

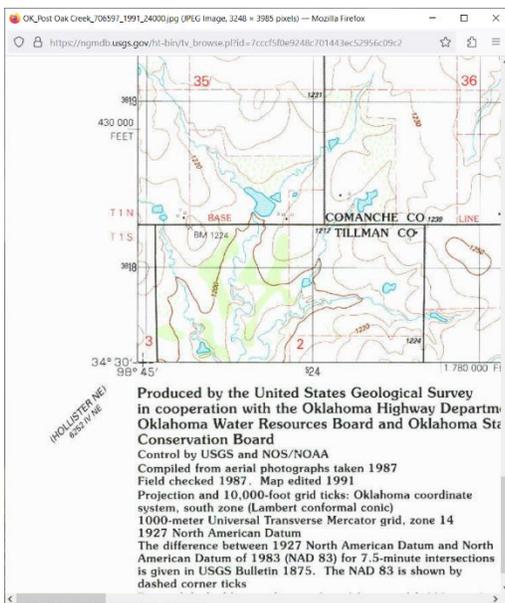
What datum(s) should be used for our geologic map GIS databases?

There are two issues here: (1) the coordinate system used to store GIS data; and (2) our convention for locating quadrangle boundaries.

GIS coordinate system Map projection (UTM, Washington State Plane South, Lambert conformal conic for the conterminous US, ...) should be documented. Differing map extents, differing publishing agencies, and other considerations demand differing projections and it is not appropriate to insist on any one projection.

Datums are not always easily discovered. We now live in a GPS world, where our smartphones give us lat-long positions with only a few meters of error. The datum for smartphone GPS—though typically undocumented—is WGS84, [functionally equivalent to](#) NAD83. Much of our legacy map data is in NAD27. Confusion over the shift from NAD27 to NAD83 datums introduces a significant uncertainty, up to about 100 m depending on location within the US, in the exact position of map data. This is awful.

To reduce this uncertainty, the GeMS validation tool and NGMDB strongly suggest that all geologic map data should be stored in projected coordinates referenced to the NAD83 datum. This is the [official civilian horizontal datum for US surveying and mapping activities](#) financed by the Federal Government.



Quadrangle boundaries We map quadrangles delimited by regularly-spaced coordinates in lat-long space, e.g., $34^{\circ}30'N$ to $34^{\circ}37.5'N$, $98^{\circ}37.5'W$ to $98^{\circ}45'W$. Where these boundaries are on the ground depends on the horizontal datum; see the ghost tic in the image at left. If adjoining quads are defined in different datums, there will be overlaps at some edges and gaps at others.

GIS coordinates and quadrangle definition need not use the same datum. It is possible to map a quadrangle defined by geographic coordinates placed on the ground with NAD27 and have all the coordinates in the GIS database referenced to NAD83-WGS84. If your best choice for a base map is a scanned image of a pre-US Topo quadrangle map, this is what you are likely to do.

The gaps between incommensurately-defined quadrangles are a problem. Possible ways to deal with the gaps (and overlaps) include: (1) live with the gaps and overlaps; (2) establish, as agency or workgroup policy, that only one set of quad boundaries will be used (e.g., NAD27); (3) include with all quadrangle-map GIS data a buffer of circa 150 m additional data beyond the quad boundary.

Ralph Haugerud, 6 February 2023