QUO VADIS LJUBLJANA'S WATER RESOURCES?

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Abstract

Ljubljana, the capital of Slovenia, has not focused on the special problems of drinking water quality deterioration since the public water supply was established in 1890. The source of drinking water is the groundwater in the vicinity of the city. Two aquifers, Ljubljana Field and Ljubljana Moor, with a mutual dynamic capacity of about 4,0 m^3/s, represent drinking water resources for almost 300.000 inhabitants. The major part of the vulnerable Ljubljana Field aquifer, which enables water supply for 90% of the population, lies beneath urban and agricultural areas.

The main feature of the Ljubljana drinking water supply is completely untreated natural water. It is distributed into the water supply system without any previous processing, since the monitoring of its quality showed that it does not contain microorganisms. Chemical substances represent the most serious threat to drinking water quality in Ljubljana.

The groundwater quality has remained at a near acceptable level as the water protection zones were established sufficiently early (1955) in order to prevent urban expansion towards vulnerable areas around the waterworks. The water resources that are exploited today are protected by water protection zones, which, however, include the major part of the city of Ljubljana. Despite this, the degree of threat to the water resources due to urbanisation, traffic, agriculture and industry has been increasing. Numerous restrictions and administrative measures have been used to prevent groundwater pollution. Groundwater quality monitoring results show that with only these restrictions, the goal of groundwater with good chemical status could not be achieved. The water protection zones are undoubtedly necessary in order to keep drinking water supplies safe, but without strong and close supervision of human activities on the protected zone, the administrative measures are only drops in the ocean.

The future water supply policy is still oriented towards natural pure water. We believe that the groundwater management problems in Ljubljana will be solved by strong co-operation between the state, municipality, public water supply company and consumers. This is the only way to assure a future high quality water supply for our customers.

KEYWORDS: Groundwater, drinking water, pollution, land use, aquifer, protection zones, groundwater quality, groundwater monitoring

1 INTRODUCTION

Water supply for the city of Ljubljana has been based on groundwater exploitation since 1890. There is plenty of good quality water in the underground reservoirs and the exploitation of this resource has been developed and extended while the number of inhabitants and water consumption rose. Most of the practical problems that we face today with the on-site management of drinking water sources and distribution of healthy drinking water, originate from past actions, interventions and political decisions.

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The environment has the essential role as a medium where the water is present. Point and dispersed sources of pollution are the result of many different human activities. The main threats to drinking water sources are anthropological. Groundwater vulnerability is increased and environmental responses are altered by human interventions to environmental structures and dynamics. Each activity or intervention changes the elementary environment, but the impacts differ according to different single components and the endangering of drinking water sources varies spatially.

The management of groundwater in urban, industrial and agricultural areas requires professional knowledge and the ability to take immediate action in case of accidents and malfunctions. For this purpose a mathematical model of groundwater flow has been developed for better drinking water exploitation and protection. The task of the model is to help the groundwater manager to better understand the dynamics of the system. The development of mathematical models begins with the schematic understanding of the physical system that we want to model. The knowledge of hydrogeology, hydrology and groundwater flow dynamics in the area of interest is the most important phase of modelling and, subsequently, managing the drinking water sources.

The Municipality of Ljubljana is responsible for the protection of local water sources as well as for establishing and maintaining the water supply system for its residents. The Vodovod-Kanalizacija Public Utility (VO-KA) is responsible for water supply to the city residents, including the management, surveillance and maintenance of the water supply system.

2 AQUIFER CHARACTERISTICS

The supply of drinking water for Ljubljana and its surroundings is based on the exploitation of groundwater from two aquifers with limited connections and different characteristics.

