[31] PRELIMINARY ACTIVITIES FOR DEVELOPING THE GROUNDWATER MONITORING NETWORK OF ROME (ITALY)

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Introduction

Groundwater quality monitoring network design is defined as the selection of sampling sites and (temporal) sampling frequency to determine physical, chemical, and biological properties of ground water. The main approaches to groundwater quality monitoring network design were identified as hydrogeologic and statistical. The various methods for network design available in the hydrologic literature have been evaluated by considering the spatial scale of the monitoring program, the objective of sampling, data requirements, temporal effects, and range of applicability (Loaiciga et al. 1992)

A number of specific factors must be considered when dealing with groundwater in urban areas. Urbanization significantly affects the natural water cycle, both in terms of quantity and quality. In particular, the main contributors to recharge and discharge clearly differ from those in natural systems. Moreover, water can affect underground structures and infrastructure characteristics of cities such as basements, public transport services (trains, underground railways, etc.), and utility conduits. As a result, urban groundwater is emerging as a distinct branch of hydrogeology (Vázquez-Suñé et al. 2005).

The area of Roma Capitale (Municipality of Rome) has a particular geological and hydrogeological setting. It is in fact strongly influenced by the coexistence of tectonic activity, volcanism of several volcanoes (the Vulsini, Cimini, Sabatini volcanic complex northward, the Colli Albani volcanic complex to the south) and eustasy. By a general hydrogeological point of view, the roman area is placed between three regional structures and aquiclude the Pliocene Clays (which can be considered the bedrock of this area, with more than 800 meters of thickness).

Going into details, main aquifers of Rome are located in the Colli Albani volcanic pozzolanaceous products and in the continental and alluvial prevolcanic and sinvolcanic sediments. Moreover olocenic valleys, filled by postvolcanic alluvial sediments, are interested by a confined aquifer into the gravels placed in the base of the alluvial sequence (Capelli et al. 2008; La Vigna et al. 2008).

Thus there are 6 hydrogeological units that can be indentified (Fig. 1): 1) the volcanic aquifers of Sabatini Volcano (right of Tiber); 2) the volcanic aquifer of Colli Albani Volcano (left of Tiber); 3) the continental aquifers of Paleo-Tiber of Ponte Galeria Formation; 4) the alluvial aquifers of Tiber; 5) the Tiber fan; 6) the aquiclude of M. Vaticano clayey Pliocene formation. Looking at hydraulic relationships between these units the main groundwater circulations which can be identified are: the basal Tiber alluvial gravel body, the volcanic and prevolcanic aquifer's body in the orographic left of Tiber, the volcanic and prevolcanic aquifer's body in the orographic right of Tiber, and the alluvial fan aquifer's body.

Main Body

In order to realize a groundwater monitoring network in the complex hydrogeological setting of the territory of Rome, the offices of the Environmental and Civil Protection Department of Roma Capitale are working to survey all the existing wells which are property of the municipal administration and which are more than 100 units.

All these wells are located in a random distribution but it should cover much of the Rome's territory. Moreover, as they were realized for the irrigation of public parks they generally are very productive wells because they were drilled until main aquifers.

The survey activity consists in two phases. The first is about the collection of all information about existing wells, the data entry in a database and in a geographic information system (GIS). The second phase will be the field survey in order to confirm the exact location using a GPS device, and to measure the hydrogeological data such as water table depth, groundwater temperature and electric conductivity, firstly manual and probably in the future with dataloggers.

When all the available wells will be surveyed, the Municipality of Rome will be able to use its monitoring network in order to detect:

1) fluctuations in groundwater levels caused by changes in land and water uses;

2) pollution problems caused by point or non-point sources in urban area;

3) characterization and quantification of the

components contributing to groundwater recharge and discharge;
4) specific characteristics of groundwater flow and solute transport models in urban areas;
5) geothermal energy potential of groundwater;
6) integration of data for sustainable urban water management.
Moreover all data could be used in order to realize a new Hydrogeological Map of Rome.

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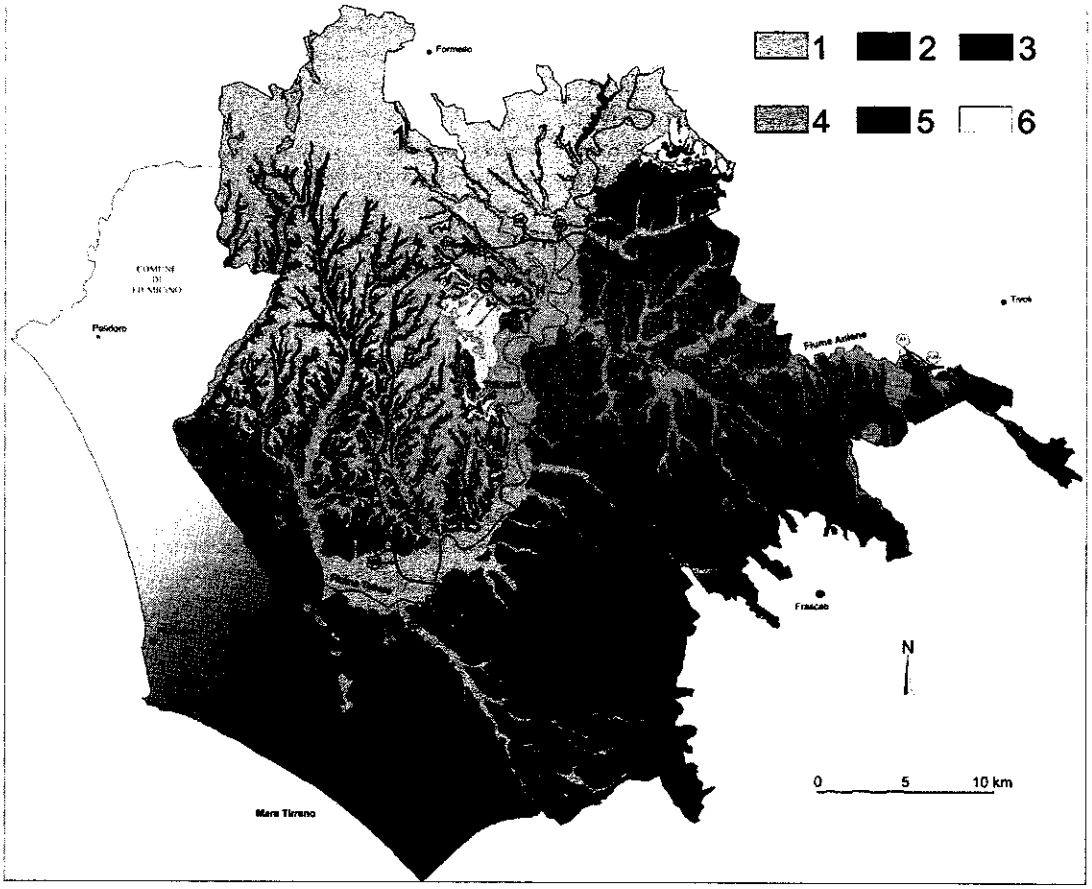

Fig. 1 – Hydrogeological Units of Rome (from Capelli et al. 2005). 1) Sabatini Mts.; 2) Alban Hills; 3) Ponte Galeria and Paleo-Tiber; 4) Recent and Present alluvia; 5) Tiber river delta; 6) M.Vaticano formation (aquiclude).