2140 l/s and Srem Q= 800 l/s [2].

According to this, total average daily exploitation of underground water for water supply of inhabitants and industry in Backa, Banat and Srem is almost 7 m3/s. About 92% of this amount is tapped from Quarter water-bearing complex, and only 8% from Pliocene water bearing.

Over abstraction effects of deeper aquifers, actually the main water-bearings from BWC, is at first manifested as a fall of piestic level in water sources, with tendency of spreading of depression cone. These effects are mostly expressed in basic aquifer, actually in polycyclic sand-gravel packs in layers from Pleistocene, then in formed aquifers in Pliocene sandy water-bearings. Progressive fall of piestic level in the system of deep aquifers is especially expressed in Backa and in North Banat.

According to data of occasional measuring in the time of 1960. -1990. general fall of piezometric levels in wider aquifer zone in North Backa was 14 m, in the water source of Becej, and over 30 m in the spring source of Vrbas and Kula. Some falls of piestic levels were registrated even to 1.5 m a year, in source area. Big falls of underground water level are also registrated in North Banat, where the general fall in wider water source area is about 17 m. This state of deep aquifers is affected by an exploitation of underground water on the border area of Romania. As a reliable evidence of overexploitation of these aquifers stands the fact that there are no artesian wells in Northern Banat today, bur before 1960. every borehole, which collected these water-bearings, had a positive piestic level [3, 4, 7, 8, 9, 10].

2. REGIONAL WATER SUPPLY SYSTEM IN VOJVODINA

Condition of the high quality water supply in Vojvodina can be characterized as the least favourable in Serbia. Needed amounts of water today are supplied by exploitation of alluvial sources and basic aquifer, which caused a big fall of underground water level, with all negative consequences. By its quality, potable water in Vojvodina is certainly the worst in Serbia (together with some small communities in Central Serbia and Kosovo). On the other side, the biggest three rivers in our region the Danube, the Tisa and the Sava run through this plain. In alluvium of the Danube, zones marked as suitable for regional sources are between Bezdan and Bogojevo, **between Kovin and Dubovac** and some smaller zones in the middle flow of this European river through our country. Alluvium of Sava gives suitable conditions in some parts from Jamena to Lacarak and from Jarak to Grabovac. Tisa does not have such suitable sectors (in hydrological way) for high quality waters, but the water quality of the Tisa is worse than the water quality of The Danube and Sava. The main advantage of the Tisa is its position near the most endangered drinking water consumers (area of North Banat and Northeast Backa). Its water can be used as potable only with the most contemporary purification procedures. Other waters in this area are not reliable now, and it will probably be the same in future. On the North of Central Serbia in the riparian zone of the Drina and the Velika Morava, in the mouth of the Sava and the Danube, these locations give significant opportunities as sources of high quality water [2].

Water supply problem of Vojvodina, cannot be solved separately. Many alternative solutions have been considered in the case that some of the considered water sources work with a small capacity or that some do not work at all. Proposed

solutions for this whole part of Serbia include many alternative solutions, which strengthen the sureness of water supply for the whole region. Developing of regional systems, which will use its own water supplies and the water from mentioned sources is inevitable for Vojvodinian region. Besides regional systems, some smaller communities should strict bond to the lows on the exploitation of local sources.

3. NEW WATER SUPPLY STRATEGY

It is obvious that the problem of water supplying in Vojvodina cannot be solved as an extension to over exploitation of deep aquifers of BWC. This kind of underground water usage causes destroying of this precious natural resource as a consequence .This is why it is needed to start a completely different way for solving the problem of water supply, which would be based on the usage of surface and underground waters in coastal riparian of big Vojvodinian rivers: the Danube, the Sava, the Tisa, the Tamis. This is, actually, all about making restorable water sources in free aquifers of alluvial water-bearings whose feeding is ensured by the interaction of the river and water-bearing system. Coastal sector Kovin-Dubovac gives remarkable opportunities, and its restorable sources of underground water have bigger capacity per a year than any other water supply object in Vojvodina [1, 5, 6].

This approach to the problem represents a new strategy in water supply policy in Vojvodina, which would contribute to the radical limiting of drinking water usage from deep aquifers and also its protection and keeping water for longer terms.

