Mapping and Digital Data Standards

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New Jersey Department of Environmental Protection

Geographic Information System

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I. INTRODUCTION

The New Jersey Department of Environmental Protection (NJDEP) maintains a Geographic Information System (GIS) for the storage and analysis of cartographic and related environmental, scientific and regulatory data. A GIS is a computer system for generating, analyzing, displaying and managing many forms of geographic and spatially-enabled data. The GIS has become a critical tool in allowing the NJDEP to fulfill its core mission of protecting the air, waters, land, and natural and historic resources of New Jersey, and the importance of the GIS in supporting this mission will continue to grow.

The effectiveness of the GIS system rests in large part on the quality of the data that are available to the NJDEP. These data are generated by the NJDEP, other state and federal agencies, universities, environmental organizations, the regulated community and the general public, among others. The submittal of spatially-enabled data by all these sectors will facilitate data input into the Department's GIS and the integration of data with the New Jersey Environmental Management System (NJEMS). As such, there can be a wide range in the types and quality of data that are generated and used by the NJDEP and the wider New Jersey environmental community. Most of the data will be shared back with the regulated community and public as appropriate.

In order to maximize utility of these disparate data sets, and facilitate data sharing, integration, and compatibility within the GIS System, the NJDEP requires that all data generated for and by the Department adhere to the set of basic standards outlined in the present document. This standard encompasses three required concepts regarding the creation, capture and delivery of digital mapped information.

The first concept addresses the need for all mapping to meet accepted accuracy standards.
All digital data must meet or reference published standards regardless of scale. Testing against base maps or photography of known accuracy determines the accuracy of data. This will ensure appropriate positional accuracy of the geographic data and, therefore, compatibility of digital information.

Secondly, digital data provided to, produced for, or by, the Department are required to be in North American Datum 1983 (NAD83) horizontal geodetic datum and in the New Jersey State Plane Coordinate system (NJSPC). NJSPC is a geographic reference system in the horizontal plane describing the position of points or features with respect to other points in New Jersey.

Lastly, GIS data produced by the NJDEP for utilization in its GIS must be documented in a metadata record that adheres to mandatory GIS elements in the Federal Geographic Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM). Metadata is information about the digital data being provided. It is important to know not only the positional coordinates of mapped information, but also how the data was produced and the accuracy of the data being made available. FGDC metadata must be included with the distribution of any GIS data. Details of NJDEP required CSDGM elements are described in section VIII. METADATA STANDARDS.

The following standards defined in this document represent the minimum standards that all data generated for the NJDEP must follow. Additional, more stringent standards and/or particular metadata documentation may be required for specific programs, and specific regulatory requirements. However, all data submitted must adhere, at least, to the following core standards outlined in this document.

Inquiries should be directed to:
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II. SPATIAL REFERENCE INFORMATION

Digital data provided to or produced for the NJDEP are required to be in the North American Datum 1983(NAD83) horizontal geodetic datum and referenced in the New Jersey State Plane Coordinate System (NJSPC); and in the North American Vertical Datum of 1988 (NAVD 88). The NJSPC is the official survey base for the State of New Jersey, as outlined in Chapter 218, Laws of New Jersey, 1989. The specifics of the referencing system requirements are as follows:

- Projection: Transverse Mercator
- Geographic Coordinate System: New Jersey State Plane
- FIPS Zone: 2900
- False Easting: 492125
- False Northing: 0
- Central Meridian: -74.5
- Scale Factor: 0.9999
- Latitude of Origin: 38.833333
- Linear Unit: Foot US (0.304801)
- Angular Unit: Degree (0.0174532925199433299)
- Horizontal Datum: North American Datum of 1983
- Vertical Datum NAVD 88
- Spheroid GRS1980
- Semi Major Axis: 6378137
- Semi Minor Axis 6356752.3141403561
- Inverse Flattening 298.25722210100002

* Note that Chapter 218 sets meters as the official units for reporting NJSPC coordinate values. The NJDEP would prefer that all coordinate values be reported in units of feet. However, both feet and meter values will be accepted, with the units clearly defined in the accompanying metadata document. This requirement applies to all ground survey data as well, which must be submitted with equivalent NJSPC values for all points, if the points were not captured in NJSPC.

III. DATA CREATION AND CAPTURE

There are many techniques that can be used to create digital data layers that will be submitted to the NJDEP. The two most common are:

a. generating data from base sources, such as digital imagery, using interactive editing, delineating on overlays which are then scanned and referenced, image analysis, classification, etc.
b. generating data from field investigations using measurements from surveying instruments and/or GPS devices

Base Sources:

For those data created from base sources, the NJDEP requires that the following sources are to be used, listed in order of preference:

1) 2012 digital ortho-imagery: produced by the Office of GIS, Office of Information Technology and the Bureau of GIS, Department of Environmental Protection. This imagery was produced at a scale of 1:2400, has a pixel resolution of 1 foot and meets a +/- 4 ft ground sampling distance (gsd) at the 95% confidence limits as tested according to the NSSDA procedures. This imagery is available free of charge from https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp. It is also viewable on several online mapping applications available through the NJDEP website.

2) 2007 digital ortho-imagery: produced by the Office of GIS, Office of Information Technology. This imagery was produced at a scale of 1:2400, has a pixel resolution of 1 foot and meets a +/- 4 ft ground sampling distance (gsd) at the 95% confidence limits as tested according to the NSSDA procedures. This imagery is available free of charge from https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp. It is also viewable on several online mapping applications available through the NJDEP website.

3) Any other more recent digital ortho-imagery at larger scales than the above imagery that meets or exceeds the NSSDA threshold accuracy values for the base map scale, as listed in Table 1. The accuracy will be determined according to NSSDA testing methodology

4) Any other recent digital ortho-imagery at smaller scales than the above that meets or exceeds the NSSDA threshold accuracy values for the basemap scale, as listed in Table 1. The accuracy will be determined according to NSSDA testing methodology

5) 2002 digital ortho-photography: produced by the Office of GIS, Office of Information Technology This imagery was produced at a scale of 1:2400, has a pixel resolution of 1 foot and meets a +/- 4 ft gsd at the 95% confidence limits as tested according to the NSSDA procedures. This imagery is available free of charge from https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp. It is also viewable on several online mapping applications available through the NJDEP website

6) Pre-2002 historical digital ortho-imagery: Since most historical base image sources were created prior to the development of the National Standard for Spatial Data Accuracy (NSSDA) testing methodology, accuracies for historical digital imagery can be reported using the National Map Accuracy Standards. The threshold accuracy values for base maps created at various maps scales are listed in Table 1

7) Non-digital (hard copy) photo-basemaps: Since some data needed to represent historical conditions may have to be generated from non-digital sources, those sources must meet a NMAS threshold value for the appropriate scale as listed in Table 1

8) User geo-referenced digital imagery: Geo-referencing is the process of defining a coordinate system and a projection for an undefined data source, such as a historic map or image. In those cases where the data submitted to the Department was generated from a source geo-referenced by the data provider, the source material should be identified and its accuracy characteristics described, along with a full description of the geo-referencing process used by the data provider. Control point files detailing the root mean square errors calculated for the control point links are also to be provided

9) Vector data sets: Data submitted to the Department may be based on existing vector data sets. In these cases, a full description of the accuracy of the base vector data sets, including the accuracy of the source layer used to create the data needs to be fully documented

10) In those cases where the data are generated on base sources not referenced in NJSPC, all data will be projected to NJSPC before submittal to the NJDEP

When data are created from digital base layers using on-screen digital editing techniques, the acceptable viewing scales for digital base source commonly referenced in NJDEP data generation projects are given in Table 1. For sources not included in this table, acceptable scale ranges would be similar to those given for digital base sources of similar source type and pixel size.

