APPENDIX G

Interpreting Topographic Maps and Drawing Watershed Boundaries

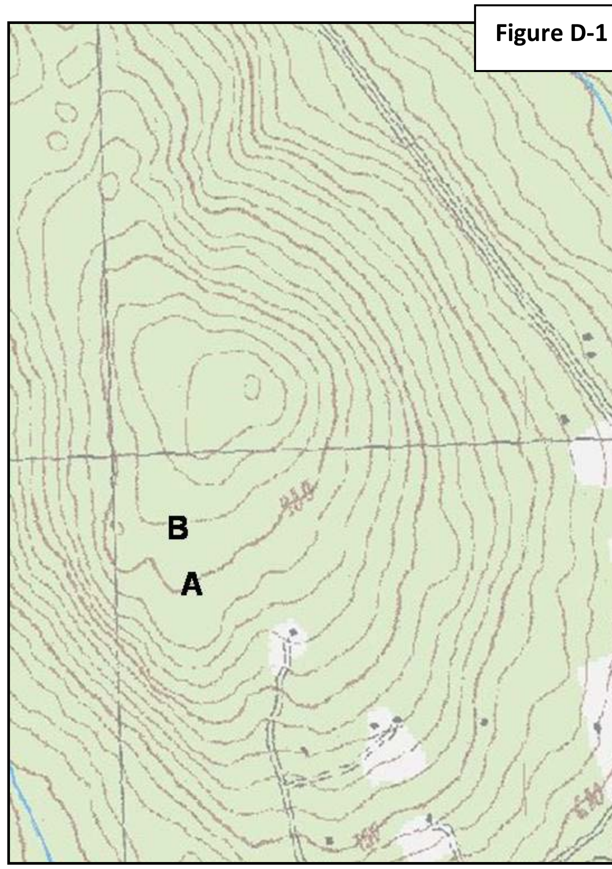
A watershed or drainage basin can be defined as the geographic area that contributes surface water runoff to a watercourse and/or wetland. The NH Method uses watersheds to answer several evaluation questions, so it is important that the user understands the basic principles of drawing a watershed boundary. Some users will use GIS tools to draw watershed boundaries and calculate acreage. Others may prefer to extrapolate watersheds from existing data sets, or to draw them manually.

INTERPRETING TOPOGRAPHIC MAPS

To draw a watershed boundary, the user needs to understand how to interpret topography off a topographic map.

Each contour line on a topographic map represents a ground elevation or vertical distance above a reference point such as sea level. A contour line is level with respect to the earth's surface just like the top of a building foundation. All points along any one contour line are at the same elevation.

Figure D-1



The difference in elevation between two adjacent contours is called the contour interval. This is typically given in the map legend. It represents the vertical distance you would need to climb or descend from one contour elevation to the next.

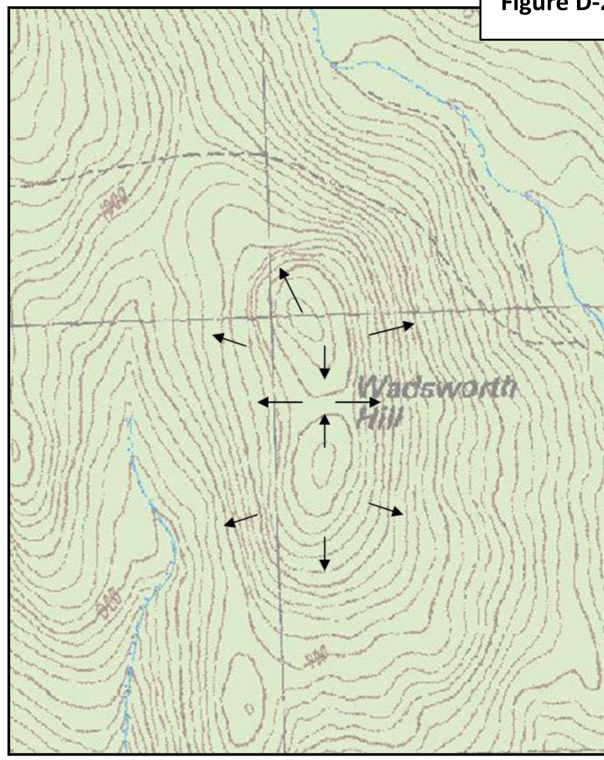
The horizontal distance between contours, on the other hand, is determined by the steepness of the landscape and can vary greatly on a given map. On relatively flat ground, two 20 foot contours can be far apart horizontally. On a steep cliff face two 20 foot contours might be directly above and below each other. In each case the vertical distance between the contour lines would still be 20 feet.

