



EMERGENCY PROTECTION OF KARST WATER SOURCES

HYDROGEOLOGICAL RESEARCH IN THE FRAME OF THE GEP PROJECT

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M. Petrič¹, J. Janež², N. Ravbar¹, J. Hočevar², J. Kogovšek¹, T. Slabe¹, J. Turk¹

¹Karst Research Institute at ZRC SAZU, Titov trg 2, 6230 Postojna, Slovenia, petric@zrc-sazu.si

²Geologija d.o.o. Idrija, Prešernova 2, 5280 Idrija, Slovenia

PARTNERS

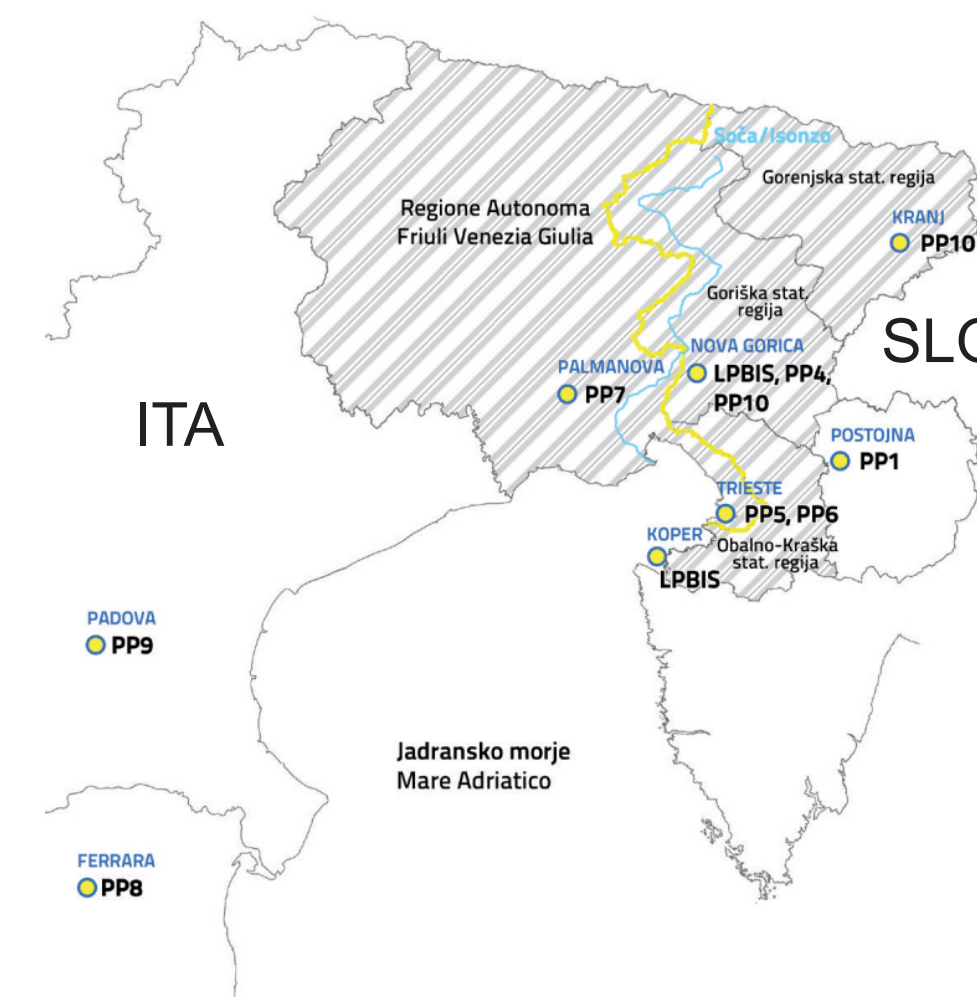
NIJZ Nacionalni inštitut
za javno zdravje

