

Learning Objectives Lecture 2

Tuesday, January 16, 2024 1:48 PM

1. Understand the meaning of a topographical map.
2. Understand common symbols used on a topographical map.
3. Understand how to draw contour lines
4. Understand how to make a X-Section (cross-section)
5. Understand how to delineate a watershed

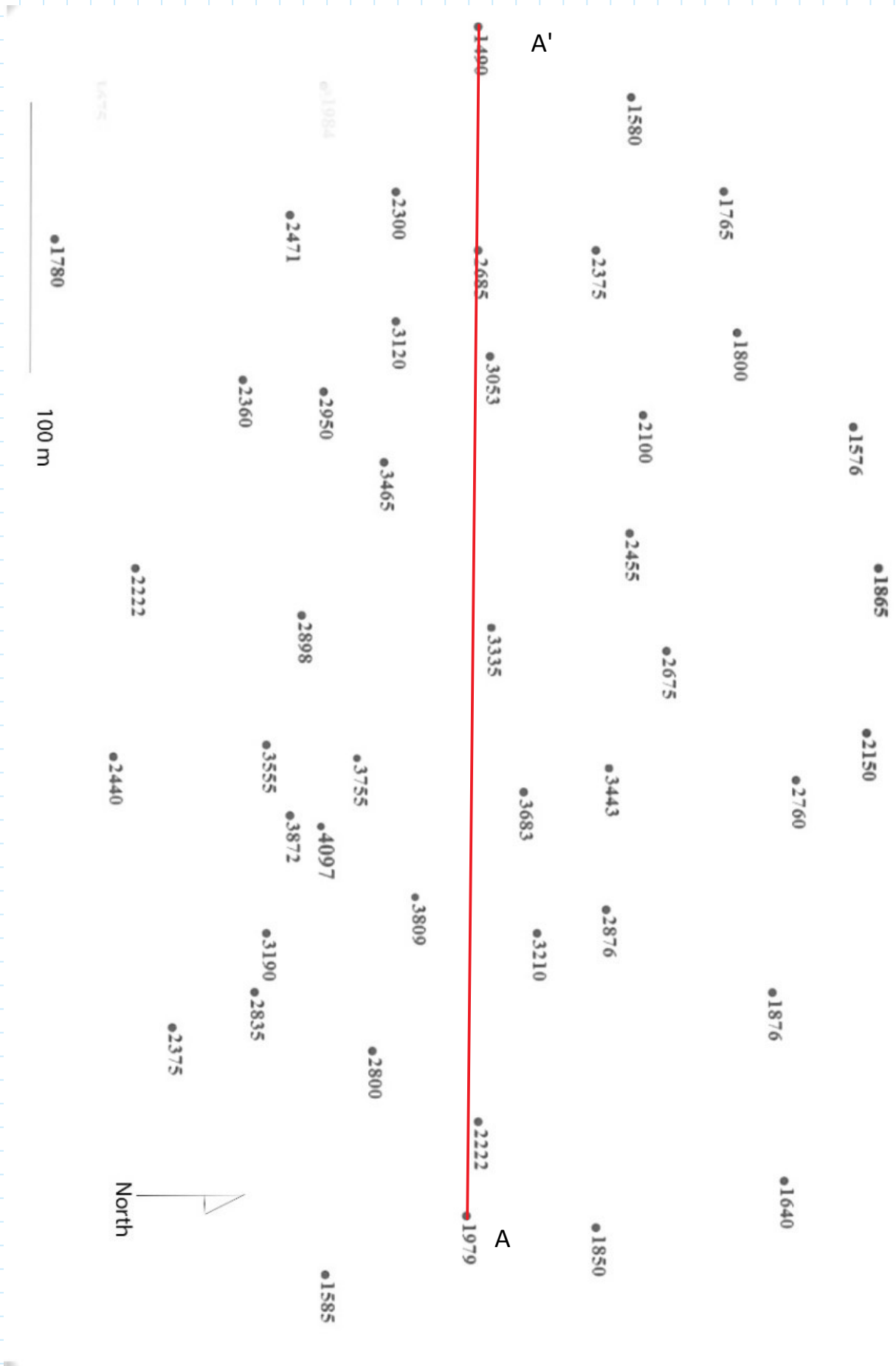
Assignment 2 - Individual

1. Using the elevation points found on the next page, develop a contour map. **(50 points)**
 - a. Hand-sketch the contour lines at 400-m intervals.
 - b. Label all contour lines
 - c. Submit the contour map as a jpg or pdf
2. Create a X-section from your contour map **(30 points)**
 - a. Start the cross-section at elevation marker 1490 (A) and end the profile at elevation 1979 (A').
 - b. Submit the contour map as a jpg or pdf
3. Draw the watershed for Red Butte Canyon **(20 points)**.
 - a. **Draw the watershed map on the contour map provided in the files folder of Canvas (Red Butte Canyon Quad.jpg)**
 - b. Submit the contour map as a jpg or pdf

Topographical Map - Submitted by:

