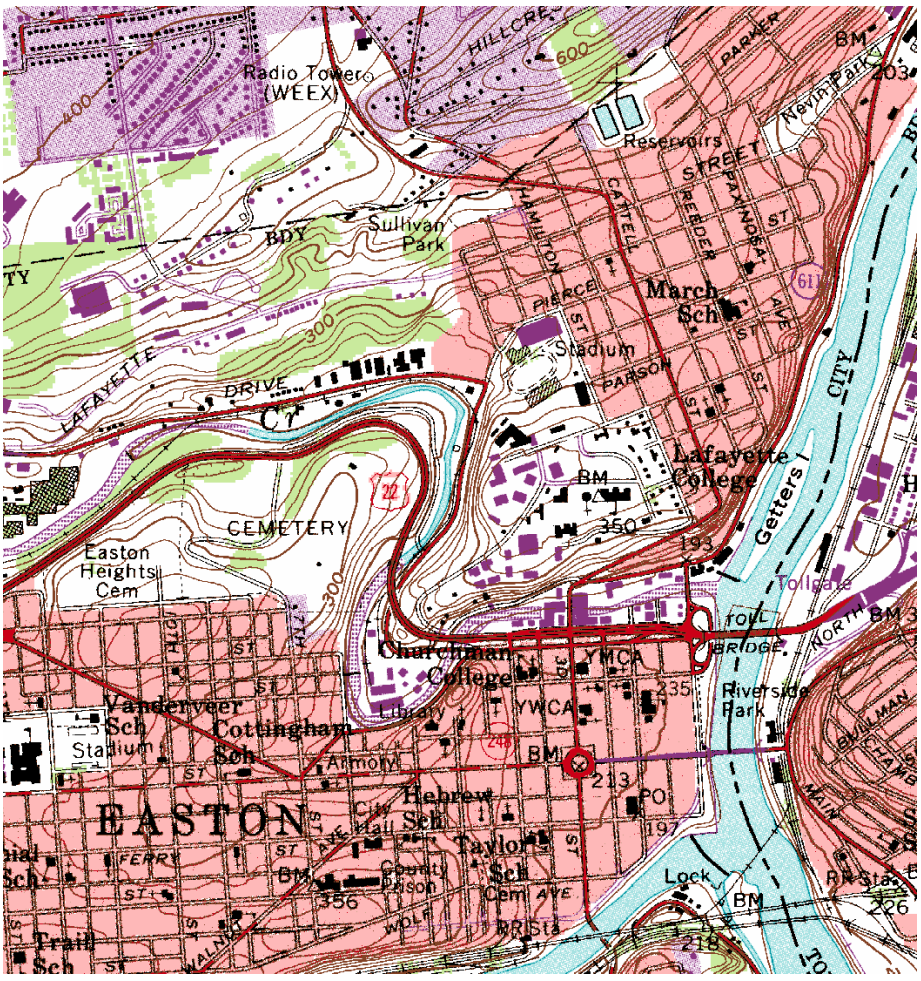
Delineation of Watershed Contributing Area
CE 421 Hydrology

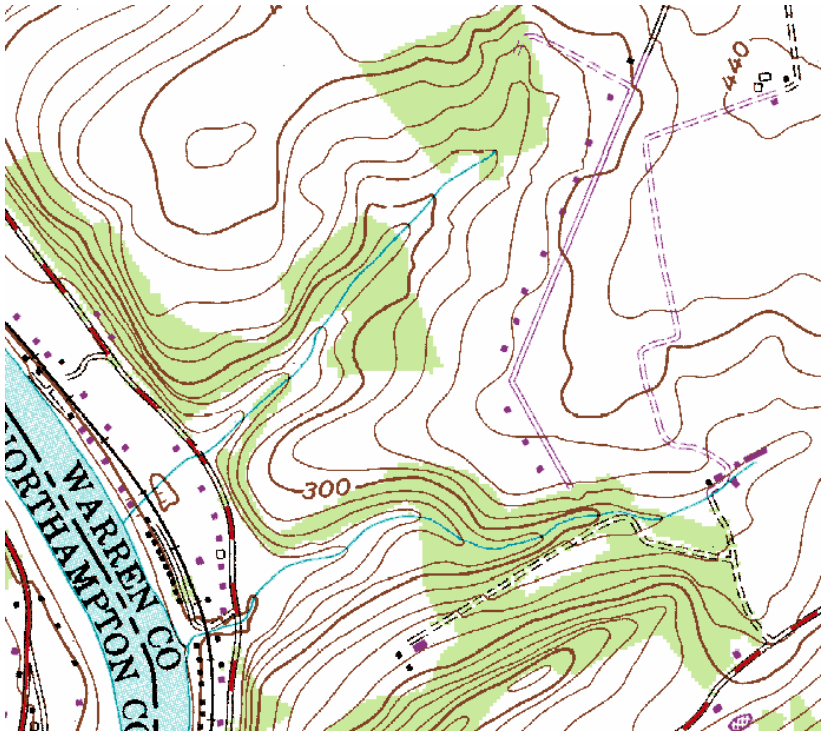
One the most fundamental skills in hydrology is to be able to accurately determine the contributing area for any point along a stream, or for a site where stormwater management is required. The contributing area (or drainage area) for a particular point of interest is the surrounding land area from which all runoff will flow to the point of interest.