LP BIS: Nacionalni inštitut za javno zdravje



Introduction

The purpose of a three-year long project “GEP Joint Geo-Information System for Emergency Protection of Drinking Water Resources” is to establish a uniform cross-border action system for the Civil Protection Service in cases of hazards posed to the sources of drinking water owing to technological risks and natural disasters. This algorithm is an important functional tool for immediate and efficient action of all institutions and bodies involved in the cases of intervention. For planning adequate measures it is necessary to consider the hydrogeological characteristics of the area which define the mode and extent of eventual pollution transfer. For the selected study areas of the Trnovo-Banjšice karst plateau and the alluvium of the Soča (Isonzo) River all available hydrogeological information as well as the results of some additional field studies and hydrological modelling were elaborated and various scenarios of pollution spreading tested. The final goal of the project is to incorporate the results obtained into the GIS of drinking water resources. Based on the information about the accident location also non-experts in hydrogeology will be able to use this GIS in order to assess the endangered water sources, the approximate time in which the appearance of pollution in these sources can be expected and its extent. Additionally, the guidelines for setting up the water quality monitoring in such emergency conditions are provided.



Study area

One of the two project study areas is the Trnovo-Banjšice karst plateau, which is bordered by the valleys of the Soča, Idrija, and Vipava Rivers and their tributaries. Deep karstified Cretaceous (marked with green colour on Fig. 1) and Jurassic (blue colour) limestone and Triassic (pink colour) dolomites prevail. Toward north-west they sink below younger, mostly Eocene (yellow-brownish colour) flysch rocks. Flysch surrounds karstified limestone at southern and eastern side too, and acts as a hydrogeological barrier. At the northern side the karst aquifer is mostly bordered by very poorly permeable Triassic rocks (violet colours). The karst aquifer contains large amounts of groundwater and is discharged through big karst springs at the border of the plateau. Several of them (e.g. Mrzlek, Hubelj, Kajža, Podroteja) are captured for the water supply.

Hydrogeological researches

- Review of existing data (geological map and cross-sections, hydrogeological map, geomorphological and speleological characteristics, hydrological measurements, hydrochemical and isotopic analysis, tracer tests).
- Data base of drinking water sources (location, characteristics, capacity, managers, water protection status, information about previous pollution incidents, etc.).
- Continuous measurements of precipitation and discharges, conductivity and temperature of the springs.
- Tracer test.
- Vulnerability mapping (Slovene approach).
- Testing of various pollution scenarios.