2.1 Ljubljana Field

The area of Ljubljana Field is a bowl shaped tectonic sink consisting of river sediments that can reach thicknesses of more than 100 m in the deepest part. In the Quaternary, the impermeable base of permocarbonic shaly mudstone and sandstone began to sink. In the last million years, the river Sava filled the depression thus forming a field. The lower part of the aquifer is composed of Pleistocene gravel and sand whilst in the upper part there are Holocene sediments of sand and gravel. Within the alluvium of sand and gravel in the field of Ljubljana Field there are several layers of conglomerate lenses. Above the lenses there are many clay layers, which, together with conglomerates, present a hardly permeable complex. On the other hand, the conglomerates in which caverns are formed due to the dissolution of carbonate gravels represent a medium with high horizontal hydraulic conductivity.

The hydraulic conductivity of Ljubljana Field is very good, from 10^{-2} m/s in the central part to 3-7 x 10^{-3} m/s on the borders of the field and 1-5 x 10^{-4} m/s at the foot of the hills. Groundwater flow velocities cover a wide range of values from several meters to several tenths of meters per day according to the infiltration of precipitation and the river Sava.

The river Sava, with its characteristics of an alpine river, flows along the northern edge of the field. It discharges several tenths to 1600 m^3/s. The river Sava is a very important hydrodynamic element of Ljubljana Field, especially due to the cross recharge along infiltration areas of Brod-Roje and Tomačevo-Jarše during periods of high river level. The groundwater level is closest to the surface along the Sava where its depth reaches 4-8 m and deepest (20-30m) beneath the area of Pleistocene terrace in the western part of Ljubljana Field.

Precipitation contributes significantly to groundwater recharge. The mean annual precipitation was 1394 mm for the period 1961 to 1990 and 1501 mm per year in 1999. Mean evapotranspiration is about 600 mm per year. In densely populated urban areas with asphalt surfaces the infiltration is reduced by run-off of about 400 mm per year.

2.2 Ljubljana Moor

During the Pleistocene and Holocene, the fractured sink of Ljubljana Moor was covered with sediments from rivers and lakes. The bedrock of these sediments is composed of Triassic dolomites and Jurassic limestone in the western and central parts, and of permocarbonic clayey gravels and sandstones in the northern and eastern parts. In the northern part, the bedrock is more than 150 m deep. In the major part of Ljubljana Moor, the groundwater, which is under artesian and sub-artesian pressure, flows through the gravel layers?

Ljubljana Moor is a swampy plain with several little hills. The river Ljubljanica, a Karstic river with numerous tributaries, flows through it. The river Iška is also an important source, supplying water to the Holocene aquifer of Iška alluvium. Due to impermeable and barely permeable clayey and silty layers in the moor, water infiltrates very slowly and tends to remain on the surface for a long time after long periods of rain.

Phreatic groundwater's from the southern and western karts areas emerge from strong karst springs at the southern and western borders of the Moor. Only a very small part of these waters can flow under natural conditions below the plain of Ljubljana Moor into the aquifers in its carbonate basement, and from these into the overlying Pleistocene aquifers, constituting the lower parts of Quaternary sedimentary fill. The aquifers in the carbonate basement and in the Pleistocene sediments of the Ljubljana Moor area must, under natural flow conditions, be confined aquifers with either artesian or sub artesian water levels.

2.3 Vulnerability

The degree of vulnerability is based on the natural dispositions of the aquifer that we can combine into characteristic parameters. The degree of threat to the aquifer is dependent on the state of urbanisation and municipal infrastructure development.

Besides the pollution processes and resultant pollutant transmission, the groundwater pollution is in the first place an aquifer property. The nature of the groundwater pollution and its dispersion through the aquifer can be defined with a number of factors, from natural properties to principles related to urbanisation. Although we can count on the self-purification ability of the aquifer in cases of accidents, we certainly can't use this as an excuse to allow aquifer loading.

Ljubljana Field is an unconfined aquifer with intergranular porosity. It is a very vulnerable drinking water resource that is very sensitive to events on the surface and actions inside unsaturated zone. The self-purification ability is limited and some chemical pollutants will not decompose in the aquifer, but be retarded and travel along the groundwater flow.