Table 1. Acceptable Scale Ranges for On-Screen Data Generation from Common NJDEP Digital Base Layers

Source	Type	Pixel Size of Digital Base Layer	Acceptable Scale Range for Data Generation
Historical Atlas Sheets	Geo-referenced basemaps	Approx. 17 FT.	1:5000 to 1:15000
1930 Panchromatic Imagery	Geo-referenced photography	Approx. 6.5 FT.	1:2400 to 1:10000
1970 Wetlands Basemaps	Geo-referenced photo-basemaps	Approx. 1 FT.	1:1000 to 1:5000
1974 Panchromatic Imagery	Geo-referenced photography	Approx. 1.25 FT	1:750 to 1:5000
1977 Tidelands Basemaps	Geo-referenced photo-basemaps	Approx. 1 FT.	1:1000 to 1:5000
1991 Panchromatic Imagery	Geo-referenced photography	5 FT.	1:2400 to 1:5000
1995 CIR Imagery	Ortho rectified imagery	1 Meter	1:1000 to 1:5000
1998 Panchromatic Imagery	Ortho rectified imagery	2 FT.	1:750 to 1:5000
2000 Panchromatic Imagery (DVRPC)	Ortho rectified imagery	1.5 FT.	1:750 to 1:5000
2002 CIR Imagery	Ortho rectified imagery	1 FT.	1:500 to 1:2400
2003 Color Imagery	Ortho rectified imagery	2 FT.	1:750 to 1:5000
2007 CIR and Color Imagery	Ortho rectified imagery	1 FT.	1:250 to 1:2400
2010 Color Imagery (DVRPC)	Ortho rectified imagery	1 FT.	1:250 to 1:2400
2010 Color Imagery (NAIP)	Ortho rectified imagery	1 Meter	1:1000 to 1:5000
2012 CIR and Color Imagery	Ortho rectified imagery	1 FT.	1:250 to 1:2400
Navigation Charts	Geo-referenced basemaps	Approx. 3 to 23.5 FT.	1:5000 to 1:15000
Coastal Sandy Imagery	Geo-referenced imagery	1 Meter	1:500 to 1:2400

Field Collection:

Data can be submitted to the NJDEP that was created using GPS or standard surveying techniques. In both cases, any data not initially recorded using the New Jersey State Plane Coordinate System, NAD83, will include the equivalent NJSPC values for all data features. If latitude/longitude values must be collected initially, decimal degree values must include at least five decimal places (e.g. Latitude: 40.22056, Longitude: -74.75684).

The Department has adopted standards for the critical settings for rover (field data) GPS receivers that are consistent regardless of which receiver model is being used. These settings should enable the results of the data collected to achieve the better than 5 meter accuracy standard. Any mapping-grade GPS receiver will allow the setting of data collection parameters. Note that recreational GPS receivers usually do not provide the capability to adjust critical settings for data collection, nor do they typically offer post-processed differential correction solutions (needed when real time differential correction services are not available), and are therefore not appropriate for accurate field data collection. These settings are detailed in Table 2.

Table 2. Critical GPS Collection Parameter Settings

Position Mode	All position fixes must be determined with 4 or more satellites. 2D fixes (using only 3 satellites) are not acceptable. 3D positions generated from 2D fixes supplemented with user entered elevations are also not acceptable.
Elevation Mask	15 degrees above horizon.
PDOP Mask	If this parameter setting exists, set it to the manufacturer's recommendation that would, at a minimum, allow the GPS data collected to achieve NJDEP's 5 meter standard.
Signal to Noise Ratio Mask (SNR)	If this parameter setting exists, set it to the manufacturer's recommendation that would, at a minimum, allow the GPS data collected to achieve NJDEP's 5 meter standard. The more noise in a signal, the less reliable the signal will be for accurate position determination.
Minimum Positions for Point Features	If this parameter setting exists, set it to the manufacturer's recommendation that would, at a minimum, allow the GPS data collected to achieve NJDEP's 5 meter standard. Solutions based on a single fix are not acceptable.
Logging Intervals	Intervals for point features will be 1 or 5 seconds. Intervals for line and area features depend on the velocity at which the receiver will be traveling and the nature of the feature and the operating environment. Under normal circumstances (i.e., when the user is walking with the receiver) the interval for line and area features will be set to 5 seconds.
Logging of DOP	If the receiver allows, this parameter setting will be set to allow the logging of DOP data along with position fixes.

A full discussion of the required GPS receiver settings and collection procedures are included in the *NJDEP GPS Data Collection Standards for GIS Data Development*. http://www.nj.gov/dep/gis/standard.htm

In the case of data collected using either GPS or standard survey techniques, complete data collection documentation will be submitted and will include coordinate offsets when applicable.

Additional Data Sources:

Data may also be submitted to the NJDEP that were generated using specialized techniques such as laser scanners for collecting LiDAR elevation data, or image scanners for digital ortho-imagery. Since the creation of data from these sources involves specialized and highly technical processes, specific standards have been developed concerning the generation of these specific data types. Several federal agencies, such as the USGS, USDA, and NRCS, and professional associations such as the American Society for Photogrammetry and Remote Sensing (ASPRS) are developing consistent standards for the collection of LiDAR and digital imagery, to which the NJDEP adheres. These standards are referenced at the end of this document.

IV. ACCURACY REQUIREMENTS

As will be discussed in section V, data generated for submittal to NJDEP can be in one of several formats depending on the specifics of the project being supported. However, regardless of the data format, all data submitted to the NJDEP must be accompanied by a full description of the processing steps used to create the data, and of the accuracy of the data set. This accuracy statement should include information on both the positional accuracy of the data, as well as on the accuracy of any attribute information submitted.

Positional Accuracy

Positional accuracy is a measurement of how closely the mapped features are to their true positions on earth (Struck, 1999), and awareness of the positional accuracy of any digital data set is critical to evaluating the results of any GIS analyses using the data. There are several components that contribute to the overall positional accuracy of digital data.

One component is the inherent accuracy of any base data sets on which the digital data layer is created. Base data sets, often geo-referenced digital imagery or hard copy photo-basemaps, need to meet some clearly defined accuracy specifications since the accuracy of the base layer sets the upper limits on the accuracy of the derived data. A derived data set cannot be of higher accuracy than the base that it is created from. There are two common accuracy standards that can be used to verify and describe the accuracy of base mapping layers. The first is the **National Map Accuracy Standards, 1947** (NMAS), and the second is the **National Standard for Spatial Data Accuracy, 1998** (NSSDA). The NMAS sets threshold limits for various scale base maps, while the NSSDA defines an accuracy testing methodology.

Another component of the final accuracy of a digital data set is the accuracy with which the data creators generate their data from the source layer. Data generated from a highly accurate base may not always reflect that accuracy, depending on the intended uses of the data created. Locations of points mapped on a base map that has a +/- 4 ft accuracy may only have been mapped to +/- 100 ft of their true surveyed positions because of the scale at which the data points were located and the intended use of the data layer. These kinds of accuracy details also need to be fully documented with the submitted data.

Still another component of the final positional accuracy of a digital data set may be the accuracy of any equipment used to capture the data. Global Positioning Systems, for example, vary in the maximum positional accuracies at which they can collect data. Some units may be able to collect positional data that is within a foot of the true position on the earth, while other units can do no better than 10 feet. Further, the actual accuracies of the collections will be affected by the different settings used at the time of data collection, such as the number of satellites used to fix the locations, the length of time the receiver is left at a particular location, and whether or not the data are differentially corrected. All of these factors need to be fully documented so that the accuracy of data generated using GPS, and other equipment, can be evaluated.

In short, there are several factors affecting the positional accuracy of submitted data and all of these factors need to be documented fully. Because of the many different data types and many different uses of data submitted to the NJDEP, it is difficult to set absolute accuracy standards for all data. In addition, it is important to state that some NJDEP programs have the authority to generate and require specific project-oriented accuracy standards.
Base map sources used to create data must at least meet the NMAS threshold accuracy standards as listed in Table 3 below. Preferably, data should be created on a base source that has been tested using the NSSDA testing methodology. In all cases, the accuracy specifications of the data set are to be fully described, as are the procedures used to verify the theses accuracies. In the case of data that are generated through on-screen digital editing, the accuracy description must include the predominant view scale or scales at which the data were created.

Table 3. Threshold accuracy values in ground units.

Scale	NMAS Accuracy (feet)	NSSDA Accuracy (feet)	NMAS Accuracy (meters)	NSSDA Accuracy (meters)
Large scale	1/30 inch (map)			
1:1,200	3.3	3.8	1.0	1.2
1:2,400	6.7	7.7	2.0	2.3
1:6,000	16.7	19	5.1	5.8
1:12,000	33.3	38	10.1	12
Small scale	1/50 inch (map)			
1:24,000	40	46	12.2	14
1:63,360	106	120	32.3	37

Derived from National Map Accuracy Standards (1947).

