Détermination à l'aide de méthodes géophysiques des paramètres hydrauliques d'un aquifère alluvial dans une vallée alpine (Valais, Suisse)

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Located in the Upper Rhône Valley, upstream the city of Sierre, (central Wallis - Switzerland), the Bois de Finges area is in a particularly favourable situation for a multidisciplinary study. Numerous boreholes, piezometers, springs, channels and small lakes allow the observation of the interactions between the alluvial aquifer, the Rhône river and the water flowing from the south valley hillside. The Bois de Finges area is a site of national interest and is protected. The alluvial aquifer is also submitted to numerous environmental constraints : the town of Sierre, industrial and agricultural activities, gravel pits, dumping sites, roads and a future national highway. The Bois de Finges area is characterized by the diversity of the Quaternary geological environments : the Rhône alluvial sediments, the Illgraben alluvial fan deposits, the Sierre rockslide deposits and the debris deposits of the south valley side.

The use of the dilution technique, the heat pulse flow-meter and the nuclear tools allows the precise determination of the main hydraulic parameters of the alluvial aquifer. It was thus possible to show that the complex porous alluvial aquifer is composed of two distinct aquifers : the unconfined alluvial Rhône river aquifer and the semi-confined alluvial Illgraben aquifer. The Rhône river aquifer is characterized by an effective porosity varying from 5 to 20 %, an important horizontal filtration velocity (0.18 - 0.27 m/h) and a high hydraulic conductivity (36 - 50 m/h).The Illgraben aquifer shows a lower hydraulic conductivity (< 10 m/h), a very low horizontal filtration velocity (< 0.03 m/h) and an effective porosity varying from 5 to 15 %. This lower aquifer is limited in depth by impermeable lacustrine deposits. It has also been shown that the effective porosity increases from the South East side of the valley to the North side whereas the total porosity decreases according to this same direction.

The interpretation of the data provided by the use of electrical methods (DC current) by taking into account lithological information collected in several boreholes made it possible to specify the spatial distribution of the alluvial aquifer components. It has been shown that most of the alluvial filling consists of clay sands and gravel-sands deposits. These deposits are mainly of rhodanian origin but also come from the Illgraben, in particular in the southern part of the alluvial plain. The distinction between these two origins is however difficult to make starting from the electrical data.

In collaboration with M. Schürch (Centre of Hydrogeology University of Neuchâtel, Switzerland), a methodology of diagnosis and intervention on a porous aquifer was developed. These instructions represent a practical guidebook to people charged to discover new drinkable water resources in porous environment. In such studies it is of the first importance not only to locate the potentially aquiferous zones but also to determine the origin and the quality of the water, to quantify the hydraulic properties

and finally to delimit the zones of protection and evaluate the risks of contamination. This guide explains the techniques and the application domain of each methods (hydrogeology, hydrogeochemistry and geophysics), in order to allow the person in charge of such studies to choose the most efficient methods to reach the goals selected , as well as to spare time and money