Appendix E

<u>Hydraulic Gradient Calculation by Triangulation.</u>

Instructions to determine groundwater (GW) gradient and flow direction based on surveyed static water elevations (SWE) of 3 wells.
In order to calculate gradient and flow direction by triangulation, three wells, completed in the same aquifer, must be surveyed for position and elevation (of measuring point). Map elevations or elevations from well logs are not acceptable. Because gradients are often quite low, accuracy is critical. Any error in position or elevation may have significant impacts on the gradient calculation. All three wells must be measured for static water levels on the same day, to 0.01-foot accuracy. When the static water level for each well is subtracted from the respective elevation of each well's measuring point, the result is the static water elevation for each well.

The EPA has provided a free calculator (Figure E-1), at
https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/gradient3.html. Other calculators may be available.

The surveyed position of each well (in feet) is entered into the calculator as "x-coordinate" and "y-coordinate", and the static water elevation is entered as "head". Click on "calculate" and the gradient and flow direction will appear in the green box.

Alternatively, the three points defined above can be used to calculate the orientation of the potentiometric surface in space. The potentiometric surface is assumed to be a plane, and three points can be used to define a plane. The mathematics of the procedure are beyond the scope of this Appendix, but it is a fairly standard geometric problem. Students of structural geology will be familiar with it as a standard three-point problem to determine strike and dip of a planar feature.

Figure E-1. Screenshot of EPA's Gradient Calculator.