

# ANALIZA NORMATIVNIH UKREPOV ZA ZAŠČITO VIROV PITNE VODE PRED NEGATIVNIMI VPLIVI S CEST AN ANALYSIS OF STANDARDIZED MEASURES FOR THE PROTECTION OF DRINKING WATER RESOURCES FROM THE NEGATIVE IMPACTS OF ROADS

Mihael BRENČIČ

*V Sloveniji je veliko število virov pitne vode, katerih zavarovana območja napajalnih zaledij pokrivajo velik del države. Zaradi tega ceste pogosto potekajo znotraj teh območij. Odloki o zavarovanih območjih vodnih virov narekujejo številne omejitve cestam in prometu, ki poteka po njih. Te omejitve so v članku analizirane in razdeljene v naslednje skupine: omejitve gradnje cest in manipulacijskih površin, gradbenotehnične zahteve za zaščito podzemne vode, omejitve hitrosti prometa, omejitve tranzitnega transporta, omejitve prevoza nevarnih in škodljivih snovi ter zahteve po postavitvi signalizacije. V članku so za vsako od skupin podane njene lastnosti, kratka analiza in njihova zastopanost glede na analizirane odloke o varovanju virov pitne vode.*

**Ključne besede:** pitna voda, podzemne voda, vodni viri, zaščiteni območja vodnih virov, zaščita podzemne vode, ceste, negativni vplivi s cest

*Slovenia has a number of drinking water resources, with their protected water recharge areas extending over a large part of the Slovenian territory. Consequently, roads and traffic often run within these areas, and are subject to numerous restrictions imposed by drinking water resource protection regulations. This article gives an analysis of these regulations and divides them into six groups: restrictions of road and manoeuvring area construction, technical and engineering requirements for ground water protection, traffic speed restrictions, restrictions of transit transport, restrictions of the transport of dangerous and harmful substances, and requirements for setting up traffic signs. The properties of each group are briefly described and analysed, and the representation of each group in the analysed water protection acts is given.*

**Key words:** drinking water, groundwater, water resources, protected water resources areas, groundwater protection, roads, negative influences from roads

## 1. UVOD

Gradnja cest predstavlja specifičen poseg v prostor, katerega značilnost je predvsem ta, da zaradi linearno poudarjene komponente, prostor razdelijo na dva ali več delov. V kakšni meri so ti deli med seboj ločeni, je odvisno od kategorije ceste ter vrste in gostote motornega prometa. Slovenija je na gosto preprejena s številnimi zavarovanimi območji vodnih virov, zaradi česar so križanja s cestami dokaj pogosta. Ceste zaradi emisij in imisij prometa ter nevarnosti razlitja nevarnih snovi predstavljajo tveganje za vire pitne vode. Tega tveganja se pripravljavci strokovnih

## 1. INTRODUCTION

Road construction is a specific activity which affects the environment and is, due to its linear component, mainly characterised by dividing the natural environment into two or more parts. The degree to which these parts are separated from one another depends on the road category and on the kind and density of traffic. Slovenia is densely covered by numerous protected water resource areas; thus their intersections with roads are fairly frequent. Because of the emissions from traffic and the possibility of hazardous spills, roads present a risk to drinking water resources.

podlag za zaščito vodnih virov zavedajo. Zato večina odlokov, ki določajo zavarovana območja, predpisuje ukrepe za zaščito podzemne vode pred negativnimi vplivi s cest. Narava teh ukrepov je odvisna od kategorije posameznega pasu znotraj zavarovanega območja. Višjo kategorijo kot ima pas, strožji so ukrepi.

Vsakdanja praksa kaže, da se ukrepi za zaščito vodnih virov pred negativnimi vplivi s cest med seboj razlikujejo. Pričakovali bi, da je to posledica razlik v naravi vodnih virov in njihovega napajalnega zaledja, toda primerjava ukrepov in lege zavarovanih območij v prostoru pokaže, da se ukrepi, tudi na območjih, kjer so naravni pogoji skorajda povsem enaki, med seboj zelo razlikujejo. Ker zavarovana območja predstavljajo precej omejujoč dejavnik pri gradnji in rekonstrukciji cest, se postavi vprašanje o upravičenosti posameznih zahtev. Hkrati pa si lahko postavimo tudi vprašanje, zakaj drugod, kjer bi bili ukrepi zaradi naravnih razmer nujni, niso bili izvedeni.

Vodni viri z enakimi naravnimi značilnostmi morajo biti pred negativnimi vplivi s cest zavarovani na podoben način in z enakim učinkom. Enaki ukrepi za zaščito vodnih virov omogočajo lažje projektiranje zaščite, hkrati pa dopuščajo celovitejšo presojo negativnih vplivov cest in cestnega prometa na vodno okolje. V nadaljevanju je, z namenom, da bi ugotovili, kakšno je stanje normativne zaščite vodnih virov pred negativnimi vplivi s cest, predstavljena analiza odlokov o zavarovanih območjih vodnih virov na območju Republike Slovenije. Takšna analiza predstavlja temelj za nadaljnje izboljšanje in racionalizacijo zaščite vodnih virov pred negativnimi vplivi s cest.

Authorities preparing expert grounds for drinking water protection are aware of this risk; therefore, most drinking water protection ordinances define measures for the protection of ground water from the negative influences from roads. The nature of these measures depends on the category of each zone within the protected area; higher zone categories have more rigorous measures.

Measures applied to different ground water protection areas vary considerably, which could be explained as a result of the differences in the nature of the water resources and their recharge areas. However, a comparison of measures taken at various locations shows big differences, as well, in areas where the natural conditions are very similar. Protected areas present a rather restrictive circumstance in road construction and reconstruction, raising the question whether a certain requirement is justified or not, and, on the other hand, why at other locations, where measures ought to be indispensable because of natural properties, they were not put into practice.

Water resources with equal natural properties should be protected from the negative impacts from roads in a similar way and with the same effect. Similar water protection measures enable easier planning of protection, and at the same time enable a more comprehensive assessment of the negative impacts from roads and road traffic on the water environment. In order to evaluate the situation of regulatory water resource protection from the negative impacts from roads, this article presents an analysis of drinking water protection ordinances in the territory of the Republic of Slovenia. Such analysis serves as a basis for the further improvement and rationalisation of drinking water protection from the negative impacts from roads.

## 2. METODOLOGIJA

Terminologija, ki jo uporabljajo odloki o varovanju virov pitne vode, je neenotna. Za potrebe predstavitve rezultatov so bila oblikovana naslednja terminološka izhodišča. Vodni viri so tista vodna telesa, ki so zajeta za potrebe vodooskrbe s pitno vodo, ne glede na to, s kakšno obliko zajema imamo opraviti. Napajalno zaledje vodnega vira, v katerem so definirani varstveni ukrepi, imenujemo zavarovano območje. Zavarovano območje je razdeljeno na več pasov. Obstoječi pasovi so v članku obravnavani le kot ožje in širše območje. Ožje območje je v neposredni bližini zajemnega objekta in zajema fizično zavarovano zajetje in najbolj ranljivi del napajalnega zaledja. Širše območje pokriva del ali celotno napajalno zaledje vodnega vira. Odlok o varovanju vodnega vira je pravni akt, ki določa zavarovano območje in varstvene ukrepe. Dopolnilo odloka je pravni akt, ki se sklicuje na odlok in praviloma ureja zaščito novih vodnih virov, ki z odlokom niso zavarovani.