According to all the available data, we can define three aquifers on Ljubljana Moor, separated by clayey layers. The upper Holocene aquifer is unconfined and has a high level of vulnerability. The upper Pleistocene and the lower Pleistocene aquifers are unconfined aquifers that are quite well protected by clay layers. Underground water flows into these aquifers from the karstic Krim-Mokerc Mountains and can be divided into two systems. The first is a fast surface runoff and the other is a near-surface runoff, flowing through cracks and fractures. The Ljubljana Moor is very sensitive and vulnerable in its karstic part, where the self-purifying ability is very low. As the renewal time of the groundwater is long, the pollution can be present for decades.

3 DRINKING WATER SUPPLY STRATEGY

The drinking water supply concept, designed more then a hundred years ago, is still valid today. The city is supplied from four waterworks on Ljubljana Field, namely: Kleče, Šentvid, Hrastje, and Jarški Brod, and one water work, Brest, on the Ljubljana Moor. The water sources are abundant enough to enable drinking water supply to a city twice the size of Ljubljana. The problems in planning the drinking water supply strategy are the safety of the source, due to its underlying of agricultural and industrial areas.

The waterworks on Ljubljana Field were designed in the time when the protection of drinking water sources was concentrated on microbiological pollution. For this reason the Kleče and Hrastje waterworks were set quite far away from the river Sava, which, although an important recharge source for groundwater, was never protected. The present pollution in the groundwater indicates that agricultural and industrial pollutants are present in the central part of the field and not in the areas where the water from the river Sava is infiltrating to the groundwater.

Regarding the drinking water consumption today, we can expect that the average drinking water consumption per inhabitants per day will reduce from 230 l today to 150-180 l, in accordance with European trends.

3.1 Water protection zones

Protection of drinking water sources is also environmental protection. Water protection, especially of groundwater, is one of the most difficult targets of environment protection. We want drinking water sources in the vicinity of the urban areas, so consequently the protection zones are near or under the urbanized areas. Groundwater is hidden from view, so people living above the aquifer, their drinking water source, have no feeling or consciousness about the influence of their activities on groundwater quality.

Controlled land use must be present in drinking water protection zones, not the harmful, unmonitored and blind use that was present in the past. The areas of protection zones should not be unexploited, but such land use must be planned with stress on their importance. The protection principle of vulnerable areas against harmful human's activities must be present. Ljubljana extends over an area of 100 km^2, with the greater part lying in the third protection zone.

The rich supply of water in the area, where, in the last million years, the Sava and Ljubljanica rivers have formed a flat region, provided the essential condition for the founding of prehistoric settlements. We have evidence that the first public water supply here was formed during the Roman age, at the beginning of the first millennium. In the medieval ages, the drinking water sources for the inhabitants of Ljubljana were public and village wells and springs. Very dry summers at the end of the 19th century caused a decrease in the groundwater level and the wells and springs dried up, creating a scarcity of drinking water in Ljubljana.

With the increasing numbers of inhabitants, pollution was rising and groundwater quality deteriorated. In 1879 an extensive hydrogeological study was prepared with detailed groundwater level descriptions and the first local hydrogeological map was designed. The result was the location of the first water field Kleče, where no sign of water was present on the surface. The location was a first step for groundwater protection, as groundwater flow is from the water field towards the city.

The first land use planning that included public drinking water supply, drainage and wastewater purification was established at the end of the 19th century. In the year 1899 the first urban plan was prepared. After 1945, the city of Ljubljana began to spread to the north. Villages in the vicinity enlarged and merged into the city decades later. Between 1947 and 1949 a crisis in

drinking water supply was occurring. New pumping wells in the Kleče water field and the new water fields in Šentvid and Hrastje began to operate. Decreasing abstraction and accepted principles of urbanisation led to the establishment of the Decree on protection zones in 1955.