Attribute Accuracy:

The NJDEP requires that all mandatory attribute data be 100% correctly coded. A description of the procedures used to assure 100% coding shall be included in the data set documentation. For example, *frequencies procedures have been run to assure that there are no invalid codes or duplicate values.*

V. DATA FORMATS

The NJDEP GIS is built on the ESRI suite of products. As such, several different formats are acceptable for data submitted to the NJDEP. These acceptable formats are listed below in order of preference, with any specific requirements applicable to each:

A. Geodatabase:

Data developed and submitted to the NJDEP shall be in the latest compatible version of an ArcGIS file geodatabase (preferred) or personal geodatabase. The geodatabase is currently the common data storage and management framework for ArcGIS. It combines spatial data with a data repository to create an intelligent structure for spatial data storage and management. In addition, the geodatabase format allows the user to define and apply a wide set of integrity rules and constraints to insure that data are created and delivered with correct topology. Topology allows data users to answer questions about adjacency, connectivity, proximity and coincidence. Topology is crucial and all data submitted to the NJDEP must be topologically correct. Both file and personal geodatabases are acceptable, with the file geodatabase preferable where large data sets are being submitted.

Geodatabases will adhere to at least the following standards:

- All feature classes included in the geodatabase will exist in one or more feature data sets.
- The XY coordinate system for all feature datasets and feature classes will be NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet
- The Z coordinate system will be NAVD_1988
- The XY tolerance will be at least 0.003280833333333 ft. A closer tolerance may be used where the accuracy of the data, such as that collected with survey grade GPS, supports it
- The XY resolution will be at least 0.003280833333333 ft.
- The domain limits will be set at (Foot US): Max X: 2955094000892.94 Max Y: 2955065037392.94
- Topologies will be created for all feature datasets and feature classes and all data will be submitted with no topologic errors
- For topologies that involve more than one layer, the most accurate layer will be given the highest rank
- The minimum topologic rules are:
    - Features will not be duplicated
    - Coincident boundaries will be corrected within a feature dataset (features that share boundaries with features in other feature classes in the dataset)
    - Linear features will not overlap; i.e., all line intersections will require a node
    - Linear features will maintain correct arc directionality for any data set with flow directions.
    - Linear features will not have pseudo-nodes unless they are required to maintain a change in arc attribution
    - Polygons must close
    - Polygons will have no overshoots or dangles
    - Polygons will not overlap
    - Polygons sharing edges will not have gaps
    - Polygons will have one and only one label point

Any additional topologic rules enforced during the creation of the data will be fully described in the metadata. The topologies should be submitted as part of the geodatabase delivered to NJDEP so that adherence to the topologic rules can be easily verified. In some cases, some NJDEP programs may develop project-oriented geodatabase templates for data submittal consistency. Users should investigate with the program whether or not geodatabase templates have been created and posted for download before developing a geodatabase for a program specific data submittal.

B. Coverages

Coverages are vector datasets depicting points, lines, polygons, regions, or routes, and are an original data format developed by ESRI.

As with geodatabases, coverages allow topologic rules to be defined and enforced so that data sets can be created without topologic errors. In addition, data tolerances can be set during data creation that insure that data created meet minimum standards.
All coverages will use the following standards:

- Double Precision
- Fuzzy Tolerance 0.0001
- Dangle Tolerance 0.0
- Tic_Match 0.0
- Edit 0.5
- NodeSnap 0.0001
- Weed 0.5
- Grain 0.5
- Snap 0.5
- All coverages must contain a projection (prj.adf), and projections will be defined with the following parameters:
    - Projection State Plane
    - Zone 4701
    - Units Feet
    - Datum NAD83
- Correct arc directionality must be maintained on streets and any dataset with flow directions
- Polygons must close without overshoots or undershoots
- Pseudo nodes must only exist where 1) a line closes on itself 2) only two lines intersect 3) there is a change in attribution along a line 4) to maintain the shape and measurements of an arc
- Lines, polygons, points and annotation must not be duplicated
- Streets and facility data do not break at overpasses and underpasses
- There is a maximum of 500 vertices per arc limit with ArcInfo software
- Polygons must edge match without slivers
- Polygons must not overlap
- Polygons will have one and only one label point, except for the background polygon, which will have none
- There will be no node errors and no dangles

Coverage data may be delivered in its native format, and must include the associated Info directory. Alternatively, NJDEP will accept coverage export files (*.E00).

C. Shapefiles

The shapefile is a simple vector data format that stores non-topological geometry and attribute information for each of the features in a data set. The features can be points, lines or polygons. The format was developed as part of the ESRI product suite, but shapefiles can be used and created by many other GIS software applications.

Shapefiles are actually a set of separate files that define the vector features and attributes. Unlike geodatabases and coverages, shapefiles do not adhere to any formal topological rules, and as such data creators need to be aware that extra care must be taken when creating shapefiles for submittal to NJDEP.

Shapefiles submitted to the NJDEP must adhere to the following standards:

- All shapefile data sets must include at a minimum the following files:
  .shp (the file that stores the geometry)
  .shx (the file that stores the feature geometry index)
  .dbf (the file that stores the feature attribute information)
  .prj (the file that stores the coordinate information)

- When applicable, the following files should also be submitted:

  .sbx, .sbn (the files that store the spatial index of the features)
  .ain, .aih (the files that store the attribute index of active fields in the attribute table)

- Shapefiles must be created so that the following basic topologic rules are not violated:
  - Features will not be duplicated
  - Linear features will not overlap; i.e., all line intersections will require a node
  - Linear features will maintain correct arc directionality for any data set with flow directions
  - Linear features will not have pseudo-nodes unless they are required to maintain a change in arc attribution
  - Polygons must close
  - Polygons will have no overshoots or dangles
  - Polygons will not overlap or self-intersect
  - Polygons sharing edges will not have gaps
  - Polygons will have one and only one label point

D. Geodatabase XML

The ESRI Geodatabase XML is a mechanism for interchanging geospatial information to and from a geodatabase. While geodatabases can be simply copied and loaded into a new directory or folder, the geodatabase XML workspace export preserves the schema developed for the geodatabase and includes all simple and custom features data, participation in networks and topologies, network connectivity and topology rules, simple and composite relationships, and any other information associated with the geodatabase datasets. Therefore any and all behaviors created within the original geodatabase will be recreated when the XML document is imported into the receiving system. For an XML extract, both the data and the schema should be exported.

E. Raster data sets

Raster data can be described as a spatial data model that defines space as an array of equally sized cells arranged in rows and columns, and composed of single or multiple bands. Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature. Raster data sets that encompass imagery or elevation data are less likely to be submitted to NJDEP than vector data (points, lines, polygons). However, in those cases where submission of raster data sets are required, the following raster data formats can be accepted by the NJDEP

- ArcInfo grids (integer or floating point)
- Triangular Irregular Networks (TINs)
- MrSid (version 2, 3 or 4) with world file
- Tiff, Geotiff, with world file
- Jpeg, jpeg2000 with world file
- ERDAS Imagine
- ASCII

All raster data sets must contain projection information, and projections will be defined with the following parameters:

- Projection New Jersey State Plane
- Units Feet
- Datum NAD83

All raster data submitted to NJDEP must meet minimum positional accuracy standards as described in Section IV. ACCURACY REQUIREMENTS. Submissions must also include the full description of procedures used to assure accuracy.

F. CAD

CAD drawing files are digital representations of a design or an object. The files are composed of various objects including graphical objects such as points, lines and polygons, and non-graphical items such as text, labels, legend blocks, etc. The various objects are grouped into drawing layers with objects that share similar physical characteristics grouped into the same layer. While there are many different CAD file formats, there are three major formats which will be accepted by NJDEP:

- AutoCAD DWG (AutoCAD 2009, Software Version 17.2, Format Version 2007 and higher)
- AutoCAD DXF (AutoCAD 2009, Software Version 17.2, Format Version 2007 and higher)
- Microstation DGN (version 7.x and higher)

All CAD data submitted will comply with the following minimum specifications:

- For all formats, the CAD files reference is NJSPC US Feet, NAD83. Unreferenced files will not be accepted
- All data will be exported using a 16 decimal places option, so that double precision accuracy will be maintained
- In addition, a text file listing individual layer names and descriptions shall be submitted with each CAD data set
- All CAD files regardless of software version used to create the files will follow the structure outlined in the draft CAD template posted at https://njgin.state.nj.us/oit/gis/NJ_NJGINExplorer/docs/NJSubdivisionCAD.xls . While this link refers to a Microstation template, the structure is the same whether the file was created in AutoCAD or Microstation
- Annotation for each layer shall be placed in separate annotation layers
- At least three separate digital files are required for each submission:
    - One file shall be the exact text of each metes and bounds description prepared for the site specific engagement. The format shall be MS Word .doc format or other text file extension format that is acceptable to the Using Agency
    - One file shall be a digital file in format containing the full survey drawing. This drawing must be created at its real New Jersey State Plane Coordinates, NAD83, NORTH position and the view shall be un-rotated from the coordinate system so that the NJPCS NORTH points orthographically vertical in the screen
    - One file shall be a single layer digital drawing containing the closed line polygon of the perimeter survey lines and certain other lines that are internal to the survey
    - Additional separate layer files may be requested by specific programs accepting CAD submissions to facilitate review of data for individual regulatory requirements. These specific layers will be listed in supporting documents for each program

G. LiDAR data.

While still a relatively new technology, LiDAR collections are becoming increasingly important sources of data for the NJDEP. LIDAR is an acronym for ***Li****ght* ***D****etection and* ***R****anging* and is a technology that uses laser light pulses to generate information about earth surface features. Several federal agencies, including the USGS and NRCS, along with professional associations such as the American Society for Photogrammetry and Remote Sensing

(ASPRS) are in the processes of publishing consistent standards for LiDAR data, to which the NJDEP adheres. These general standards are included at the end of this document.

