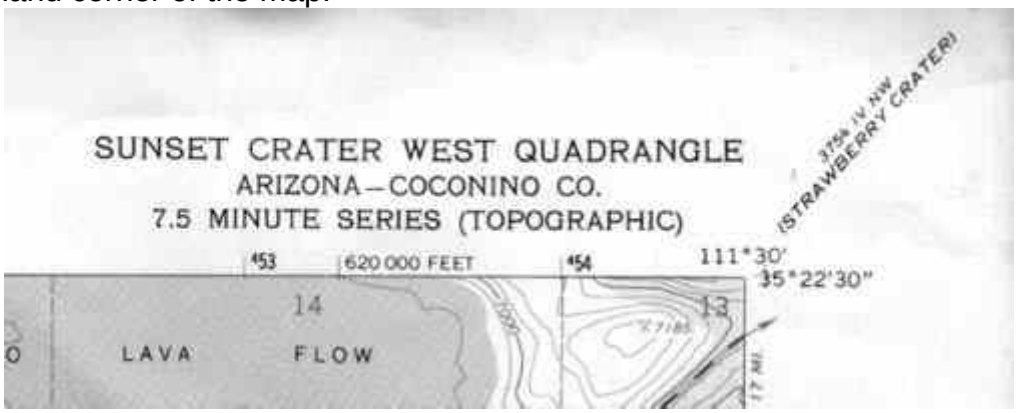
Mapping – Level 2

HOW TO READ TOPOGRAPHICAL MAPS

Knowing how to read a USGS topographical map is essential to successfully finding a ghost town. USGS topographical maps are useful because they show the terrain and lay of the land as well as feature like roads, structures and mines. As you read this, it would be helpful if you also had your own topographical map to refer to.

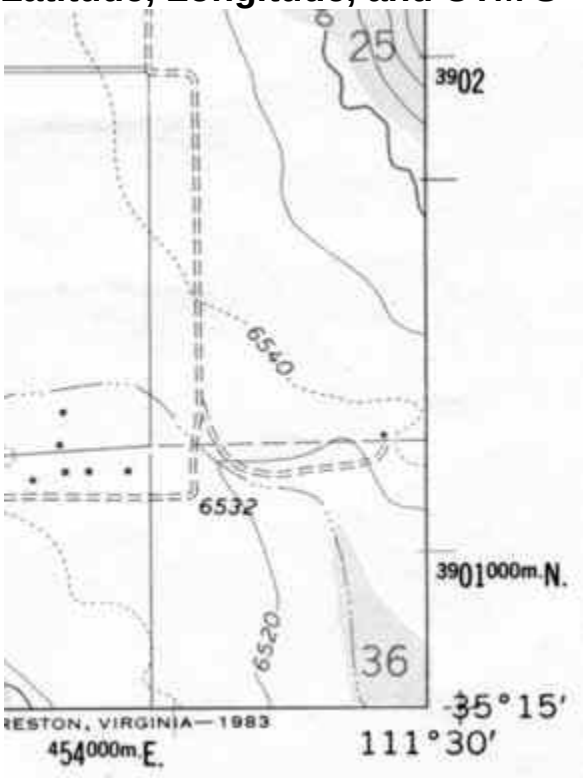
Title

The first thing to notice on a topographical map is the title. It is found in the top right hand corner of the map:



The title for this particular map is, "Sunset Crater West Quadrangle." At the corner, but in smaller print is another title called Strawberry Crater. That is the title of the next topographical map to the northeast of this one. You will find similar titles on all the corners of a topographical map as well as halfway between the corners. Use that information to find the other maps that you may need**.**

Latitude, Longitude, and UTM'S



The next thing that you should notice on a topographical map are the numbers running all around the outside of the map. These numbers represent two grid systems that can be used to find your exact location. The first is called latitude and longitude. The exact latitude and longitude is given at each corner of that map and at equally spaced intervals between the corners. The second is called UTM's. These are the smaller bold numbers that run along the border of the map**.**

Latitude & Longitude

Latitude and longitude is the most common grid system used for navigation. It will allow you to pinpoint your location with a high degree of accuracy. Latitude is angular distance measured north and south of the Equator. The Equator is 0 degrees. As you go north of the equator the, latitude increases all the way up to 90 degrees at the north pole. If you go south of the equator, the latitude increases all the way up to 90 degrees at the south pole. In the northern hemisphere the latitude is always given in degrees north and in the southern hemisphere it is given in degrees south.

