Converting Virginia State Plane NAD 83 to WGS 84

Context

Virginia localities and state agencies often maintain GIS and mapping data in coordinate systems such as Virginia State Plane North, Virginia State Plane South, or Virginia Lambert Conformal Conic using the 1983 North American Datum (NAD 83) (e.g., EPSG 2284, EPSG 2283, EPSG 3968). Some Virginia localities use high accuracy reference network (HARN) variations (e.g., EPSG 2924, EPSG 2925, EPSG 3969).

Sometime there is a need to change GIS data from coordinate systems using NAD 83 to the World Geodetic Survey 1984 datum (WGS 84) (EPSG 4326). Similar to NAD 83 and NAD 83 HARN, there are also updates of the WGS 84 datum based on International Terrestrial Reference Frames (ITRF). WGS 84-based datums that use ITRFs have their own EPSG codes because they are their own unique datum, such as WGS 84 (G1150) (EPSG 7660).

Transformations are the methods and software operations used to change GIS data from one datum to another. The recommended transformation for moving between NAD 83 and WGS is "NAD83 to WGS 84 (1)" (EPSG 1188). Your software may not use this as the default option, and may provide many other options. Some GIS documentation suggests "NAD83 to WGS 84 (5)" (EPSG 1515), but this has been deprecated. Some transformation options will output an ITRF flavor of WGS 84 and show as original WGS 84 in the metadata and layer properties.

Recommendations

If you are transforming Virginia NAD 83 or Virginia NAD 83 HARN data to WGS 84:
1. Confirm the desired output. Is the "original" WGS 84 (EPSG 4326) desired, or is an updated flavor of WGS 84 desired? If you are working with PSAP polygons, determine if the output should be clipped by the Next Generation 9-1-1 provisioning boundary or not. Generally if it is not part of the i3 NG9-1-1 system, you would not clip.
2. Determine an appropriate transformation for your needs. Consider:
   a. NAD 83 to WGS 84 (1) (EPSG 1188) for moving between NAD 83 and WGS 84.
   b. NAD 83 to NAD 83 (HARN) (27) / Virginia (EPSG 1500) and NAD 83 to WGS 84 (1) (EPSG 1188) for moving from Virginia NAD 83 HARN and WGS 84.
3. When transforming data, open a new instance of your mapping software without any data loaded into it and add your local NAD 83 data first to insure you are starting with a clean slate.
4. When your mapping software prompts you to select a transformation when adding data of one datum to a session that includes data from another datum, select and use appropriate transformations. If you don't see this option, you may have opted not to see the box. Check your settings and options to view the Transformation Warning box.

Resources

o Burch, Tim. 2016. Data collection of WGS 84 Information – or is it? GPS World. Last accessed 12 April 2021 at https://www.gpsworld.com/data-collection-of-wgs-84-information-or-is-it/.
o European Petroleum Survey Group (EPSG) Geodetic Parameter Dataset. Last accessed 12 April 2021 at https://epsg.org/home.html.
o EPSG.io. Last accessed 12 April 2021 at https://epsg.io/.
o Spatial Reference. Last accessed 12 April 2021 at https://spatialreference.org/.
o Pennsylvania State University Geography 862 Lesson 5: Geodetic Datums. Last accessed 12 April 2021 at https://www.e-education.psu.edu/geog862/node/1669.
o Esri. Coordinate Systems, Projections, and Transformations. Last accessed 12 April 2021 at https://pro.arcgis.com/en/pro-app/latest/help/mapping/properties/coordinate-systems-and-projections.htm with transformation tables and coordinate system tables.
o Esri. Choosing an Appropriate Transformation. Last accessed 12 April 2021 at https://desktop.arcgis.com/en/arcmap/latest/map/projections/choosing-an-appropriate-transformation.htm.