In addition to the general standards, NJDEP requires the following:

- Raw and classified point clouds delivered in LAS file format, version 1.2 or higher
- Horizontal coordinates expressed in New Jersey State Plane Feet, NAD83
- Vertical elevation values referenced to the North American vertical Datum of 1988 (NAVD88) and expressed in feet
- Classified point clouds, and bare earth digital elevation models will be tiled. Tiles will be based on the "New Jersey 2007-2008 High Resolution 5000 foot Tile Index (rev 2009)" available at (https://njgin.state.nj.us/NJ_NJGINExplorer/DataDownloads.jsp).

H. Other Data formats

Other data formats may be accepted by NJDEP based on program requirements. NJDEP strongly suggests that those submitting data to the NJDEP first check with the associated program to verify other acceptable formats.

VI. NAMING CONVENTIONS

Locally, data may follow program-specific naming conventions. To avoid possible data import/export problems, the following dataset and attribute naming conventions are applicable for data being submitted to and by NJDEP for distribution:

a) Dataset naming conventions

- Dataset names will contain only alphanumeric characters (i.e. letters, numbers)
- Dataset names will start with a letter
- Dataset names will be entirely in lowercase
- No spaces, dashes, special characters other than an underscore will be used
- Dataset names will be 10 characters or lessCommon abbreviations should be used where applicable
- Datasets used in department enterprise GIS applications will be re-named by the Bureau of GIS following the ESRI GIS For the Nation (GFN) Data Model described at: http://www.esri.com/news/arcnews/fall05articles/gis-for-the-nation.htm

b) Attribute Field Naming

- Attribute field names will contain only alphanumeric characters (letters and numbers) and underscores
- Attribute field must start with a letter
- No spaces, dashes or special characters other than an underscore will be used
- Attribute field names will be 10 characters or less to avoid data conversion issues with truncation.

VII. NJDEP DATA DISTRIBUTION AND CONSTRAINTS

The NJDEP publishes environmental spatial data through its website located at http://www.nj.gov/dep/gis. Data can also be viewed on NJDEP's online mapping application called NJ-GeoWeb, located at http://www.nj.gov/dep/gis/geowebsplash.htm. By downloading the data, the user agrees to abide by certain restrictions and/or other legal prerequisites for using the data after downloading. NJDEP's Data Distribution and Use Constraints, listed below, can also be found in each layer's metadata record:

New Jersey Department of Environmental Protection (NJDEP)
Data Use and Distribution Agreement

By downloading NJDEP data layers, the user agrees to abide by the terms and conditions of the following:

I. DESCRIPTION OF DATA TO BE PROVIDED:

Subject Data Layers

For all data contained herein, NJDEP makes no representations of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied with respect to the digital data layers furnished hereunder. NJDEP assumes no responsibility to maintain them in any manner or form.

II. TERMS OF AGREEMENT:

1. Digital data received from the NJDEP are to be used solely for internal purposes in the conduct of daily affairs.

2. The data are provided, as is, without warranty of any kind and the user is responsible for understanding the accuracy limitations of all digital data layers provided herein, as documented in the associated metadata file. Any reproduction or manipulation of the above data must ensure that the coordinate reference system remains intact and any data manipulation documented in the metadata by the user. NJDEP assumes no responsibility for any reproduction or data manipulation done by the user.

3. Digital data received from the NJDEP may not be reproduced or redistributed for use by anyone without first obtaining permission from the NJDEP via email gisnet@dep.state.nj.us. This clause is not intended to restrict distribution of printed mapped information produced from the digital data.

4. Any maps, publications, reports, or other documents produced as a result of this project that utilize NJDEP digital data will credit the NJDEP's Geographic Information System (GIS) as the source of the data with the following credit/disclaimer: "This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized."

5. Users shall require any independent contractor, hired to undertake work that will utilize digital data obtained from the NJDEP, to agree not to use, reproduce, or redistribute NJDEP GIS data for any purpose other than the specified contractual work. All copies of NJDEP GIS data utilized by an independent contractor will be required to be returned to the original user at the close of such contractual work.
Users hereby agree to abide by the use and reproduction conditions specified above and agree to hold any independent contractor to the same terms. By using data provided herein, the user acknowledges that terms and conditions have been read and that the user is bound by these criteria.

VIII. METADATA STANDARDS

Metadata is literally "data about data". It is a description of the content, quality, lineage, contact, condition, and other characteristics of data. Pertaining to spatial data, metadata can help provide answers to such questions as:

1. Who created it the data?
2. When was the data created?
3. Why was the data created?
4. How often is the data updated?
5. What kind of data is it?
6. How accurate is the data?

The NJDEP recognizes metadata as a critical and mandatory component of a data set. Metadata records created by the NJDEP preserve the usefulness of all types of environmental data over time by detailing methods for data collection and data set creation. Metadata can reduce the chance of duplication of effort among NJDEP programs, a serious issue when dealing with the collection of expensive environmental digital data. Metadata supports local data asset management such as local inventory and data catalogs, and for the sharing of spatial data on external user communities (clearinghouses) such as the New Jersey Geospatial Information Network (NJGIN). Metadata provides adequate guidance for end-use application of data such as detailed lineage and context. Metadata makes it possible for data users to search, retrieve, and evaluate many different issues associated with the data set. The following list pertains to NJDEP metadata requirements:

A. The NJDEP requires that all spatial data created by the Department, which is then distributed internally and/or externally, be documented with metadata that adheres to the Federal Geographic Data Committee (FGDC) Standard. The NJDEP has developed a template of selected fields from the FGDC's Contend Standard for Digital Geospatial Metadata (CSDGM). Using this field template (as shown in section C), the Department requires that each NJDEP data creator/editor maintain accurate metadata for the current, distributed version of their data set. The template can be obtained by contacting the NJDEP Bureau of GIS (BGIS) at gisnet@dep.state.nj.us.

B. Data can also be submitted by various outside entities to NJDEP data creators/editors as part of the data creation/compilation process for specific projects. In these cases, outside entities may not need to fill out the NJDEP template of FGDC-compliant metadata, as required for NJDEP employees for final distributed data set. Only a small subset of information may be needed by the program during this phase. NJDEP suggests that users submitting spatial data to the NJDEP first check with the associated program regarding their project-specific metadata requirement.

