

## Determining the Slope of Your Shoreland

Slope is a site characteristic that must be measured to determine the boundary of the Protected Shoreland Area and for any work proposed within it. Shoreland property owners are asked to provide the slope of their project site because water runoff from steeper sites carries more velocity and potential for erosion than from flat areas. Sites with a slope 20 percent or steeper will require more attention for any construction work, such as selecting erosion control practices like planting techniques and plant species for stabilizing steep banks.

### Calculating Slope

The slope of a land area, also called the grade, is expressed as the number of feet the land rises (RISE) over a distance of the land (RUN). Once you know the Rise over Run for the *project site*, use the formula below to turn those measurements into percent slope.

#### **(Rise ÷ Run) x 100 = % Slope**

*For example, if the elevation gain was 23 feet over 100 foot distance, then use the formula to calculate slope:*

$$(23' \div 100') \times 100 = 23\% \text{ Slope}$$

### Area to Measure

- The Protected Shoreland Area. The PSA is the entire shoreland area surrounding the lake as measured horizontally 250 feet from the lake's mean water level outwards.
- The Project Site Area. This area covers a 100 foot distance. Starting in the center of the project site, measure out 50 feet in either direction, perpendicular to the contour lines. If there is less than 50 feet between the project site and the water's edge, add **the distance not measured to the other side to achieve a full 100 feet**. For new development, the slope of the proposed project site must be determined before any grading occurs and the land is in its natural condition.

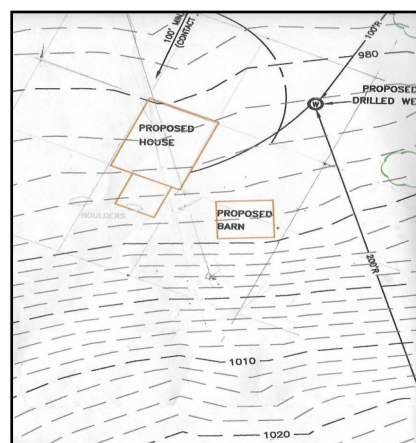
### Methods for Calculating Slope

There are several ways to measure the slope of your parcel. Select which method is best for you.

#### 1. Parcel Map or Site Plan Map

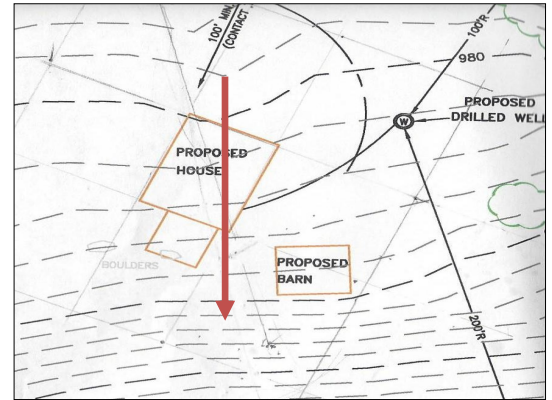
If you don't already have a copy of your parcel map, then your town should be able to provide you one. Otherwise, a Licensed Land Surveyor, Engineer, or Site Installer would be able to create a map for you. These professionals could also include all your shoreland measurements right on the map, such as the boundary of the Protected Shoreland Area and its area, the boundary of the Lakeside and Upland Zones, the slope, and the percent cleared and the percent of impervious surface areas.

For a list of [Licensed Designers](#), visit the Vermont DEC Watershed Management Division web site.



**Slope can be determined from a Parcel Map or Surveyed/Engineered Site Plan that contains a scale and provides the contour intervals.**

To measure slope using a parcel or site plan map, draw a line that best represents 100 feet (based on the scale of your map), through the proposed project site, perpendicular to the contours. The map on the right shows contour intervals at 2 feet, and seven contour lines are crossed by the 100 foot project site area, resulting in 14 feet of rise over a 100 foot run. Using the slope formula, this building site has a 14 percent slope.  $(14' \div 100') \times 100 = 14\% \text{ Slope}$



The arrow, measuring a 100 feet distance, spans the building site area and runs perpendicular to the contour lines.