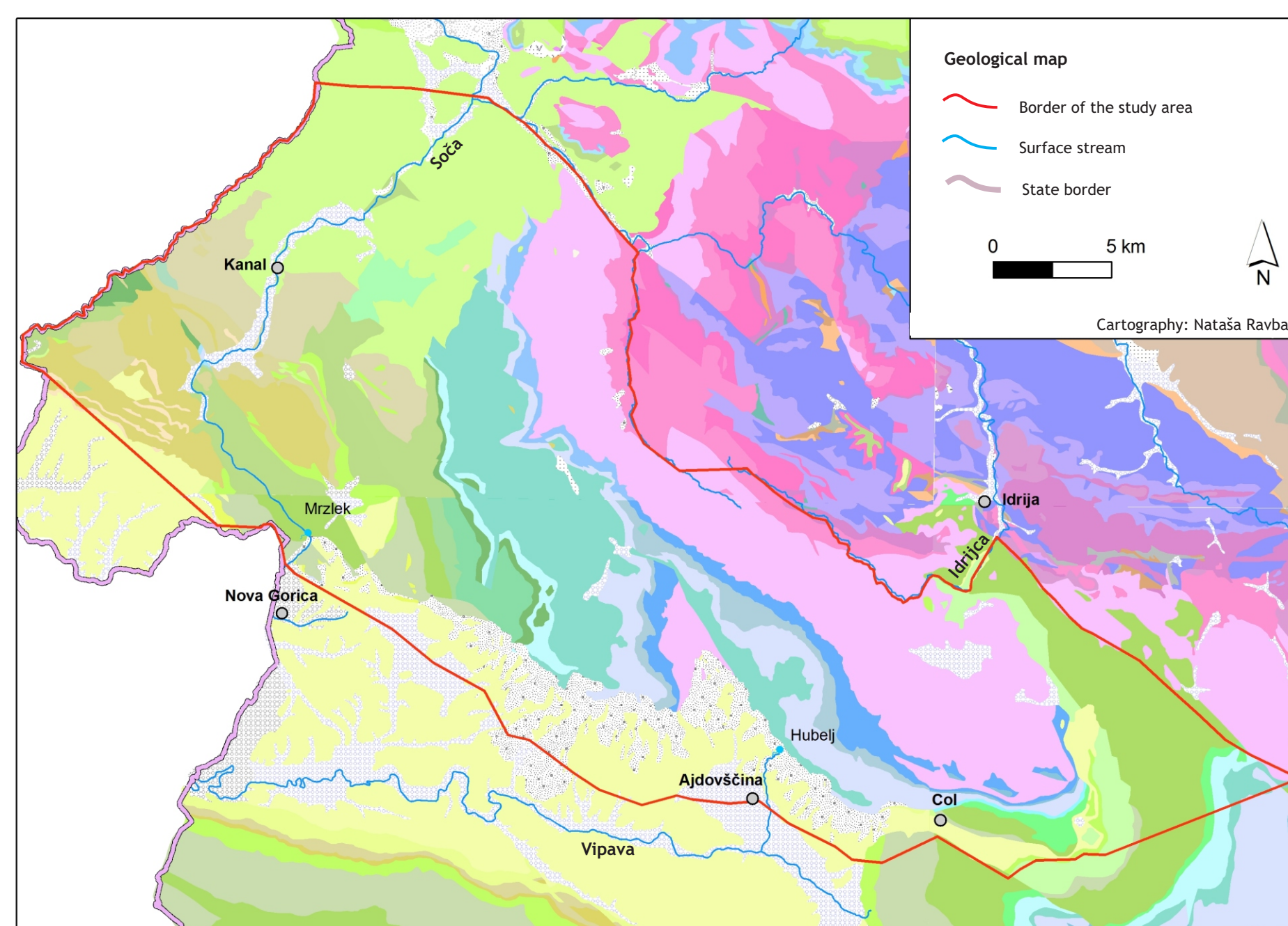


Fig. 1. Geological map of the study area in south-western Slovenia.



The Hubelj spring is an important drinking water source. Its discharges range from 0.25 to 59 m³/s.



Injection of 6 kg of uranine into a fissure on the karst surface at the Malo polje area.