Zbrali smo 171 odlokov o zavarovanih območjih in njihovih dopolnil. Strokovnih podlag, ki so služile kot temelj za sprejem odlokov, nismo analizirali. Podatke o teh pravnih aktih smo črpali iz Digitalne prostorske baze zavarovanih območij vodnih virov RS - novelacija na stanje 1999 (Brilly et al., 2000) in iz arhiva Geološkega zavoda Slovenije. Podatke o nekaterih odlokih smo preverili s pisno ali z ustno komunikacijo pri upravljavcih vodovodov (vaški in vodovodni odbori, občinske uprave, komunalna podjetja). Pregled odlokov smo zaključili maja leta 2001. Odloke o zavarovanih območjih smo uredili po posamezni občini in izvedli njihov pregled. Vsakega od aktov smo pregledali in izločili določbe, ki se nanašajo na ceste in na promet ter jih primerjalno obdelali. Člene in določbe odlokov, ki se nanašajo na cestno infrastrukturo in promet, smo v nadaljevanju klasificirali v različne skupine in jim določili frekvenco in deleže. Pri primerjalni analizi

## 2. METHODOLOGY

The terminology used in drinking water resource protection acts is not uniform. The following terminological bases were formed for the presentation of the results. Water resources are those water bodies that are captured for the needs of the drinking water supply, irrespective of the type of water capturing being used. A water resource recharge area with defined protection measures is called a protected area. Protected areas are divided into several zones. The article treats the existent zones only as the inner and outer protected areas. The inner area is in the immediate vicinity of the capture site, and comprises the physically protected capture site and the most vulnerable part of the recharge area. The outer area covers a part of, or the entire recharge area of the water resource. The water resource protection ordinance is a legal act which defines the protected area and the protection measures. The ordinance amendment is a legal document referring to an ordinance, and, as a rule, determines the protection of the new water resources which are not protected by the ordinance itself.

In order to gain an overview of groundwater protection areas, a compilation of 171 ordinances and their amendments was prepared. Expert grounds for the implementation of drinking water ordinances were not analysed. Data about these legal documents were derived from the Digital area database of the protected water resource areas of Slovenia – an update to the situation in 1999 (Brilly et al., 2000) and from the archives of the Geological Survey of Slovenia. Data about some of the ordinances were checked through verbal or written communication with waterwork managers (village and waterwork committees, community administration, etc.). The survey of acts was finished in May, 2001. Ordinances defining protection areas were grouped according to communities, then reviewed and examined. A comparative analysis of the provisions dealing with roads and traffic was made, then the articles and provisions referring to the road infrastructure and traffic were classified into different groups and a comparative analysis was carried out. The frequency and share for these groups were

posameznih odlokov in njihovih dopolnitev je največjo težavo predstavljala klasifikacija posameznih zahtev. Odloki so v navajanju zahtev precej neenotni, čeprav pogosto obravnavajo podobno ali celo isto problematiko. V primerjalno analizo odlokov smo poskušali vključiti čim višjo raven informacije, vendar pa dokumenti, ki so bili predmet obdelave, niso bili vedno popolni. To je pogosto onemogočalo neposredno primerjavo med posameznimi odloki. Pri nekaterih pravnih aktih smo imeli na voljo le fragmente (manjkajoči listi, nečitljive fotokopije ali skenogrami). To ima za posledico, da se pri podrobnejših primerjalnih analizah število odlokov med analizami ne ujema.

Domnevamo, da v primerjalno analizo nismo zajeli vseh v Sloveniji obstoječih odlokov o varovanju virov pitne vode. To je posledica tega, da so odloki o varovanju virov pitne vode težko dostopni. Nekateri od še veljavnih odlokov so objavljeni v uradnih glasilih lokalnih skupnosti starejšega datuma. Ker se je v zadnjem času organiziranost lokalne samouprave precej spremenila, je dostop do teh dokumentov otežen. V nekaterih primerih se je zaradi številnih reorganizacij upravljalcev vodovodov, informacija o tem, kje je bil posamezen odlok objavljen, izgubila, obstajajo pa le fotokopije strokovnih podlag, ki so služile za pripravo pravnega akta. Prav tako je v nekaterih primerih težko ugotoviti, kateri od odlokov še veljajo in ali je prišlo do uveljavitve novih odlokov.

Pri analizi obstoječih odlokov o varovanju vodnih virov smo izhajali le iz besedila odloka, ne pa tudi iz strokovnih podlag, ki so bile podlaga za sprejem odloka. Večina teh strokovnih podlag je nedostopnih. Zaradi tega pri analizi nismo upoštevali, za kakšen tip vodnega vira gre, ker je to, le na podlagi besedila odloka pogosto nemogoče ugotoviti. Tako na primer med seboj nismo ločili kraških vodonosnikov od medzrnskih vodonosnikov. Pri klasifikaciji zavarovanih območij in pasov so se pojavljale številne težave. Iz besedil odlokov ni razvidno, katera metodologija

determined. The classification of each individual requirement was the biggest problem in the comparative analysis of the individual ordinances and their amendments, since the requirements stated by the various acts differ considerably, although they frequently address similar, or even the same problem. There was an attempt to include the highest possible level of information in the comparative analysis of the ordinances. However, the analysed documents were not always complete, so a direct comparison between the individual ordinances was not always possible. Of some ordinances, only fragments were available (missing pages, illegible copies or scanograms), resulting in a disagreement between the number of ordinances in the more detailed comparative analyses.

It is supposed that not all existing drinking water resource protection ordinances were included in the comparative analysis, because they are hard to access. Some of the still valid ordinances are published in the old copies of local gazettes, and because the organisation of local governments has recently undergone considerable changes, these documents are not readily available. In some cases, the information about where an individual ordinance was published has been lost during the several reorganisations of waterwork management, and only photocopies of the expert grounds for the preparation of the legal documents are available. It is also difficult to find out which of the ordinances are still valid, and whether new ones have been put into force.

In the analysis of the drinking water protection ordinances only the wording of the ordinances was analysed. The expert grounds were not included in the analysis. The greater part of these expert grounds is beyond our reach. On the basis of the wording of an ordinance, it is usually impossible to determine the type of water resources treated in the ordinance. For this reason, the karst aquifers and the intergranular aquifers were not distinguished from one another in the analysis. In the classification of the protected areas and zones, several problems appeared. From the wording of the ordinances, it is usually not clear which methodology valid in

(Breznik, 1976; Rismal, 1993; Veselič & Petauer, 1997) je predstavljala izhodišče za pripravo strokovnih podlag za sprejem posameznega odloka. Iz porazdelitve pasov znotraj varstvenih pasov pa je pogosto razvidno, da so avtorji strokovnih podlag obstoječe metodologije v veliki meri prilagajali krajevnim razmeram ali postavljali svojo metodologijo.

### **3. PREGLED ODLOKOV O VAROVANJU VODNIH VIROV**

V skladu s pravnimi načeli, je v vsakem od odlokov na začetku podana zakonodaja, iz katere odlok izhaja. Pregled teh seznamov pokaže, da predpisovalci veljavnih odlokov izhajajo iz različne zakonodaje. V preglednici 1 je podan pregled izhodiščnih pravnih aktov. Ker posamezni pravni akt praviloma izhaja iz več pravnih aktov, so deleži prikazani glede na posamezen akt. Pregled preglednice kaže na precej raznolika pravna izhodišča. Pričakovali bi, da so temeljni zakoni, kot je na primer Zakon o vodah (Uradni list SRS št. 38/1981), citirani v vseh primerih, vendar temu ni tako. Zakon o vodah je citiran največkrat, vendar le v 90 odstotkih odlokov, sledijo mu različni statuti občin z 81 odstotki, ostali zakonski akti pa so citirani v manjšem številu. Poleg navedenih pravnih aktov sezname izhodiščne zakonodaje v odlokih navajajo tudi posamezne odloke o oblikovanju občinskih skupščin ali nekatere odločbe Ustavnega sodišča. Števila teh aktov nismo analizirali.