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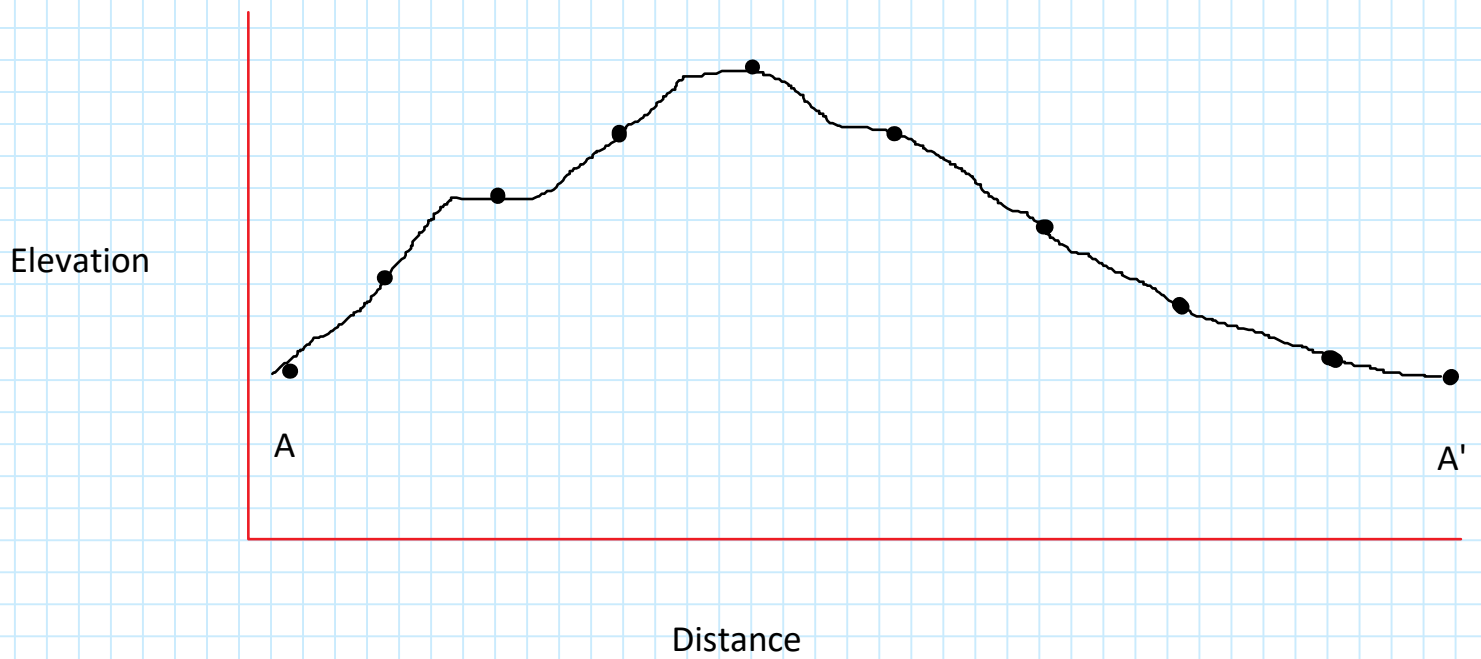
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X-Section - Submitted by:

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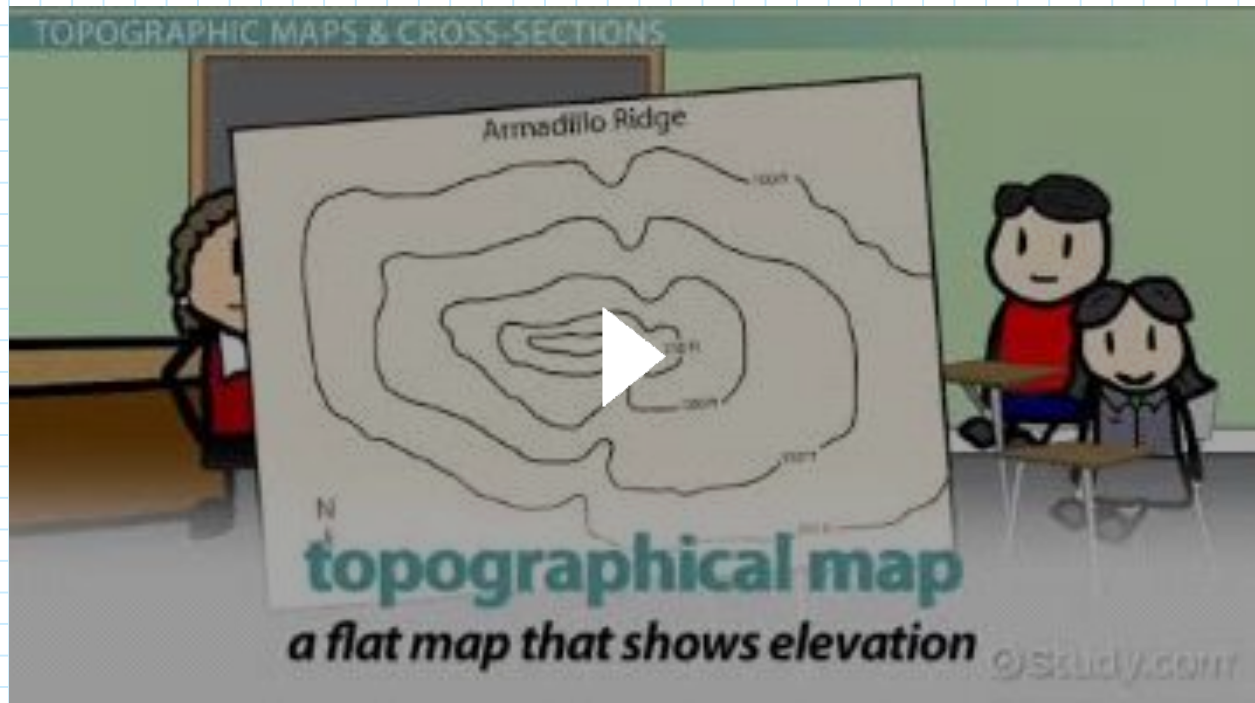


Topographical Map - Introduction Video

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[CVEEN 1400 How to Construct a Cross Section from a Map](#)



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Digital Elevation Model

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Digital Elevation Model - Salt Lake Valley

