Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 05–65

Potentiometric Surface Mapping in Ohio

Potentiometric Surface and Flowing Wells

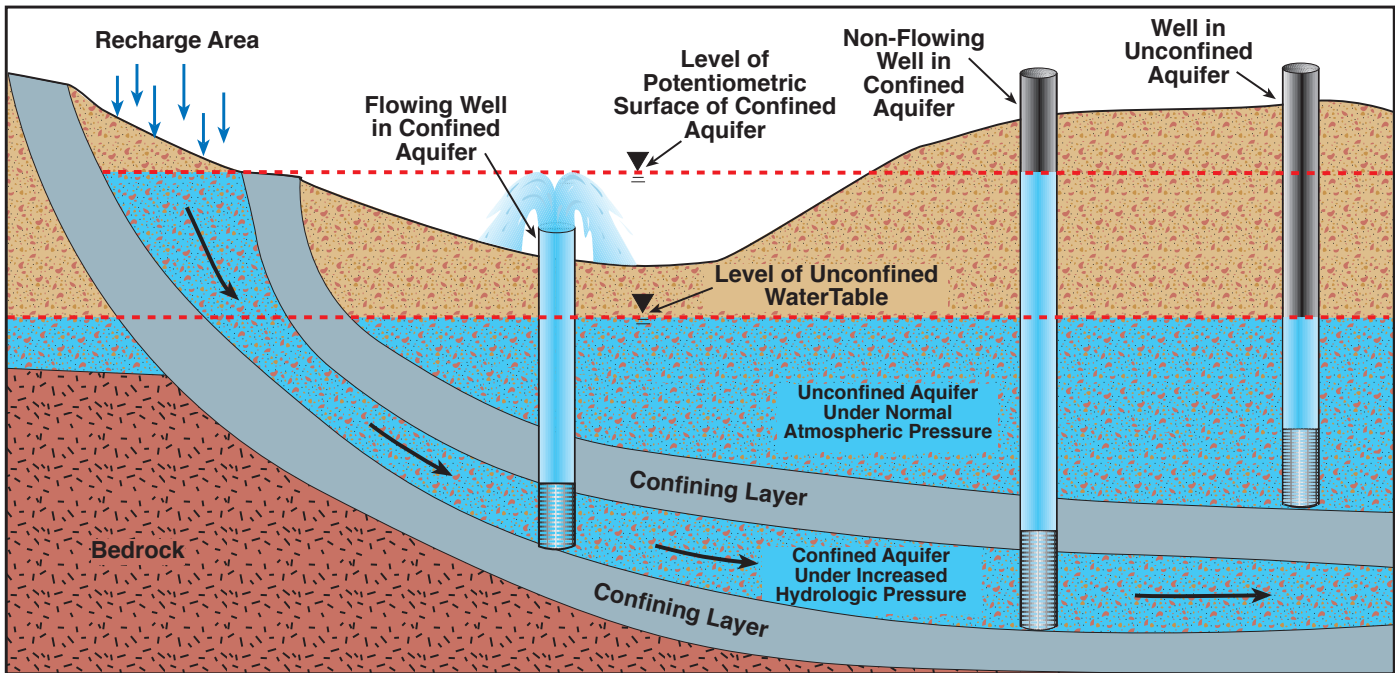

Figure 1.

What is a Potentiometric Surface Map?

A potentiometric surface map is a contour map that represents the top of the ground water surface in an aquifer. The contour lines illustrate the potentiometric surface much like the contour lines of a topographic map represent a visual model of the ground surface. A potentiometric surface map is very similar to a water table map in that both show the horizontal direction and gradient of ground water flow. However, a water table map shows the level of saturation in an unconfined aquifer. The potentiometric surface is generally not the physical top of the water table but is a representation of the potential energy that is available to move the ground water in a confined aquifer. A confined aquifer is totally saturated and is bounded by less permeable formations, top and bottom. Whenever a borehole is drilled into a confined aquifer, the pressure in the aquifer causes the water to rise up the borehole until the pressure exerted on the water in the borehole (gravity) equals the pressure in the aquifer. In a confined aquifer, the water in a borehole will rise above the top of the aquifer. If the pressure head is greater than the surface elevation, water would flow out the borehole, onto the surface of the earth creating a flowing artesian well (See figure 1 above). Most aquifers in Ohio are under some confining pressure. It is not uncommon though for an aquifer to be confined in one part of Ohio but be unconfined (water table conditions) in other areas. The potentiometric surface maps do not indicate where water table conditions may exist.

Figure 2 (on back) is a portion of a completed potentiometric surface map. The gray lines are lines of equal ground water head in the aquifer. The arrows indicate the direction of ground water flow.

Continued on back!