Pri analizi posameznih odlokov smo ugotovili, da se po posameznih obdobjih med seboj močno razlikujejo, tako po obsegu, kot tudi po prepovedih, zahtevah in omejitvah, ki jih nalagajo dejavnostim in posegom v prostor. Najstarejši še veljavni odlok izhaja iz leta 1964. To je Odlok o določitvi varstvenega pasu za zavarovanje vodnih virov konjiškega vodovoda (Uradni vestnik okraja Celje št. 67/1964 str. 5). Naslednji je Odlok o zaščitenem območju vodnega vira Malni in vodnega

Slovenia (Breznik, 1976; Rismal, 1993; Veselič & Petauer, 1997) was used for the preparation of the expert grounds that form the basis for the implementation of the drinking water protection ordinances. From the division of the protected zones inside the protected areas, it is clear that the authors of the expert grounds adapted the existing methodologies to the local conditions, or that they even established their own methodology.

### **3. OVERVIEW OF WATER RESOURCE PROTECTION ORDINANCES**

In accordance with the legal rules, the underlying legislation is cited at the beginning of each ordinance. An overview of these lists makes it evident that different legislation was used in preparing the ordinances. Table 1 gives an overview of underlying legal documents. Because each legal document is, as a rule, based on several legal documents, the proportions are given for each act separately. The table shows quite different underlying legislation. Basic acts, as, for example, The Waters Act (Official Gazette of the Republic of Slovenia, 1986) could be expected to be quoted in all the documents, but this is not the case. The Waters Act is quoted in most of the cases, yet only in 90% of all the ordinances; various community statutes range second, with 81%; and other legal acts have a smaller number of citations. Besides the mentioned legal documents, lists of the underlying legislation in the ordinances also include some ordinances regarding the formation of community assemblies or certain decisions of the Constitutional Court. The number of these documents has not been analysed.

The analysis of individual ordinances shows big differences among them during different periods, as well in their extent, as also in the prohibitions, requirements and restrictions that they impose on the human activities that affect the environment. The oldest ordinance that is still in effect is from the year 1964. This is The Ordinance on Determining the Protected Zone for Water Resources of the Konjice Waterworks (Official Gazette of the Celje District No. 67/1964, p. 5). The second oldest is The Ordinance on The Protection Area of the

zajetja pri Planini pri Rakeku iz leta 1971 (Uradne objave SRS 13/1971). Odloka prometa, transporta in cest ne obravnavata. Oba sta zelo kratka in nalagata le zelo splošne ukrepe za zavarovanje podzemne vode.

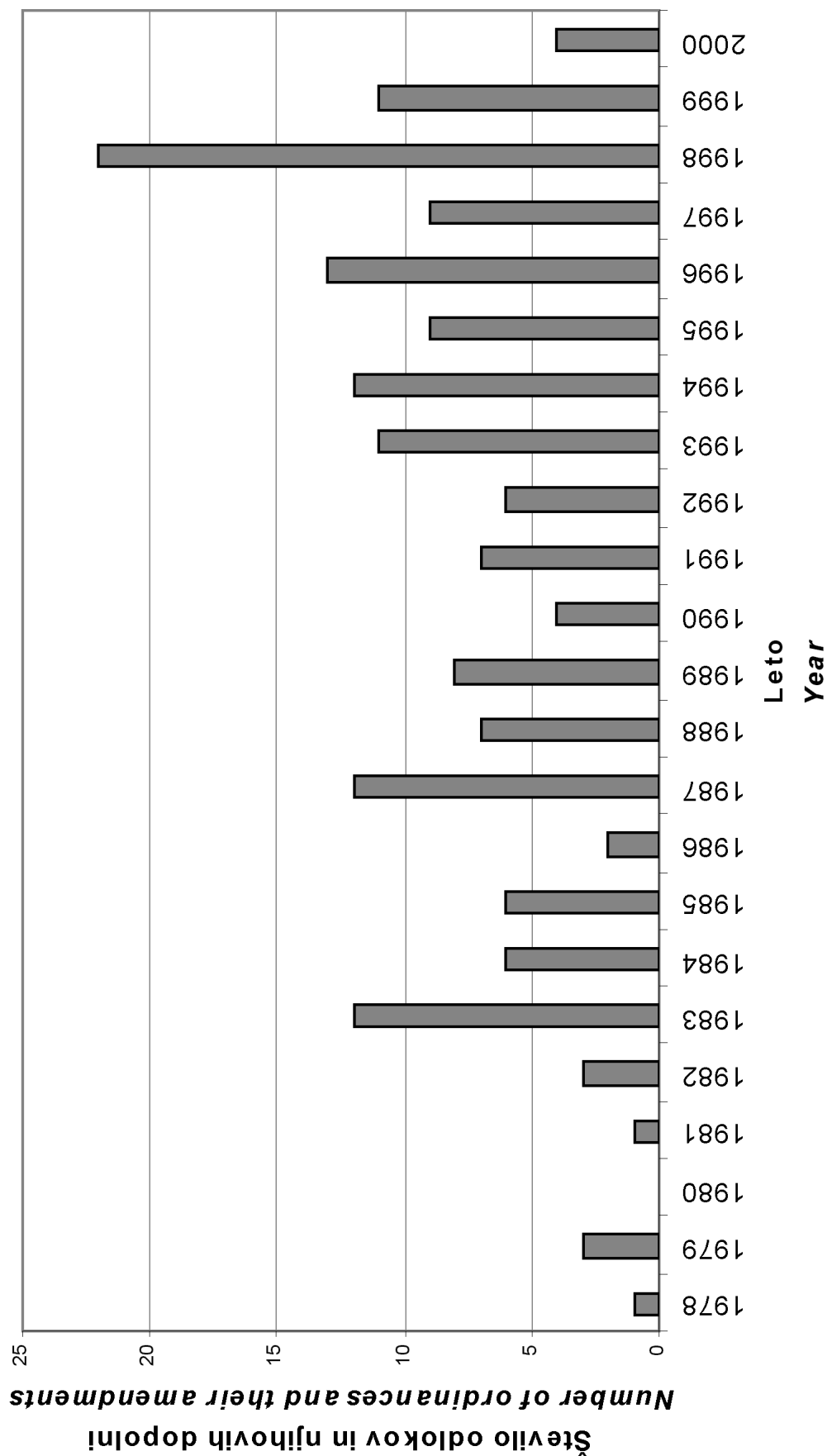
S sprejemanjem odlokov o zaščiti vodnih virov se je intenzivneje pričelo po objavi metodologije prof. Breznika (1976), ki je bila vključena tudi v takratne prostorsko izvedbene akte. Večje število odlokov je bilo sprejeto sredi osemdesetih let. Porast števila odlokov pa opazimo tudi po letu 1995. To je v veliki meri povezano z reorganizacijo lokalne samouprave, saj so za zaščito vodnih virov pristojne lokalne skupnosti. Leta 1993 je bil sprejet Zakon o lokalni samoupravi (Ur. L. RS št. 72/1993), na podlagi katerega je v letu 1995 nastalo veliko število novih občin, ki so v nekaj letih pripravile vse potrebne akte za zaščito vodnih virov pitne vode. Največje število veljavnih odlokov in dopolnitev je bilo sprejeto leta 1998. Pregled števila veljavnih odlokov in njihovih dopolnil po posameznih letih, ko so bili sprejeti, je podan na sliki 1. Najstarejša odloka v sliko nista vključena.