The aims of the 1955 Decree were considerable, as it prevented constructions in the influential areas of the Kleče and Hrastje water fields. The provisions of the Decree were strictly implemented for more than ten years but then, under pressure, the new urban spatial plan in 1966 allowed new settlements in the second protection zone.

In the seventies it was not possible to speak about high ecological awareness of the Ljubljana residents. The more restrictive measures given in the Decree on Protection Zones of Drinking Water Resources for the Municipality of Ljubljana and arrangements for protection from the year 1997 caused dissatisfaction from the residents, who asked for verification of the knowledge of the experts that were involved in preparation of the Decree. Proposed protection measures had to be less restrictive in certain water zones. The final Decree was a compromise between professional opinion and demands of the residents.

The 1977 Decree was being supplemented and adapted to the demands of new regulations and legislation. Due to the numerous appendices the Decree was difficult to follow, so the Municipality authorities decided to prepare a new Decree based on the1977 Decree. The Decree from 1988 on Drinking Water Protection was added and complemented in certain paragraphs.

All the Decrees that were formed up until now were based on methodologies according to the most recent findings and technologies as well as the demands that were present at that time. Today we are aware of how difficult it is to maintain and preserve the large water protection areas on the Ljubljana Field and Ljubljana Moor, which is required due to the exploitation of the groundwater for water supply. Due to the complex geological structures in the supply hinterlands of the underground drinking water source, it is impossible to recognize all influencing conditions. This fact causes the uncertainty that consequently lowers the degree of safety and reliability provided by the protection measures that are being taken.

The Decree that is still valid became obsolete and does not satisfactorily cover the problems concerning the drinking water protection that are currently present. Due to the application of new technologies and new substances on the groundwater body, pollution of the water body is increasing and it is becoming more and more endangered. Even though the previous Decree proposed sanitation measures, these have not been fully carried out. We know that the sanitation of the water sources should have been previously completed. The sanitation of the water sources should be carried out in the near future, as the costs are increasing with the time delay. At the same time the efficiency of the sanitation is decreasing with the increasing costs. It is important to be aware that in the local vicinity there is no such other extensive water source as the Ljubljana Field aquifer.

3.2 Conflicts of interests

There are questions as to where be the tolerance limits to human activities and their impact on the environment and water quality.

Ljubljana is the city, where the interest between drinking water sources is in contradiction to urban development of the city. Land use planning is constantly in conflict with drinking water sources protection. The town planners have not been aware the drinking water source protection should be the restrictive factor by planning city extension, not the secondary factor as it was till now. For the drinking water source protection on several 10 ha of land the urbanisation is restricted and limited. In the past the urbanisation was taken into consideration the protection zones, that the reason why the city was spreading to several shanks.

What has the city acquired or preserved with the existent principle of protecting the drinking water resources? Undoubtedly the Ljubljana City is in the position many of cities in EU want to achieve in view of conserve the existent drinking water supply. The goal of EU environmental politics is to improve the condition of environment or to conserve the good state of it as far as in Ljubljana on the field of waters succeed to certain limits, but not completely. Today when the conservative water resource protection principle, with all restrictions and limitations, have been hold out, when so state as public and individuals are aware in environmental problems and defined legal instruments are establish, we should not allowed the yielding and radical changes which we effectively resisted in the past.

The problems of groundwater quality and quantity that occupy us today are much more diverse and urgent than those that led to development of the first environmental and water policies several decades ago. Groundwater pollution and the effect of different pollutants on the human body can be a serious health problem on account of the large dependent population. The disperse sources of groundwater pollution include agriculture, industrial areas, traffic and dispersed urbanisation without properly settled sewage systems. Agriculture is responsible for the majority of elevated nitrate, pesticides and phosphate concentrations in the groundwater. Cattle farms create much pollution with organic substances and ammonium compounds. Industry is a source of phenols, organic solvents and heavy metals, which also originate from traffic.

