A

Confined and Unconfined Aquifers Respond Differently to Pumping

The markedly different response of confined and unconfined aquifers to pumping (before the ground-water system returns to a new equilibrium) is demonstrated by calculations of drawdown resulting from a single pumping well in an idealized example of each type of aquifer (Figures A–1 and A–2). The numerical values used in the calculations are listed in Table A–1. Inspection of these values indicates that they are the same except for the storage coefficient *S*. Herein lies the key, which we discuss further in this section. To a hydrogeologist, the values in Table A–1 indicate a moderately permeable (*K*) and transmissive (*T*) aquifer, typical values of the storage coefficient *S* for confined and unconfined aquifers, and a high rate of continuous pumping (*Q*) for one year (*t*).

A mathematical solution was developed by Theis (1940) to calculate drawdowns caused by a single well in an aquifer of infinite extent where the only source of water is from storage. This solution was used to calculate drawdowns at the end of one year of pumping for the confined and unconfined aquifers defined by the values in Table A–1. These drawdowns are plotted on Figure A–3. Inspection of Figure A–3 shows that drawdowns in the confined aquifer are always larger than drawdowns in the unconfined aquifer, and that significant, or at least measurable, drawdowns occur at much larger distances from the pumping well in the confined aquifer. For example, at a distance of 10,000 feet (about 2 miles) from the pumping well, the drawdown in the unconfined

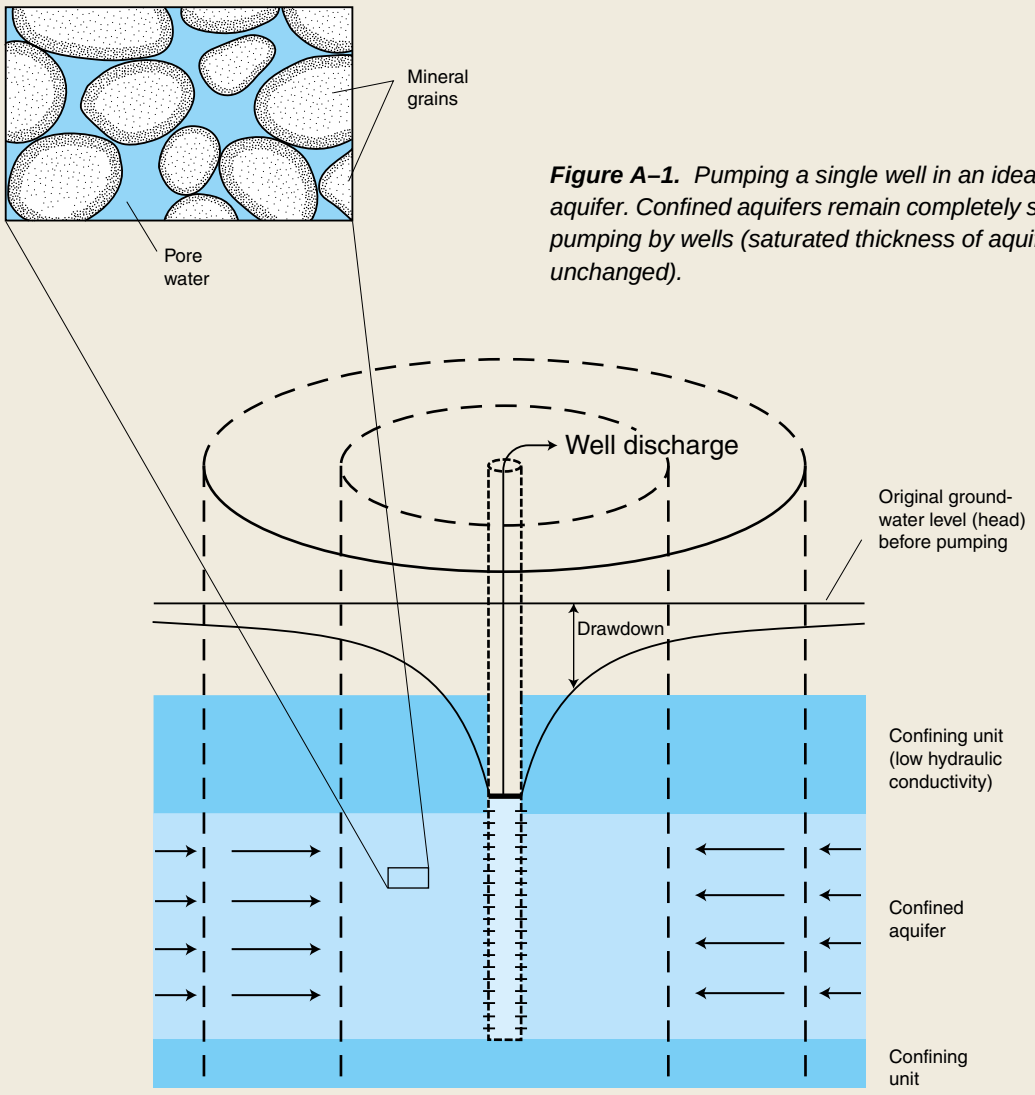

Figure A–1. *Pumping a single well in an idealized confined aquifer. Confined aquifers remain completely saturated during pumping by wells (saturated thickness of aquifer remains unchanged).*