One of the easiest landscapes to visualize on the topographic map is an isolated hill. The map will show the hill as a series of more or less concentric circles (Figure D-1). If two people start walking in opposite directions on the same contour line, beginning at point A, they will eventually meet face to face.

If these same two people start out in opposite directions on different contours, beginning at points A and B respectively, they will pass each other somewhere on the hill and their vertical distance apart would remain 20 feet. Their horizontal distance apart could be great or small depending on the steepness of the hillside where they pass.

A more complex situation is where two hills are connected by a saddle (Figure D-2). Here each hill is circled by contours but at some point toward the base of the hills, contours begin to circle both hills.

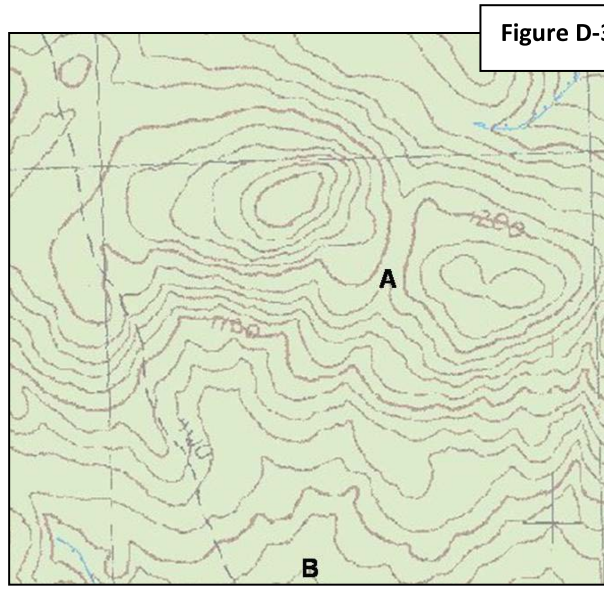
Figure D-2



Water always flows downhill and is generally perpendicular to contour lines. In the case of the isolated hill, water flows down on all sides of the hill. Water flows from the top of the saddle or ridge, down each side in the same way water flows down each side of a garden wall (See arrows on Figure D-2).

As the water continues downhill, it flows into defined water courses (streams and rivers) that get progressively larger as they flow towards the ocean. Any point on a watercourse can be used to define a watershed. For example, entire drainage area of a major river like the Merrimack is a watershed, but the drainage areas of each of its tributaries are also watersheds. Each tributary has smaller tributaries, and each one of these smaller tributaries also has a watershed. This process of subdivision can continue until very small, local watersheds are defined which might only drain a few acres, and might not contain a defined watercourse, but may include a wetland.

Figure D-3



A general rule of thumb is that topographic lines always point upstream. With that in mind, it is not difficult to make out drainage patterns and the direction of flow on the landscape even when there is no stream depicted on the map. In Figure D-3, for example, the direction of streamflow is from point A to point B.

As one proceeds upstream, successively higher and higher contour lines first parallel then cross the stream. This is because the floor of a river valley rises as you go upstream. Like-wise the valley slopes upward on each side of the stream. Ultimately, you must reach the highest point upstream. This is the head of the watershed, beyond which the land slopes away into another watershed. At each point on the stream the land slopes up on each side to some high point then down into another watershed. If you were to join all of these high points around the stream, you would have the watershed boundary. (High points are generally hill tops, ridge lines, or saddles).

DRAWING A WATERSHED BOUNDARY

This example shows how to locate and connect all of the high points around a watershed on a topographic map (Figures D-4 and D-5).

1. Draw a circle at the outlet or downstream point of the wetland in question (Figure D-4)

2. Put small "X's" at the high points along both sides of the watercourse, working your way upstream towards the headwaters of the watershed (Figure D-4)..

3. Starting at the circle (wetland outlet) that was made in step one, draw a line connecting the "X's" along one side of the water course (Figure D-5). This line should always cross the contours at right angles, i.e., it should be perpendicular to each contour line it crosses).

4. Continue the line until it passes around the head of the watershed and down the opposite side of the water course. Eventually it will connect with the circle from which you started. At this point you have drawn the watershed boundary for the wetland being evaluated.

The watershed boundary is shown in Figure D-5 as a broken line around the watercourse. Surface water runoff from rain falling anywhere in this area will ultimately drain to the outlet point, whether this is a wetland outlet or a point on a stream.

