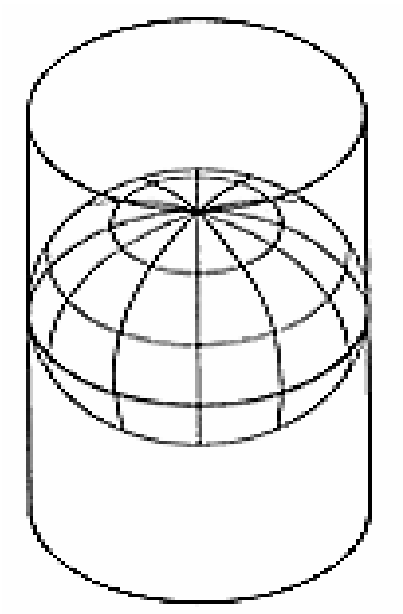
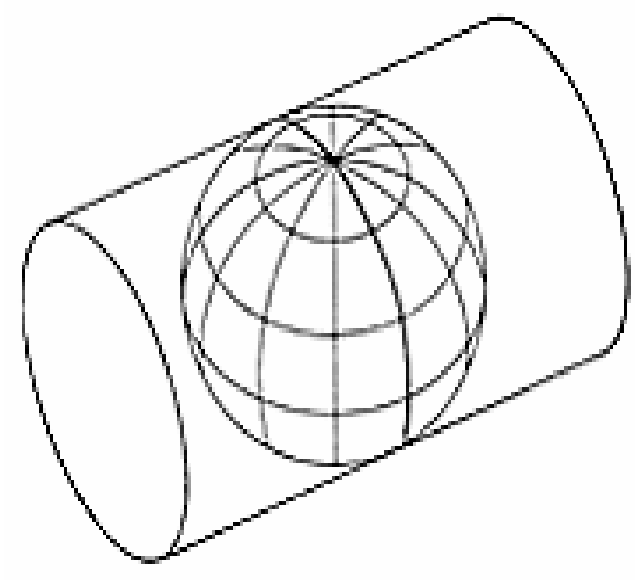
Universal Transverse Mercator