C. Department endorses use of Environmental Protection Agency metadata editor tool (EME) for use in metadata creation. http://www.nj.gov/dep/gis/epaeme.htm . Contact BGIS at gisnet@dep.state.nj.us for training information or for training materials. The following is the list of CSDGM fields used in EME and also in the metadata template:

SECTION 1- IDENTIFICATION INFORMATION

Abstract
Purpose
Supplemental Information
Access Constraints
Use Constraints Title
Originator
Publication Date
Edition
Online Linkage
Publication Place
Publisher
Currentness Reference
Calendar Date
Progress
Update Frequency
North, South, East, and West Bounding Coordinates
Theme Keyword & Thesaurus
Place Keyword & Thesaurus
Temporal Keyword & Thesaurus

SECTION 2- DATA QUALITY INFORMATION

Logical Consistency Report
Completeness Report
Accuracy Report
Horizontal Accuracy (Accuracy Report)
Vertical Accuracy (Accuracy Report)
Source Scale Denominator
Type of Source Media
Source Citation Abbreviation
Source Contribution
Source Title
Source Originator
Source Date
Source Edition
Source Geospatial Presentation Form
Source Publication Place
Source Publisher
Source Currentness Reference
Source Calendar Date
Process Description
Process Date

SECTION 3 - SPATIAL DATA ORGANIZATION

Direct Spatial Reference Method
SDTS Terms
SDTS Point & Vector Object Type
SDTS Point & Vector Object Count

SECTION 4 - SPATIAL REFERENCE INFORMATION (Based on NJSP NAD 83)

Geographic Coordinate System Name
Projected Coordinate System Name
Horizontal Data Name
Ellipsoid Name
Semi-major axis
Denominator of Flattening Ratio
Planar Coordinate Information
Coordinate Pair
Abscissa and Ordinate Resolution
Planar Distance Units
Encoding Type
Transverse Mercator Selection
SPCS Zone Identifier
Scale Factor at Central Meridian
Longitude of Central Meridian
Latitude of Projected Origin
False Easting
False Northing

SECTION 5 - ENTITY/ATTRIBUTE INFORMATION

Entity Label Entity Definition
Entity Definition Source
Attribute Label
Attribute Definition
Attribute Definition Source

SECTION 6 – DISTRIBUTION INFORMATION

Resource Description
Distribution Liability
Distributor Organization
Distributor Contact Voice Telephone
Distributor Contact Fax Number
Distributor Contact Instructions
Distributor Address Type
Distributor Address
Distributor City
Distributor State or Province
Distributor Postal Code
Fees
Ordering Instructions
Format Name
Format Version
File Decompression Technique
Network Resource Name
Offline Media
Recording Format

SECTION 7 – METADATA REFERENCE

Metadata Date
Language of Metadata
Metadata Standard Name
Metadata Standard Version
Metadata Time Convention
Metadata Contact Person
Metadata Contact Organization
Metadata Contact Position
Metadata Contact Voice Telephone
Metadata Contact Fax Number
Metadata Contact Email Address
Metadata Contact Address Type
Metadata Contact Address
Metadata Contact City
Metadata Contact State or Province
Metadata Contact Postal Code

IX. GLOSSARY

A Note on Glossary Sources

This section provides definitions for many terms and acronyms used in the document. The glossary entries were drawn from various sources, which used are cited in the text and full references are listed as at the end the end of the document.

GLOSSARY

95% Confidence Limits, 95% Confidence Level

A statistical statement on the probability that results found (or the hypothesis proposed) is correct. At the 95% confidence interval it would be expected that the test result would be correct 95 percent of the time, and there is a 5 percent risk that the result is incorrect. Stating a result at the 95% confidence level indicates a very high probability that the results are correct.

Accuracy

Accuracy is a measure or statement of correctness or the degree to which measured or collected data agree with what is considered true or accepted values. Accuracy is distinguished from precision, which is statement exactness, or refers to the number of significant digits in a number.

Spatial or locational accuracy reflects the degree to which a reported coordinate value conforms to the true position on the earth. Attribute accuracy refers to the degree to which the information in an attribute field correlates with the true value.

Angular Unit

The unit of measurement on a sphere or a spheroid, measured in degrees, minutes and seconds. The latitude- longitude geographic reference system uses an angular unit of measurement.

Annotation

Text, labeling or graphics, (but not geographic features) that presents information on a map. Common examples include street names, tax parcel numbers, lot dimensions, etc. In CAD and GIS software annotation is stored as a separate layer and individual text strings or graphics can be placed on the map, selected, moved, sized, and edited separately from geographic data layers.

Arc

Term used to describe a linear feature on a map in a geospatial data set. Arcs may be line features or form the boundaries of polygons.

Arc/Info, ArcInfo

A GIS software product developed and marketed by Environmental Systems Research Institute (ESRI), Inc., that has been superseded by the ArcGIS suite of products. The ArcInfo name is still used to denote the ArcGIS license level, that features the most numerous and most powerful data management and geoprocessing features.

ArcGIS

A GIS software product suite developed and marketed by Environmental Systems Research Institute (ESRI), Inc.

ArcView

A GIS software product of ESRI, Inc. ArcView is the lowest level license in a three-tier desktop GIS product group. ArcGIS provides more functionality through licenses of ArcView, ArcEditor and ArcInfo.

ASCII

Acronym for American Standard Code for Information Interchange. ASCII is the de facto format standard for text files in computer systems, and is limited to 128 different characters. ASCII text is often informally referred to as "plain text."

Attribute(s)

Non-spatial information about the characteristics of geographic features in a geospatial dataset. Attribute information is linked to geographic features and is generally stored in tabular format. For example, attributes of a river would include its name, length, stream order, hydrologic unit code, the watershed in which it exists, etc.

Attribute Information, Attribute Data

Tabular or textual data describing the characteristics of geographic features (see Attribute(s).

Attribution

The process of assigning attributes to features in a geospatial data layer.

AutoCAD

Software developed and marketed by the AutoDesk Corporation, it is one of the leading drawing, drafting and design software packages, for both 2-dimentional and 3-dimentional CAD design work. The software is often used for creating maps for surveying, planning, and engineering work, and now has many features in common with advanced GIS software. CAD files created with AutoCAD have the DWG or DXF file extensions (see entries for DWG and DXF).

Background Polygon

Also known as the "universe polygon" in the ESRI Coverage format. This is a characteristic of a polygon coverage, where the first record in a polygon attribute table, represents the area beyond the outer boundary of the coverage. The background polygon is unique in that it has no label point and no attributes are assigned to it.

Base Data Set(s)

The source data used in the compilation or development of mapped data (for example digital aerial photography, satellite imagery, USGS topographic quadrangle digital raster graphic files).

Base Map, Basemap

A map of background reference information (e.g., roads, rivers and streams, buildings, political boundaries, geodetic control) that serves as the basis for the mapping of another data layer. A base map could be digital data or a hard copy map on paper or Mylar.

Base Sources

The fundamental sources used for data development. The base map data from which data are generated. Common examples are digital aerial ortho-photography, hardcopy Mylar aerial ortho-photography, or hardcopy USGS topographic quadrangles.

CAD

The Acronym for computer-aided design; sometimes also denoted as CADD for computer-aided drafting and design. CAD is computer-based system for the creating drawings, plans, maps and designs. It can be differentiated from GIS in its primary focus on the graphical drawing rather than on spatial data management, spatial analysis or geoprocessing. However,

contemporary CAD software contains many of the same features as GIS software, and also uses an approach that uses layers of digital information.

CAD File

The digital equivalent of a drawing, plan, map, figure, or schematic created using a CAD system. GIS software can often import and use CAD data files. Important CAD file formats include DWG (AutoCAD drawing file), DXF (AutoDesk Drawing Exchange Format), and DGN (the file format used by the Bentley Microstation CAD software).

Cartographic

Having to do with cartography, mapping, map creation and design or map publishing.

Cartography

The art and science of making maps and charts. The term is often used more broadly to include all the tasks involved in creating a map, mapping information or digital mapping products (Kansas Association of Mappers; Univ. of Texas Library).

Central Meridian

The line of longitude that defines the center and often the x-origin of a projected coordinate system. (ESRI OGD).

Control Point(s)

Exact positions of (usually) surveyed geographic features used to register (georeference) map sheets and transform coordinates (Kansas Association of Mappers).

Control Point File

The data file that contains information on the control points used to register or geo-reference a mapped data, spatial data layer, feature class or raster image.

Coordinate Offsets

An offset, using distance and direction, to place coordinates in a different position from which they were measured or indicated. Coordinate offsets are commonly used in cases where actual coordinates could not be accurately measured (e.g., using a GPS receiver under dense tree canopy). By use of the offset values coordinates are moved from one location to another.

Coordinates, Coordinate Values

A set of values that define a position within a spatial reference or coordinate system indicating horizontal and/or vertical positions. Coordinate values are associated with a coordinate system that sets the appropriate measurement parameters (datum, units, etc.) used by that system.

Coordinate System, Coordinate Reference Systems

A set of rules for specifying how coordinates are to be assigned to points or locations. The rules usually specify an origin of coordinates and of axes (for example, x and y for Cartesian systems) from which distances or angles are measured to yield coordinates..

Coverage

Often used synonymously with “layer” or “feature data set”. It is a specific vector data format, created by ESRI, Inc., for storing geographic features. Coverages cannot be edited in ArcGIS 8.3 and subsequent versions, but can be imported (ESRI OGD).