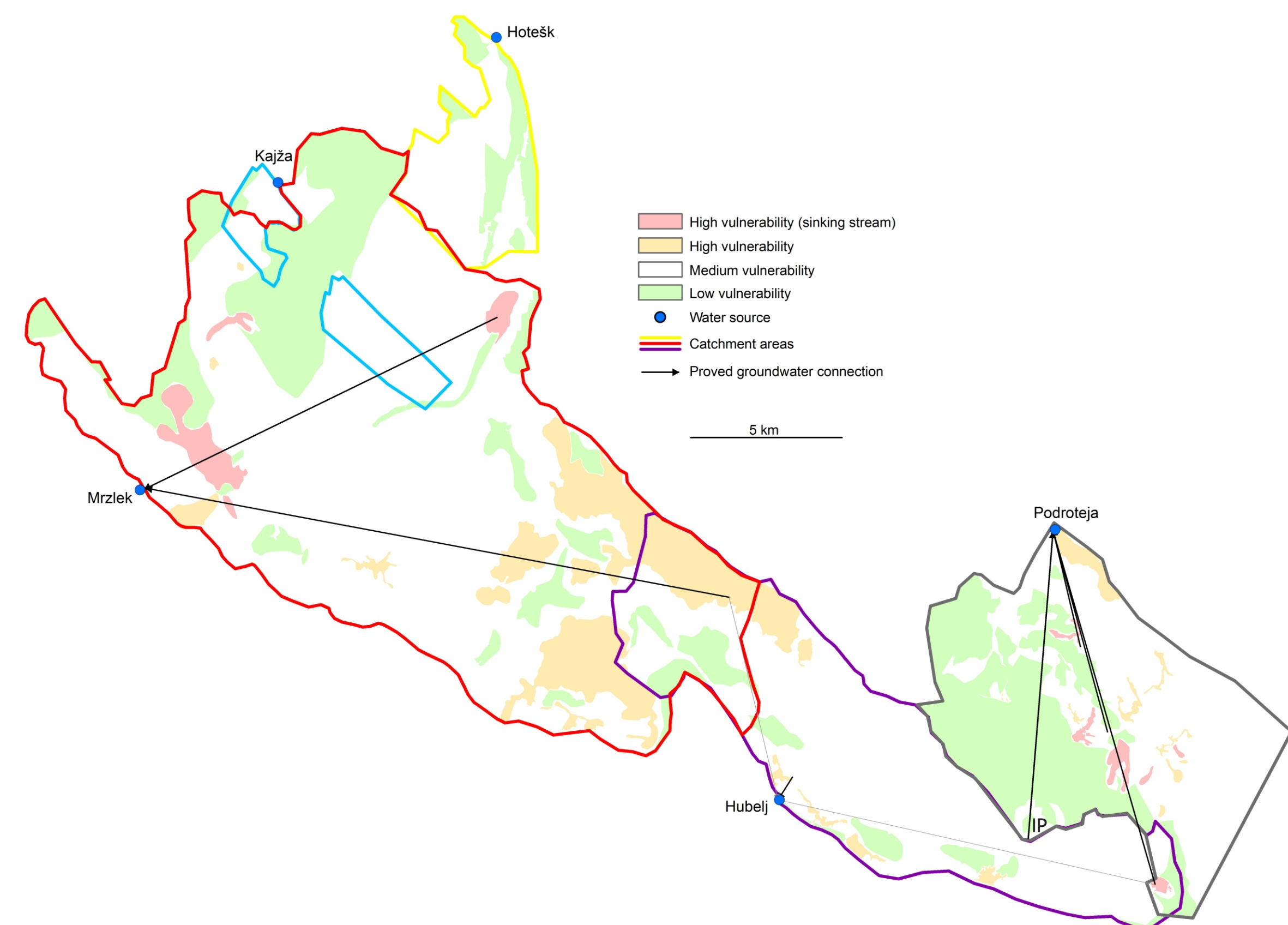


Fig. 3. Vulnerability maps for the catchment areas of the main water sources in the study area. Based on the existing data the catchment areas of the main drinking water sources were defined. Within these areas different vulnerability classes were set and for each of them possible scenarios of pollution spreading in dependence on hydrological conditions will be assessed in the final stage of the project. This information will be incorporated into the GIS of drinking water resources.

Guidelines for setting up the karst water quality monitoring in emergency conditions

- Data acquisition (location of the incident, type of infiltration - diffuse or concentrated, type and amount of pollutants, hydrological conditions).
- Assessment of the endangered water sources - list of sampling points.
- Measurement of precipitation and spring discharges.
- Sampling plan (frequency and time of sampling depends on the type of infiltration and hydrological conditions; the plan is constantly adapted to the results of the analysis of samples).