Figure 3 represents a 3-D block diagram view along line A-B in Figure 2. Figure 3 shows both a side and top view of the direction of ground water flow in shallow and deep aquifers. The topography has a greater control on the direction of flow in the shallower aquifer than it does in the deeper aquifer (arrows labeled Regional Flow indicate direction of flow in the deeper aquifer).

How the Maps are Produced

Location data from the water well log database is used to create a water-well point coverage. In order to have the maximum amount of data points, geocoding software is run on the well log database. This allows for the best point coverage to be generated.

The horizontal component of flow can be different for different discrete zones or aquifers. Because of this, wells completed in the bedrock aquifers (e.g. limestone or sandstone) and the unconsolidated aquifers (e.g. sand and gravel) were mapped separately. The elevation of the water level in each water well is plotted on 7.5-minute topographic maps, which are then contoured to create the potentiometric surface map. Each map is then digitized to create a GIS file. A paper layout, available as a PDF, has been generated for all completed counties. Both the GIS file and/or the PDF can be downloaded from the Division's website.

Ground Water Flow Direction Arrows over Potentiometric Surface Map Contours

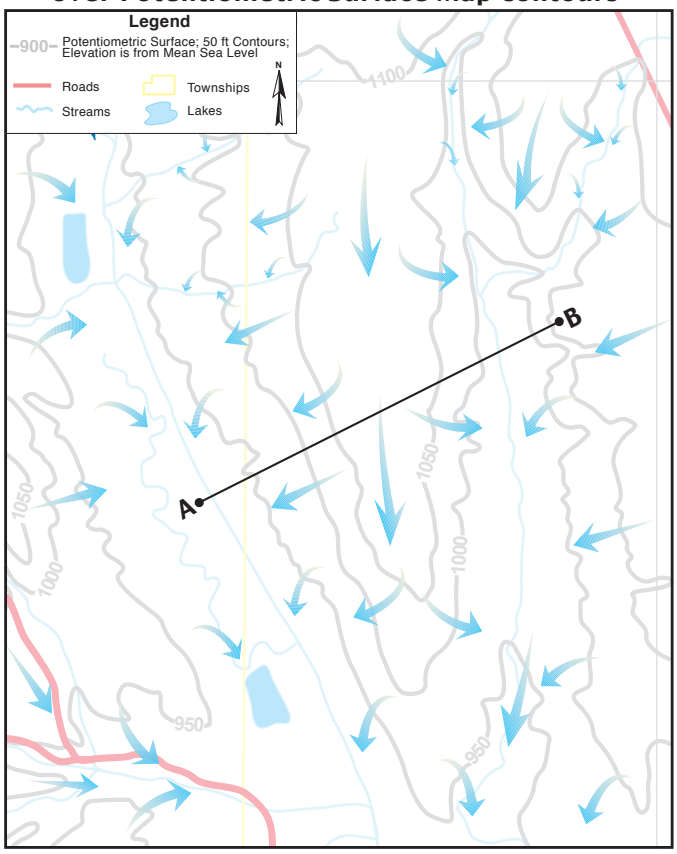

Figure 2.

Topographically Influenced and Regional Ground Water Flow

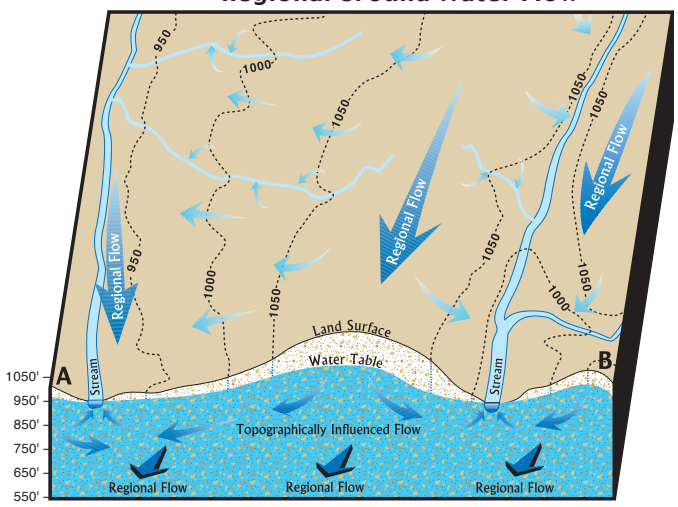

Figure 3.

Applications of Potentiometric Surface Maps:

Ground water potentiometric surface (water level) maps indicate the elevation and direction of ground water flow. These maps could be used to calculate the gradient or slope, determine ground water recharge and discharge areas, and as input data into ground water modeling programs. These maps could also be used to assist in preparing water resource plans, to assist in preparing technical studies, the mapping of stress areas, and in possible ground water diversion issues. Since these maps were created from existing data collected over a fifty-year period, field verification of the ground water flow direction should be conducted before the drilling of monitoring wells to satisfy compliance monitoring.

Any other questions, comments, concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

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