Critical Settings

Hardware and software settings that are necessary for the collection or creation of accurate data. Usually this in reference to settings made in a GPS receiver prior to collecting data.

Dangle Tolerance

In ArcInfo coverages, the minimum length allowed for dangling arcs by the clean process, which removes dangling arcs shorter than the dangle tolerance (ESRI OGD).

Dangle, Dangling Arc

Term for a feature created where a digital line extends past the intended boundary line or end point. The extension past the intended juncture point is called a dangle. A dangling arc is not always an error (e.g., dead end street, cul-de-sac), but is a common data editing oversight. Sometimes referred to as an overshoot.

Data Layer

A geographic dataset in any digital map environment that can be registered and overlaid with other datasets (in the same coordinate system). The layer concept derives from the way in which dataset representing different thematic datasets (parcels, roads, hydrography, land use, etc.) can be stacked up in layers. The data layers that makeup the map display generally appear in the map key or legend

Datum

A set of parameters and control points used to accurately define the three-dimensional shape of the Earth (e.g., as a spheroid). The datum is the basis for a planar coordinate system. For example, the North American Datum for 1983 (NAD83) is the datum for map projections and coordinates within the United States and throughout North America (Kansas Association of Mappers).

Decimal Degrees, DD

Values of latitude and longitude expressed in decimal format rather than in degrees, minutes, and seconds. Latitude-longitude values are converted to decimal degrees mainly for ease of use. Decimal degrees can be calculated by adding the value for degrees to the result of degrees divided by 60 plus seconds divided by 3,600. Using this formula the longitude 74° 44' 35" is equal to 74.7430 in decimal degrees.

Degree

A unit of angular measure represented by the symbol °. The earth is divided into 360 degrees of longitude and 180 degrees of latitude (ESRI OGD). A degree is 1/360th of a circle. A degree is further divided into 60 minutes, and a minute is divided into 60 seconds. In New Jersey, on average, a degree of longitude measuring east-west is roughly 280,200 feet, and a degree of latitude measuring north-south is roughly 364,200 feet. A degree of longitude is roughly 8,500 feet wider in areas in the southern part of the state (Cape May County), compared to areas in the northern part of the state (Sussex County). The width of a degree of latitude is approximately the same throughout the state.

Derived Data

Information that is created using another source as its basis. For example, land use polygon data can be considered as derived from the interpretation of aerial imagery.

Differential Correction

Differential correction is the process of correcting GPS data collected using a rover (GPS receiver collecting data in the field) with data collected simultaneously at a base or reference station. Because it is collecting GPS measurements at a known location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the rover data. Differential correction can be done in real time, or after the data has been collected by post processing (NY State GPS Glossary).

DGN

A CAD file format used in MicroStation software. MicroStation is a prevalent CAD software package developed and marketed by Bentley. DGN files are denoted by the .DGN file extension.

Digital Data

Electronic machine readable data stored in a computer data system. Digital data is most often categorized in GIS as spatial (georeferenced vector or raster information) or non-spatial (tabular or attribute data linked to georeferenced features).

Digital Imagery

Digital imagery is a computer compatible version of an aerial photograph, satellite photo or other map image. It is a raster data layer, composed of a matrix or grid of individual picture elements (pixels).

Digital Ortho-imagery

A computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map (USGS, 2001). Digital ortho-imagery is often referred to as an orthophoto, orthophotograph or orthoimage.

Domain

Specifies what values are permitted in a database field in an attribute table or database table. It is a mechanism for enforcing data integrity in a database by limiting data input to accepted values.

Domain Limits

The range of permissible values for a database field in an attribute table or database table.

DOP

An acronym in Global Positioning Systems (GPS) for dilution of precision. An indicator of the quality of a GPS position, which takes account of each satellite's location relative to the other satellites in the constellation, and their geometry in relation to the GPS receiver (New York State GPS Glossary). A low DOP value indicates a higher level of accuracy.

Double Precision

The level of coordinate exactness based on the possible number of significant digits that can be stored for each coordinate. Datasets can be stored in either single or double precision. Double-precision geometries store up to 15 significant digits per coordinate (typically 13 to 14 significant digits), retaining the accuracy of much less than 1 meter at a global extent (ESRI OGD).

Double Precision Accuracy

Accuracy values consistent with data coded at the level of double precision (stored with up to 15 significant digits).

DWG

The DWG file is a widely used file format and specification for CAD drawing files which carry the .DWG file extension. It is the main file format of output from AutoCAD software, and the source of a great deal of mapping data imported and used by GIS software users.

DXF

A standard data exchange file format for AutoCAD drawing files that enables the export and import of AutoCAD data for use with software other than AutoCAD. DXF Files have a .DXF file extension. As noted in "AutoDesk 2012 DXF Reference" (AutoDesk 2011, p.1.), the "DXF™ format is a data representation of all the information contained in an AutoCAD drawing file. Furthermore, almost "all user-specified information in a drawing file can be represented in DXF format." Therefore, the import of DXF formatted files is a common function for GIS users.

Easting

The east-west, X, coordinate in a rectangular coordinate system, the equivalent of longitude in a geographic reference system (Kansas Association of Mappers).

Elevation data, Elevation Layer

A data value or geospatial data layer containing information about the vertical distance of a point or object above or below a reference surface or datum. Generally elevation data is referenced to mean sea level, in which case elevation data would be given as height above sea level. (Univ. of Texas Libraries).

Elevation Mask

The angle above and relative to the horizon, below which your GPS rover will not track satellites. It is normally set to 15° to avoid interference problems caused by buildings and trees and multipath errors (New York State GPS Glossary).

EME

EPA Metadata Editor (EME) endorsed by NJDEP as a metadata creation and editing tool.

ERDAS

The company that developed and markets ERDAS Imagine software used for image analysis.

ERDAS Imagine

A software product of ERDAS used for the analysis of geospatial imagery, such as aerial and satellite photography.

ESRI, ESRI, Inc., Esri

Environmental Systems Research Institute. The company that develops and markets GIS software, including the ArcGIS system of software.

False Easting

The linear value added to all x-coordinates of a map projection so that none of the values in the geographic region being mapped are negative (ESRI OGD)

False Northing

The linear value added to all y-coordinates of a map projection so that none of the values in the geographic region being mapped are negative (ESRI OGD).

Feature Class

A collection of geographic features with the same geometry type (such as point, line, or polygon), the same attributes, and the same spatial reference. Feature classes can be stored in geodatabases, shapefiles, coverages, or other data formats (ESRI OGD).

Feature Dataset

A collection of feature classes stored together that share the same spatial reference; that is, they share a coordinate system, and their features fall within a common geographic area. Feature classes with different geometry types may be stored in a feature dataset (ESRI OGD).

Feature

A representation of a real-world object on a map, or in a spatial database. Usually represented in a vector dataset graphically as a point, a line or a polygon.

FEMA

Federal Emergency Management Agency.

Field Collection

The collection of raw data through measurements and observations conducted on site, in the field (out in the environment).

Field Data

Data generated through field collection.

File Geo-databases, File Geodatabases

A geodatabase stored as a folder of files. A file geodatabase can be used simultaneously by several users, but only one user at a time can edit the same data (ESRI OGD).

FIPS Zone, FIPS Code

Federal information processing standards codes (FIPS codes) are a standardized set of numeric or alphabetic codes issued by the National Institute of Standards and Technology (NIST) to ensure uniform identification of geographic entities through all federal government agencies. The entities covered include: states and statistically equivalent entities, counties and statistically equivalent entities, named populated and related location entities (such as, places and county subdivisions), and American Indian and Alaska Native areas. (US. Census Bureau; NIST).

Flow

The movement or transport, and direction of movement from one point to another along a linear network. Flow direction along a linear network in important in hydrologic modeling, traffic analysis or any other network layer where information on the direction of transport is necessary.

Foot (US)

The U.S. Survey Foot is the unit of measure used in the New Jersey State Plane coordinate system (NJSPC), NAD 83 (feet). It is defined in reference to a meter, and differs slightly from the International Foot. The US Survey Foot is defined as: 1 meter = 39.37 inches. If you divide 39.37 by 12 (12 inches per foot), you get the conversion factor: 1 meter = 3.280833333... (US NGA).