Because of activities that where present on the protection zones in the past, today is the most urgent problems the pesticide present in the groundwater and consequently in the drinking water. It's not the local problem in Ljubljana but in the greater part of Slovenia and in Europe, so it demand new, global view on pesticide use all over the world and consequently modified farming and general use of pesticides.

From the dates receiving the Decree of the Drinking Water Sources modifications, we can see how the adjustment of interests in defining the protection zones is pretentious to save the conflicts situations. After each receiving the important urbane decisions, the period that new arguments for protection were collected and prepared and try them legally put into the force against the new bigger interventions inside protection zones. Regarding the water protection zones, there was a conflict within the Municipality of Ljubljana due to the building of the northern and western bypasses. The traffic dispositions were determined in a general urban development plan and the Decree on Urban Planning for the Area of the City of Ljubljana. In the 1977 Decree on Water Protection Zones the northern bypass was planned in the closest protection zone, with the demand that the most restrictive groundwater protection measures should be taken with the construction of the road. The 1988 Decree prohibits the building of major and regional roads within the second water protection zone. Therefore the building of the bypass road should be terminated. In 1993 a change of the Decree was accepted with the explanation that enabled the proceeding of the works on the Ljubljana bypass road. Still the most rigorous water protection measures should be applied.

The last Decree defines the responsibilities for the sanitation of water protection zones. VO-KA Public _Utility was responsible for preparation of the sanitation guidelines. The guidelines were prepared in 1991, but they were not confirmed at that time by the competent authorities. Regretfully there were no sanitation measurements inside protection zones, the result of them will be the reducing the pesticide and theirs metabolites concentration. The pollution dynamic and intensity that travel with groundwater flow is not very well known.

The decision for drinking water treatment could have long-term consequences and will not improving the groundwater status but could raising costs and consequently the drinking water price. It could fail decision about reducing or even give up the protection zones.

4 THE GROUNDWATER QUALITY AND QUANTITY MONITORING

Since the 1987 the systematic groundwater quality monitoring on Ljubljana Field is establish. The results of fifteen years indicate the quality of groundwater was not making worse, even concentrations of some pollutants were higher in nineteenth than today. The caused could be the cancellation many trade and industrial activities.

Today more than twenty observations points are around the Ljubljana Field and Moor where two to twenty-four times the groundwater samples were taken during the year and more than ten physical-chemical parameters were defined (temperature, pH, electroconductivity, basic anions and cations such as chloride, nitrate, potassium and magnesium, microelements, adsorbed organic halogens and volatile organic compounds, oils, pesticides and e.t.

Monitoring of the compliance of drinking water with health requirements provides a constant source of information on the current quality of pumped water. In accordance with the regulations, about 3800 water samples per year are taken for microbiological tests and 1700 samples per year for physical and chemical test.

It is considered that the health requirements for drinking water are met. In addition to the constant supervision by an authorised external institution, the quality of pumped water is also being checked by an internal laboratory. Water samples are taken at the pumping stations, at outlets from the waterworks, in collection pipelines, and at the consumption end of the distribution network. All events that could affect the quality of the water resource are regularly monitored and recorded within the scope of sanitary control. Any observed irregularities are brought to the attention of the competent authorities.

Monitoring results show that pollutant concentrations are being kept within the authorized limits and within EU directives, except for with pesticides. On some sampling sites concentrations of certain pollutants are rising and sometimes exceed EU recommended values. These are nitrates, Zn and volatile organic compounds. At present, pollution from atrazine and its metabolites is the main problem considering Ljubljana's groundwater. The average annual values of this pesticide are decreasing slightly, but the decreasing trends, especially at Hrastje water field, are too slow. The recommended values were not reached until January 2003.

Average annual values of nitrates are, except at two sampling sites, kept beneath the EU recommended value. Large oscillations in nitrate concentrations are observed at one sampling site.