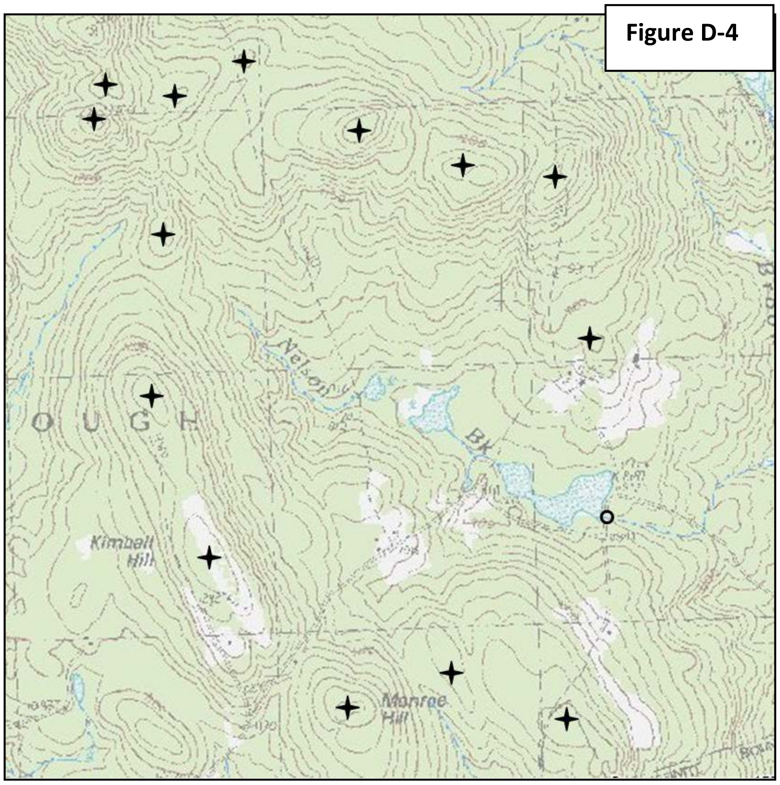


Figure D-4

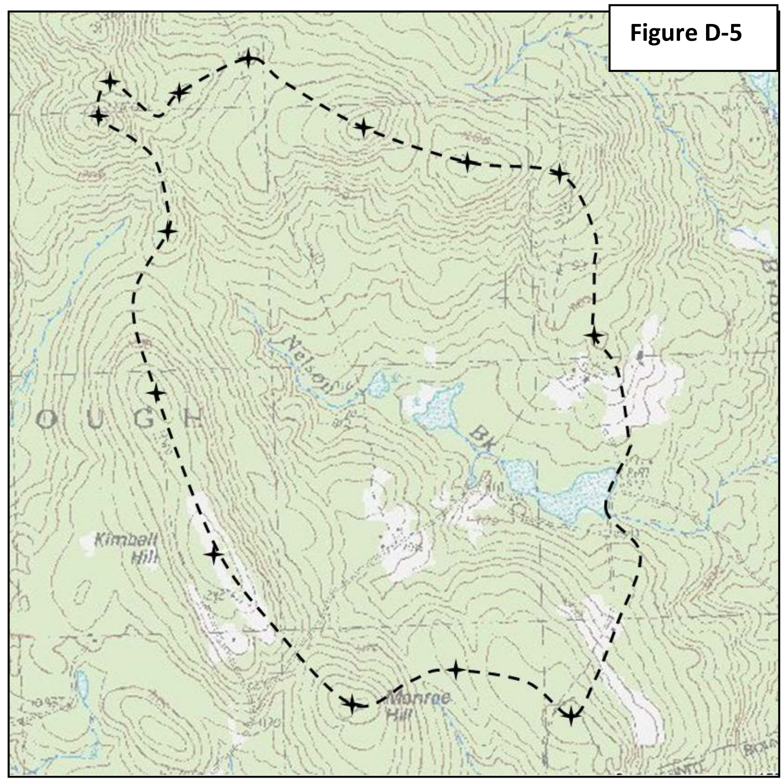


Figure D-5

CALCULATING WATERSHED ACREAGE

1. Watershed acreage can be easily calculated using GIS tools.
2. The grid method uses a sheet of acetate or Mylar, with a series of squares of a known area. This is laid over the map area to be measured. The user counts the squares that fall within the area to be measured and multiplies by a scale factor to determine the area.