Drinking water supply from karst water resources (The example of Koprsko primorje, SW Slovenia)

Nataša Ravbar

Karst Research Institute, ZRC SAZU, Titov trg 2, SI-6230 Postojna, Slovenia;
E-mail: natasa.ravbar@zrc-sazu.si

Abstract: Water supply in Koprsko primorje is being founded on efficacious karst springs Rižana and Gradole and karst underground water, which is pumped in Klariči. Because of the increased need of drinking water, problems of water provision appear, especially in summertime. Enormous and still growing consumption of drinking water in Koprsko primorje is forcing into search for new efficacious water resources.

Key words: karst waters, human impact, drinking water supply, the Rižana karst spring, Koprsko primorje.

Introduction

Resembling many European regions also Koprsko primorje is anxious how to provide sufficient amount of quality water. It turned up, that needs of exploring potential water resources for the effective and sustainable usage of drinking water increased. But population and economy growth and numerous other socio-economic processes increase pressure on environment.
Objectives of this contribution are to present historical development and situation of drinking water supply and water sources in Koprsko primorje of today. Final results about the drinking water exploitation in the studied area are presented: water resources, water supply extent and drinking water distribution, number of inhabitants, quantity and purpose of consumption data.

Results and discussion

Water from the Rižana River has already been used in the early 19th century, when the Rižana valley has still been the granary of Trieste. In 1935 the Rižana spring was captured and supplied all bigger cities at coast. But, rapid development of the coastal area and increasing consumption of drinking water dictated spread of the water supply network and incorporation of other drinking water sources.
Drinking water supply of today basis on the efficacious karst springs of Rižana and Gradole and on the karst groundwater, which is pumped in Klariči. There is almost eighty percent of water derived from the Rižana spring, twelve percent from Gradole spring and only eight percent from Klariči[1].

Scientific paper

Since 1994 more than 99 percent of the population in the studied area is connected to the public water supply, among which the cities of Koper, Izola and Piran have been completely supplied. Out of tourist season 80,000 people and during the season more than 120,000 people are supplied. Some of the remote villages, among which only three settlements (Podgorje, Rakitovec and Tinjan) count more than one hundred people, are still dependant on private water resources. Altogether 700 people are not yet supplied by public water supply[2,3].
On the water supply network nearly 25,000 households are connected. Joint quantity of consumed water in households is 3.9 millions m^3 of water per year, while joint quantity of consumed water in economics is 2.15 millions m^3. The biggest consumers of water in the coastal area are port Luka Koper, that uses 150,000 m^3 water per year, hotels, health resort, food, car and other industry (Fig. 1).

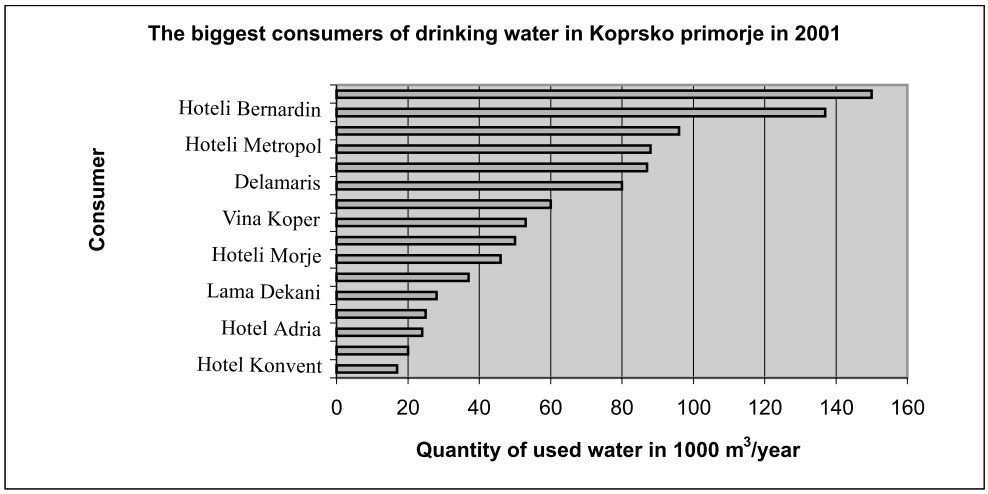

Figure 1. The biggest consumers of drinking water in Koprsko primorje in 2001

Almost half a century ago sale of drinking water did not reach one million of m^3 per year, but in 1970 it already exceeded four millions m^3. In the seventies great increase of economic development of Koprsko primorje and expressive urbanization, which basis on industry, tourism and transport, followed. In this time also first bigger consumers appeared and first bigger tourist resorts and residential quarters have been built. Concerning individual consumers, with the growth of standard also the consumption of water and number of new customers increased[1].
Consumption doubled in the decade that followed. It reached summit in 1985, when almost eight millions m^3 was sold. Since than consumption decreased and varies around six millions m^3 yearly (Fig. 2). Reasons for decrease of consumption are numerous, but the most important is certainly careful management, because price of water in Slovene Istria is the highest. This situation is due to great decline of the economic activity, which affected numerous firms and industry in late eighties and nineties. Besides renewal and maintenance of pipelines reduced water losses in the system.
Yearly amount of water let in the system is around 8.6 million m^3, while quantity of sold water is 6.1 million m^3. Water losses in the system are nearly 30 % due to old network, bad

quality of pipeline, lowering of the ground and other reasons. In 1987, before the program of sustainable drinking water supply in Koprsko primorje was accepted, water losses exceeded 43 % (5.8 million m^3 of water per year)[1]. Invests in pipeline renovation were strengthened and essentially decreased water losses. Despite effort to improve water supply network more than 40 percent of pipelines are still older than 30 years.

