UNIT 1C. USING TOPOGRAPHIC MAPS
WHERE IN THE WORLD ... ARE YOU?

TIME	LEVEL
60-90 minutes	All

BENCHMARKS	
Next Generation Science Standards	MS-LS1.D
Science & Engineering Practices	Developing and Using Models

MATERIALS:

- Topographic maps of your local area, county and or state and a map which shows your field trip site. U.S. Geological Survey (USGS) 7.5-minute maps are optimal, but any map showing township, range and section will do. Use a map at either a 1:100,000 or 1:24,000 scale of the area you're visiting. Maps at a 1:100,000 scale show less detail, but a larger area; maps at a 1:24,000 scale show a smaller area in more detail. Both scales are helpful in determining your site location. For approximately $3-$5, maps generally can be purchased at your local outdoor store, bookstore, Forest Service or BLM office.

- Overhead transparency sheets and pens
- Tracing paper
- STUDENT HANDOUT 1C-1: Using Maps
- STUDENT HANDOUT 1C-2: TOPO MAP SECTION
- STUDENT HANDOUT 1C-3: Topographic Mapping Symbols

OBJECTIVES:

Students will:

1. become familiar with topographic maps.
2. be able to use maps to identify the location of sites using township, range and section.
3. be able to read the elevation of sites through an understanding of contour lines.
4. be able to identify watersheds and stream flow through topo maps.

PROCEDURE:

- Give each student a copy of STUDENT HANDOUTS C1 and C2.

- As a class, follow along through the materials that explain how to use topographic maps, and how to determine township, range and section (TRS).

- Now that students have some knowledge of maps and map reading, divide the class into small groups. Give each group a topographic map of the local area (you can make copies of topo maps, but be sure that copies include the map's edges that have the TRS degrees).

- Ask students to locate familiar landmarks such as their school or roads. Have students locate local streams.
- Ask students to look at the contour lines on their maps. Note that some of them are thicker than others.
- Select one of these thicker lines and follow it. Somewhere along the line there will be a number, written in the direction of and in place of the line. This is the elevation of the line. Elevation is the height-in feet or meters above sea level of a particular point or line. Every point on that line is at the same elevation.

Other points about contour lines to go over with students:

- A contour line never goes up or down hill.
- Contour lines never cross each other.
- The vertical distance between contour lines is called the contour interval. The contour interval used varies from map to map.
- By locating the closest labeled contour line and then counting lines, one can determine the elevation of a point.
- The closer together the contour lines, the steeper the slope.
- When contour lines cross a stream they form a "V" that points upstream.
- Ask students to locate the highest points (ridgelines) between two streams, thus locating the boundaries of watersheds.
- Have students use the "Topographic Map Symbols" handout to identify land uses in the watershed.
- Finally, choose three or four labeled locations on the map. Have students identify the TRS. Also, choose three or four TRS coordinates and have them write what is located there.
- Practice and review is the key to preparing students for mapping their location.

STUDENT HANDOUT C1. USING MAPS

Contour lines…quads…elevation…true north. Welcome to the world of topographic maps.

Topographic maps, also called “topo” maps, are the least expensive means for determining your location. For a few dollars, U.S. Geological Survey (USGS) topo maps are optimal for Salmon Watch. Like most maps, they show a portion of Earth’s surface by reducing it to a practical size with various symbols representing feature in the mapped area. Unlike typical two-dimensional maps, topographic maps add a representation of the vertical dimension through the use of contour lines.

Each contour line represents a particular elevation above mean sea level. Although other types of maps may show the hills and valleys of the mapped area, the contour lines on topo maps provide much more detail and accuracy. To one who does not understand the markings, lines, and symbols on a topo map, it may well look like some two year old had fun with a light brown pencil. But to a person with a bit of training, these squiggly lines provide a wonderful view of the countryside.

Global Positioning System Receiver

One of the most accurate methods for determining site location is a Global Positioning System (GPS) receiver. This handy device picks up signals from satellites orbiting the Earth and instantly displays the latitude and longitude (and altitude, if desired) of your location.