<https://www.regioregisieur.nl/salt-lake-city-topographic-map/>



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Topographical Map

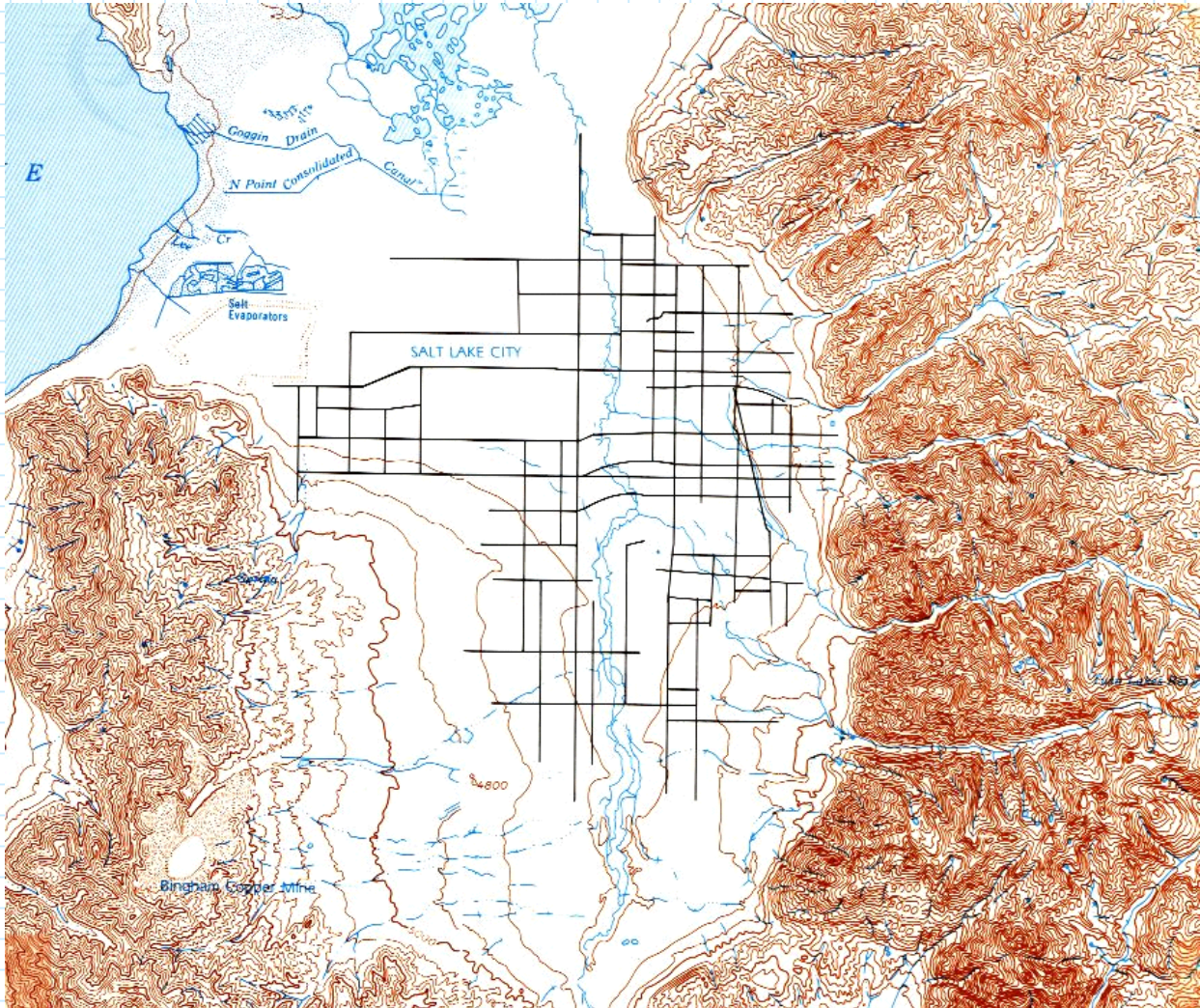
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Topographic maps allow you to see a three-dimensional landscape on a two-dimensional surface.

From <<https://adventure.howstuffworks.com/outdoor-activities/hiking/how-to-read-a-topographic-map.htm>>

Example of Topographical Map - Salt Lake City



<https://www.regioregisieur.nl/salt-lake-city-topographic-map/>



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Map Symbols

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BATHYMETRIC FEATURES	
Area exposed at mean low tide; sounding datum line***	
Channel***	
Sunken rock***	
BOUNDARIES	
National	
State or territorial	
County or equivalent	
Civil township or equivalent	
Incorporated city or equivalent	
Federally administered park, reservation, or monument (external)	
Federally administered park, reservation, or monument (Internal)	
State forest, park, reservation, or monument and large county park	
Forest Service administrative area*	
Forest Service ranger district*	
National Forest System land status, Forest Service lands*	
National Forest System land status, non-Forest Service lands*	
Small park (county or city)	
BUILDINGS AND RELATED FEATURES	
Building	
School; house of worship	
Athletic field	
Built-up area	
Forest headquarters*	
Ranger district office*	
Guard station or work center*	
Racetrack or raceway	
Airport, paved landing strip, runway, taxiway, or apron	
Unpaved landing strip	
Well (other than water), windmill or wind generator	
Tanks	
Covered reservoir	
Gaging station	
Located or landmark object (feature as labeled)	
Boat ramp or boat access*	
Roadside park or rest area	
Picnic area	
Campground	
Winter recreation area*	
Cemetery	
COASTAL FEATURES	
Foreshore flat	
Coral or rock reef	
Rock, bare or awash; dangerous to navigation	
Group of rocks, bare or awash	
Exposed wreck	
Depth curve; sounding	
Breakwater, pier, jetty, or wharf	
Seawall	
Oil or gas well; platform	
CONTOURS	
Topographic	
Index	
Approximate or Indefinite	
Intermediate	
Approximate or Indefinite	
Supplementary	
Depression	
Cut	
Fill	
Continental divide	
Bathymetric	
Index***	
Intermediate***	
Index primary***	
Primary***	
Supplementary***	
CONTROL DATA AND MONUMENTS	
Principal point**	
U.S. mineral or location monument	
River mileage marker	
Boundary monument	
Third-order or better elevation, with tablet	
Third-order or better elevation, recoverable mark, no tablet	
With number and elevation	
Horizontal control	
Third-order or better, permanent mark	
With third-order or better elevation	
With checked spot elevation	
Coincident with found section corner	
Unmonumented**	