## 2. The Vermont Agency of Natural Resources Atlas

The Vermont Agency of Natural Resources provides a web application to look at maps with different information layers. For example, the *Map Theme* called *Lake Shorelands*, shows the slope of the shoreland, parcel and town boundaries, and a few other features, such as mapped wetlands. One can view a shoreland parcel and identify the slope of that parcel by using this map.

Using this link to the ANR Atlas, <http://anrmaps.vermont.gov/websites/anra5/>, follow the steps below to find the slope of your parcel.

- Select “Show Map Layers”
- Under Map Theme (top drop down menu of Atlas Layers), select Lake Shorelands
- Click on the Slope Box/Category under the Lake Shorelands theme
- Zoom to your lake and property and read the slope

Select Map Layers

Lake Shorelands

Click on Slope

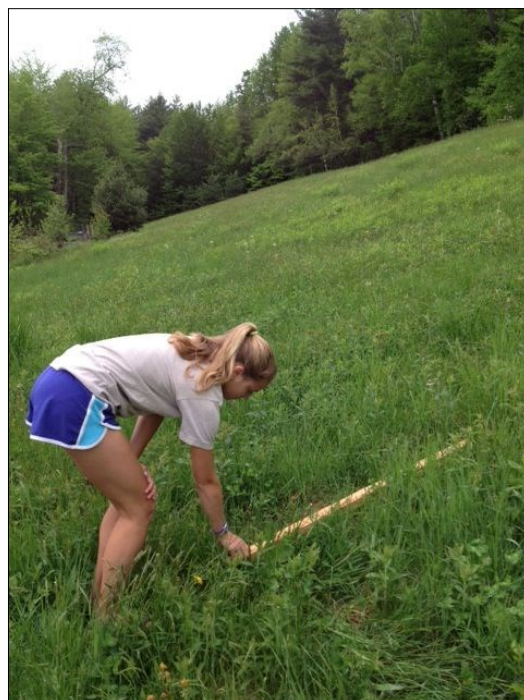


### 3. Do - It - Yourself Field Work

- Taking a 50 inch board, start at the bottom of the distance you will be measuring to determine the slope. The Mean Water Level marks the bottom of the slope for the Protected Shoreland Area, otherwise, for a project site, start at the lowest point of the distance needed to measure slope.
- Laying the board perpendicular to the slope, place the carpenter's level on the board and raise it until it's level.
- Use the tape measure to determine the board's distance from the ground. Take your measurement from the bottom of the board.
- Plug the Rise and Run measurements into the slope formula to determine percent slope. Repeat these steps every 10 paces in locations that are most representative of the terrain. You will average your results.

#### Materials:

- 50 inch Board
- Carpenter's Level
- Tape Measure



To determine slope, start at the bottom of the 100 foot Project Site, or distance needed to measure slope

For example, the photo with the level and tape measurer show that the Rise is 17 inches. The Run is the 50 inch board.

$$17 \div 50 \times 100 = 34\% \text{ Slope}$$

Repeating this four more times yielded:

$$18 \div 50 \times 100 = 36\% \text{ Slope}$$

$$16 \div 50 \times 100 = 32\% \text{ Slope}$$

$$18 \div 50 \times 100 = 36\% \text{ Slope}$$

$$18 \div 50 \times 100 = 36\% \text{ Slope}$$

To calculate the average of the measurements, add the measurements and divide by the number of them.

For the example above, the average slope is:

$$36 + 32 + 34 + 36 + 36 = 174$$

$$174 \div 5 = 34.8, \text{ or } 35\% \text{ Slope}$$



Once the board is level, from the bottom of the board, measure how many inches off the ground it is. This measurement is the Rise and the 50" board is the Run. The slope formula will give the percent slope.