To be able to delineate, one first needs to know how to read a contour map. Typically we are working with a 7.5-Minute Series Topographic Map from the United States Geological Survey (USGS). They are named by "Quadrangle", and usually the largest town on the map is the name of the Quadrangle. These maps have a scale of 1:24,000 or 1" = 2000' and a contour interval of 20 feet. The contours connect points of equal elevation and are shown in brown. Heavy brown lines are the 100-ft contours. The figure below is from the Easton, PA Quadrangle. Based on the contours shown, our elevation here at Lafayette is about 350 ft MSL.

Other features shown on the USGS topographic quad maps are rivers, streams, municipal boundaries, towns, roads, buildings, forested areas, etc.

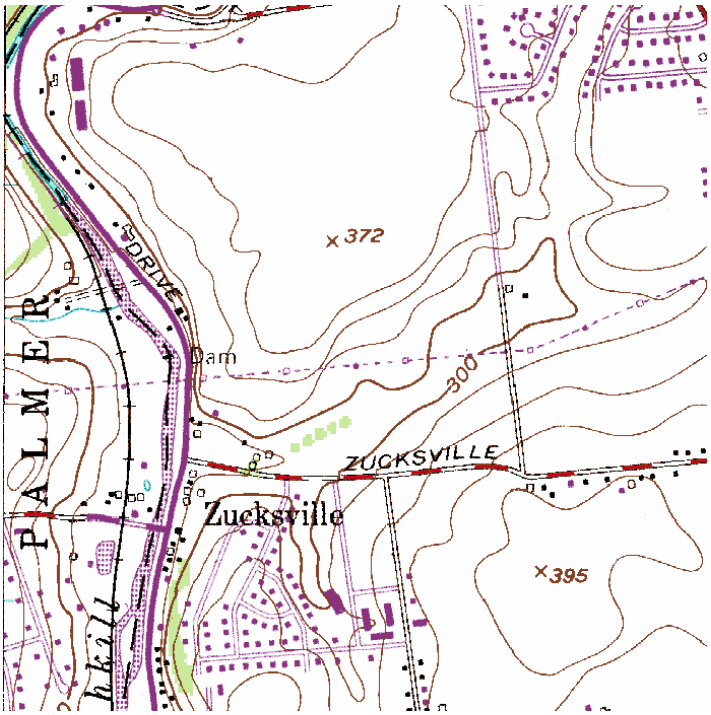


The following figure illustrates some important features about topographic maps:



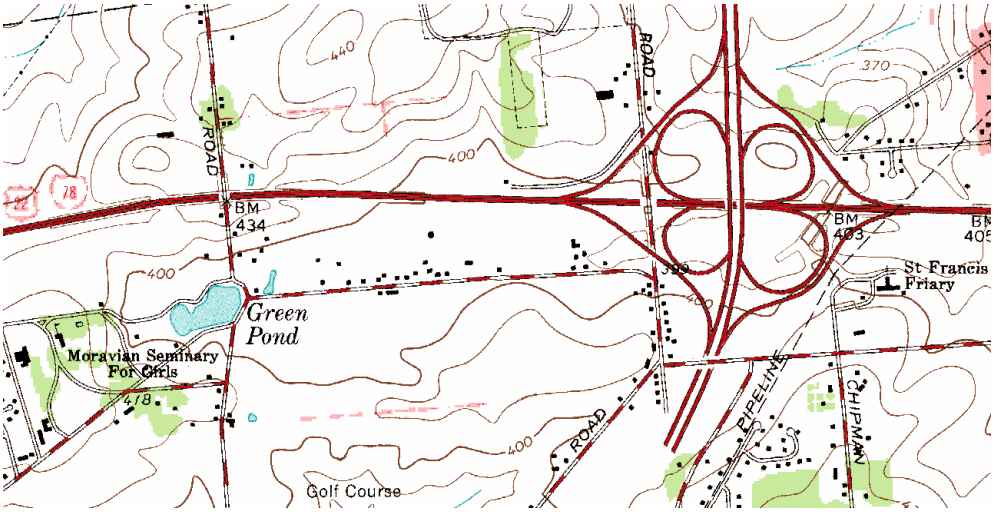
- Water flow is perpendicular to contour lines
- The closer the contours, the steeper the slope; the farther apart the contours, the flatter the slope
- If the V or U shape in the contours points uphill, the feature is a valley - streams often connect these points
- If the V or U shape in the contours points downhill, the feature is the nose of a hill – you will never see a stream here
- Wide loops in the contours represent hills; narrow loops in contours represent ridges – these are often drainage divides
- Sometimes you may see a loop with tic marks along the inside – this is a depression
- Permanent (perennial) streams are shown with solid blue lines, intermittent (seasonal) streams are shown with dash-dot line (but sometimes the maps are wrong!)
- Floodplains are not marked on topo maps, but they are often evident as flat ground adjacent to rivers

Sometimes (esp. in terrain underlain by limestone bedrock), small valleys do not have streams in them, but they still may be major drainageways for stormwater:



- Never rely on topographic maps as your primary source of land use information (many recent land developments are not shown here)

Sometimes it is not at all obvious which way the water goes:



Tools for delineation:

Pencil & eraser (or use AutoCAD with topo map as background raster image)
Topographic map

General method (as they say, practice makes perfect):

- Identify the point of interest – your goal is to enclose all the area upstream of this point from which all runoff will flow to the point of interest
- Locate the "drainage divides", or major topographic features such as hills and ridges that divide flow between adjacent streams - sketch in these boundaries first
- Delineate the watershed boundaries such that they: 1) are always perpendicular to contour lines (because water flows downhill by the steepest path available), and 2) do not cross drainage divides
- Check that there are no areas within your delineated watershed where the contours show flow going away from your point of interest