How to Read Topographical Map

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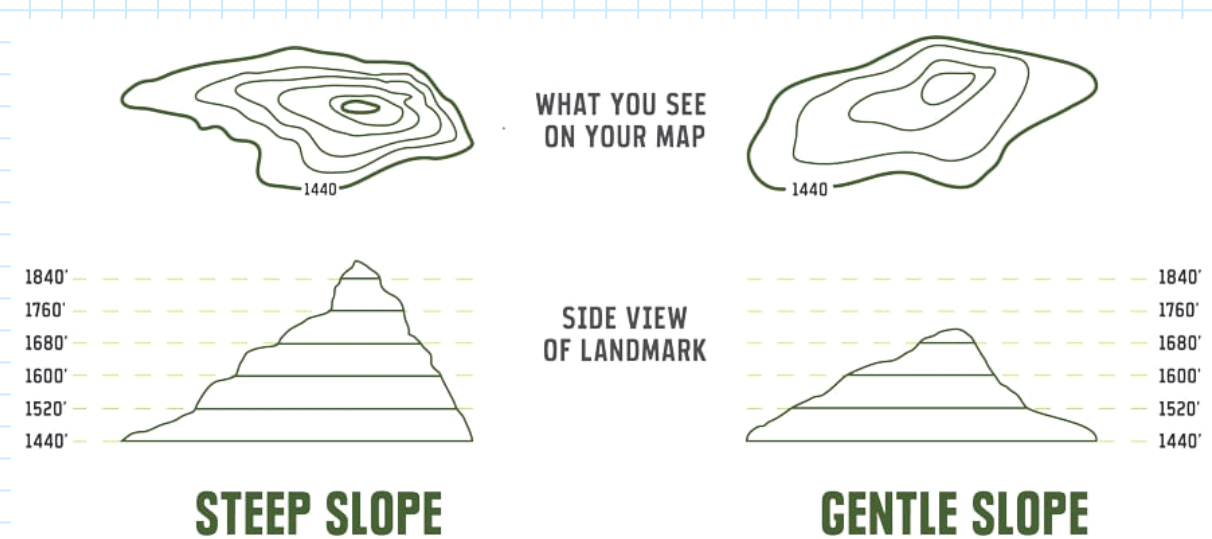
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- How contour lines let you visualize your terrain
- How map scales work
- Other useful map details
- Where to find topo maps

How Contour Lines Describe Terrain

Simple trail maps are useful for trip planning but NOT for navigation in the field. Topographic maps go further, giving you the power to visualize three-dimensional terrain from a flat piece of paper. The feature that makes this possible is contour lines:

Contour lines indicate the steepness of terrain. Contour lines connect points that share the same elevation: Where they're close together (they never intersect), elevation is changing rapidly in short distance and the terrain is steep. Where contour lines are wide apart, elevation is changing slowly, indicating a gentle slope.



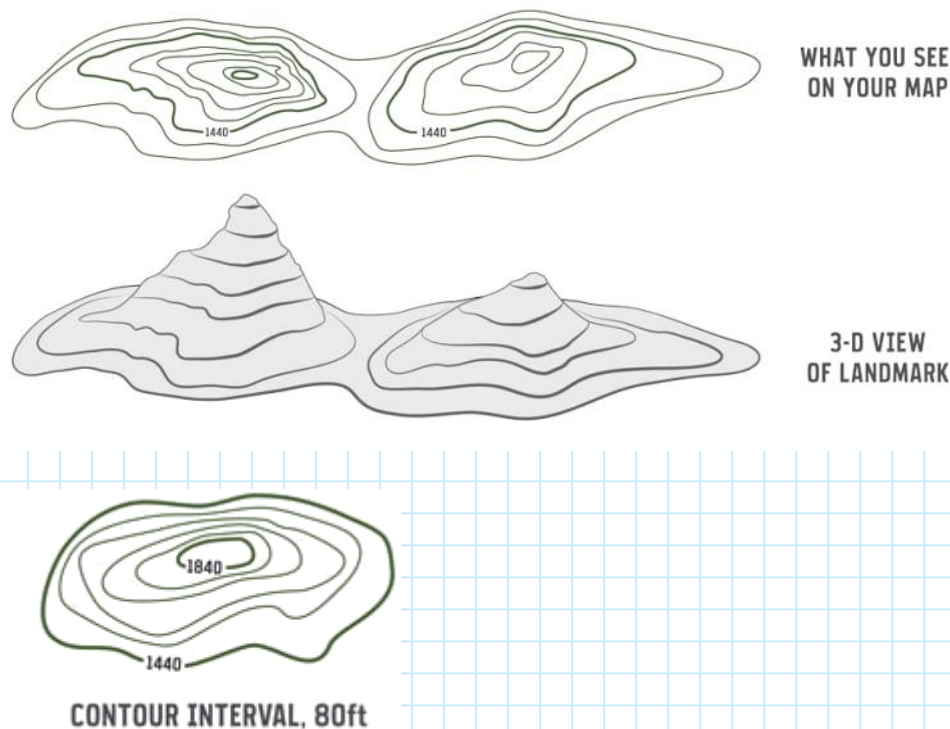
From <<https://www.rei.com/learn/expert-advice/topo-maps-how-to-use.html>>

How to Read Topographical Map (cont.)

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Contour lines also indicate the shape of the terrain. Roughly concentric circles are probably showing you a peak, and areas between peaks are passes. Studying a topo map of a familiar area is a great way to learn how to match terrain features with the contour lines on a map.



Index contour lines: Every fifth contour line is a thicker, “index” line. At some point along that line, its exact elevation is listed.

Contour interval: The change in elevation from one contour line to the next is always the same within the same map. Many maps have either a 40- or 80-foot contour interval: An 80-foot interval simply means that each contour line is 80 vertical feet away from the next closest line. You find the contour interval for your map in its legend.



Every once in a while, a circle indicates a depression rather than a peak. A circle with tick marks inside it indicates a depression, rather than a peak. You should also see elevations decreasing as you get near the depression.

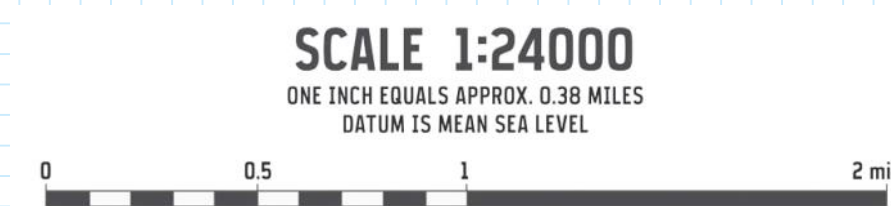
From <<https://www.rei.com/learn/expert-advice/topo-maps-how-to-use.html>>

How to Read Topographical Map (cont.)

