Instruction Set: How to Delineate a Drainage Area

Warning: Since this is an engineering study, accuracy is very important. Calculating a drainage area incorrectly may result in flooding damage due to underestimated flows. There are a couple of rules that should always be followed when calculating a drainage area:

- Utilize USGS topographic mapping
- A stream or body of water should not be crossed
- A basin divide will not fall in a drainage swale
- All ridge lines should be followed
- When in doubt, consult someone with more experience
- After the area has been delineated, it should be reviewed for accuracy
- Watershed delineation lines should always intersect contour lines perpendicularly

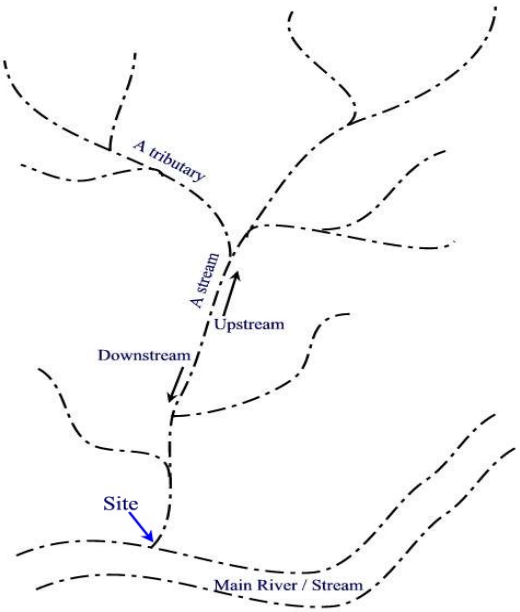
Materials Needed

- Topographic map (paper or electronic)
- Pencil if using paper map
- AutoCAD or other type of drafting software if using electronic map

Introduction

A drainage area can be calculated pre-development or post-development. It is the quintessential tool in providing stormwater management analysis for a land development project. A drainage area, also commonly referred to as a watershed throughout this set, is a boundary in which theoretically any drop of rain that falls will eventually make its way to a single known point. In other words, based on topography, a drop of water flowing naturally downhill in this area will flow to a common stream.

Drainage areas are determined by tracing all of the water bodies flowing into the stream or river upstream of the proposed site. A divide or ridge surrounds every drainage basin. A divide is defined as "the line of separation or dividing ridge marking the boundary between two drainage systems."



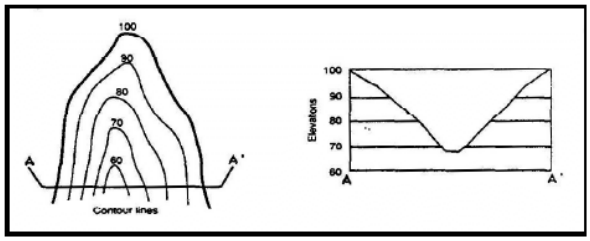
Step 1
Determine the discharge point and which part of the streams and tributaries are upstream from that point.

Step 2
Next, working upstream, trace all of the streams that drain into the water body on which your site rests. Remember that the tributaries point upstream.

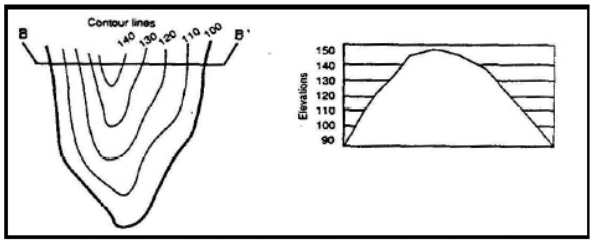
> **Note:** Contour lines spaced far apart denote that the landscape is more level and gently sloping. This is an indication of flat land. Contour lines spaced very close together denote dramatic changes in elevation over a short distance. Close contour lines mean steep slopes.

Step 3
After tracing the streams, you can delineate your drainage area by tracing the divide that encircles all of the tributaries draining into the main stream. Begin by recognizing valleys and ridges.

A valley is recognizable because contour lines point towards the highest elevation:



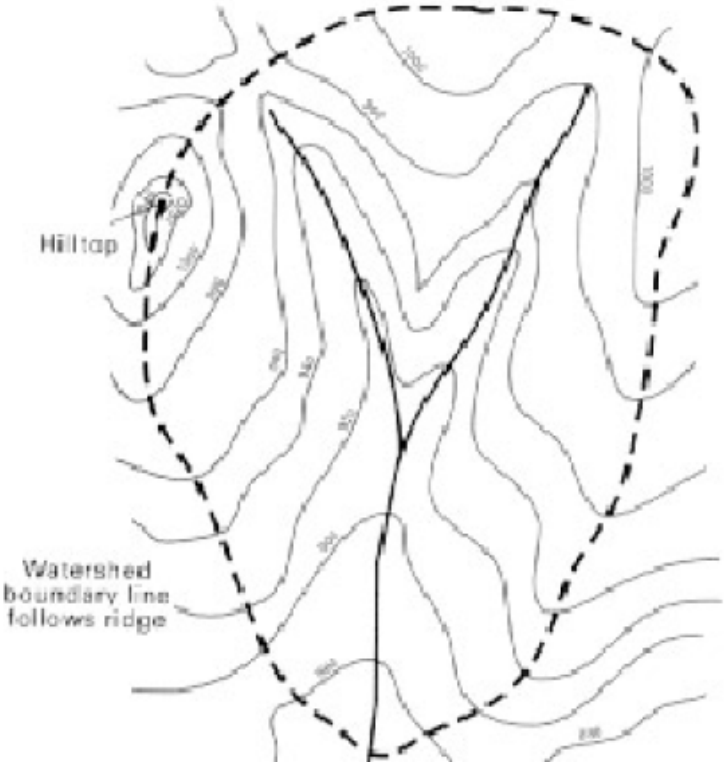
A ridge is recognizable because contour lines point towards the lowest elevation:



Step 4
Starting at a designated downstream point, draw a line perpendicular to the nearest uphill contour line.

Step 5
Repeat Step 5 continuing from contour to contour. Make sure to intersect the contours at break points. Break points are the highest elevations where half of the precipitation in that area would flow to one stream and half the precipitation would flow to another.

Step 6
Connect all break points, making sure to hit all high points in the area. Also, make sure the line connects to the original discharge point. The completed line represents the drainage area boundary. The watershed is now delineated. The following page displays an example of a delineated watershed.



Step 7

Picture a drop of rain falling on the surface of the map, inside of the drainage area boundary. Envision the water flowing down the slopes as it perpendicularly crosses contour lines. Trace its path to the nearest stream that flows to the discharge point you are studying. Repeat this process for different points on the watershed boundary to verify that the boundaries are correct.

Conclusion

A drainage area can be related to a bowl. The drainage area boundary is the rim of the bowl, and a rain drop on the rim will either fall into the bowl (drainage area) or out. Engineers use the delineated watershed boundary in conjunction with precipitation, infiltration, and evaporation rates to determine water balances in drainage areas.

These calculations can be used to effectively size stormwater management facilities like ponds and basins. They can be used to determine dam, bridge, and culvert sizes. In general, drainage area calculations are very critical to the water engineering aspect of a job. Although this is a very basic instruction set for determining a drainage area boundary, it should form a basic foundation for this crucial engineering practice.