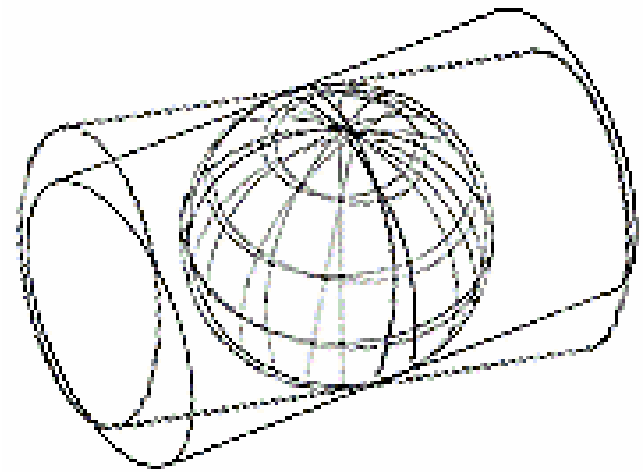
Application of Cylindrical Projection



Mercator projection Sphere to Cylinder



Tranverse Mercator projection onto cylinder tangent along a meridian



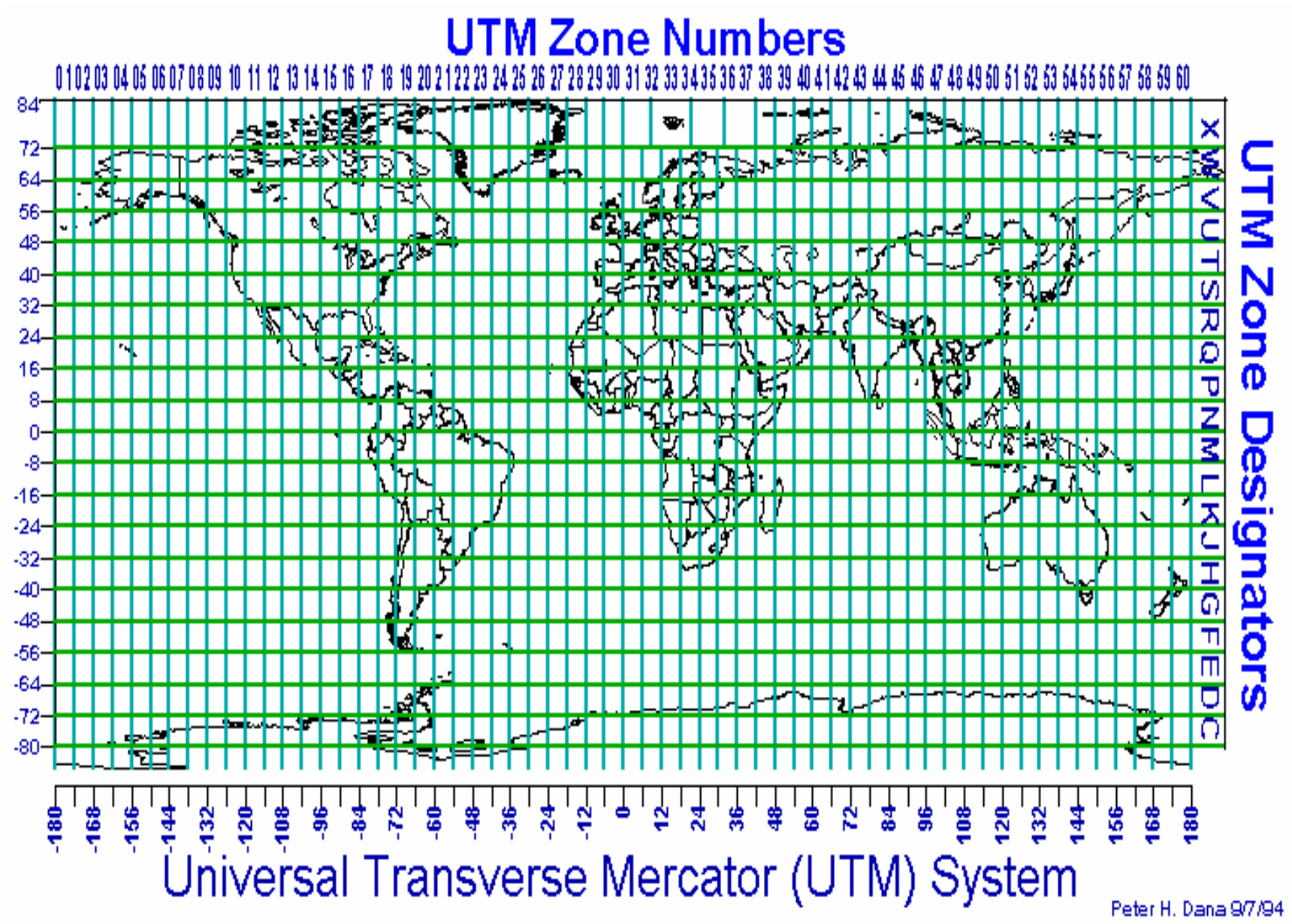
Universal Transverse Mercator consists of separate projections for each meridian every six degrees

http://exchange.manifold.net/manifold/manuals/manifold/projections/manifold_projections/universal_transverse_mercator/universal_transverse_mercator_utm_.htm