Location Methods

There are two primary methods used to determining site location:

- Township, range and section (TRS), or
- Latitude and longitude (Lat/Long)

The former can be determined by using maps; the latter by maps or GPS receivers. If you don’t have access to a GPS receiver, you’ll need to use a topo map.

Township, Range and Section

On the following handout is a portion of a USGS map of Christmas Valley, Oregon (1:100,000 scale). We have identified a site, Doughnut Mountain (circled on the map), and drawn arrows from the Township and Range numbers in the margins to illustrate its location. To practice your skills at determining TRS, follow the sets below to determine the TRS of Doughnut Mountain.

Township Template

R

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

T T

R

Explanation: All states are divided into township grids of 36 square miles. Township numbers are found on the extreme right and left sides of a map; range numbers at the top and bottom. Each grid is further divided into 36, one square-mile sections, numbered in sequence and beginning in the top right-hand corner. Section 8 is highlighted here to indicate the section location of Doughnut Mountain.

Note: Some 1:24,000-scale maps use non-standard section numbers (i.e., numbers other than 1-36). In these cases, locate your township/range grid of 36 squares and assign the correct number to each of the 36 squares following the number sequence of the above grid.

Determining Township: A township is 36 square miles. Township numbers are printed in the margins on the extreme right and left sides of maps (in this example, we only show numbers for the right side of the map) and centered between two lines that delineate the township. Notice that the two horizontal lines are slightly darker in color than the surrounding lines.

Doughnut Mountain is located in Township 29 South, or T 29 S

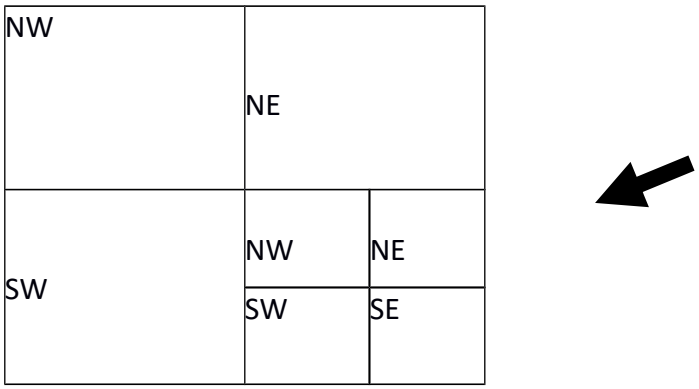
Determining Range: Range numbers are printed in the margins at the top and bottom of maps (in this example, we only show numbers for the bottom portion of the map), and are also centered between two slightly darker vertical lines that delineate the range.

Doughnut Mountain is located in Range 22 East, or R 22 E

Determining Section: A section is one square mile. There are 36 sections in each township. On most maps, only the four corner section numbers (1, 6, 31, 36) are printed within each township. The first row of section numbers (1-6) reads from right to left, the second row (7-12) reads from left to right, and so forth to section 36. You'll need to count across the grid in this sequence to find the section for Doughnut Mountain. (Refer to the Township template to help you determine the correct section number for Doughnut Mountain.)

Try to be accurate to within a quarter of a quarter mile. Well, what do we mean by “a quarter of a quarter mile”? Since a section is one square mile, divide the section into four equal quadrants (NE, SE, NW, SW) to get your location down to a quarter of a mile.