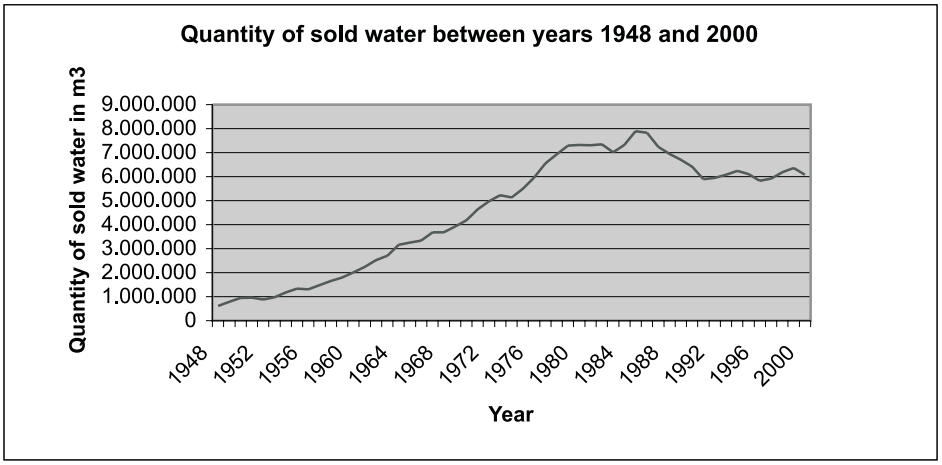

Figure 2. Quantity of sold water between years 1948 and 2000

Difficulties in drinking water supply in the studied area are not only in deficient quantities of water, but also in a serious ecological hazard of the existing water sources. Apparent velocity of groundwater in the Rižana spring hinterland depends on different hydrological situation and directions of underground streams, but still it was proved, that it ranges between 11 to 520 m/h[4].

Among the drinking water resources the most endangered is the Rižana spring. Even though an influential area and protecting zone is defined, Koper – Hrpelje – Kozina railway still passes the first protecting zone, in springs immediate vicinity. Some other local, regional and main roads and trails pass the second protecting zone. Eventual accident could cause strong contamination of the Rižana and some other nearby springs, as it already happened in 1993, when due to the car accident 18 tons of petroleum and fuel oil flew out[5]. Also in October 1994 came to an accident near Obrov, when 16 m^3 of gas oil was split in the area of the second protecting zone. Springs of Rižana, Osapska reka and Ara in the vicinity of Mlini village were polluted[6].

Illegal dumps could strongly burden karst water as well. Nocuous water that leak out, flow directly into karst, into drinking water storage. Šebenik reports, that in 1994, when removal of waste was organized only in Kozina and its surrounding, there were still 18 illegal dumps with average volume of 36 m^3 in Matarsko podolje and 14 illegal dumps with average volume of 7 m^3 in Podgorski kras, which is in the Rižana springs immediate vicinity[7].

In case of frequent accidents and uncontrollable pollution springs could be permanently contaminated, like it had happened in case of the Krupa River.

CONCLUSIONS

Characteristic for karst are numerous very efficacious springs that supply vast surrounding. Because they are mainly situated on the area, where due to lithological particularity leak of water prevail, karst springs are very important for drinking water supply (for example the Rižana spring). So karst in many places and also in Slovenia is of vital economic importance, while almost half of the country is karstic and more than half of drinking water is obtained from karst aquifers.

Needs after water for industry, agriculture and drinking water in Koprsko primorje are much bigger than available quantities. Therefore reasonable use of water is necessary. While planning water supply in the studied area it would be convenient to include numerous local water sources in connection to traditional way of water supply. Water resources that have been abandoned in the past century could be refreshed, thus intensifying care for environment protection. Qualification and modernization of local water supply systems, wells and rainwater tanks could contribute to better quality and quantity of drinking water at the same time.

Economically more practical are therefore smaller catchments for individual settlement in connection to the central one. This would disburden large catchment and reduce risk of drinking water shortage. Nevertheless all the catchments must be connected in order to avoid inconvenience in water supply.

In case of such quantity of losses (about 30 percent) as in Rižana water supply is found, searching of new water resources is totally unnecessary. Insignificant renovation of the old pipelines causes damage and a considerable quantity of water losses. Effort for water loss reduction in network needs to be supported and Water Supply Company should therefore invest more into maintenance and renewal of the system.

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