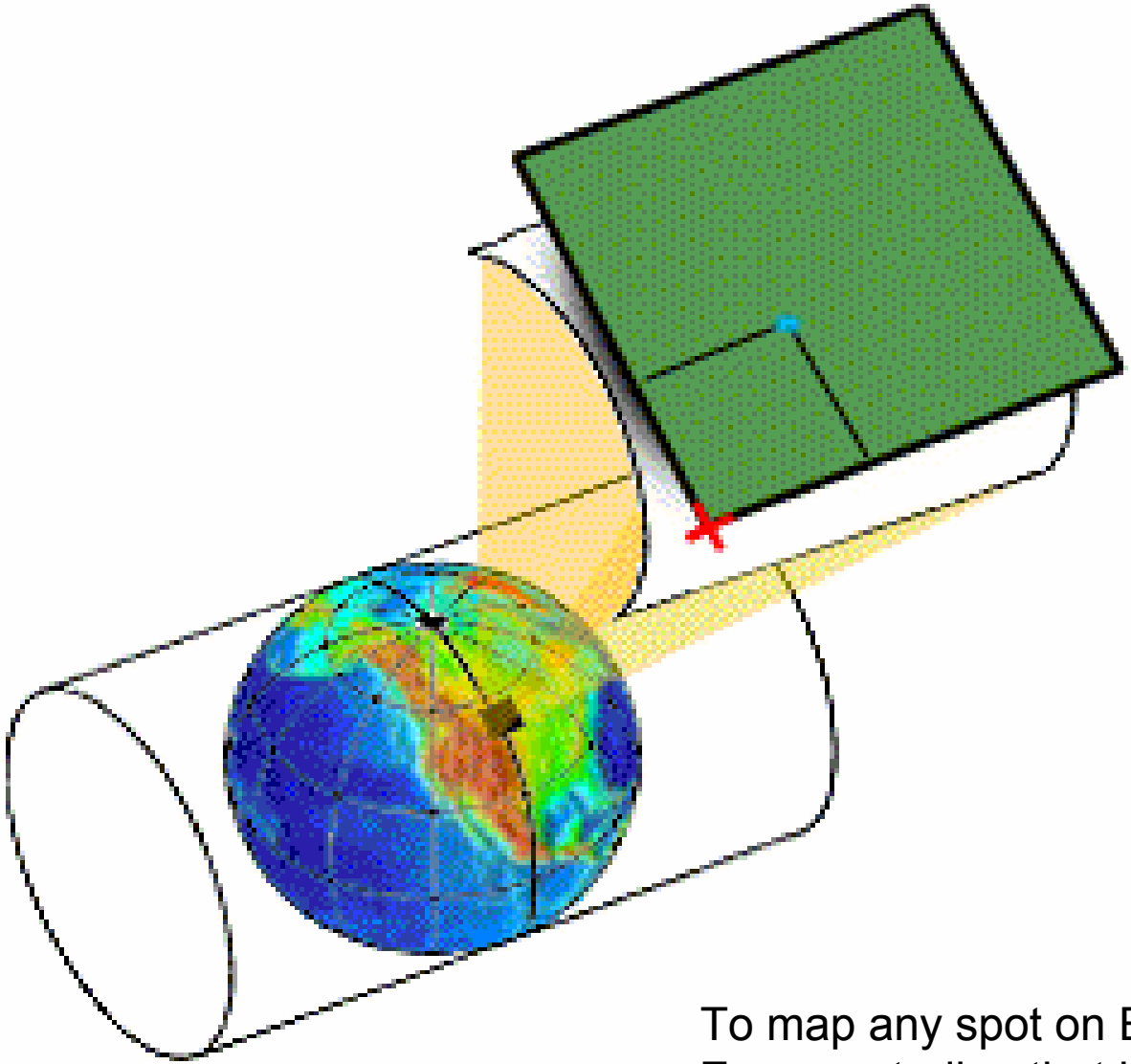
The Universal Transverse Mercator

- The Gauss-Kruger version of the transverse mercator projection covers latitudes from 80°S to 84°N.
- Longitude is divided into 60 zones each 6° wide. The zones are bounded by meridians 3° either side of a central meridian.

D H Maling, *Coordinate Systems and Map Projections*,



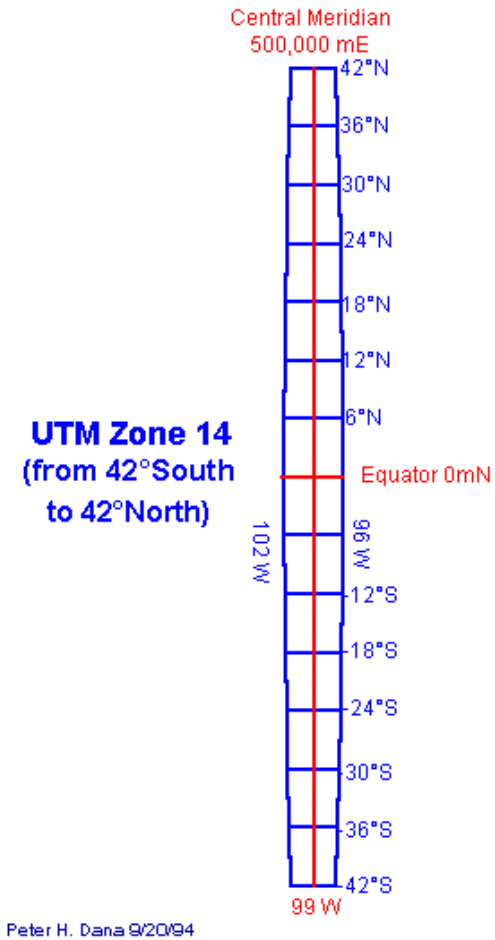
http://www.colorado.edu/geography/gcraft/notes/coordsys/gif/utmzones.gif



To map any spot on Earth, one picks the UTM Zone centerline that is closest to it and then makes a map using that "UTM Zone" cylindrical projection.

http://exchange.manifold.net/manifold/manuals/manifold/projections/manifold_projections/universal_transverse_mercator/universal_transverse_mercator_utm_.htm

Advantages of The UTM



- Cylindrical projection preserves Area
- Small extent minimizes distortion of distance
  - Only 3° either side of central meridian
  - Good for larger scale maps
- Plane Coordinate System
  - A standard