Fuzzy Tolerance

A term relating to ESRI GIS software, and the geometry of spatial data. The distance within which coordinates of nearby features are adjusted to coincide with each other when topology is being constructed or polygon overlay is performed. Nodes and vertices within the fuzzy tolerance are merged into a single coordinate location . Fuzzy tolerance is a very small distance, usually from 1/1,000,000 to 1/10,000 times the width of the coverage extent, and is generally used to correct inexact intersections (ESRI OGD).

Geo-database, Geodatabase

A database or file structure used primarily to store, query, and manipulate spatial data. Geodatabases store geometry, a spatial reference system, attributes, and behavioral rules for data (ESRI OGD).

Geo-database XML, Geodatabase XML

A software language or encoding system for information stored in a geodatabase. XML is an acronym for *Extensible Markup Language*, which is a set of rules for creating standard information formats using customized tags and sharing both the format and the data across applications

Geographic Coordinate System

A reference system that uses latitude and longitude to define the locations of points on the surface of a sphere or spheroid. A geographic coordinate system definition includes a datum, prime meridian, and angular unit.

Geometry

The measures and properties of points, lines, and surfaces. In a GIS, geometry is used to represent the spatial component of geographic features.

Geo-reference, Georeference (Georeferencing, Georeferenced)

Aligning geographic data to a known coordinate system so it can be viewed, queried, and analyzed with other geographic data. Georeferencing may involve shifting, rotating, scaling, skewing, and in some cases warping, rubber sheeting, or orthorectifying the data.

GeoTiff

A TIFF based interchange format for georeferenced raster imagery that was developed as an open standard. TIFF is an acronym for Tagged Image File Format (OSGEO GeoTiff).

GIS

An acronym for Geographic Information System(s).

Global Positioning Systems

A satellite-based navigation system commonly used by GIS data creators, mappers and surveyors.

GPS

An acronym for Global Positioning Systems. GPS is the generic term used to describe the satellite-based timing and positioning system operated by the United States Department of Defense (DoD). The system is used in navigation, mapping, surveying, and other applications in which precise positioning is necessary (New York State GPS Glossary).

GPS Receiver(s)

Devices used in the field to collect geographic locations by receiving transmissions from Global Positioning Systems satellites.

Grid

In cartography, any network of parallel and perpendicular lines superimposed on a map and used for reference. These grids are usually referred to by the map projection or coordinate system they represent, such as universal transverse Mercator grid (ESRI OGD).

Also, an ESRI data format for storing raster data.

GRS

An acronym for Geodetic Reference System. This denotes a standard measurement system for mapping, for example, GRS 80, the standard measurements of the earth's shape and size adopted by the International Union of Geodesy and Geophysics in 1979.

GSD

And acronym for Ground Sample Distance, meaning distances or measurements taken on the ground rather than from a map or aerial photograph.

Hard Copy

Other than a digital copy, usually a map or mapped data on paper, Mylar or film.

Horizontal Geodetic Datum

A geodetic datum specifying the coordinate system in which horizontal control points are located (NGS, 2009).

Image Analysis Classification

The science classifying geographic features by studying images of the object. The term includes image interpretation and the more specialized subjects of photogrammetry, radargrammetry, and photo-interpretation (NGS, 2009).

Jpeg, JPEG

Joint Photographic Experts Group. A standardized image compression mechanism which can obtain high compression ratios, but may cause some data loss. Pixel values will be slightly different after decompression (Kansas Association of Mappers).

Label Point

A term related to the ESRI coverage file format. In a coverage, a feature class used to represent points or identify polygons. When representing points, the x,y location of the point describes the location of the feature. When identifying polygons, the point can be located anywhere within the polygon (ESRI OGD).

Large Scale

A statement of map scale. Relative to a smaller scale, a large scale map that shows greater detail for a smaller area. For example and map at a scale of 1:2,400 is large scale when compared with a map that has 1:24,000 scale.

Latitude

The first component of a spherical coordinate system used to record positions on the earth's surface. Latitude indicates the angular distance north or south of the earth's equator measured through 90 degrees (Kansas Association of Mappers).

Latitude of origin

The latitude value that defines the origin of the y-coordinate values for a projection (ESRI OGD).

Latitude/Longitude

A spherical coordinate system used to record positions on the earth's surface with reference to a grid composed of lines of latitude and meridians of longitude. Latitude is indicated as north or south of the equator from 0 degrees at the equator to 90 degrees at the poles. Longitude is measured east or west from 0 degrees at the prime meridian to the 180-degree longitude line which is opposite the Prime Meridian on the globe.

LiDAR

Acronym for light detection and ranging, it is a remote-sensing technology that uses lasers to measure elevations and terrain feature .

Logging interval

The interval, or amount of time between position fixes taken by the GPS receiver. The interval set in the receiver can be short, such one fix per second, or longer, such as one fix every 10 seconds.

Longitude

The second component of a spherical coordinate system used to record east-west positions on the earth's surface, measured in degrees as the arc or position of the earth's equator intersected between the meridian of a given place and the prime meridian, which runs through Greenwich, England. (Kansas Association of Mappers).

Metadata

Metadata consist of information that characterizes data. Metadata are used to provide documentation for data products. In essence, metadata answer who, what, when, where, why, and how about every facet of the data that are being documented (USGS, Frequently-asked questions on FGDC metadata). Metadata is often referred to as "the data about the data."

Microstation

CAD Software product of Bently Microsystems. Also see entry DGN.

MrSid

Acronym for Multiresolution Seamless Image database, developed by LizardTech, A Celartem Company. MrSid is a file compression technology and format for storage of geospatial imagery such as digital aerial and satellite photography (LizardTech, 2010).

NAD

Acronym for North American Datum (see entry for Datum). Two common North American datum are NAD 1927 (NAD 27) and North American datum 1983 (NAD 83).

National Map Accuracy Standards (NMAS)

A system for indicating the spatial accuracy of mapped data. The United States National Map Accuracy Standards defines accuracy standards for published maps, including horizontal and vertical accuracy, accuracy testing method, accuracy labeling on published maps, labeling when a map is an enlargement of another map, and basic information for map construction as to latitude and longitude boundaries (USGS, NMAS).

National Standard for Spatial Data Accuracy (NSSDA)

A statistical and testing methodology for estimating the positional accuracy of points on maps and in digital geospatial data, with respect to georeferenced ground positions of higher accuracy (FGDC, 1998, p 3-1).

NAVD

Acronym of North American Vertical Datum. Denotes the vertical datum used for data development, such as The North American Vertical Datum of 1988 (NAVD 88). See entry for Datum.

New Jersey State Plane Coordinate System (NJSPC)

The designated planar coordinate system used for mapping in New Jersey, measured in either feet (US foot) or meters, using the North American Datum of 1983 (NAD 83).. Unlike many other states, New Jersey has only one state plan zone. The State Plane Coordinate system provides coordinates on a flat grid for easy computation. The State Plane Coordinate system divides the U.S. into a hundred or more distinct grid surfaces (Zones).

NJSPC

See New Jersey State Plane Coordinate System.

NMAS

See National Map Accuracy Standards.

Node

In a geospatial data set, it is a point at the beginning, ending ore intersection of a line.

Node errors

Errors of topology within a geospatial data set. A common node error is a "dangle" where a line goes beyond an arc to which is was intended to snap (see Dangle). Another node error often encountered is when polygon features are not completely enclosed by a boundary line, leaving a gap in the feature intended to be a polygon.

North American Datum

The horizontal control datum for the United States, Canada, Mexico, and Central America. See NAD.

North American Vertical Datum

The vertical (elevation) control datum for the United States, Canada, Mexico, and Central America. See NAVD.

Northing

The north-south, Y, coordinate in a rectangular coordinate system, the equivalent of a latitude value in a geographic coordinate system (Kansas Association of Mappers).

NRCS

The US National Resources Conservation Service.

NSSDA

See entry for National Standard for Spatial Data Accuracy.

NSSDA testing methodology

A defined process for testing the spatial accuracy of a digital geospatial data set against data of a higher accuracy.

OGIS, Office of GIS

The New Jersey Office of GIS that is part of the New Jersey Office of Information Technology (NJ OIT).

OIT, Office of Information Technology

The New Jersey State government agency that serves oversees and coordinates Information Technology/Information Systems for State entities.

Offsets

See entry for Coordinate offsets.

Overshoots

Situation where a digital line extends past the intended boundary line. This extension past the intended juncture point is called a dangle. (Kansas Association of Mappers).