DEVELOPMENT OF OPERATIVE-COMMUNAL CENTER

New information technologies, although they ask for investitions, positively affect the integrating processes-connecting big number of smaller waterworks, what enables forming of better material and technical conditions for integral planning, managing and protection of water sources, in other words the total water system. It is usually hard for waterworks to provide needed means and personnel for the researches of water source, but it is a different situation with the whole water resources. At first, it is related to hydrological and hydro geological researches, researches related to water quality measuring etc.

Operative-communal center, based on modern technology and current water legislature, must fulfil the aims:

- *Operative-communal center must be a part of communal organization information system, and then part of integral managing of water sources information system, which can enable data, experience and knowledge exchange.*
- *Communal organizations will enable to a Communal Center: expanse data, demographic data, hydro geological data, available sources data and possibilities of its usage, amounts and water quality that can be tapped from available sources and other general data.*
- *Operative-communal center will enable the softwares connected to GIS technology, working with database, information about available water sources and contaminators, then, statistical data works, specialized software for water systems, surface and underground water managing etc.*

In the aim of developing GIS database, within **Balkan University Support Programme, Project 6, GIS Education in Forestry and Agriculture** started to work on a project **"Competence transfer and institutional contact and co-operation between faculties of Agriculture, Forestry and Veterinary Medicine in South Eastern Europe"**. Institution from Norway, responsible for realization is **Agricultural University of Norway, Noragic centre for International Environment and Development studies**; agreement was signed by the Faculty of Agriculture in Novi Sad. The project has started with its realization in 2002. There was a coordination meeting in Sarajevo, in March 2002., where the ways of cooperation, aims and criterions of donation distributions were defined. In September 2002. there was a 7-day course for using GIS. Lecturers were Mr. Knut Bjorkelo, MSc, Norwegian institute of land inventory. P.O. Box 115, N-1430 As, Norway and Mr. Ahmet Lojo, MSc, Faculty of Forestry, Zagrebacka 20, 71000 Sarajevo, Bosnia and Herzegovina. Donation was 150.000 NOK (12.460 EUR), 4 computer configurations, scanner, etc. Project is a result of three-year working, but it is planed to be continued in next 2 years. Fig. 1. shows the work-surrounding of **ProGIS** Programme package, which includes **WinGIS** - graphical part and **WinMonitor -** database.