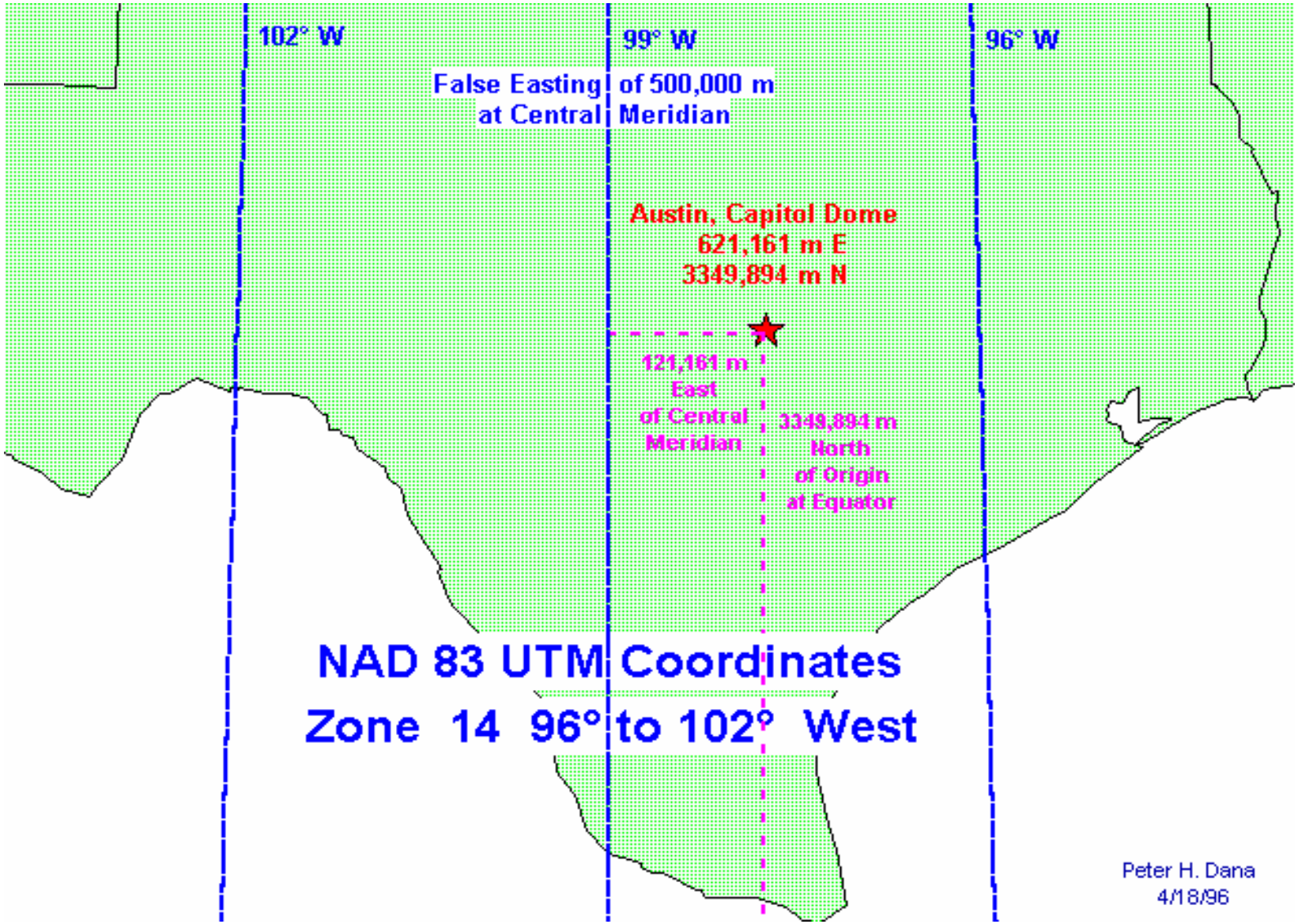
Disadvantages of The UTM

- Small extent
  - Not good for small scale maps
- Can not combine zones
  - Origins not the same
  - What if the feature you want to map lies on a zone boundary?
- It is not Global
  - Does not extend to north and south pole

UTM Coordinates

- Meter is the unit of measure
- Origin at central meridian and equator
  - Coordinates (E,N)
- False Easting of origin +500,000m
  - Ensures positive E
- The equator is given the value N=0m for the northern hemisphere, and N=10^8m for the southern hemisphere.