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Map Scales

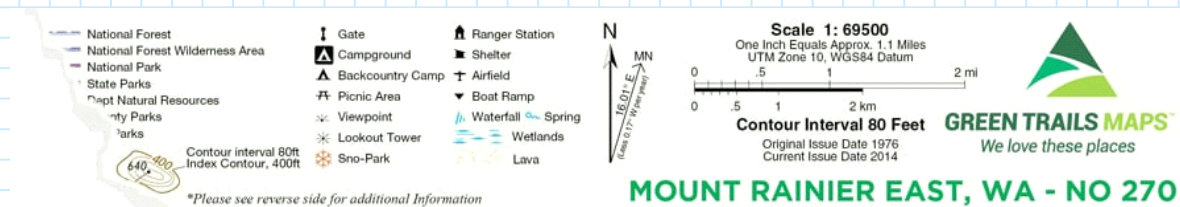
The map's scale tells you how detailed your map is. A 1:24000 scale, for example, means one inch equals 24,000 inches in reality. A larger scale, like 1:65,000, means that a map covers a larger area, but that it will have less detail.



Maps also have a representative scale to help you visualize real-world distances. You can use this scale and a string or the edge of your compass to get a rough estimate about hiking distances on your map.

Other Useful Map Details

Look closely at the map legend. It's loaded with map-reading clues and navigational data. Start by studying what each line, symbol and color means. Generally, green indicates denser vegetation, while light or colorless areas suggest open terrain. And, as you'd expect, streams and lakes are shown in blue.



The legend also lists key data like the map's scale, contour- and index-line intervals, grid systems (used for more advanced navigation) and magnetic declination (needed to set up your compass).

From <<https://www.rei.com/learn/expert-advice/topo-maps-how-to-use.html>>

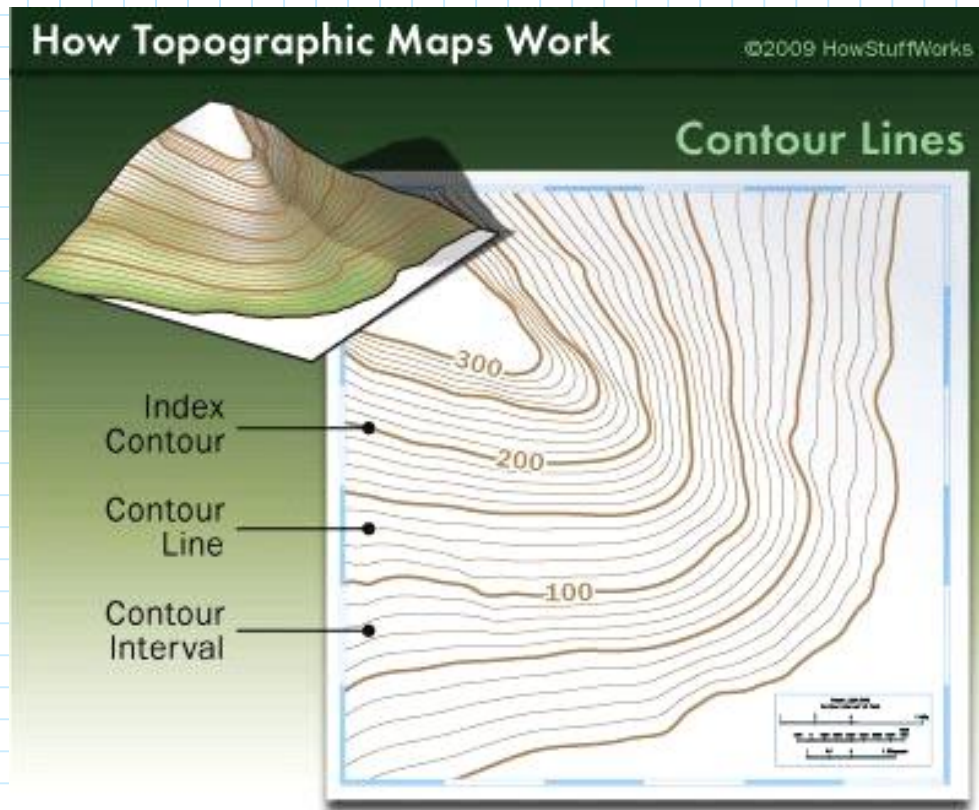


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Contour Lines

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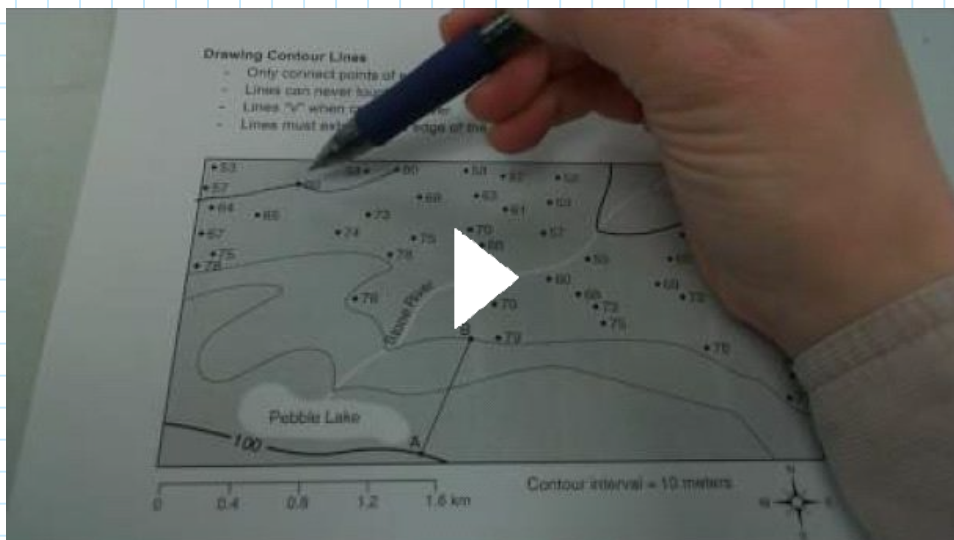
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<https://adventure.howstuffworks.com/outdoor-activities/hiking/how-to-read-a-topographic-map2.htm>

