Watershed Analysis Lab – U.S.G.S. Regression Equations for Peak Discharge

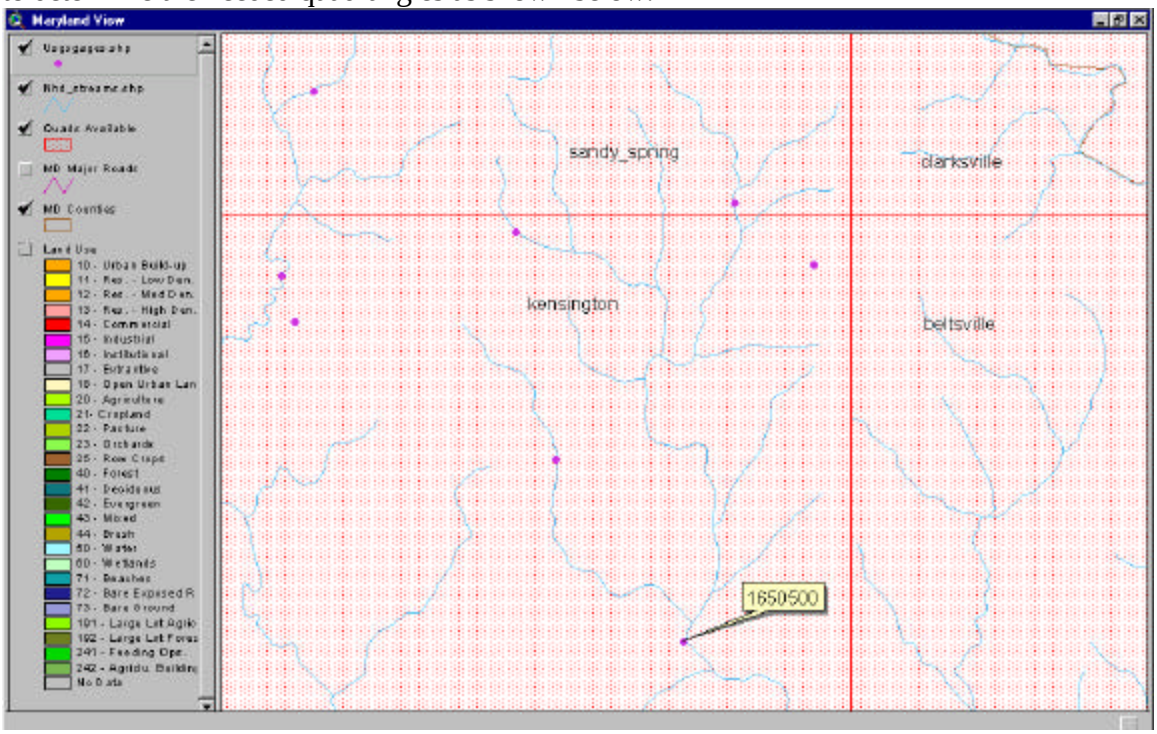
This lab will familiarize the user with the use of GISHydro2000 to extract topographic, land use, and soils data for the performance of a basic hydrologic analysis. The lab assumes the user has general familiarity with the use of the ArcView interface. This lab also serves as a launching point for a more involved analysis using the TR-20 hydrologic model as much of the information needed to run this model is prepared in the process of determining the USGS equations.

Task

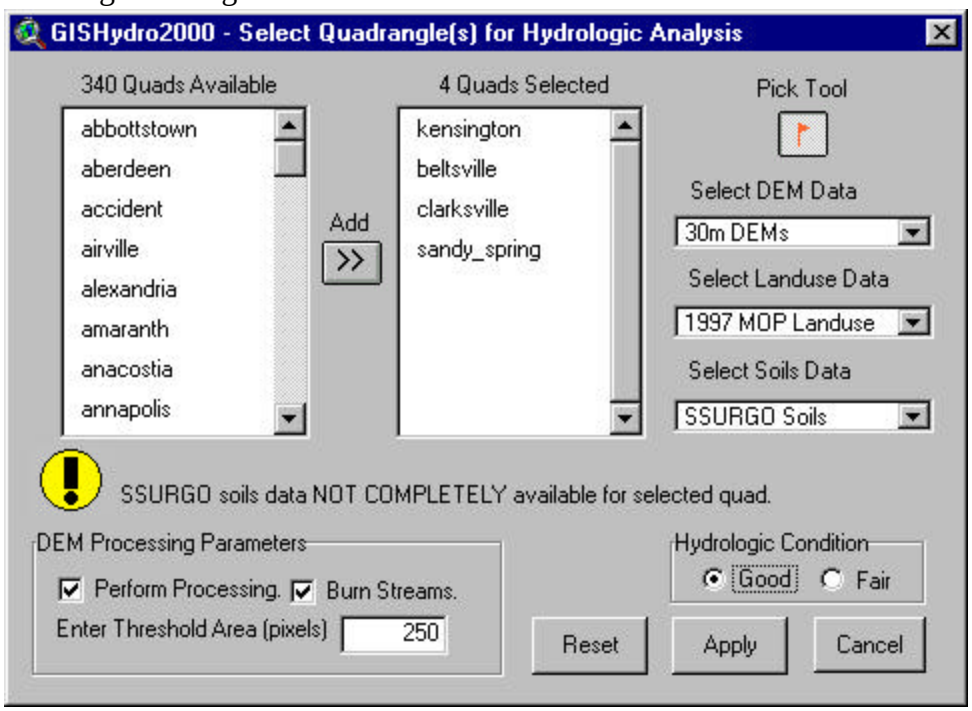
Determine the range of peak discharges for the 2- 500-year flood events at USGS gage 01650500 (Northwest Branch at Colesville, MD). Also determine the hydrograph corresponding to the 2-year event. Use the USGS peak discharge equations from Dillow's (1996) report and the hydrograph method from Dillow's (1997) report. Along the way, you should determine the basin statistics such as drainage area, average curve number, % forest cover, etc.