Podobno raznolikost, kot pri zakonodajnih izhodiščih in starosti veljavnih odlokov, opazimo tudi pri razdelitvi zavarovanih območij. Primerjalna analiza dostopnih odlokov pokaže, da se načini zaščite med seboj zelo razlikujejo. Te razlike bi bile sprejemljive v primeru, da gre za različne tipe vodonosnikov v različnih predelih države. Toda s primerjalno analizo ugotovimo, da je zaščita na območjih z enakimi hidrogeološkimi razmerami zelo različna (npr. Prekmurje) in odvisna od izdelovalca strokovnih podlag za zaščito vodnega vira ter od organa, ki je ta odlok sprejel. Strokovne podlage za sprejem zavarovanih območij so praviloma izdelane na podlagi strokovnih metodologij (Breznik, 1976; Rismal, 1993; Veselič & Petauer, 1997) in kot takšne odražajo razdelitev, ki jo te metodologije uvajajo. Močno prevladujejo zavarovana območja, kjer so definirani trije pasovi, sledi pa jim razdelitev na štiri pasove.

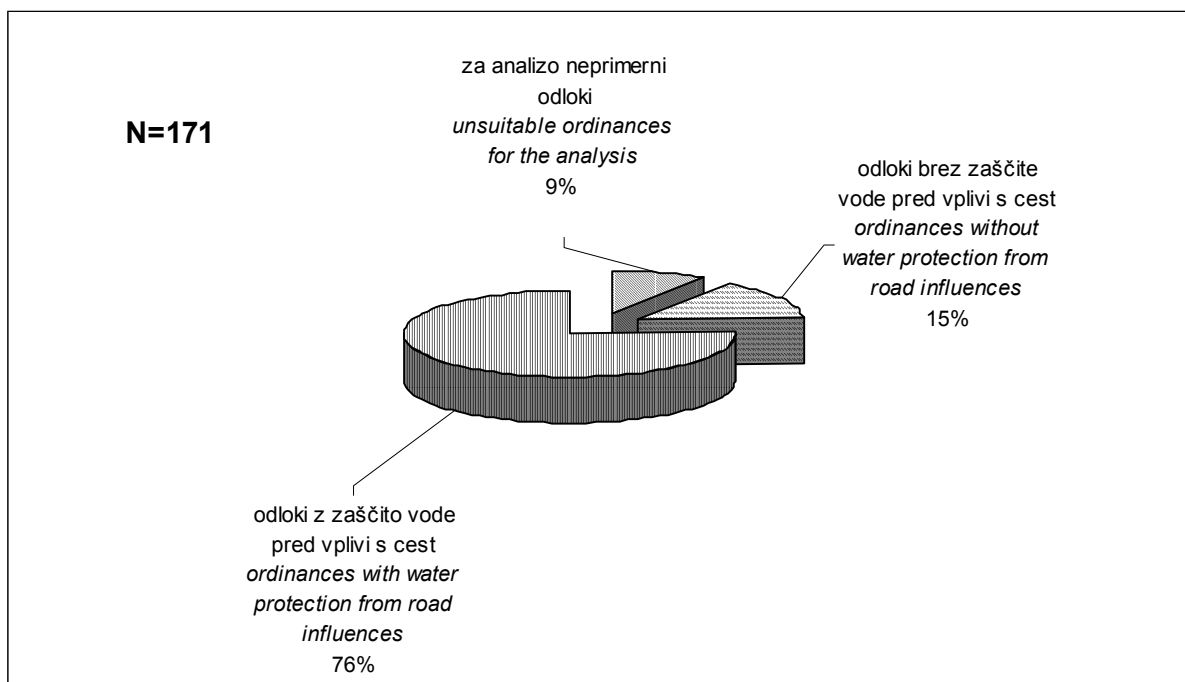
Malni Water Resource and Water Capture Site at Planina near Rakek from 1971 (Official Gazette of Republic of Slovenia 13/1971). These Ordinances do not address traffic, transport and roads. Both are very short and provide only very general measures for the groundwater protection.

A more intensive period of passing water resource protection ordinances began after the methodology of Professor Breznik was published (1976). This methodology was also included in the spatial planning documents. A considerable number of ordinances were also passed in the mid-eighties, and there was also a noticeable increase after 1995. This fact is, to a great extent, in relation with the reorganisation of local government, which gives responsibility for water resource protection to the local communities. A number of new communities were formed in 1995, based on the new Local Government Act from 1993 (Official Gazette of Republic of Slovenia). Within a few years, these communities prepared all the necessary water-protection legislation. The greatest number of ordinances and their amendments were passed in 1998. An overview of the number of ordinances and their amendments for each year is given in Figure 1. The oldest two ordinances are not included.

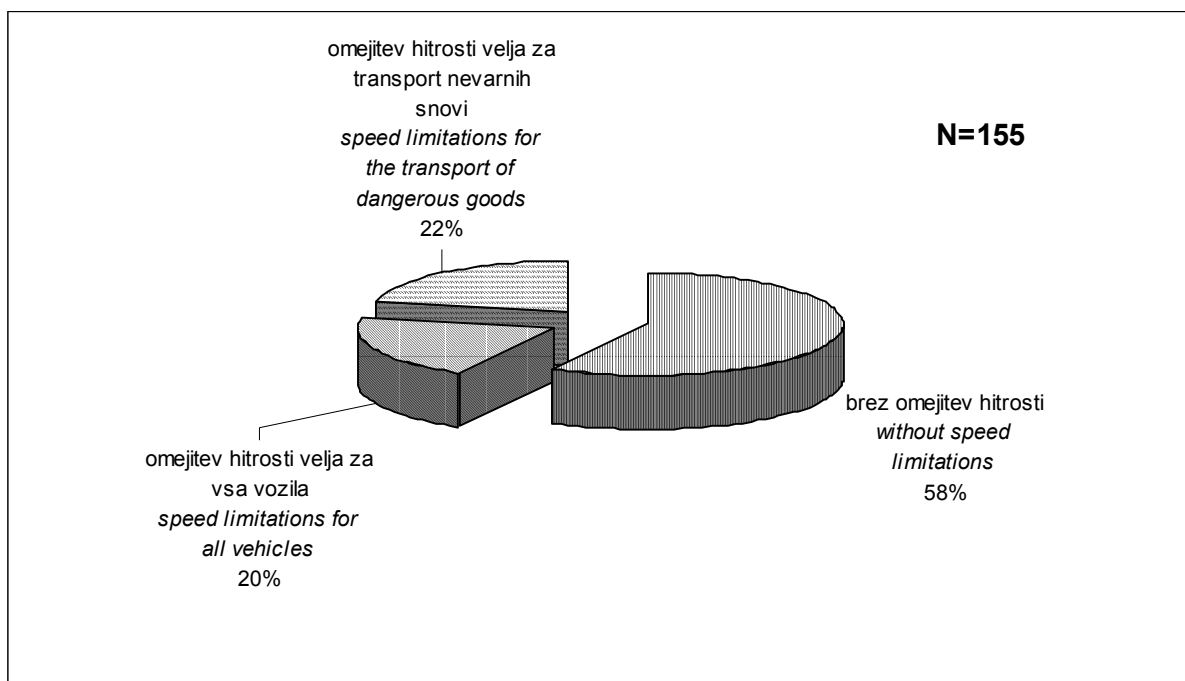
A similar diversity as in the legislation grounds and the age of the valid ordinances can also be observed in the classification of protected areas. A comparative analysis of the disposable ordinances shows big differences among the methods of protection. These differences would be acceptable in the case of various aquifer types in the different parts of the country. However, protection measures in the areas with the same hydrogeological properties were also found to be very diverse (e.g. Prekmurje) and dependent on the author of the expert grounds for the protection of the resource and on the institution that passed a certain act. Expert grounds for the delineation of protected areas are generally prepared on the basis of methodologies (Breznik, 1976; Rismal, 1993; Veselič & Petauer, 1997), and, as such, reflect the division introduced by these methodologies. Protected areas with three zones prevail, followed by those divided into four zones.



