Geology of aquifers

Literature, Russian Literature

The geology of a region and its soil properties play the most important role in determining the location and characteristics of an aquifer. In this paper, we shall discuss the factors that need to be considered while determining the geology of potentially usable aquifers and also the areas that should be avoided taking into account various human and natural factors. However, before that, it is necessary to understand the meaning of aquifers.

An aquifer is a layer of porous substrate that stores, transmits and yields groundwater to wells and springs. To be an aquifer it is very important that the unit should be fully saturated, has open voids or spaces and could provide sufficient amount of groundwater at fast rates to wells and springs. An aquifer can of three types – unconfined, confined or perched. An unconfined aquifer is one which has no confining layer between the zone of saturation and the land surface. A confined aquifer has a layer in between the land surface and the saturated zone. This confining layer either allows water to pass through it at a very low rate or not at all. Confining layers are generally made up of clay, silts or rocks such as shale. Lastly, a perched aquifer is the saturated zone which is situated in the zone of aeration and lies above the confined layer. The unconfined aquifer has the capability to provide the maximum amount of water, followed by the confined aquifer. A perched aquifer can provide water enough only for a household (“ Groundwater storage in aquifers”, n. d).

The potentiality of an aquifer in a region can be determined on the basis of the permeability (capacity to transfer water) and porosity (capacity to hold water) of the geological material. According to research, the most potential usable aquifers are found in regions where the land is comprised of

unconsolidated sand and gravel because they allow the maximum permeability of groundwater to be transferred to wells and also have the capacity to hold maximum water (“ Maine Geological Survey”, 2011). Other regions where productive aquifers are found are the aquifers which are formed of sandstone, limestone, dolomite or basalt flows. Sedimentary rocks such as sandstones or carbonates form one of the best aquifers since they have high levels of porosity. Certain fractured or dissolute sedimentary rocks also have the capacity of holding a significant amount of water and therefore can act as good aquifers. Limestones are also productive aquifers since they are highly permeable. Aquifers formed by fractured metamorphic or igneous rocks like basalt having significantly interconnected vesicles are also marginally good ones. However, geological materials like fractured granitic rocks which are confined by sedimentary rocks have a very low level of porosity and permeability and therefore cannot be classified as potential aquifers (Bahr, 2011, para. 2). Further, while examining the geology for a potential aquifer one should consider whether a water body like a river is located nearby or not. The reason behind it is that the river supplies and recharges the aquifer with water regularly and thus keep it saturated (Anderson, 2011, para. 10).

Further, areas having fine-grained silt and clay should not be considered since they transmit water poorly and have very low levels of permeability. Also, areas with the high possibility of surface runoff or, with very low or no vegetation lead to soil infiltration and therefore needs to be avoided (“ Basic Ground Water Hydrology”, 1986). Regions near human wastage dumping grounds, mining sites (mine acid drainage) and industrial areas (toxins and

heavy metals drainage) should be restricted because the contaminants from these areas will pollute the ground water and make it undrinkable. Also, areas with extensive agriculture will lead to high infiltration of soil and pesticides into the aquifers and make it polluted and a non-reliable source of a potable water (Anderson, n. d, para. 10). Therefore, it can be concluded that aquifers are best found in regions with flat topography, natural vegetation cover, soils with high levels of permeability and nonexistence of confining beds.