Longitude works the same way. It is angular distance measured east and west of the Prime Meridian. The prime meridian is 0 degrees longitude. As you go east from the prime meridian, the longitude increases to 180 degrees. As you go west from the prime meridian longitude increases to 180 degrees. The 180 degree meridian is also known as the international date line. In the eastern hemisphere the longitude is given in degrees east and in the western hemisphere it is given in degrees west.

How Accurate Can Latitude and Longitude Get?

At the equator, one degree of latitude or longitude represents approximately 70 statute miles. At higher latitudes the distance of one degree of longitude decreases. Latitude stays the same because they are always equally spaces apart. If you look on a globe you will see this to be the case. On the other hand , if you look on a globe you will notice that the lines of longitude get closer together as

they approach the north and south poles.

Degrees are not accurate enough to find a precise location. At best, one degree of latitude and longitude would define a 70 square mile area. To overcome this problem, 1 degree is divided into 60'(minutes). So if 1 degree equals 70 miles and one degree can be divided into 60' then 1' equals 1.2 miles. Dividing 1 degree into 60' allows one to calculate their position with much better accuracy. In some instances even more accuracy is needed. To do this we can divide 1' into 60"(seconds). If 1' equals 1.2 miles and we can divide it into 60", then 1" equals 0.02 miles. It is worth taking a few seconds to memorize the following numbers. It will help you to use latitude and longitude more effectively:

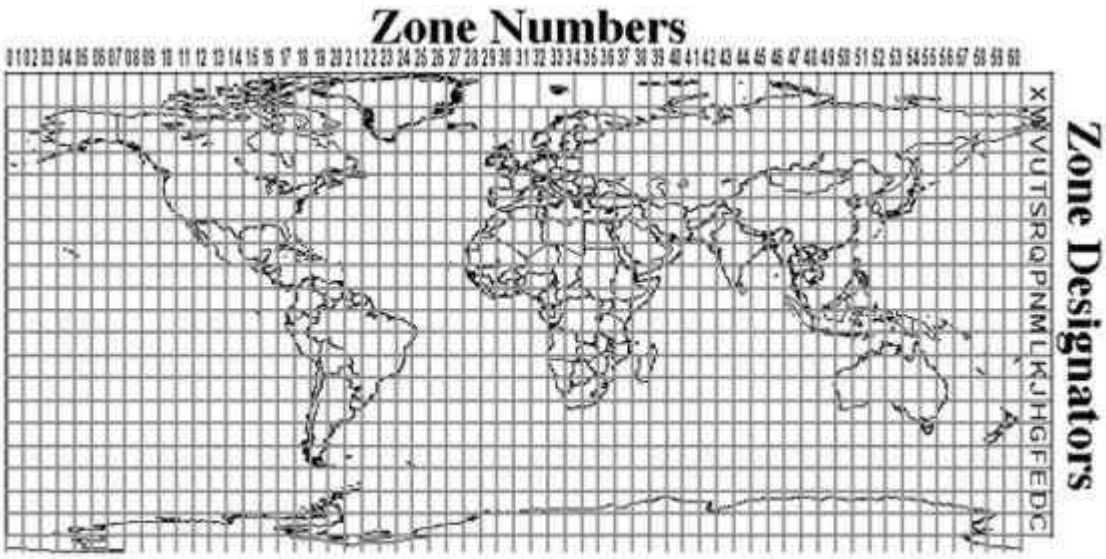
1 degree = 70 miles
1' = 1.2 miles
1" = .02 miles

If you look at the picture above you will notice the latitude and longitude in the lower right hand corner of the map. You would read it as 35 degrees 15 minutes north latitude and 111 degrees 30 minutes west longitude.