Slika 1. Pregled števila odlokov in njihovih dopolnitev po letih njihove uveljavitve.  
 Figure 1. Overview of the number of ordinances and their amendments according to the years of their enforcement



Slika 2. Pregled števila odlokov in njihovih dopolnitev glede na deleže zaščite podzemne vode pred negativnimi vplivi s cest.  
*Figure 2. Overview of the number of ordinances and their amendments according to water protection from road influences.*



Slika 3. Pregled števila odlokov in njihovih dopolnitev glede na omejitve hitrosti znotraj zavarovanih območij.  
*Figure 3. Overview of the number of ordinances and their amendments according to speed limits in the protection zones*



#### **4. ANALIZA NORMATIVNIH UKREPOV ZA ZAŠČITO PRED NEGATIVNIMI VPLIVI S CEST**

Analizo odlokov s stališča cest in prometa smo razdelili v več skupin. Na obratovanje cest, njihovo vzdrževanje in transport se posredno nanašajo tudi nekatere druge dejavnosti, kot so skladišča nafte in plina, gradnja ponikovalnic in spremljevalnih objektov. Analize določb v zvezi s temi objekti in dejavnostmi v članku ne navajamo.

Analizirali smo 155 odlokov in njihovih dopolnil, preostalih 16 odlokov ni omogočalo analize. Med analiziranimi pravnimi akti jih 25 ali 16 odstotkov zaščite pred negativnim vplivi s cest ne obravnava, od tega gre za 7 odlokov, ostalo pa predstavljajo dopolnitve in spremembe odlokov. Problem cest in transporta v dopolnilih je urejen v odlokih, na katere se nanašajo. Pregled števila odlokov in njihovih dopolnitev glede na deleže zaščite podzemne vode pred negativnimi vplivi s cest je podan na sliki 2.

V številnih odlokih zasledimo omejitve in prepovedi gradnje cest. Te omejitve so definirane zelo raznoliko in se nanašajo na različne kategorije cest in poti. Vsak vodni vir je na območju, kjer je zajetje, praviloma ograjen in zavarovan z drugimi ukrepi. Odloki na tem območju prepovedujejo kakršne koli posege, izjemoma le za potrebe vodovoda. Včasih je v odlokih definirana tudi določba, ki se nanaša na gradnjo poti znotraj tega območja, vendar le v primerih rekonstrukcije in razširitve že obstoječih poti.

V zavarovanih območjih zunaj najožjega območja zajetja pa so omejitve za gradnjo cest precej raznolike in neenotne. V velikem delu odlokov zasledimo prepovedi za gradnjo določenega tipa cest. Člene o prepovedi gradnje cest zasledimo v 78 odlokih, kar je 50 odstotkov vseh analiziranih odlokov. V nekaterih primerih, ko so uveljavljene prepovedi o gradnji cest, so dovoljene izjeme. V takšnem primeru je dovoljena gradnja cest v

#### **4. ANALYSIS OF THE NORMATIVE MEASURES FOR THE PROTECTION AGAINST NEGATIVE IMPACTS FROM ROADS**

Ordinances dealing with roads and traffic were divided into several groups. The operation of roads, their maintenance and transportation are also indirectly related to some other activities, such as oil and gas depots, the construction of sinkholes and accompanying facilities. This article does not provide an analysis of the regulations dealing with these facilities and activities.

A total of 155 ordinances and their amendments were analysed; an analysis of the remaining 16 documents was not feasible. Twentyfive documents do not deal with the protection from the negative impacts from the roads, which amounts to 16%. Seven of these are ordinances, the rest are amendments. The problem of the roads and transport in amendments is dealt with in the related ordinances. An overview of the number of ordinances and their amendments according to water protection from road influences is given in Figure 2.

A number of ordinances define the restrictions and prohibitions of road construction. These restrictions are defined very diversely and refer to the different categories of roads and ways. As a rule, the capture area of each water resource is surrounded by a fence and secured by other means. Any kind of activities and construction work are prohibited, exceptional only for the needs of the waterworks. Sometimes the provisions of certain ordinances are included which deal with the construction of the ways within that area; however, only as a reconstruction and widening of the existing roads.

The restrictions of road construction outside the inner protected zone are quite diverse. A greater part of the ordinances includes the prohibition of the building of a certain road type. Articles prohibiting road construction are to be found in 78 ordinances, which amounts to 50%. In some cases where road construction is prohibited, exceptions are permitted. In this case, road construction is permitted in

skladu s planskimi dokumenti, prostorsko izvedbenimi akti ter predpisi in ob predhodnem upoštevanju predpisov o varovanju podzemne vode.

Primerjava med prepovedmi v ožjem in širšem zavarovanem območju pokaže, da je število omejitev v ožjem območju mnogo večje kot v primeru širšega pasu. Omejitve za gradnjo cest v širšem varstvenem pasu zahteva le 10 odlokov, kar je le 6 odstotkov vseh odlokov. Združeni pregled prepovedi za gradnjo cest znotraj zavarovanega območja je podan v preglednici 2. Omejitve smo le našteali, posamezne zahteve pa smo med seboj le združili, ker jih je zaradi raznolikosti težko združiti v enotne kategorije.

Ukrepi za zaščito v širšem varstvenem območju so bolj načelni. Kot varstveni ukrep je predpisana takšna gradnja cest, ki preprečuje onesnaženje podzemne vode. Kot primer podajamo nekaj načel iz posameznih odlokov:

- opremiti ceste tako, da tekočine ne prenikajo v podtalje
- magistralne in regionalne ceste ter manipulativne površine graditi tako, da bo zagotovljena največja možnost zaščite zalog pitne vode
- obstoječe ceste je treba preurediti tako, da v primeru incidentov morebitne razlite tekočine ne morejo posredno ali neposredno pronicati in prenikati do podtalnice
- ceste, po katerih poteka promet s tovornimi motornimi vozili, morajo biti urejene tako, da je onemogočeno neposredno ogrožanje vodnega vira
- graditi nove in preurediti obstoječe ceste v skladu z najboljšo razpoložljivo tehnologijo glede zaščite zalog pitne vode

V nekaterih novejših odlokih je predpisano, da morajo imeti novozgrajene ceste ali tiste, ki se rekonstruirajo, izdelan projekt zaščite podzemne vode in druge projekte, ki se navezujejo na gradnjo in vzdrževanje ceste. Pomemben ukrep za zaščito vodnih virov pred negativnimi vplivi s cest predstavljajo tudi gradbenotehnični ukrepi. Gradbenotehnični ukrepi so predpisani v 21 odlokih, kar je 14 odstotkov vseh analiziranih odlokov.

accordance with planning documents, spatial planning documents and regulations, taking into account the preliminary regulations about groundwater protection.