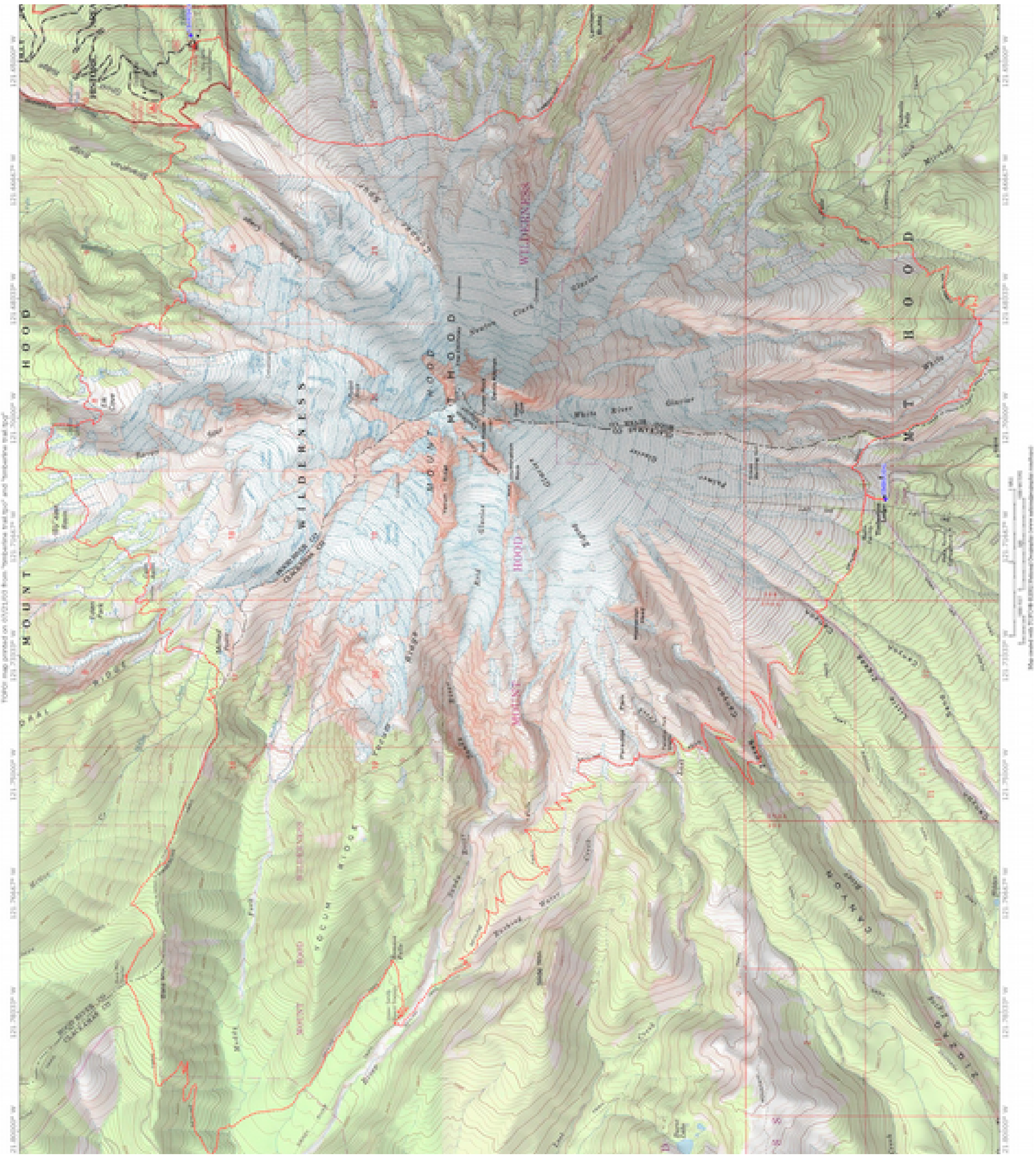
Then, to get it even smaller to a quarter of a quarter mile, divide the quadrant into four again. Thus, in the case of Doughnut Mountain, your site might be in the NE quarter of the SE quarter of Section 8, as shown by the dark square that follows:

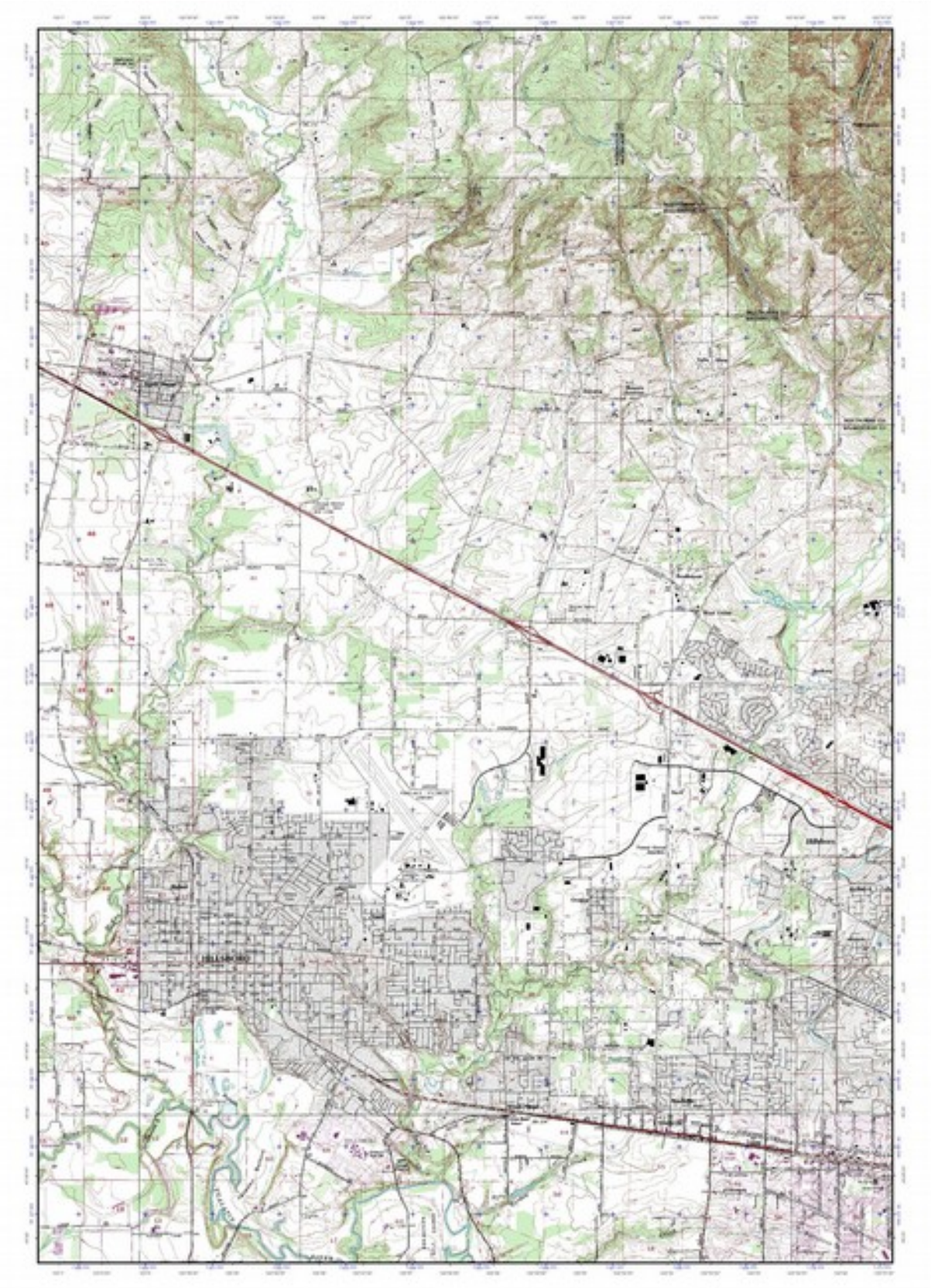


Putting It All Together: Standard recording procedure requires that the final location recording begin with the smallest area and work backwards.

Thus, your final site identification for Doughnut Mountain should read:
NE !, SE !, S8, T29S, R22E

STUDENT HANDOUT C2. TOPO MAP





STUDENT HANDOUT C3. TOPOGRAPHIC MAPPING SYMBOLS