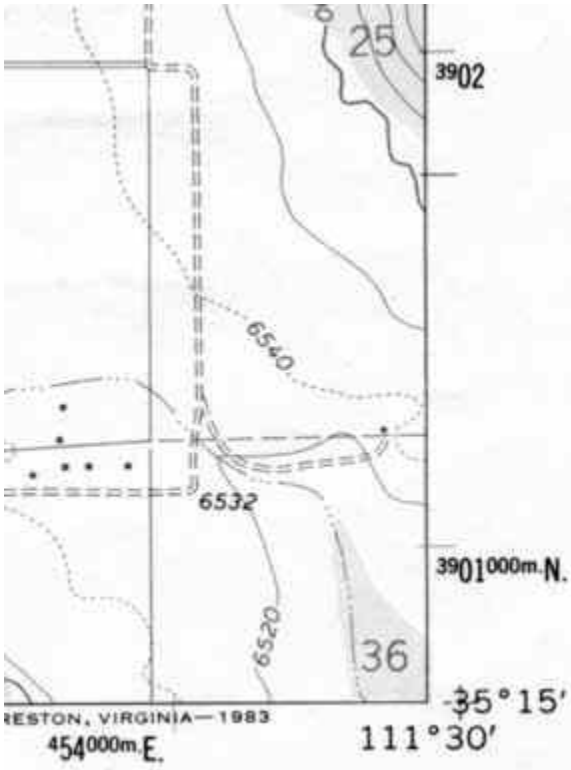
Below the title you will notice the words 7.5 minute map. This means that the map covers an area of approximately 7.5 minutes of latitude and longitude.

UTM Coordinates

UTM Stands for Universal Transverse Mercator. It is another grid system that can be used to find your position. It is most commonly used in the military and for research as well as survey purposes. The UTM system divides the surface of the earth up into a grid. Each grid is identified by a number across the top called the zone number and a letter down the right hand side called the zone designator. For example, Phoenix Arizona is in UTM grid 12 S.

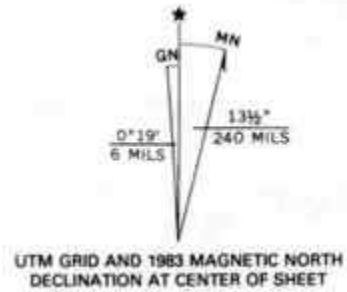


UTM Coordinate System



Every spot within a zone can be defined by a coordinate system that uses meters. Your vertical position is defined in terms of meters north and your horizontal position is given as meters east. They are sometimes referred to as your northing and easting. In the following picture you can see the northing and easting coordinates on the boarder of the topo map. They are the small bold black numbers. Along the edge of the map the first UTM shown is 3901000 meters north. On a regular topo map the dash above that number would be blue. As you go up the right hand side of the map, the next UTM is 3902000 meters north. As you go up the right hand side of the map every time you pass a the small blue dash you have gone up 1000 meters (one meter = 3.281 feet). The same applies with the UTM's across the bottom of the map.

