(c) Evapotranspiration.

Report your answers in inches/year (think of it as volume/time/basin area).

6. Every summer you visit the same lake in Maine, and every summer the neighbor goes on and on about how the lake is "spring-fed" (groundwater discharges up into the lake bottom). You got to wondering if that was true, so you collected all the information you could from the local geological survey office about the lake hydrology for the month of June:

   - The surface area of the lake is 285 acres.
   - There is one inlet stream. For the month of June, the total discharge measured at a stream gage at the lake inlet was 2.77×10^7 ft^3.
   - There is one outlet stream. For the month of June, the total discharge measured at a stream gage at the lake outlet was 3.12×10^7 ft^3.
   - During the month of June, the total precipitation measured in a rain gage at the lakeshore was 1.63 inches.
   - Direct evaporation off the lake surface totaled 3.47 inches during the month of June.
   - The lake level dropped 4.30 inches during the month of June.

   (a) List the items that contribute flow into the lake, and items that contribute flow out of the lake (there may be unknown items I have not listed above). Write a hydrologic equation for the water balance of the lake in June.

   (b) Quantify each of the terms in the hydrologic equation in units of ft^3 for the month of June, and solve for unknowns in the equation.

   (c) What, if anything, can you conclude about the notion that the lake is "spring-fed"?

   (d) What measurements would you make to prove whether or not groundwater is discharging up into the lake bottom? (Assume someone is willing to pay for it.)

7. The discharge of a stream and the concentration of a trace element in stream water has been monitored through the course of a single storm. The concentration in precipitation is 2.5 μg/L (10^{-6} grams/liter) and the concentration in groundwater is 55 μg/L. Use the chemical baseflow separation technique to create a graph showing stream discharge and estimated baseflow vs. time. Get the stream discharge and concentration vs. time data from a tab-delimited text file available on the book internet site (see Appendix **??**). Use spreadsheet software to open this file and to do the computations and graphing. In this file, discharges (Q) are in m^3/sec, time t is in hours, and concentrations (c) are in μg/L.

   (a) Derive a mathematical formula $Q_b = \ldots$ that expresses baseflow in terms of other parameters that are known in this problem. Label all units in this equation, and show how the units of Q_b are consistent with the units of quantities on the other side of the equation.

(b) Create a scaled graph showing stream flow, quickflow, and baseflow vs. time. Clearly annotate the graph with axis labels and a legend for the three curves.

8. Consider the water balance for a reservoir with a surface area of 2.3 km^2. A tab-delimited text file on the internet site (see Appendix **??**) contains measurements of the following fluxes over the course of a year:

- Discharge of the inlet stream (m^3/month).
- Discharge of the outlet stream (m^3/month).
- Precipitation rate on the reservoir surface (cm/month).
- Evaporation rate off the reservoir surface (cm/month).
- Reservoir elevation above sea level at the beginning of the month (m).

Other than the net groundwater discharge into the reservoir, the above fluxes are the only significant ones.

(a) Write out the equation for hydrologic balance for the case of this reservoir.

(b) Download the tab-delimited data file for this problem, open it with a spreadsheet program and use the program to do all computations and graphing. Determine the average net groundwater discharge each month of the year, and create a graph of net groundwater discharge vs. time through the year. In your computations, make sure to convert all fluxes to a common set of units such as m^3/month.