How to Draw Contour Lines

CCSD Earth Science

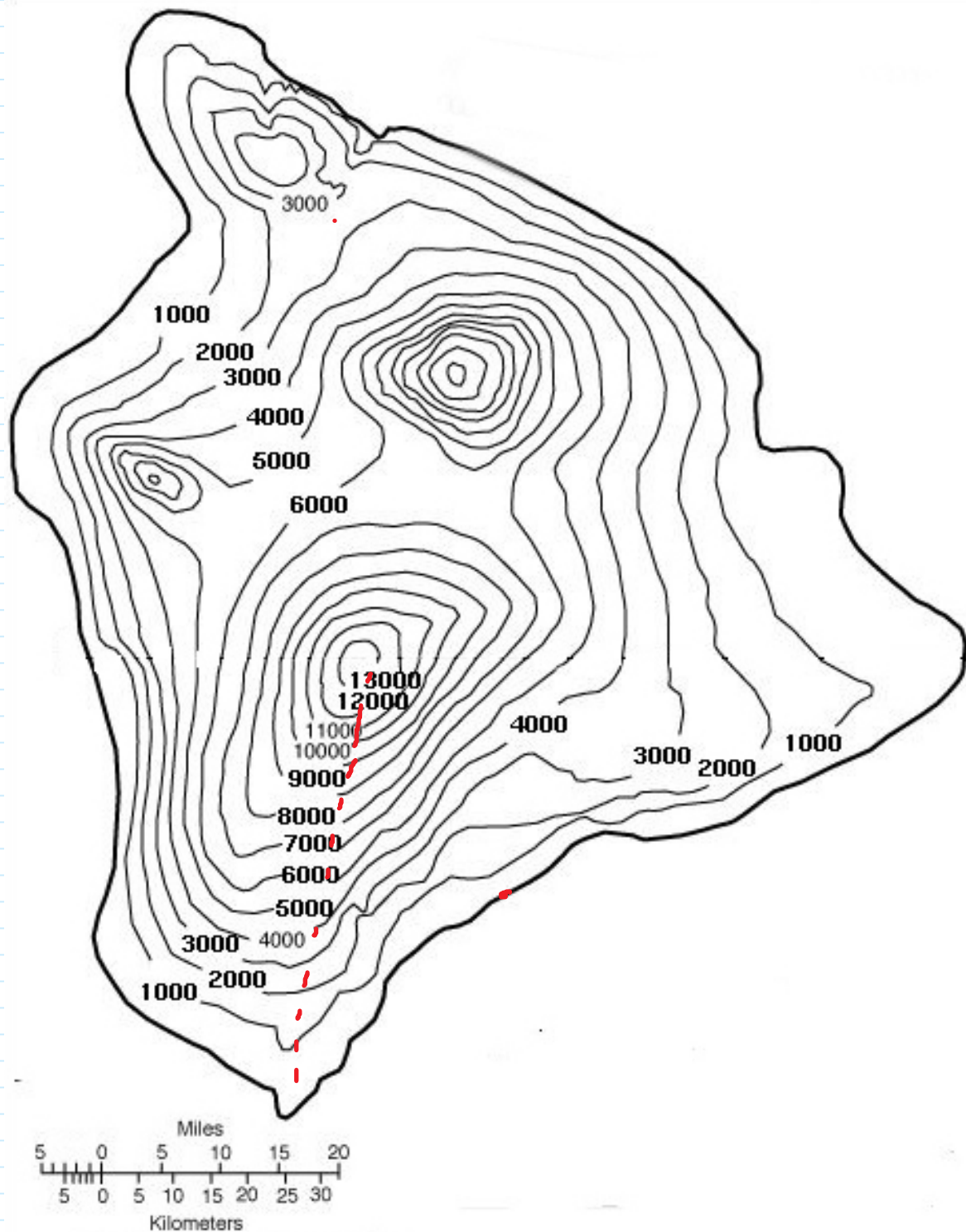


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Contour Map - Example

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X-Sections from Contour Maps

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[Cross section mapwork / mapping](#)

Fish

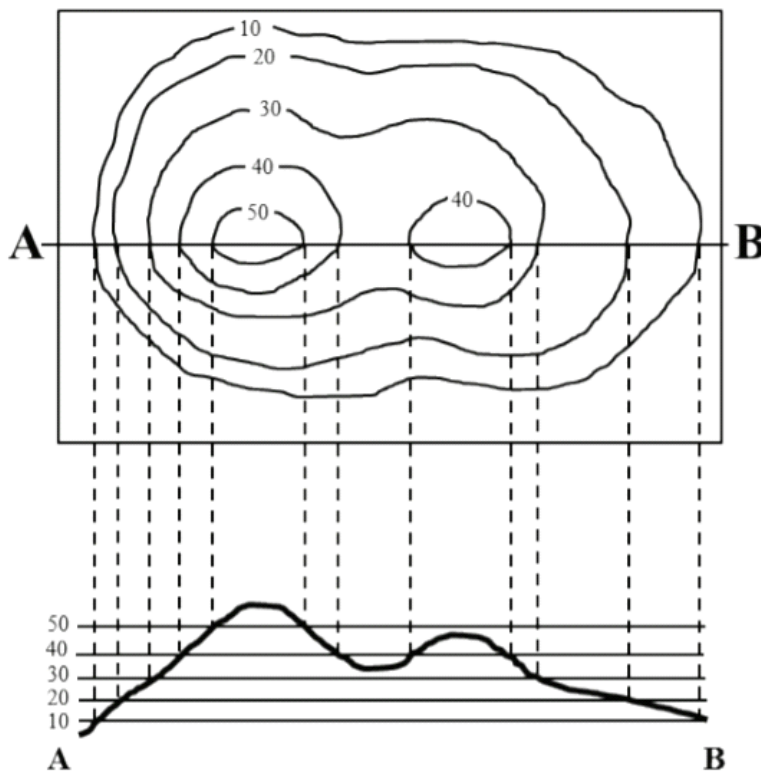
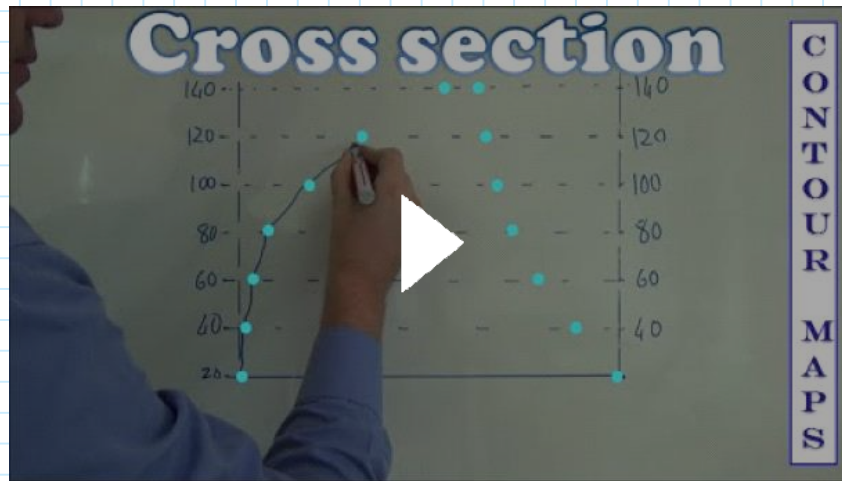


Figure 3.6 | Contour map and topographic profile of two hills and a valley between them.