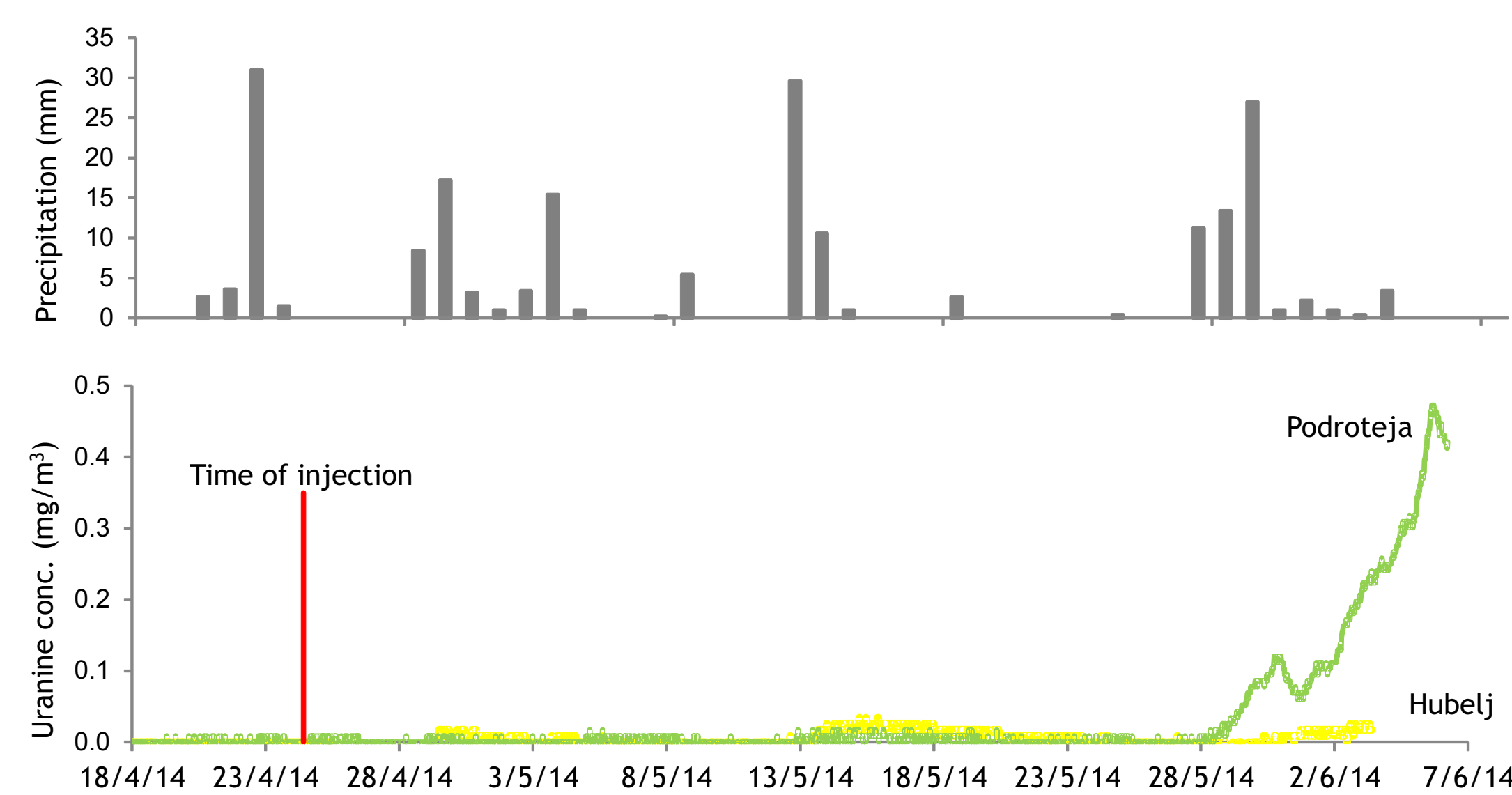


Fig. 2. Several multi-tracer tests with artificial tracers were carried out in the study area in previous years and their results were used in this study. To solve some remaining open questions a new tracer test was carried out to define the watershed between the Hubelj and Podroteja springs. Only preliminary results are presented on the graph. From the injection point (a fissure on the karst surface; marked as IP on Fig. 3) the underground water connection with the Podroteja spring was proved. Tracer has not been detected yet in other observed springs. New information about the extent of the catchments was gained, and further elaboration of the results will help us to interpret the characteristics of groundwater flow and transport of substances in the area.

Dissemination activities

- Workshop “Protection of drinking water sources in case of emergency - Basics of hydrogeology, karstology and spatial analysis (140 participants: managers of water systems, civil protection units, representatives of municipalities, inspection services, the police, representatives of national environment agency and Ministries) .
- Booklet “Guidelines for setting up the karst water quality monitoring in emergency conditions”.