A comparison of the restrictions pertaining to the inner and outer protected areas shows a much higher number of restrictions in the inner areas. The restrictions of road construction in the outer protected zone are defined in only 10 documents, which makes 6% of all the ordinances. An overview of road construction restrictions within the protected areas is given in Table 2. The restrictions are only listed; particular requirements are joined together due to difficulties in the classification.

Measures for groundwater protection in the outer protected areas are of a more general nature, prescribing road construction that prevents groundwater pollution. The following are some illustrative principles from several ordinances:

- the roads are to be equipped in a way that prevents the seepage of fluids into the ground
- the construction of the main and regional roads and the manoeuvring areas must ensure the highest possible protection of the drinking water resources
- the existing roads must be reconstructed so as to prevent the possibility of the direct and indirect seepage of spills into the groundwater system
- roads carrying cargo traffic must be designed and constructed so as to prevent the possibility of causing a direct hazard to the water resource
- road construction and reconstruction must be in compliance with the best available drinking water resource protection technology.

Some more recently passed acts demand that newly constructed and reconstructed roads have a groundwater protection scheme and other projects dealing with road construction and maintenance. An important measure for the protection of water resources from the negative impacts from roads are also technical engineering measures. They are defined in 21 of the ordinances, which amount to 14% of all the analysed documents.

Elementi ceste, ki jih zahtevajo ti odloki, morajo biti naslednji:

- neprepustno cestišče,
- odbojna ograja (nekateri odloki predpisujejo tudi enakovreden visok robnik)
- neprepustna koritnica v peti nasipa,
- 2 ali 3 metra širok pas ob cesti, nagnjen proti koritnici
- neprepustna brežina
- vodotesna (neprepustna) kanalizacija
- lovilci maščob, s katerih mora biti voda speljana v vodotesno kanalizacijo ali preko izpusta v vodotok s stalno vodo

Zgoraj naštetimi ukrepi za zaščito podzemne vode pred negativnimi vplivi s cest izhajajo iz metodologije prof. Breznika (1976), ki je zaščito podzemne vode pred negativnimi vplivi s cest razdelil na dve stopnji zaščite. Nekateri odloki to stopnjo zaščite predpisujejo (npr. »...cestišče mora imeti prvo stopnjo zaščite...«). Za kakšno stopnjo zaščite gre, je včasih pojasnjeno z dodatnim komentarjem. V primerih, ko komentar ni podan, je ta določba sporna, saj z nobenim od veljavnih, pa tudi predpisov, ki jim je veljavnost pretekla, zaščita podzemne vode po stopnjah ni predpisana. Prav tako pa v preambulah odlokov ali v opisih strokovnih podlag, na podlagi katerih so bili izdelani odloki, ni zahtevano, da je treba takšno zaščito upoštevati. Večina drugih odlokov, ki urejajo gradnjo in obratovanje cest, definira predvsem načelo, da se morajo ceste graditi in rekonstruirati tako, da ne pride do onesnaženja podzemne vode.

V nekaterih odlokih, poleg splošnih načel za zaščito cest pred negativnimi vplivi s cest, zasledimo tudi konkretne zahteve za rekonstrukcijo obstoječih cest. Te ceste so definirane s konkretnimi imeni ali z oznakami. Odlokov, ki določajo ukrepe na teh cestah, je 18 ali 12 odstotkov.

Eden od pogostih ukrepov za zaščito podzemne pitne vode pred negativnimi vplivi s cest je tudi omejitev hitrosti vozil. Omejevanje hitrosti vozil kot varstveni ukrep izhaja iz dejstva, da je tveganje, da bo do prometne

These ordinances demand the following road construction elements:

- an impermeable roadway
- protective fencing (some acts also define an equivalently high curb)
- an impermeable ditch at the foot of the embankment
- a 2- to 3-m wide strip along the road inclined towards the ditch
- an impermeable embankment
- an impermeable sewage system
- oil separators, from which the water must be drained into impermeable sewage pipes or through the drain into a stream with permanently flowing water

These measures are based on the methodology of Professor Breznik (1976), who divided the protection of the groundwater from the negative impacts from roads into two degrees. Some acts prescribe one of these degrees of protection (e.g. "the roadway must be constructed according to the first degree of protection..."). The type of protection is, in some cases, explained with additional commentary. In the cases where no commentary is given, the requirement is disputable, since none of the ordinances, either valid or expired, define groundwater protection measures according to the degrees. The preambles of the ordinances or the expert grounds underlying these ordinances also do not demand that this protection should be respected. In most other ordinances regulating the construction and use of roads, protection is defined only as a principle that roads are to be built and reconstructed in a way that prevents groundwater pollution.

Besides the general principles for the protection of the groundwater from the negative impacts from roads, concrete demands for the reconstruction of the existing roads are defined in 18 cases, or 12% of the ordinances, giving the exact names or designations of roads.

One of frequently applied measures for groundwater protection from the negative impacts from roads is also the speed limit of the vehicles. This measure is based on the fact that the risk for a traffic accident to happen

nesreče prišlo, manjše pri nižjih hitrostih kot pri višjih. Isto velja tudi za morebitne nesreče cistern in razlitja nevarnih tekočin, ki jih te prevažajo. Izmed vseh analiziranih odlokov jih je 90 ali 58 odstotkov brez določb o omejevanju hitrosti na cestah, ki prečkajo posamezna zavarovana območja. Podrobnejša analiza odlokov, kjer so omejitve predpisane, pokaže, da so omejitve hitrosti dokaj raznolike.

Omejitve hitrosti razdelimo v dve skupini, in sicer v prvo skupino, kjer velja omejitev hitrosti za vsa vozila, in v drugo skupino, kjer velja omejitev hitrosti le za vozila, ki prevažajo nafto, tekoče naftne derivate ter nevarne in škodljive snovi. V obeh skupinah prevladuje omejitev hitrosti na 40 km/h, predpisane pa so tudi druge hitrosti, tako nižje, kot tudi višje. Pri nekaterih odlokih ni jasno, ali veljajo omejitve le za vozila, ki prevažajo nevarne snovi ali za vsa motorna vozila. V prvi skupini 34 ali 22 odstotkov odlokov predpisuje omejitev hitrosti za vsa motorna vozila, ne glede na to, kaj prevažajo. V 29 primerih je zahtevana omejitev hitrosti skozi zavarovano območje vodnega vira 40 km/h. Ostali odloki omejitve hitrosti ne predpisujejo, ali pa gre za izjeme, ki natančno predpisujejo omejitve hitrosti pri določenih pogojih.

V drugi skupini so omejitve predpisane le za transport snovi, ki so nevarne za podzemno vodo. Tudi znotraj te skupine so omejitve vezane predvsem na hitrost 40 km/h. Ločimo pa omejitve, ki veljajo za ves transport nevarnih snovi, ne glede na to, ali gre za tranzitni promet ali za lokalni transport, in omejitve, ki veljajo le za tranzitni promet. Odlokov, ki postavljajo omejitve v zvezi s hitrostjo transporta nevarnih snovi je 31 ali 20 odstotkov, v 5 primerih velja ta omejitev le za lokalni promet, ker je tranzitni promet prepovedan. V dveh primerih pa je z odlokom natančno določena cesta, po kateri je tranzitni promet nevarnih snovi dovoljen. Pregled števila odlokov in njihovih dopolnitev glede na omejitve hitrosti znotraj zavarovanih območij je podan na sliki 3.

decreases considerably with lower speeds. The same is also true for the possible spills of dangerous liquids from vehicle tankers. On the whole, 90 of the ordinances, or 58%, lack any kind of provisions regarding the speed limits on the roads crossing groundwater protection zones. An analysis of the ordinances including these provisions shows much diversity in speed limits.