Author: Karen Tefend

Source: Original Work

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Watershed

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[What is a Watershed](#)



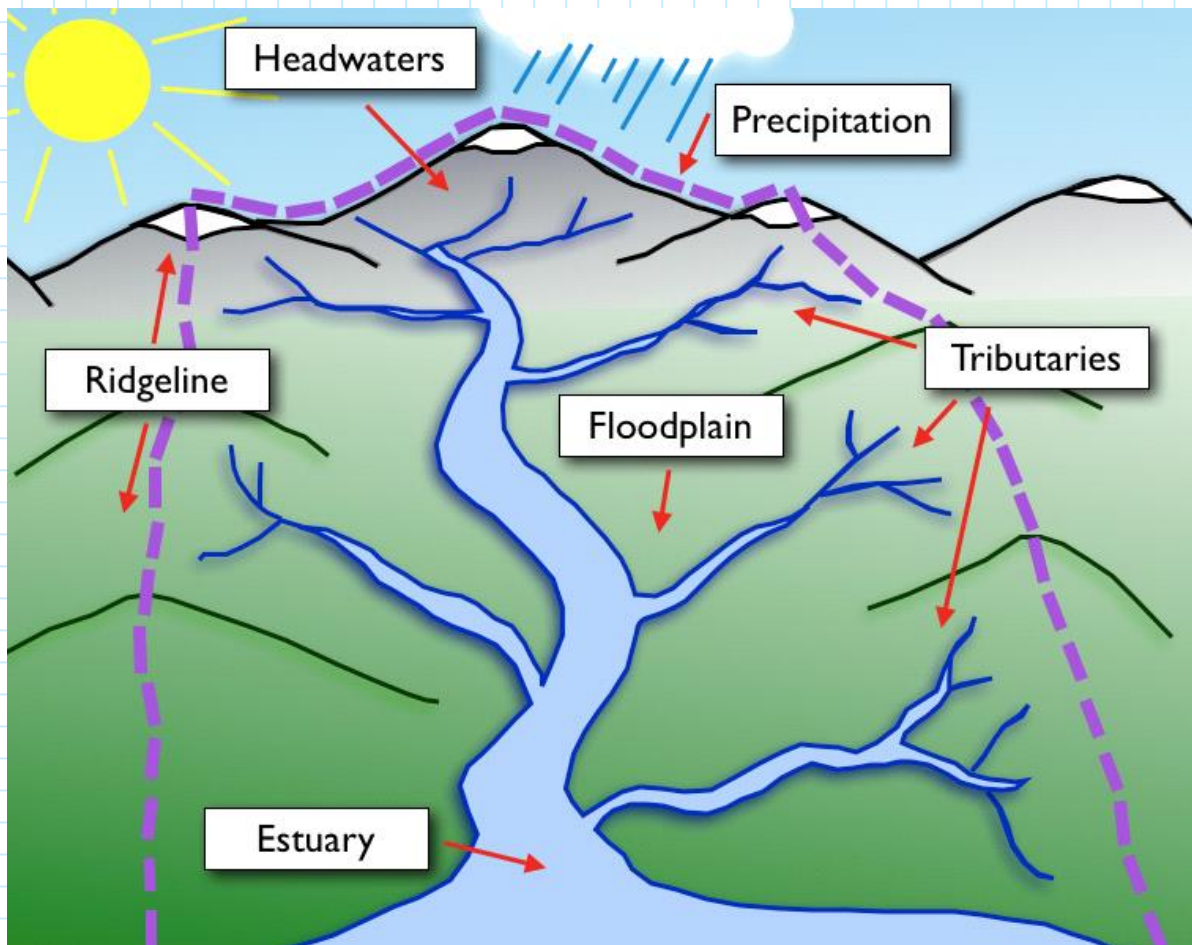
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Watershed

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A **watershed** is an area of land that feeds all the water running under it and draining off of it into a body of water. It combines with other **watersheds** to form a network of rivers and streams that progressively drain into larger water areas. Topography determines where and how water flows.

From <https://www.google.com/search?q=watershed&source=lmns&bih=694&biw=1396&rlz=1C1SQJL_enUS822US822&hl=en&ved=2ahUKEwjmusHY7PrnAhXhxisBHVH5DKwQ_AUoAHoECAEQAA>



<https://www.cserc.org/sierra-fun/games/watershed-game/>



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Watershed Identification

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1. Define an outlet
2. Identify the high points
3. Identify ridges and valleys
4. Connect highpoints and outlet using ridges with lines perpendicular to contour lines
5. These lines delineate the watershed

[Hydrology: Watershed Delineation Example](#)

Simmy Sigma



How to Read a Topographic Map and Delineate a Watershed

This fact sheet is an excerpt from Appendix E of the *Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire*, 1991. Alan Ammann, PhD and Amanda Lindley Stone. This document and method is commonly called "The New Hampshire Method."

Interpreting Topographic Maps

In order to successfully delineate a watershed boundary, the evaluator will need to visualize the landscape as represented by a topographic map. This is not difficult once the following basic concepts of the topographic maps are understood.

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.

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 twenty feet.