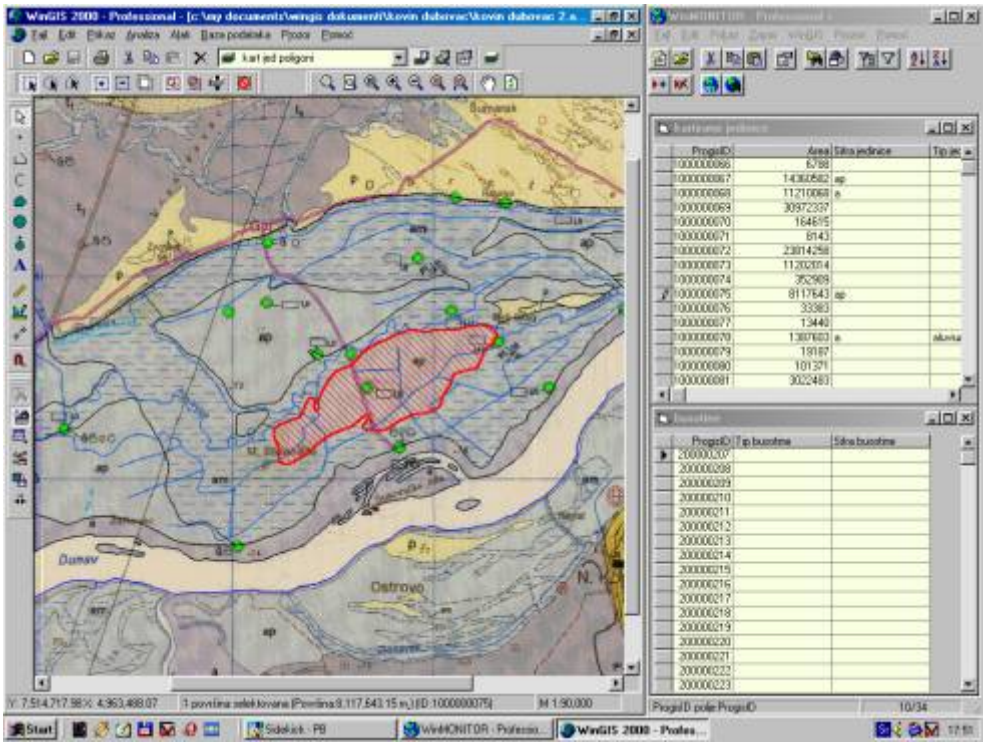

Fig. 1. *Work-surrounding of* ***ProGIS*** *Programme package (****WinGIS*** *- graphical part and* ***WinMonitor*** *- database).*

4. CONCLUSION

Modern water supply strategy implies to rational organizing of perception and measuring different meteorological and hydrologic phenomena, establishing geological and hydrological field characteristics, establishing physical, chemical and biological water characteristics, dynamic and changes of time parameters etc. During the observation, measuring and analysis of natural phenomenon it is necessary to

use modern information systems for integral managing of water sources, which enable quick and efficient data, experience and knowledge exchange.

However, available data about the characteristic of intake areas are generally poor, dissatisfying and extremely unequal. In the work of communal water supply system, main problem is an equipage level. Measuring of exploited water amounts is done by the direct measuring with different kinds of flow measurers or indirect evaluation based on payments. Laboratory equipage level cannot response to all law regulations in the meaning of the analyses that need to be conducted. All this influences the final quality underground water researching results.

Final selection of the way of using the potential source Kovin-Dubovac will be taken based on detail and all-inclusive technical-economic analysis, which must be included in the Expanse Plans conformably to the interests of the state.

For the mentioned reasons, there is a proposition in this work, for starting an initiative for the study: **"FIZBILITI STUDY OF THE POTENTIAL UNDERGROUND WATER SOURCE KOVIN-DUBOVAC"**.

Therefore, due to overexploitation of underground waters in some hydro geological areas of Vojvodina or agravation (naturally unsatisfied) of drinking water quality, according to current standards, here is a preposition for undertaking studies and pre investment researches for protection and establishing underground water reserves in the area of potential regional source Kovin-Dubovac. It is known that (in the aim of protection of left Danube coast) in this zone there are constantly working drainage objects (artesian wells) with acceptable quantitative and qualitative parameters of water sources, which could be used in a new conception of regional water supply of Middle and South Banat. Proposed study will verify the opportunity of using this area in the aim of collecting and distribution of existing amounts of underground water from existing drainage line, or in the aim of underground exploitation in the whole area of Kovin-Dubovac.

Based on this study and researches of Kovin community, preparing of the base is enabled:

- To cede the area and mineral resources for usage (clay, sand, gravel, coal and water):
- Charging the taxes for an expanse and resources usage
- Easier selection for interested users or for tenants of expanse for using an alternative pure energy sources in the extent of its activity (wind, sun)
- Selection of different area purpose (ecological food production, chemical industry, food industry, secondary raw materials...)
- Research conditions
- Protecting conditions
- Extra research conditions (assignative) for corresponding expanse usage, which is also an obligation for future owners and tenants

Besides, the development of **OPERATIVE-COMMUNAL CENTRE**, as a long term aim in the realization of result application, will enable transition to new power sources in free aquifer systems of alluvial type, based on the usage of total water resources in coastal areas of big Vojvodinian rivers. Accordingly, considerate example of coastal sector Kovin-Dubovac, on the left Danube coast, has manifold significance and it presents a big contribution to the promotion of **new strategy for water supply in Vojvodina.**

Acknowledgements: The work was undertaken as a part of the SOIL DETERIORATION, CONSERVATION AND UTILISATION AT LAND RECLAMATION SYSTEMS Research Projects No. 0419, under contract BTR.5.01.0419.B. It has been funded partially by the Ministry of Science, Technology and Development, Goverment of Serbia end "SRBIJAVODE" WATER AUTHORITY – Beograd (The River Danube Water Resource Center - Novi Sad).

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