Speed limits can be divided into two groups. In the first group, speed is limited for all vehicles, and in the second, restrictions refer only to vehicles transporting oil, liquid oil products and dangerous and harmful substances. Most common in both groups is the speed limit of 40 km/h, although there are also higher and lower limits. Some documents do not specify clearly enough whether speed limits refer only to vehicles with dangerous cargo or to all motor vehicles. The first group includes 34 ordinances (22%) defining a speed limit for all motor vehicles, regardless of their cargo. In 29 cases, the speed limit of 40 km/h is defined in the water resource protection area. Other documents either do not set a speed limit, or exactly define speed limits under certain circumstances.

Speed restrictions in the second group apply only to the transport of substances hazardous to groundwater. The speed limit in most cases is 40 km/h. There is also a distinction between the restrictions applying to the entire transport of dangerous substances, both for the transit of goods and for local traffic, and between the restrictions referring only to the transit of goods. The speed limit for the transport of hazardous substances is defined in 31 cases, which makes 20%. In five cases the restriction applies only to local traffic, because the transit of goods is prohibited, and in two cases, the ordinance exactly determines the road where the transit of any dangerous substances is allowed. An overview of the number of ordinances and their amendments according to the speed limits inside the protection zones is given in Figure 3.

Omejevanje prevoza preko zavarovanih območij virov pitne vode se nanaša predvsem na nevarne snovi. V zvezi z definicijami pitni vodi nevarnih snovi zasledimo številne opise. Vodi nevarne snovi so v odlokih navedene poimensko kot: nafta, tekoči (lahkotekoči) naftni derivati, nevarne snovi, škodljive snovi, nevarne tekočine, nevarne kemične tekočine in mineralna olja. Število poimenovanj pitni vodi nevarnih snovi kaže na nenatančnost definicij. Nekateri odloki se definiciji nevarnih snovi poskušajo izogniti z omenjanjem ustrezne zakonodaje, kot na primer: «... nevarne in škodljive snovi, ki so navedene v predpisih o prevozu nevarnih snovi». Redki odloki pa navajajo tudi predpis, ki ga je treba pri tem upoštevati.

Večina odlokov določa, da je zavarovana območja potrebno označiti z ustrezno signalizacijo. Pomen signalizacije se od odloka do odloka razlikuje. Praviloma je postavljena le zahteva po označitvi zavarovanih območij ob cestah in poteh. V nekaterih odlokih pa so oznake predpisane zelo natančno. Predpisana je vsebina in izgled opozorilnih tabel.

Limitations of the transport over drinking water resource protection areas refer, above all, to substances hazardous to drinking water. These substances are defined in many different ways, with names such as: oil, liquid oil products, dangerous substances, harmful substances, dangerous liquids, dangerous chemical liquids and mineral oils. The number of descriptions indicates an inaccuracy of definitions. Some ordinances try to avoid the definition of hazardous substances by mentioning relevant legislation, e.g.: "dangerous and harmful substances listed in the regulations about the transport of dangerous substances." Yet very few acts also quote the relevant regulation.

Most acts require that protected areas should be marked with adequate road signs. The importance of signs varies from one act to the other. As a rule, only the designation of protected areas along the roads and ways is demanded. In some acts, the signs are very precisely defined, determining the content and form of the warning signs.

Preglednica 1. Pregled zakonskih izhodišč za sprejem odlokov o varovanju vodnih virov.  
*Table 1. Overview of the legal grounds for the passing of water resource protection acts.*

| pravni akt<br><i>legal document</i>   | število odlokov<br><i>number of ordinances</i> | delež [%]<br><i>share (%)</i> |
|---|--|-------------------------------|
| Zakon o vodah<br><i>Water Act</i>   | 159  | 90                            |
| Zakon o prekrških<br><i>General Offences Act</i>  | 96   | 54                            |
| Zakon o varstvu okolja<br><i>Environmental Protection Act</i>   | 13   | 7                             |
| Zakon o lokalni samoupravi<br><i>Local Government Act</i>   | 12   | 7                             |
| Zakon o urbanističnem planiranju<br><i>Urban Planning Act</i>   | 3  | 2                             |
| Statut občine<br><i>Community Statute</i>   | 144  | 81                            |
| Zakon o urejanju naselij in drugih posegih v prostor<br><i>Urban Planning and Other Forms Of Land Use Act</i> | 3  | 2                             |

Preglednica 2. Pregled prepovedi za gradnjo cest znotraj zaščitenih območij.

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*V ožjem zaščitenem območju:*

Prepovedana je gradnja novih cest

Prepovedana je gradnja prometnic

Prepovedano je graditi magistralne in regionalne ceste

Prepoved gradnje lokalnih cest

Prepovedana je izgradnja magistralnih cest in parkirišč

Prepovedana je gradnja javne ceste in cest za javni promet

Prepovedana je izgradnja novih cest z izjemo dovoznih cest, manjših poti in kolovozov

*V širšem zaščitenem območju:*

Prepovedana je gradnja avtocest

Prepovedano je graditi ceste za tranzitni promet brez varstva podzemne vode

Prepovedana je gradnja novih cest z izjemo dovoznih

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*Table 2. Overview of the prohibitions for road construction within the protected areas.*

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*In the inner protection areas:*

Construction of new roads

Construction of traffic routes

Construction of main and regional roads

Construction of local roads

Construction of main roads and parking places

Construction of public roads and roads for public traffic

Construction of new roads with the exception of access roads, minor ways and tracks

*In the outer protection area:*

Motorway construction

Construction of roads for transit traffic without groundwater protection

Construction of new roads with the exception of access roads

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## 5. SKLEP

Velik del Slovenije je pokrit z zavarovanimi območji vodnih virov. Poleg pozitivne vloge pri zaščiti virov pitne vode, predstavljajo zavarovana območja številne omejitve urbanističnemu razvoju, med drugim tudi razvoju cestnega omrežja in prometa. Z namenom, da bi ugotovili, kakšne so omejitve, ki se nanašajo na ceste in promet, smo analizirali vse veljavne in hkrati dostopne odloke o zavarovanih območjih virov pitne vode in njihove dopolnitve. Izhajali smo le iz odlokov, strokovnih podlag, ki so služile kot temelj za sprejem odlokov, nismo analizirali.

Pregled odlokov je pokazal, da se med seboj precej razlikujejo, tako po starosti, kot tudi po vsebinski plati. Odloki, ki so bili sprejeti kasneje, so praviloma bolj obsežni in vsebujejo večje število zahtev, prepovedi in omejitev. Takšne lastnosti veljajo tudi za določila, ki se nanašajo na ceste in cestni promet.

V zvezi s cestami, prometom in transportom, ki se odvija po cestah, smo prepovedi, ukrepe in omejitve, ki jih nalagajo odloki, razdelili v naslednje skupine:

- omejitve gradnje cest in manipulacijskih površin,
- gradbenotehnične zahteve za zaščito podzemne vode
- omejitve hitrosti prometa,
- omejitve tranzitnega transporta,
- omejitve prevoza nevarnih in škodljivih snovi,
- zahteve po postavitvi signalizacije na zavarovanih območjih.