•D H Maling, *Coordinate Systems and Map Projections*

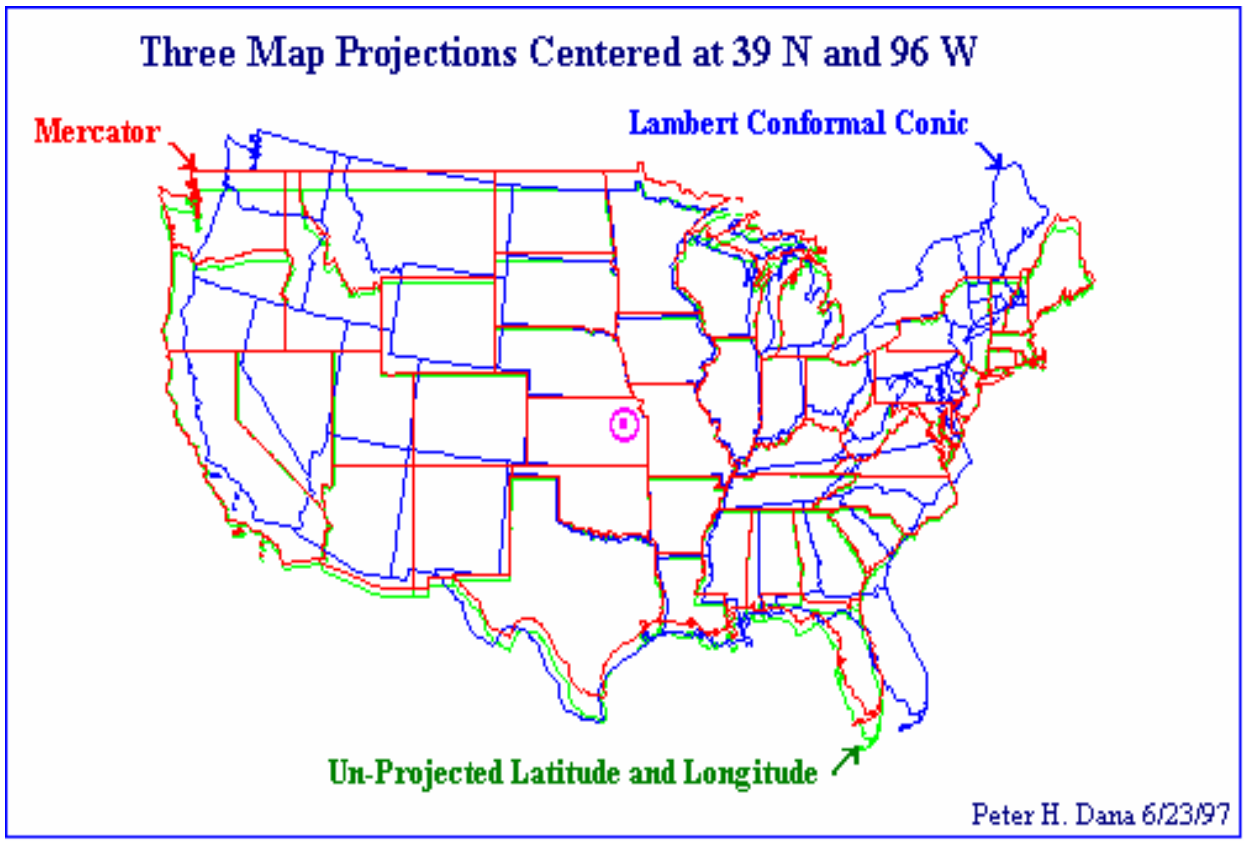


http://www.colorado.edu/geography/gcraft/notes/coordsys/gif/utm14det.gif

Coordinates and Overlay

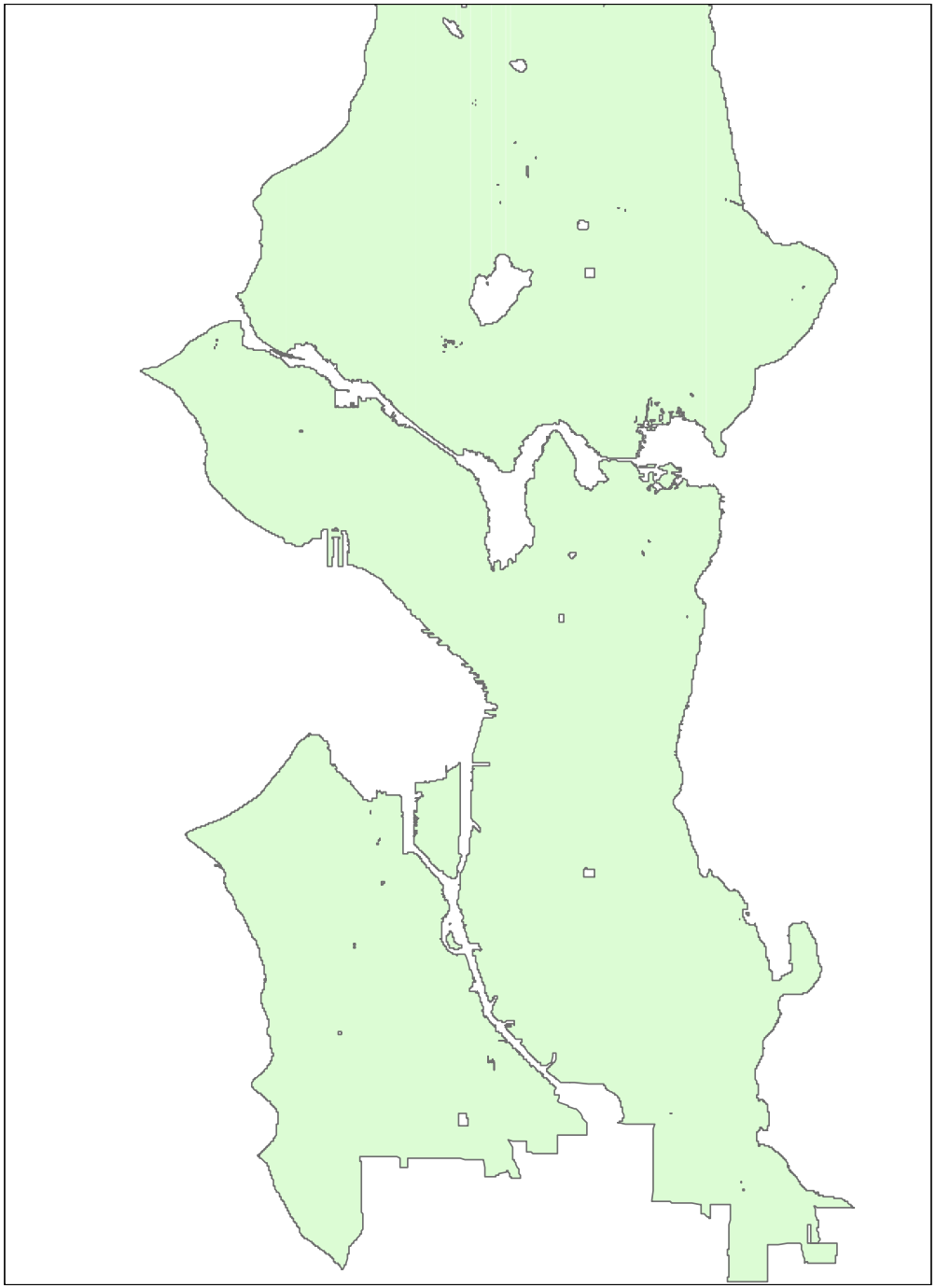
- Geographers use GIS software to store, manipulate, analyze, and display geographic data.
- Coordinate systems allow them to locate the data on a map as a layer.
- Layers with the same coordinate system can be overlaid on one another for the purpose of analysis or display.