Step One – Locate Watershed Outlet and Select Quads

Starting from the opening "Maryland View" within GISHydro2000, load the "usgsgages.shp" theme to this view and build a query to locate the gage: 01650500. Load in the "nhd_streams.shp" theme and zoom to the area draining to the selected USGS streamgage. You can use the label tool with the "Quads Available" theme active to determine the needed quadrangles as shown below:



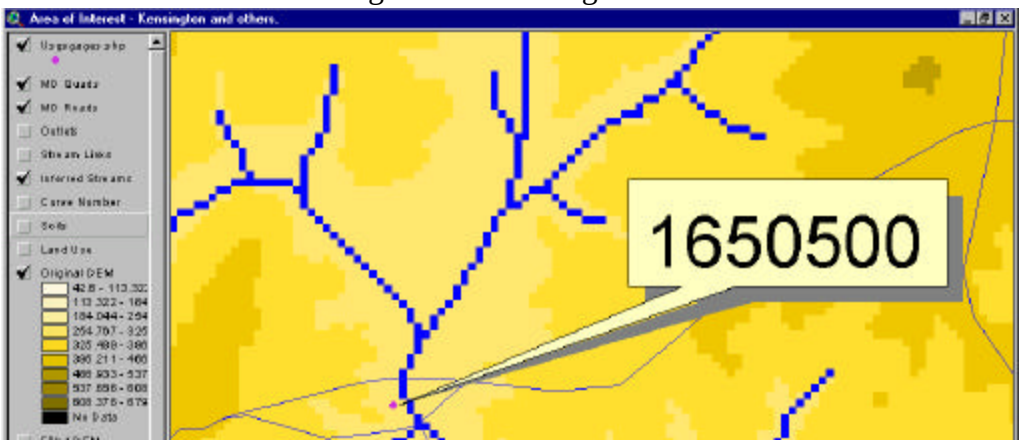
Now click the "Q" button to begin the data extraction step. This will produce the following file dialogue:



You can use either the "Pick Tool" or scroll through the list of quads at left to select the necessary quads to cover this watershed. Select the DEM's, land use and soils necessary. Note that we have chosen SSURGO soils acceptably since all of Montgomery county is covered by this highest quality soil description. Press the "Apply" button and data extraction/processing will commence. In a few minutes (times vary depending on area covered and processor speed) you will be presented with the "Area of Interest" view.

Step Two - Delineate the Watershed

You can either cut and past the "usgsgages.shp" theme from the "Maryland View" to the "Area of Interest" or simply load the theme anew into this view. You will need to do so in order to correctly located the desired watershed outlet. Now zoom in tight to the watershed outlet. The view might look something like that shown below:



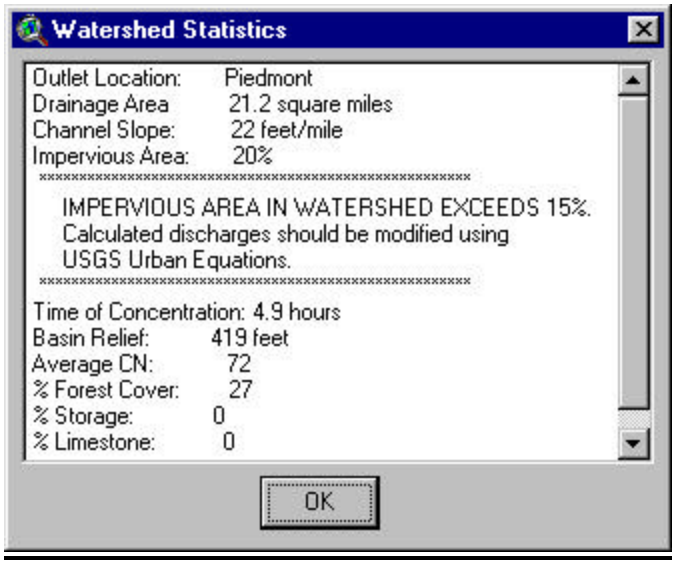
Select the "W" tool and click on the blue stream pixel closest to the indicated gage location. This will initiate a watershed delineation resulting in the creation of a new theme in the "Area of Interest" view called "A Watershed" unless you have modified the name of this theme in the "Hydro: Properties" list.

Step Three – Determine Basin Composition

Select menu choice: "Hydro: Basin Composition". After a few moments of calculation two tables will appear called: "Distribution of Land Use and Curve Numbers Use" and "Distribution of Land Use by Soil Group". The contents of these tables can also optionally be sent to an output file for later reporting. These tables summarize the curve number used and detail the land uses and their spread across the four hydrologic soil groups.

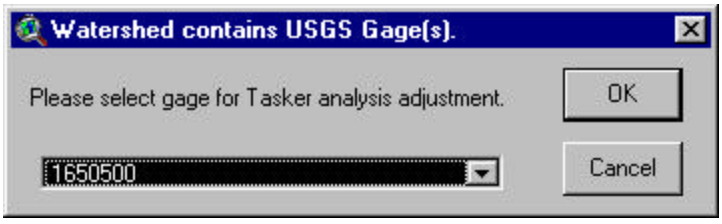
Step Four – Determine Basin Statistics

Before the USGS Regression equations can be calculated, it is necessary to determine the values of the predictor variables to these equations such as drainage area and percent forest cover. This is done by selecting the "Hydro: Basin Statistics" menu choice. After a few moments of calculation, you should be greated with the following dialogue box which can, again, be sent to an output file if desired:



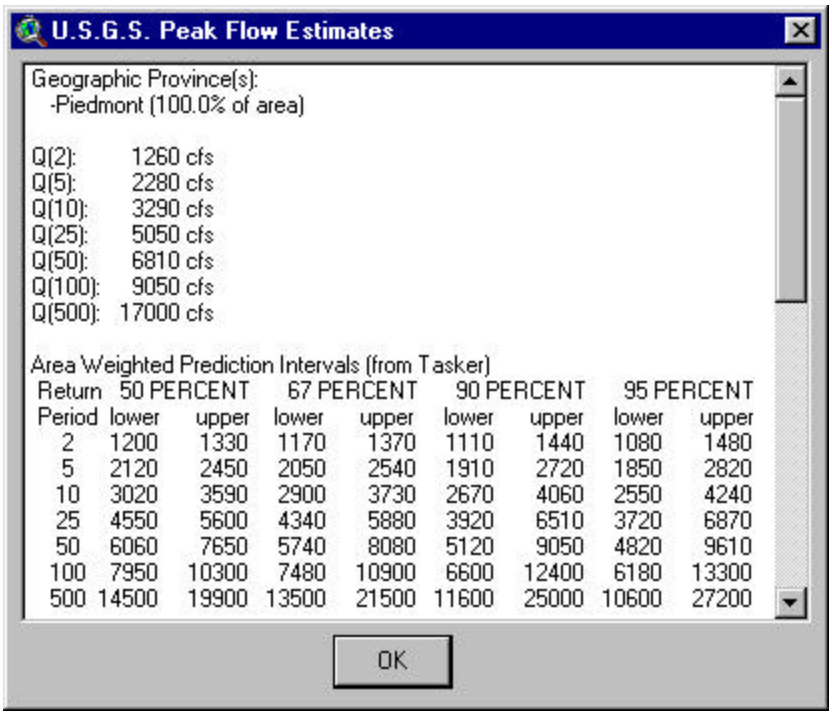
Step Five – Determine Peak Discharges

Peak discharges are next calculated using the "Hydro: Peak Discharges" menu choice. In this case, because we are working in the vicinity of an existing USGS gage, GISHydro2000 will prompt you with the dialogue shown to the right:



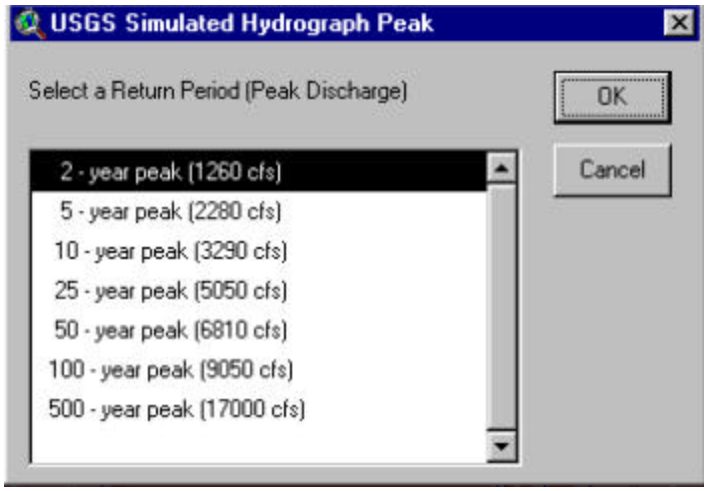
You may choose either neither or the displayed gage. Choosing the displayed gage will force an adjustment of the USGS peak discharges according to the statistical model developed by Gary Tasker of the USGS. You will then see the following dialogue box which may optionally be sent to a file for later reporting.

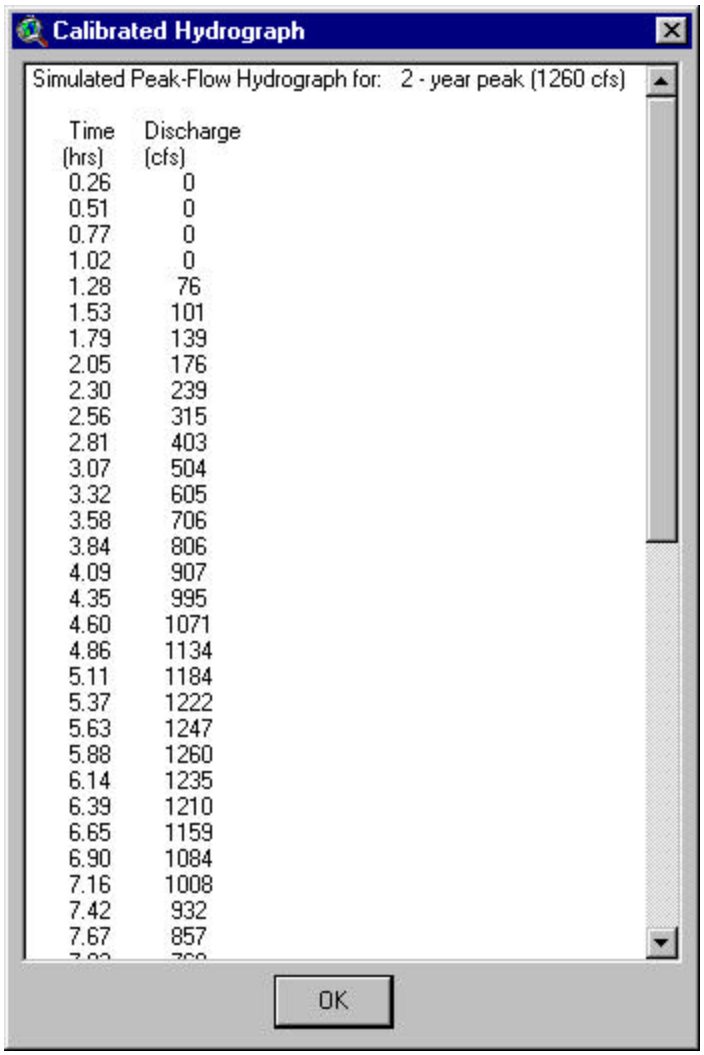
This dialogue presents not only the predicted 2- through 500-year flows, but also the 50, 67, 90, and 95 percent confidence intervals on these flows. These confidence intervals are determined using the program developed by Tasker. Note that if adjustments are made for proximity to any USGS gage, then the predicted discharges will differ somewhat from what would be calculated based on the USGS peak discharge regression equations alone.



Step Six – Determine 2-year Hydrograph

The final step is to calculate the hydrograph associated with the 2-year peak discharge determined above (1260 cfs, in this case). Select the "Hydro: Calculate Hydrograph" menu choice. You will see the dialogue box shown to the right which lists the hydrograph peaks determined in the previous step. These peaks, along with other basin properties are then used to determine the ordinates and time increments of the associated hydrograph using the methodology developed by Dillow (1997). The result is the dialogue shown on the next page which may also be written to an output file for reporting purposes.





Results

In the spaces provided, enter the peak discharges and associated confidence intervals calculated for the Northwest Branch Watershed.

Return Period	Peak Q (cfs)	95% Lower CI	95% Upper CI
5-yr			
100-yr			