Besides pesticides and nitrates, VOC's are also appearing in the groundwater that supplies the municipal water supply system. Special concern should be given to the fact that originally these compounds were only detected at Hrastje waterworks, while nowadays they are present, in low concentrations, in practically all sampling points across the whole field.

Groundwater is also polluted with Cr^{+6}. Concentrations are far below the permitted levels. In the Kleče water work, which was first polluted with this metal, the average annual values are decreasing, while they are increasing in Hrastje wells.

5 WATER AND ENVIRONMENTAL POLICY

5.1 Policy framework

Goals for management of water resources in Slovenia are primarily orientated towards the fulfilment of obligations arising from international agreements and from the Water Framework

Directive (WFD). Sustainable management and conservation of water resources (including groundwater) are an integral part of national development policy. Much of EU legislation has been transposed into national legislation. Priority objectives for Slovenia in the area of urban pollution are the reduction of air pollution, improvement of water quality, and modernization of waste control, preservation of biodiversity and strengthening of environmental protection institutions at all levels.

The National Environment Action Plan (NEAP) was approved in 1999 (UNECE, 1999). This sets priorities and strategic guidelines in water management. Development in urban, industrial and agricultural wastewater management and the protection of drinking water sources are prioritised.

The national Assembly adopted the national Water Act, designed for harmonisation with EU legislation and policy, in July 2002. This act regulates the legal status and provides for planning and protection of all water related areas and activities. It regulates the general and special use of waters, provides for the establishment of a Water Fund for the funding of water infrastructure and provides for the organisation of water resource management and development.

The Local Self-management Act gives the local government bodies the responsibility of local government bodies the responsibility of local public drinking water supply. As such, Municipality of Ljubljana (MOL) is obliged to assure the long-term water supply for Ljubljana. According to the EPA, municipalities are obliged to establish local public utilities for water supply and sanitation (VO-KA in the case of Ljubljana). The municipality assures the appropriate quality of drinking water by applying the Decree on the Protection of the Drinking Water Sources (1988), as well as local spatial planning legislation, water zone protection legislation and other MOL measures. This decree, based on methodologies and technologies appropriate at the time of development, is considered unsatisfactory for the protection water resources today. Sanitation measures prescribed by the previous decree have not been realised. The 2002 Water Act passes the competences of proclamation of water protection zones to the state.

The implementation of national water and urban groundwater policies, the clear definition of goals for urban groundwater management and development, and the allocation of responsibilities are considered to be reasonably effective. However, the level of success and efficiency in the allocation of resources and the enforcement of specific strategies and action plans are less clear. The Last United Nations environmental performance review, in November 1999, identified significant problems in environmental inspection, and the need for improved coordination between environmental institutions (particularly in regard to NEAP implementation) and improved regional administration (UNECE, 1999). Observed problems in water resource management in Ljubljana, such as the regulation and inspection of private abstraction and wastewater discharges and the infringement of water protection zones, evidence that these challenges have not yet been fully overcome.

5.2 Responsible Public Authorities

The Ministry of Environment and Spatial Planning is responsible for the national legal basis and management of environmental issues, nuclear safety, regional planning, meteorology and the monitoring of air, groundwater, and land and soil pollution. In recent years, the ministry has decided to expand its activities from the strictly legislative to more practical areas.

Directly under the authority of the Ministry of Health is the Institute of Public Health, consisting of 9 regional institutes, of which the institute in Ljubljana is the core one. Its key responsibility lies in the analysis of food and drinking water. Also in 1997 a national environmental inspection body began operating in Slovenia. The duties of this include the monitoring and registering of all events and activities connecting with environmental pollution.

The Municipality of Ljubljana is responsible for the protection of water sources in its area and for establishing and maintaining the water supply system. The Department of Environmental Protection, which is a part of municipality administration, is responsible for the performance of extended monitoring, public information, record keeping, and sanitation actions and for the proposal and preparation of local legislation concerning environmental issues.

