



North American Vertical Datum of 1988 Conversions

Every Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) that contains flood elevation information is referenced to a specific vertical datum. The two standard datums nationwide are the National Geodetic Vertical Datum of 1929 (NGVD29) and the North American Vertical Datum of 1988 (NAVD88). The Federal Emergency Management Agency (FEMA) Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix B: Guidance for Converting to the North American Vertical Datum covers issues associated with converting NGVD29 to NAVD88.

Why Convert Datums?

Historically the most common vertical datum was NGVD29. The datum assumed that 26 tide gages across the United States and Canada all represented the same zero elevation that was based on mean sea level. As surveying technology evolved it became more apparent that different tide stations actually had different elevations relative to each other. The warping effect by different gages was as great as 1.5 meters. NAVD88 was developed based on a single tide gage and an additional 625,000 kilometers of leveling. This is now the only supported vertical datum in the United States. Because the NGVD29 datum is no longer supported, it is desired that all new studies reference NAVD88. One of the goals of FEMA's Map Modernization Program is to convert all flood maps from NGVD29 to NAVD88. Most geospatial products are based on NAVD88 and this often increases the cost of using data in NAVD29 which then makes the data incompatible with other federal, state and local datasets. To not convert to NGVD29 can be a "pay now or pay more later" situation since the datum is no longer supported and every time new datasets are incorporated, additional expenses will be incurred by the required datum conversion.

Datum Conversion Software

The National Geodetic Survey (NGS) and the U.S. Army Corps of Engineers (USACE) have each developed software to aid the conversion of datum's which is available free of charge. These programs have been implemented in DFIRM production projects in NFWFMD. NGS VERTCON can be downloaded at the NGS homepage at www.ngs.noaa.gov by selecting the NGS Geodetic Tool Kit option. USACE CORPSCON software can be downloaded at www.tec.army.mil by selecting: What we do; Products and Services; Software Available, and CORPSCON. Both programs compute the difference in orthometric heights between NGVD29 and NAVD88 for a given location specified by geographic coordinates. CORPSCON allows the user to input Transverse Mercator or State Plane Coordinates instead of geographic coordinates if desired.

Determining Conversion Factors

Because the conversion factor varies at different points, it is necessary to consider the conversion factors at multiple locations across a county or study area to determine the range of conversion factors. The range of conversion factors will determine whether a single or a multiple conversion factor should be used to convert elevations to NAVD88 from NGVD29. The following are conversion steps from FEMA's Guidelines and Specifications, Appendix B:

Step 1: The first step to determining the conversion factor is to identify the county area on a 7.5-minute USGS Quadrangle map. The Latitude and Longitude of each corner of the quads must be taken as the conversion points. Any corner within 2.5 miles of the county boundary must also be considered.

Step 2: Either VERTCON or CORPSCON can then be used to determine the conversion factor



at each corner of the quads. In areas of ocean or large water bodies, any quad corner falling more than 2.5 miles from land should be disregarded other than in the case of small islands or barriers.

Step 3: Once the point conversion factors have been determined, the average conversion factor must be calculated by taking a simple unweighted arithmetic mean.

Step 4: The range of the point conversion factors must be determined by identifying the maximum and minimum values.

Step 5: The maximum variance from the average conversion factor must be determined by calculating the difference between the average conversion factor and both the minimum and maximum conversion factor. If the maximum variance exceeds 0.25 feet, then multiple conversion factors must be used. If the variance is less than 0.25, the average conversion factor can be applied across the whole county.

If the average conversion factor is less than 0.1, then a passive conversion factor may be applied which will only involve changing elevations shown in the FIS tables. It would not be necessary to make any changes to either the FIRM panel or the Flood Profiles shown in the FIS.

Where a single conversion factor greater than 0.1 is to be used, this should be applied to all components of the FIRM and FIS that display the 1% annual chance flood elevation including flood profiles, still water elevations and base flood elevations. If digital models like HEC-RAS are available, the Vertical Datum Conversion option should be used to convert the model Geometry to NAVD88. Any changes to model geometry data should be carefully documented by both comments in the model files and clear notes in the Technical Support Data Notebook (TSDN).

When multiple conversion factors are required, the conversion should be applied by creating an average conversion factor on a stream by stream basis. The stream by stream conversion factor should be shown in a table in the FIS report.

When any conversion factor greater than 0.1 feet is applied to a FIRM, the existing locations of BFE lines will become invalid and cannot simply be converted. The cross section locations and map panel index must be used to carefully redetermine BFE lines for the flood elevations in NAVD88 in accordance with the Guidelines and Specifications for Flood Hazard Mapping Partners.

On all conversions, the Mapping Partner must carefully label and document the conversions used and the datum of data in the TSDN to ensure that any future studies, restudies or revisions use the correct datum.

County Name	Point No.	Quad Corner Longitude	Quad Corner Latitude	Conversion to NAVD 88 feet
Santa Rosa County, Florida	1	87.125	31.000	-0.13
	2	87.000	31.000	-0.14
	3	86.875	31.000	-0.15
	4	86.750	31.000	-0.18 *
	5	87.250	30.875	-0.03
	6	87.125	30.875	-0.13
	7	87.000	30.875	-0.20
	8	86.875	30.875	-0.21
	9	87.250	30.750	-0.09
	10	87.125	30.750	-0.17
	11	87.000	30.750	-0.22
	12	86.875	30.750	-0.24
	13	87.250	30.625	-0.09
	14	87.125	30.625	-0.07
	15	87.000	30.625	-0.11
	16	86.875	30.625	-0.31
	17	87.125	30.500	-0.06 *
	18	87.000	30.500	-0.12
	19	86.875	30.500	-0.36
	20	87.125	30.375	-0.23
	21	87.000	30.375	-0.33
	22	86.875	30.375	-0.36
SUM				-3.93
* quad intersections outside the county boundary but within 2.5 miles of that boundary				
Statistical Factors		If Max Var. <= 0.25 ft Then test Passes		
Number of Points Used:		22		
Average Conversion		-0.18 ft		
Maximum Conversion Factor:		-0.03 ft		
Minimum Conversion Factor:		-0.36 ft		
Maximum Variance from Average:		0.18 ft		
Use Average Conversion Factor:		-0.18 ft. Pass		



Summary of Conversion Factors for Counties in Northwest Florida Water Management District

COUNTY	APPLICABLE AREA TO APPLY FACTOR	CONVERSION FACTOR NGVD29 to NAVD88 (feet)
Bay	Entire County	-0.45
Calhoun	Entire County	-0.46
Escambia	Mainland	-0.03
	Western portion of barrier islands	-0.16
	Eastern portion of barrier islands	-0.30
Franklin	Entire County	-0.58
Gadsden	Entire County	-0.53
Gulf	Entire County	-0.52
Holmes	Entire County	-0.31
Jackson	Entire County	-0.42
Jefferson	Entire County	-0.68
Leon	Entire County	-0.64
Liberty	Entire County	-0.53
Okaloosa	Entire County	-0.29
Santa Rosa	Entire County	-0.18
Walkulla	Entire County	-0.63
Walton	Entire County	-0.31
Washington	Entire County	-0.35