Omejitve, ki jih odloki narekujejo cestam in cestnemu prometu, segajo od načelnih zahtev do konkretnih določb, ki se nanašajo na projektiranje gradbenotehničnih zahtev za zaščito vodnih virov. S podobnimi razmerami imamo opraviti tudi pri predpisanih omejitvah hitrosti vozil na zavarovanih območjih, kot tudi pri drugih omejitvah. Nekatere od teh težav bi bilo mogoče razrešiti z ustreznimi tehničnimi specifikacijami, v predpise pa bi bilo treba vgraditi zahtevo po praktični presoji in nadzoru izvedenih ukrepov.

## 5. CONCLUSION

A great part of Slovenia is covered with drinking water protected areas. Despite their positive role in the protection of drinking water resources, these protected areas pose numerous restrictions to urban development, and, among other things, to the development of road infrastructure and traffic. With the aim of obtaining an overview of the restrictions applying to roads and traffic, all the accessible acts on drinking water resource protection areas and their amendments have been analysed. Only the ordinances were analysed, while the expert grounds, on which they were based, were not included in the analysis.

The survey of acts showed considerable differences among the ordinances, as well with regard to their dates of issue as also to their contents. The documents which were passed more recently are generally more comprehensive, including more requirements, prohibitions and restrictions. This is true, as well, of the provisions referring to roads and road traffic.

The prohibitions, measures and restrictions demanded by the acts were grouped as follows, with regard to the roads, traffic and the transport on roads:

- restrictions of road and manoeuvring area construction
- technical engineering requirements for the protection of the groundwater
- traffic speed restrictions
- restrictions of transit transport
- restrictions of the transport of dangerous and harmful substances
- demands regarding the setting up of road signs in the protected areas

The restrictions referring to roads and road traffic range from the general requirements to the concrete provisions determining the planning of the technical requirements for construction. A similar situation can also be observed with regard to speed limit regulations in the protected areas and with regard to other restrictions. Some of these problems could be solved by means of adequate technical specifications. In addition to this, the regulations should also require the practical judgement and monitoring of the realised measures.

Zaščita virov pitne vode je v pristojnostih lokalne skupnosti, kar ima za posledico, da so podatki o zavarovanih območjih in odlokih, ki jih določajo, pogosto težko dostopni. Vsebina nekaterih odlokov je že nekoliko zastarela in ne upošteva današnjega stanja razvoja stroke, kot tudi ne veljavne zakonodaje. Takšno stanje je mogoče izboljšati le s tekočim vodenjem podatkov o zavarovanih območjih vodnih virov. Ustanova, ki bi upravljala s temi podatki, bi morala upravne organe, pristojne za zaščito vodnih virov, opozarjati na trenutno stanje, ti pa bi morali na podlagi dopoljenih zakonskih podlag in strokovnih podlag ustrezno ukrepati.

V zvezi z analizo normativnih ukrepov za zaščito pred negativnimi vplivi s cest, ki so podani v posameznih odlokih, ostajajo odprta še številna vprašanja. Za podrobnejši vpogled v stanje bi bilo treba izvesti tudi analizo strokovnih podlag, ki so služile kot temelj za sprejem odloka in analizo metodologij, ki so predstavljale izhodišče za pripravo strokovnih podlag. Na podlagi teh informacij je treba pri nadaljnjih analizah izhajati tudi iz vrste vodnega vira. Upoštevati bi bilo treba, ali gre za površinski vodni vir, kraški, razpoklinski ali medzrnski vodonosnik. Žal pa je velik del strokovnih podlag težko dostopen, kar otežuje natančno in celovito analizo. Seveda pa ostajajo odprti še številni drugi vidiki odlokov o varovanju virov pitne vode, ki zahtevajo natančno in obsežno analizo.

## ZAHVALA

Podatki in rezultati, ki so predstavljeni v članku, so bili obdelani v okviru raziskovalne naloge Zaščita podzemne pitne vode pred negativnimi vplivi s cest, ki jo je financirala Direkcija Republike Slovenije za ceste v okviru Ministrstva za promet in zveze. Manjši del obdelav in priprava članka so bili izvedeni v okviru projekta Urbana hidrogeologija – vpliv infrastrukturnih objektov na podzemno vodo, ki ga financira Ministrstvo za šolstvo, znanost in šport RS (št. Projekta L-1-3107-0215-01). Avtor se za pomoč pri pripravi podatkov o zavarovanih območjih zahvaljuje absolventki geologije Saški Vidmar.

The protection of drinking water is within the responsibility of local communities: hence, information about the protected areas and their pertaining documents is not always readily available. The contents of some ordinances is somewhat outdated, paying no regard to the present stage of professional knowledge and valid legislation. This situation can be improved only by the current and ongoing monitoring of the protected water resource areas. The institution dealing with these data should keep the competent administrative authorities informed about the present situation, and these institutions should take the appropriate measures on the basis of the new legislation and the expert grounds.

In the analysis of the drinking water protection ordinances, a lot of questions about the influence of roads on drinking water resources still remain open. For more detailed insight into the ordinance, the expert grounds and methodologies that formed the basis for the implementation of the ordinance should be analysed. In further analysis, the type of drinking water resource must be considered. On the basis of this information, drinking water resources must be divided into the following groups: karst aquifers, fissured aquifers and intergranular aquifers. For some ordinances, these facts are not accessible, which makes a precise and complete analysis impossible. Indeed, some further views of drinking water resources still remain open, and they require a precise and comprehensive analysis.

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## VIRI - REFERENCES

- Breznik, M. (1976). Metodologija zaščite podzemne pitne vode ter določitve varstvenih območij in pasov (Methodology for drinking groundwater protection and protection areas and zones determination). In: Regionalni prostorski plan za območje SR Slovenije, Zasnove uporabe prostora – vodno gospodarstvo. SR Slovenija, Zavod SR Slovenije za družbeno planiranje, Področje za prostorsko planiranje, 119 – 176. (in Slovenian).
- Brilly, M. Vidmar, A., Šraj, M. (2000). Digitalna prostorska baza zaščitenih območij vodnih virov RS - novelacija na stanje 1999 (Digital spatial data base of water resources protection zones in RS – update to year 1999), Unpublished report, Ministry of planning and the environment, CD ROM (in Slovenian).
- Odlok o določitvi varstvenega pasu za zavarovanje vodnih virov konjiškega vodovoda (1964). Uradni vestnik okraja Celje št. 67,5 (The Ordinance on Determining the Protected Zone for Water Resources of the Konjice Waterworks, in Slovenian).
- Odlok o zaščitenem območju vodnega vira Malni in vodnega zajetja pri Planini pri Rakeku (1971). Uradne objave SRS 13, 69. (The Ordinance on The Protection Area of the Malni Water Resource and Water Capture Site at Planina near Rakek, in Slovenian).
- Rismal, M. 1993. Zaščita podtalnice – strokovno navodilo za izdelavo normativnih aktov za zavarovanje kakovosti podtalnice (Groundwater protection – guidelines for preparation of legislation for groundwater quality protection). Inštitut za zdravstveno hidrotehniko, Ljubljana, 69 p. (in Slovenian).
- Veselič, M. & Petauer, D. 1997. Metodologija določevanja zaščitenih območij podzemnih voda (Methodology for groundwater protection zones determination). IRGO, GEOKO d.o.o., Ljubljana, 13 p. (in Slovenian).
- Zakon o lokalni samoupravi (1993). Uradni list RS št. 72. Local Government Act (in Slovenian).
- Zakon o vodah (1981). Uradni list SRS št. 38. Water Act (in Slovenian).

## Naslov avtorja - Author's Address

*dr. Mihael Brenčič*  
Geološki zavod Slovenije -  
Dimičeva 14, SI-1000 Ljubljana,  
Email: mbrencic@geo-zs.si