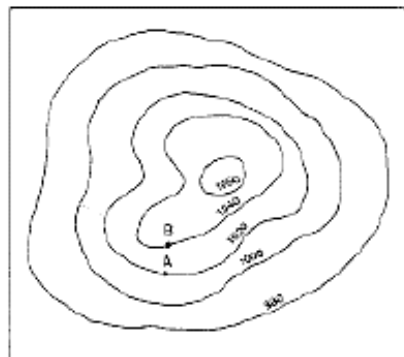


Figure E-1: Isolated Hill

One of the easiest landscapes to visualize on a topographic map is an isolated hill. If this hill is more or less circular the map will show it as a series of more or less concentric circles (Figure E-1). Imagine that a surveyor actually marks these contour lines onto the ground. 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.

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Watershed (cont.)

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

How do contours relate to water flow? A general rule of thumb is that water flow is 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 arrow on Figure E-2).

As the water continues downhill it flows into progressively larger watercourses and ultimately into the ocean. Any point on a watercourse can be used to define a watershed. That is, the entire drainage area of a major river like the Merrimack can be considered a watershed, but the drainage areas of each of its tributaries are also watersheds.

Each tributary in turn has tributaries, and each one of these tributaries 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.

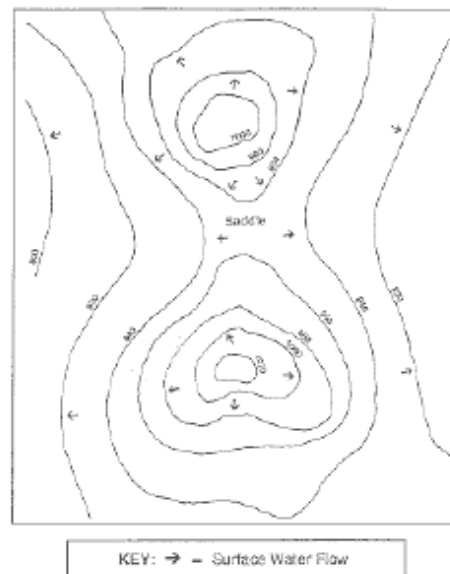


Figure E-2: Saddle

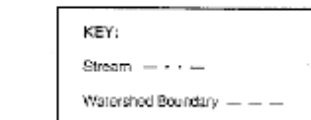
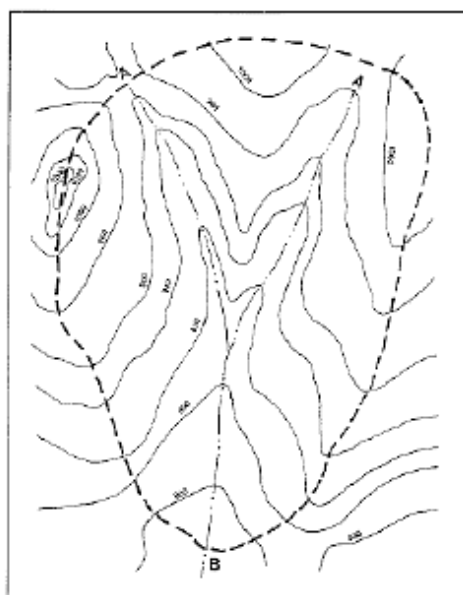


Figure E-3: Idealized Watershed Boundary

Figure E-3 shows an idealized watershed of a small stream. Water always flows downhill perpendicular to the contour lines. 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. Likewise the valley slopes upward on each side of the stream. 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 E-3, for example, the direction of streamflow is from point A to point B.

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).

Watershed (cont.)

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Delineating a Watershed

The following procedure and example will help you locate and connect all of the high points around a watershed on a topographic map shown in Figure F-4 below. Visualizing the landscape represented by the topographic map will make the process much easier than simply trying to follow a method by rote.

1. Draw a circle at the outlet or downstream point of the wetland in question (the wetland is the hatched area shown in Figure E-4 to the right)
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.
3. Starting at the circle that was made in step one, draw a line connecting the "X's" along one side of the watercourse (Figure E-5, below left). 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 watercourse. Eventually it will connect with the circle from which you started.



Figure E-4: Delineating a Watershed Boundary - Step 1

At this point you have delineated the watershed of the wetland being evaluated.



Figure E-5: Delineating a Watershed Boundary - Step 2

The delineation appears as a solid line around the watercourse. Generally, surface water runoff from rain falling anywhere in this area flows into and out of the wetland being evaluated. This means that the wetland has the potential to modify and attenuate sediment and nutrient loads from this watershed as well as to store runoff which might otherwise result in downstream flooding.

Measuring Watershed Areas

There are two widely available methods for measuring the area of a watershed: a) Dot Grid Method, and b) Planimeter. These methods can also be used to measure the area of the wetland itself as required by The New Hampshire Method.

- a) The dot grid method is a simple technique which does not require any expensive equipment. In this method the user places a sheet of acetate or mylar, which has a series of dots about the size of the period at the end of this sentence printed on it, over the map area to be measured. The user counts the dots which fall within the area to be

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Watershed (cont.)

measured and multiplies by a factor to determine the area. A hand held, mechanical counting device is available to speed up this procedure.

- b) The second of these methods involves using a planimeter, which is a small device having a hinged mechanical arm. One end of the arm is fixed to a weighted base while the other end has an attached magnifying lens with a cross hair or other pointer. The user spreads the map with the delineated area on a flat surface. After placing the base of the planimeter in a convenient location the user traces around the area to be measured with the pointer. A dial or other readout registers the area being measured.

Planimeters can be costly depending on the degree sophistication. For the purposes of The New Hampshire Method, a basic model would be sufficient. Dot counting grids are significantly more affordable. Both planimeters and dot grids are available from engineering and forestry supply companies. Users of either of these methods should refer to the instructions packaged with the equipment they purchase.

For more information on The New Hampshire Method, wetlands restoration programs, conservation planning, ecosystem restoration, and other technical references, visit www.nh.nrcs.usda.gov or call (603) 868-7581.

Red Butte Canyon

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Red Butte Canyon



What's here?

Approximate Street Address

No house address found.

[Google Street View](#)

City

Unincorporated

Zip Code

84108

County

SALT LAKE

UTM 12 NAD83 Coordinates

436698.68, 4519082.14 meters

WGS84 Coordinates

-111.75065, 40.82032

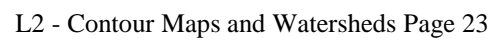
Elevation Meters

Elevation Feet



<https://atlas.utah.gov/>

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