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A vertical cylindrical collector system for the indirect energetic use of groundwater

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The extraction of heat from the underground and its transfer to a heat pump is mostly done in Europe using borehole heat exchanger (BHE). BHE's are filled with a calorific medium that extracts heat from the underground and transfers it to the heat pump. Ordinary a double U-pipe system is installed vertically into the ground. To extract enough heat out of the ground, BHE's have to be installed to certain depths depending on the required heating or cooling demand (up to several hundred meters, one or more boreholes are needed). Especially in situation with high groundwater flow BHE's are limited in extracting the available convective groundwater heat flow, because BHE's behave like a "line element" with a relatively low surface area for a possible heat transfer. Thus a large volume cylindrical ground spiral collector system, which could be installed directly in a groundwater flow, promises a substantially higher efficiency in relation to the use of conventional systems. Such a system should guarantee efficient heat extraction rates under high groundwater flow conditions especially because of the higher available surface area for a heat exchange.
Such a cylindrical ground spiral collector system is installed in the first aquifer at Ettlingen, Germany (EnBW Regional AG, Upper Rhine Graben). The system is designed for a length of 17 m and an inner diameter of 800 mm with an effective pipe length of $\sim$300 m. In the centre of the cylinder shape collector system a 5" groundwater well is installed. At this well it is possible to do pumping tests or to adjust a groundwater streaming to the collector system. In the surrounding three 3" groundwater wells are installed to have the possibility to determine the local groundwater flow conditions and to monitor possible temperature plumes at any test phase. At the vertical collector system and the groundwater observation wells a detailed on-site monitoring system is installed consisting of punctual PT100 sensors as well as fiber optic cable installations. Besides the theoretical design and the installing of the system, first results of a kind of Thermal Response Test (TRT) will be presented.