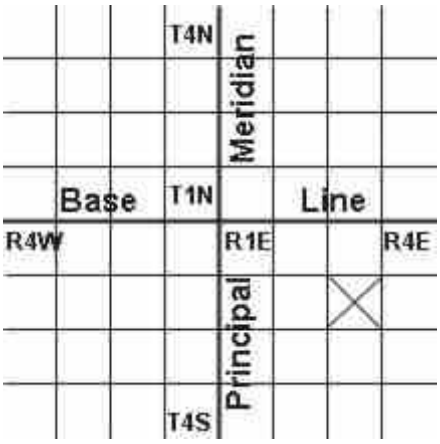
Magnetic Declination



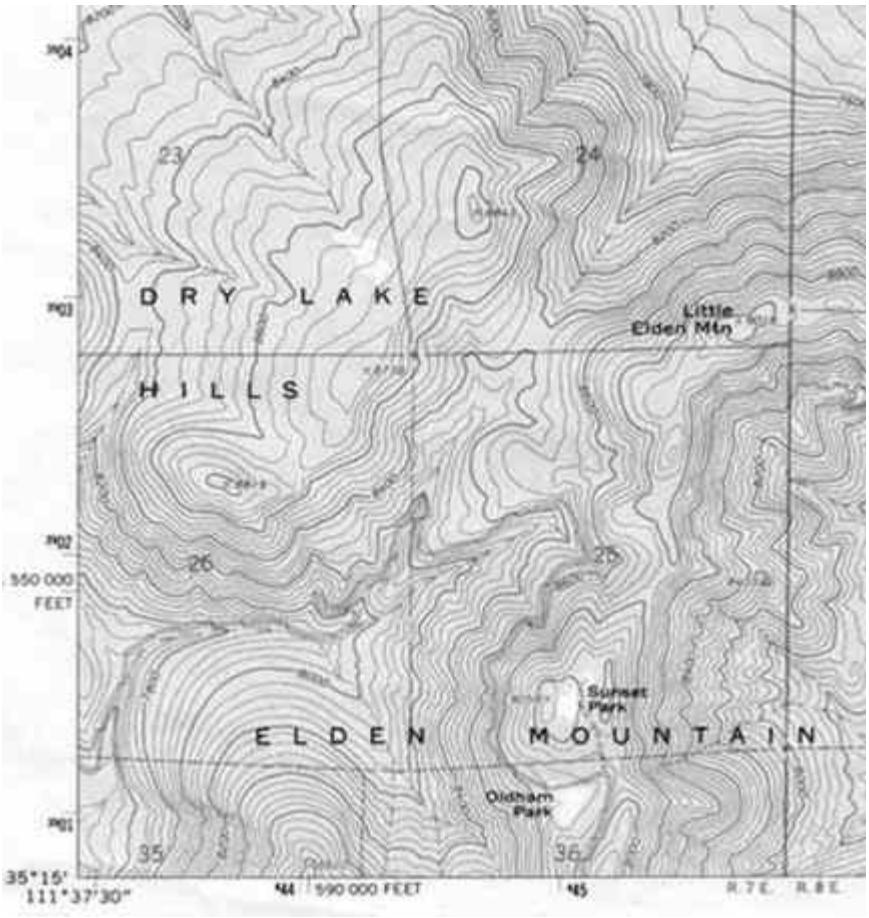
At the lower left hand corner of topographical maps there is a symbol called the magnetic declination. The symbol is used in conjunction with a compass for navigational purposes. The center line with the star above represents the direction of true geographic north. The line coming of to the right represents the direction of magnetic north, When using a compass, the needle always points to magnetic north. The symbol tells you that for the area the map covers, the magnetic compass needle will always point 13.5 degrees to the east of true geographic north. To the left of the true north line is the grid north line. This tells you how much the UTM grid and zone lines are offset from true north.

Township & Range

The Township and Range system, sometimes called the Public Lands Survey System, was developed to help parcel out western lands as the country expanded. The system takes many western states and divides them up using a base line and a principal meridian:

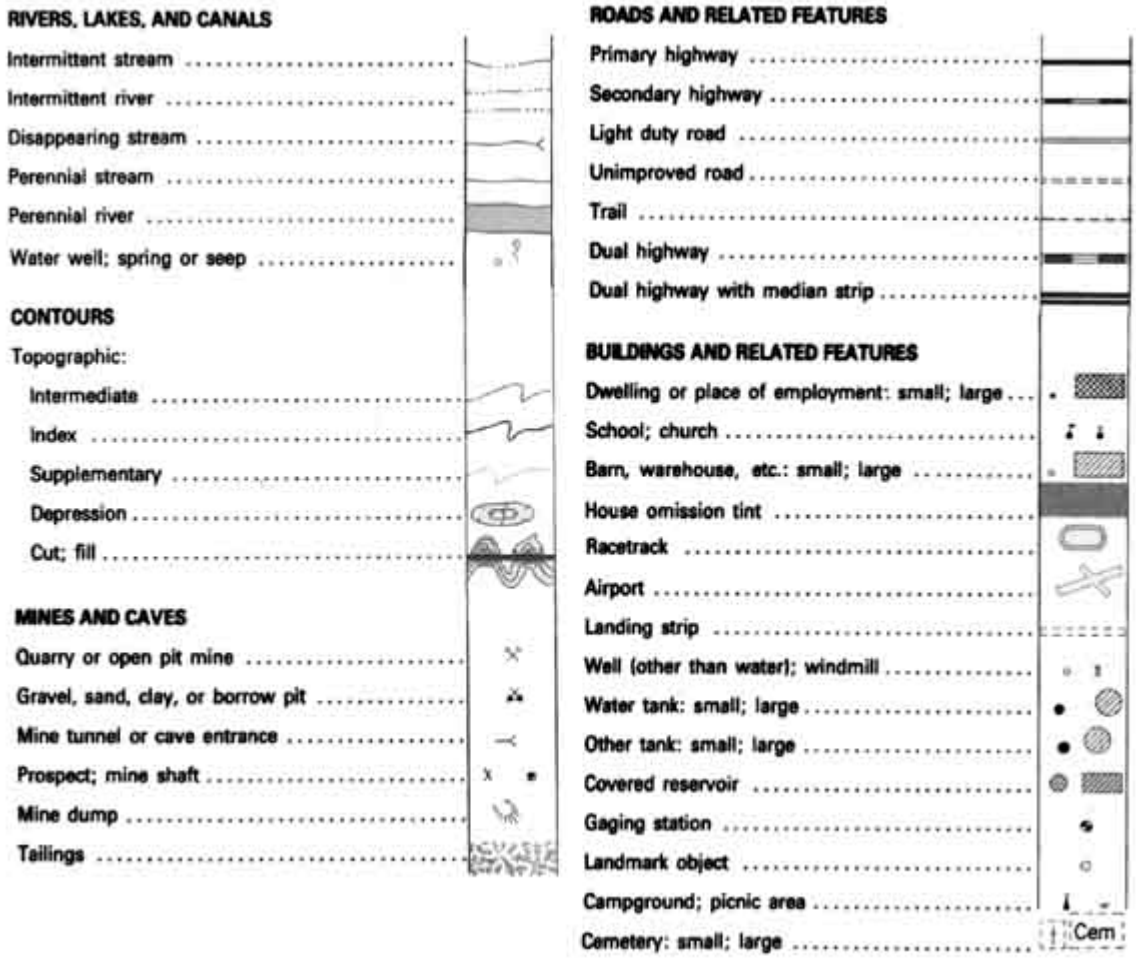


As you go to the east or west of the principal meridian, the range increases in that direction. If you go north or south of the base line, the township increases. This system divides the land up into townships and ranges that are 36 square miles each. In the diagram above, the square with the X in it would be defined as township 2 south (T.2S), range 3 east (R.3E). Each township and range is then subdivided into 36 sections. Each section is one mile square. Individual sections are then subdivided into half sections and quarter sections and so on. On a topo map, you will notice a grid with red lines and text crisscrossing the map. The lines represent the boarders of the various sections in the township and range of that area. In the map below you can see sections 23, 24, 26 and 25 of T.22N, R.7E.


23
24
DRY LAKE
HILLS
Little
Elden Mtn
26
25
550 000
FEET
Sunset
Park
ELDEN MOUNTAIN
Oldham
Park
35
36
35°15'
111°37'30"
590 000 FEET
R.7E.
R.8E.

Topographical Map Symbols

There are many other symbols on USGS topographical maps. Here are some of the most common:



TRIANGULATION

If you are in the middle of a wilderness and have been following your topo map, but are not sure exactly where you are, you can use a method called triangulation. Your location on a map can be accurately located in this manner. First, orientate your map as described above. Then find two major landmarks that are on your map and try to find them in your surroundings. They should be at least 90 degrees apart for this method to work accurately. Take a bearing on both landmarks and then draw these lines on your map. Where the two bearings intersect, this will be your point of location. If you are on an easily distinguishable landmark, such as a river or highway, only one bearing is necessary.

Care of your Map

A good map is not really expensive, but when you are in the field it may be your only guide back to civilization. Take care of it properly. If it might get wet or dirty, it should be kept in a plastic case. It should not be left lying around. Always place it back in your pack as soon as you are finished with it.

After a while, reading and using a topo map will become second nature. You will be able to plan your wilderness trips from home. With your map on the table, you will be able to find good campsites, measure how far you will have to travel, find water for cooking and a lot of other information necessary for a successful trip.

Level 2 Requirements

1. Know all the symbols for:
   a) Rivers , Lakes and Canals
   b) Contours
   c) Mines and Caves
   d) Roads and Related Features
   e) Buildings and Related Features
2. The Title of the Topographical Map
3. Longitude and Latitude and where are they on the Topographical Map
4. What are the titles of adjoining Topographical maps
5. Be able to explain Triangulation and perform the method.
6. Explain the Township and Range system.