The Vodovod-Kanalizacija Public Utility is responsible for the water supply to city residents and the management of the water supply and wastewater systems, their surveillance and maintenance.

The main constraint to long-term water resource management in Ljubljana is not the absence of knowledge, but the lack of dialogue between experts, professionals, and policy and decision makers. Efforts are being made to bring stakeholders, experts and politicians together for involvement in policy and development decisions and improved mutual understanding.

Institutions dealing with groundwater management are considered to have the technical, financial and management skills and resources to fulfil designated tasks and functions. The regulatory bodies have the capacity and authority to monitor compliance with groundwater-related legislation, and to enforce controls.

There is a functional separation between groundwater regulation and groundwater development. Legally binding procedures exist for the allocation of groundwater and resolution of conflicts between competing users and uses. However, there are not efficiently implemented or provided for, with limited regulation, inspection and monitoring of private abstractions and discharge.

5.3 Policy instruments for groundwater management

Ambient groundwater quality standards (listing permissible concentrations) are legislated and enforced (as drinking water receives no treatment, and hence is of the same quality as the groundwater). Effluent standards (quality and quantity) exist for specific pollutants, industries and for vulnerable recharge areas. Abstraction controls and regulations are also detailed in national and local legislation. Legislation is considered quite strong in most areas (with many recent additions in lead up to EU accession). However, there are not efficiently implemented or regulated, as monitoring, inspection and enforcement are not well provided for, professional awareness is limited, and the definition of water protection zones has been strongly influenced by conflicting political and economic interests. Similarly, mandatory treatment regulations, discharge permit systems, technical standards, land use and building controls are legislated for but not fully implemented.

Economic pollution control incentives of effluent taxes, marketable discharge permits and clean technology subsidies exist, but the level of implementation is unclear. Public mains groundwater tariffs, domestic water metering and administrative charges are fully implemented. Private abstractions tariffs, enforcement incentives, marketable permits and industrial metering exist, but again are not fully implemented due to the level of provision for inspection and enforcement. This is especially true for old private wells which, although previously abandoned, may have re-commenced abstraction. More detailed laws are currently being developed on enforcement incentives, marketable abstraction quotas and, licences and subsidies for water efficient technologies.

6 CONCLUSIONS

Integrated groundwater source management on the whole catchment area is efficient method for controlling its quantities and quality. We should handle the catchments area as one site and the coordination between different involved sides will be better. For efficient water source

management, conservation and improving the groundwater quality and quantity the cooperation between experts, stakeholders, consumers, land users and not at least politicians on the local and state level is necessary.

Drinking water supply in Ljubljana is on the turning point. Eventual changes in the drinking water supply concept are linked to large financial funds. The sanitation costs are the main outgoing, if the present drinking water supply concept will be keep. With regards to situation today, without sanitation measurements the central drinking water supply system is under the question in the following ten years. Certainly the consumers will pay much more for the drinking water, than today, if the appropriate decisions are accepted today.

We strongly believe that the protection of drinking water sources will be one of the most important future environmental tasks. Despite the new act on waters that transfers the water resource management competence to the state level, it is necessary that the local communities still play an active role in water resource management. Safe and healthy drinking water supply is one of the most essential primary factors for a better quality of life. It has become obvious that water protection and remedial measures are dependent on strong financial support. The question is if state and local communities will be able to provide sufficient support for all activities that will be required. Water is frequently considered a social commodity and the political pressure to provide water and also sewerage services at below-costs prices to consumers is still present. The higher price of water will become a necessity. During this process the consumers will have to be given detailed explanations of the reasons and motives for higher prices. This is the only verified way to effectively include the public into the processes of environmental protection.

It is the duty of this generation to continue the vision of drinking water supply that was foreseen over a century ago. We hope that the remedial measures we employ will have effects that will still be observable over a hundred years from now.

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