Different projections do not overlay one another.



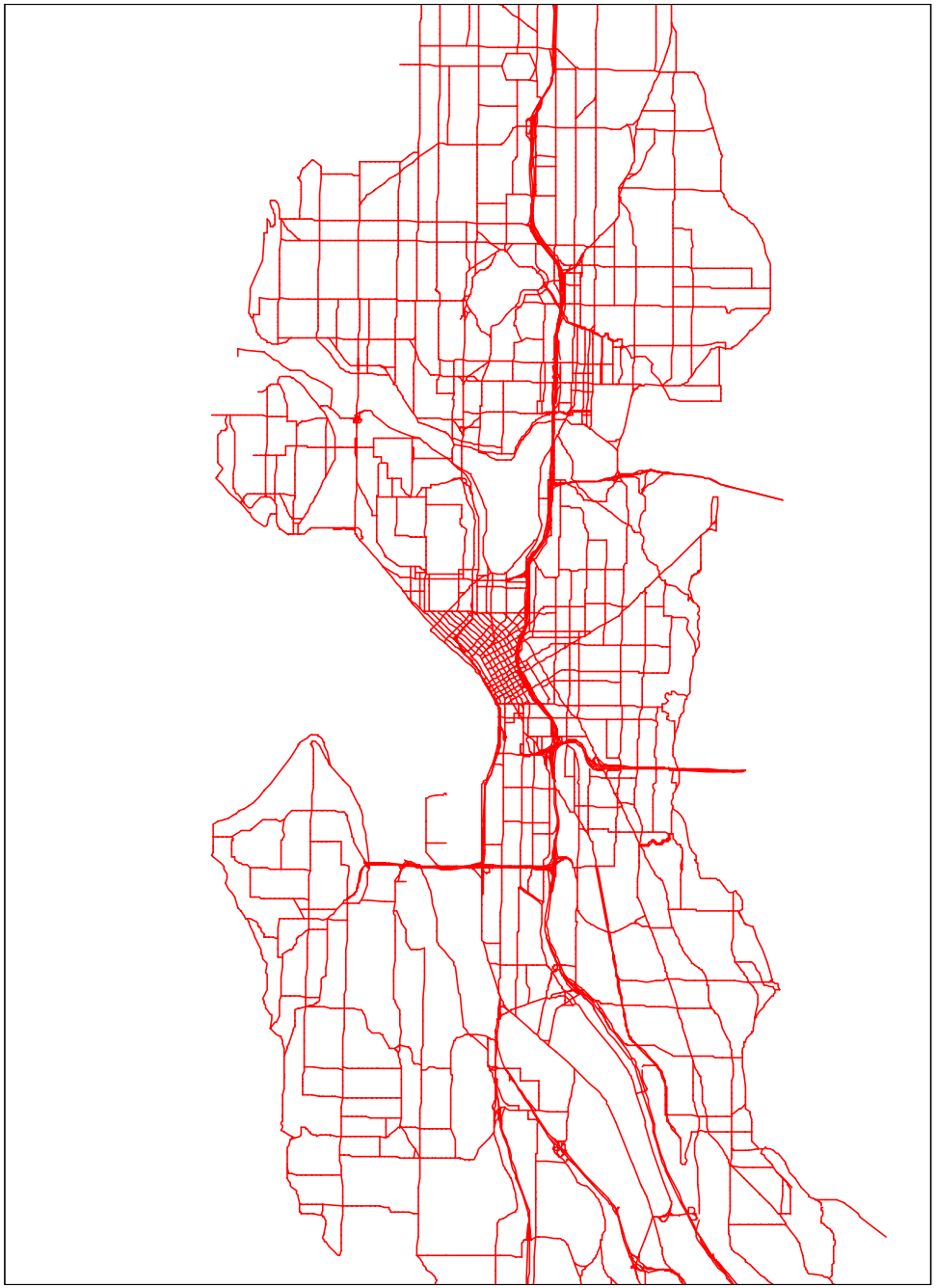
Here is a map I made using GIS software

The layers first and then the overlay

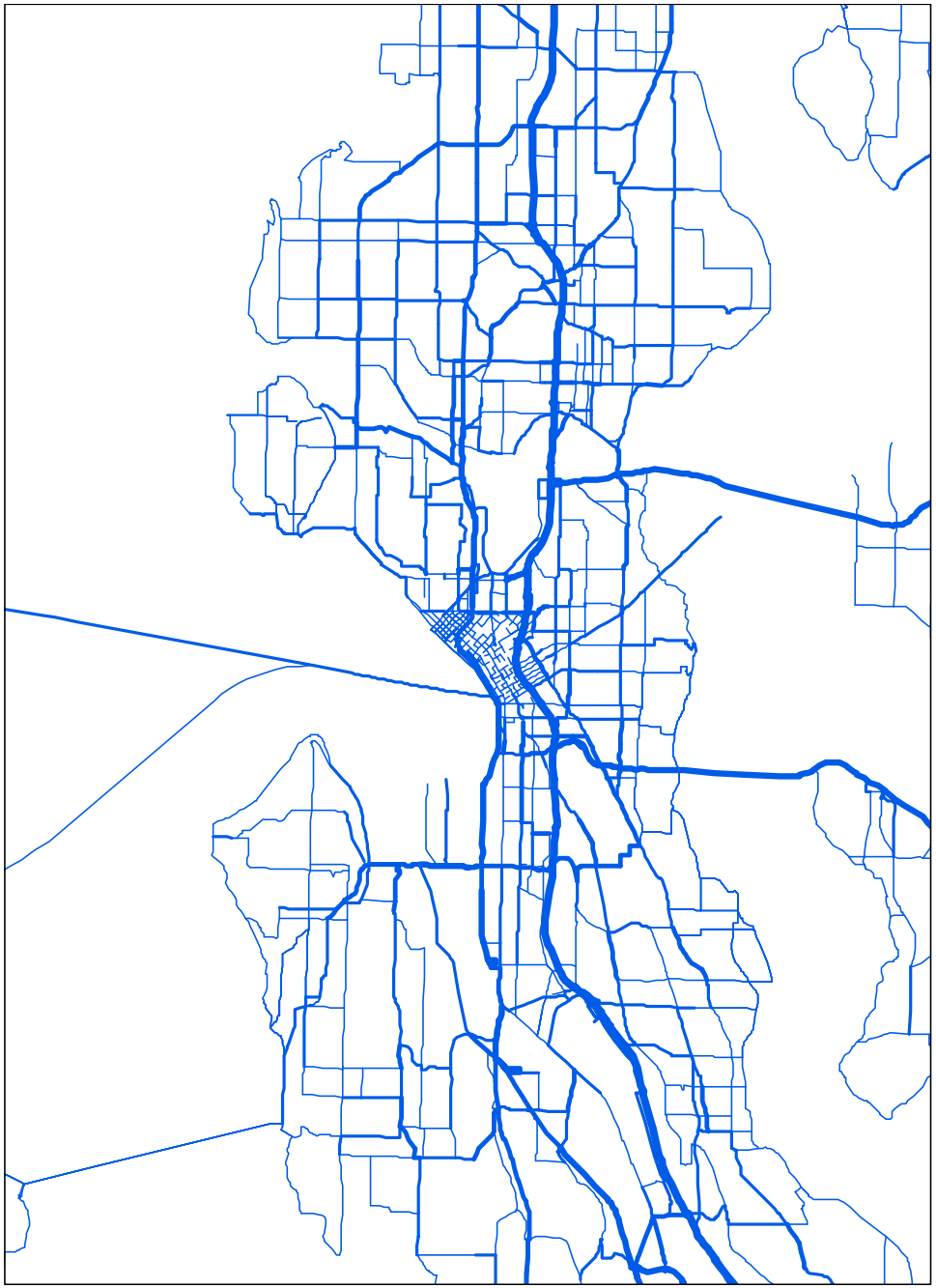


City of Seattle Boundary

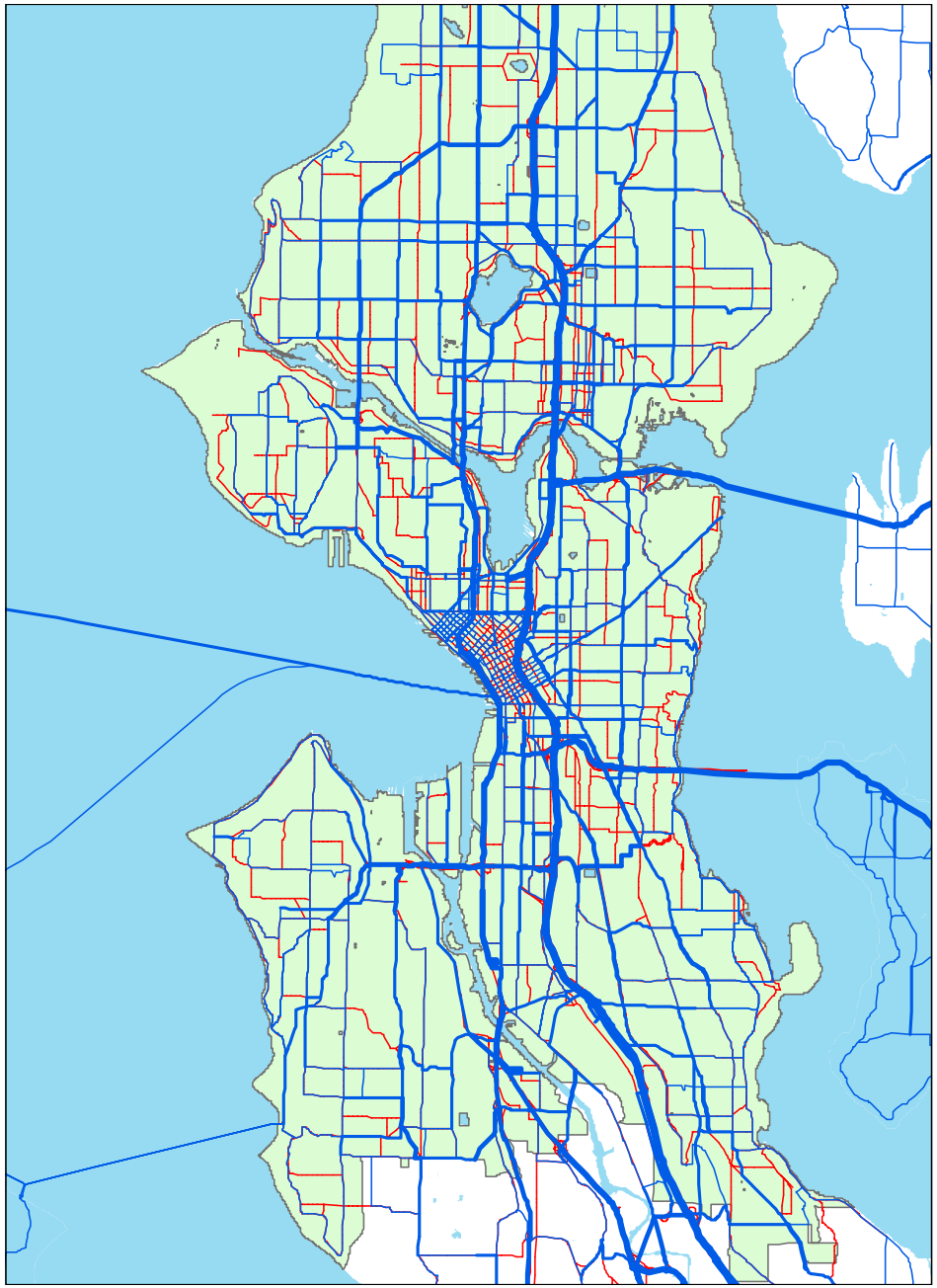
Bodies of Water



Arterials



Traffic Volume



Overlay all the layers.

Oooo pretty!

Traffic Volume

VOL2010

Traffic Volume Vehicles/Day

- 0 - 11103
- 11104 - 31486
- 31487 - 71835
- 71836 - 157176
- 157177 - 289273
- arterial
- City of Seattle
- Bodies of Water

The Coordinate System For My Map Layers

Horizontal coordinate system
Projected coordinate system name:
NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet
Geographic coordinate system name: GCS_North_American_1983
Details
***Standard Parallel:* 47.500000**
***Standard Parallel:* 48.733333**
***Longitude of Central Meridian:* -120.833333**
***Latitude of Projection Origin:* 47.000000**
***False Easting:* 1640416.666667**
***False Northing:* 0.000000**

Geodetic Model
***Horizontal Datum Name:* North American Datum of 1983**
***Ellipsoid Name:* Geodetic Reference System 80**
***Semi-major Axis:* 6378137.000000**
***Denominator of Flattening Ratio:* 298.257222**

Bounding coordinates
Horizontal
In decimal degrees
West: -122.438162
East: -122.235645
North: 47.735878
South: 47.493342
In projected or local coordinates
Left: 1245522.699999
Right: 1293771.729404
Top: 271598.524999
Bottom: 184055.475617

Questions:

- Why might a high school math teacher find it useful to demonstrate the connection between the surface area of a sphere and the surface area of a cylinder to his or her students?
- Which latitudes of the rubber ball have a projected length twice that of their spherical length.
- In the UTM projection, the central meridian has scale factor of one from the sphere to the projection. If the boundaries of the UTM zones were parallels to the central meridian, what would the scaling factor be for distances along the borders from the sphere to the projection?