Ortho-imagery

Aerial photography in digital format that has been digitally processed and transformed from image coordinates to real-world coordinates. Orthogonal (ortho) rectification makes corrections within a photograph so that the scale is uniform throughout the resulting image. The digital ortho-photographs combine the image characteristics of a photograph with the geometric qualities of a map. Distances and locations from these images can be accurately measured, and they can be used just like other GIS data layers (NJ DEP-BGIS).

PDOP

Acronym for Position Dilution of Precision, which refers to GPS data collection. A unitless figure of merit expressing the relationship between the error in user position and the error in satellite position. Values considered good for positioning are small, such as 3. Values greater than 7 are considered poor (NYS GPS Glossary).

Personal Geodatabases

A geodatabase format of ESRI, Inc. that is stored in Microsoft Access database format.

Photo-Basemaps

Aerial or satellite imagery that is used as a base for mapping or data compilation.

Pixel

Abbreviation for Picture Element, the smallest nondivisible image-forming unit of a plot or video display. Each cell can have assigned attributes, in addition to color. In raster processing, pixels refer to a single cell within a matrix of grid cells (Kansas Association of Mappers).

Pixel Resolution

The size of a single pixel in an image file (aerial or satellite), that defines the minimum size of features that can be identified in the image.

Point Features

Features in a geospatial data set stored as point locations (see entry for Point).

Point

Single X,Y (optionally Z) location in space. Dimensionless geometric feature having no other spatial properties except location. Many natural and man-made features are modeled as points in a geospatial database including trees, hydrants, poles, buildings, etc. (URISA GIS Glossary).

Polygon

A closed plane figure bounded by three or more line segments, used to represent area features in a geospatial data set (URISA GIS Glossary).

Position Mode

The settings made on a GPS receiver that puts it in a state to records positions (locations).

Positional Accuracy

The accuracy (correctness) of the locations recorded by the GPS receiver. A measure or statement of the quality of locational data recorded by a GPS receiver.

Post-processed

Manipulation of GPS data after it has been recorded in the field. Generally the raw positions recorded by the receiver must be transferred to a computer for additional processing to improve accuracy of positions through differential correction and to export to a geospatial file. See entry for Differential correction.

Projection

A mathematical method for representing the shape of the earth on a flat plane; a formula that converts latitude-longitude locations on the earth's spherical surface to X,Y locations on a map's flat surface (URISA GIS Glossary).

Pseudo-nodes

In a geodatabase topology or ArcInfo coverage, a node connecting only two edges or arcs, or the endpoint of an edge or arc that connects to itself (ESRI ODG)

Raster Data Sets

Raster data is a spatial data stored using the raster data model. This model stores data in an evenly spaced grid, where each grid square (pixel) stores a data. Raster datasets are commonly used to store imagery (aerial and satellite) or continuous data, such as elevation values, for examples. Examples of data file formats for raster data sets include JPEG, JPEG 2000, ESRI Grid, MrSid, TIFF,and GeoTiff.

Root Mean Square (RMS), Root Mean Square Error (RMSE)

A calculated value that measures the error of a point measurement. RMSE is the square root of the average of the set of squared differences between dataset coordinate values and coordinate values from an independent source of higher accuracy for identical points.
Or more simply, a statement of the root mean square error calculated between a mapped location and a location of higher accuracy known to be correct (FGDC, 1998, Part 3, p. 3-4).

Rover

Any mobile GPS receiver and data collector used for determining location in the field. A roving receiver's position can be differentially corrected relative to a stationary base GPS receiver (NYS GPS Glossary).

Satellites

The orbiting space vehicles (SVs) that make up the space-based portion of the GPS system. Satellites send the radio transmissions that are the basis for the calculation of location using GPS receivers.

Scale

Relationship between the dimensions of a feature on a map and the geographic features they represent on the earth, commonly expressed as a fraction. For example, a map scale of 1:24000 means that one unit of measure on the map equals 24,000 of the same unit on the earth (1 inch would equal 24,000 inches, or 2000 feet). Also, scale often refers to a calibrated line, as on a map or an architectural plan, indicating such a proportion (URISA GIS Glossary).

Schema

The structure or design of a database or database object, such as a table, view, index, stored procedure, or trigger. In a relational database, the schema defines the tables, the fields in each table, the relationships between fields and tables, and the grouping of objects within the database. Schemas are generally documented in a data dictionary. A database schema provides a logical classification of database objects (ESRI OGD). Schema files are often coded in XML (Extensible Markup Language).

Shapefile

A vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a set of related files and contains one feature class (ESRI OGD). Due to its wide spread use, the shapefile format has become an unofficial standard in the geospatial industry.

Signal to Noise Ratio (SNR)

The signal strength of a satellite is a measure of the information content of the signal, relative to the signal's noise. The typical SNR of a satellite at 30° elevation is between 47 and 50 dBHz. The quality of a GPS position is degraded if the SNR of one or more satellites in the constellation falls below 39. This value is used to determine whether the signal strength of a satellite is sufficient for that satellite to be used by the GPS receiver. If a satellite's SNR is below the configured minimum SNR, that satellite is not used to compute positions (NYS GPS Glossary).

Significant Digits

The number of significant digits in a measurement is the number of digits that are known with some degree of reliability. This is indication of the accuracy and precision of a number, especially related to coordinate location values.

Sliver, Sliver Polygon

Refers to polygons formed when two adjacent polygons do not abut along a single common line resulting in the creation of a very thin polygon being present between the larger two. A small gap between two lines created erroneously (Kansas Association of Mappers).

Small Scale

A statement of map scale. Relative to a larger scale, a small scale map that shows a relatively larger but less detail. For example and map at a scale of 1:24,000 is smaller scale when compared with a map that has 1:2,000 scale. See entry for scale.

Snap, Snapping

An automatic editing operation in which points or features within a specified distance (tolerance) of other points or features are moved to match or coincide exactly with each other. (ESRI OGD).

SNR

See entry for Signal to Noise Ratio.

Spatial Reference

Information geospatial data that indicates what spatial reference system (SRS) or coordinate reference system (CRS) was used. This would include reference to the geodetic characteristics of the data, such as the datum and projection.

Spheroid

Any surface differing slightly from a true sphere. A spheroid model of the shape of the Earth is a basic component of many geographic and coordinate reference systems.

State Plane

A plane rectangular coordinate systems known as the state plane coordinate systems.
Each State in the United States of America has its own state plane coordinate system (or state coordinate system). When necessary, the coordinates in the coordinate system of a particular state are referred to by the name of the state, e.g., New Jersey state plane coordinates. State plane coordinates are used extensively for calculating and recording the results of land surveys (NGA Geodetic Glossary).

Survey, Surveying

The orderly process of determining data relating to any physical, chemical or geometric characteristic of the Earth. Surveying, in New Jersey is conducted by licensed land surveyors and produces highly spatially accurate locational information.

Survey Grade

Geospatial data created by a licensed land surveyor, or that was collected in accordance with, and has the positional accuracy of a survey. Survey grade data or data collection methods and instruments are considered highly accurate.

Threshold Value

Often used in reference to GPS data collection. A value that serves as an indicator when it is reached or surpassed, or a value that should not be breached. An example from GPS data collection is PDOP greater than 6 (the threshold). Data collected with a PDOP greater than the threshold is unacceptable, and the GPS receiver can be prevented from collecting data when PDOP exceeds that value.

Tic

A term associated with the ESRI coverage format. A registration or geographic control point for a coverage representing a known location on the earth's surface. Tics allow all coverage features to be recorded in a common coordinate system. Tics are used to register map sheets when they are mounted on a digitizer. They are also used to transform the coordinates of a coverage, for example, from digitizer units (inches) to the appropriate values for a particular coordinate system (ESRI OGD).

Tic Match

Identifying, or matching a tic in a coverage layer with its related point on a map or geospatial data layer, for the purpose of georeferencing.

TIFF

TIFF is an acronym for Tagged Image File Format (OSGEO, GeoTIFF). It is a format that is commonly used to store geospatial imagery (see entry for GeoTIFF).

TIN

Acronym of Triangulated Irregular Network. A TIN is a format for representing a continuous surface (such as elevation) in a vector rather than a raster format.

Topology, Topologies , Topologic Rules

In a vector data model, the rules and requirements relating to and describing the spatial relationships of features (points, lines, polygons) within a geospatial data set and also among various related datasets. Topology rules in a GIS enforce the ways in which points connect to lines, and lines connect to form polygons, and the way in which these feature should or should not overlap (e.g., lines may intersect only where there is a point in both line features, a polygon must be enclosed by lines or it is not a polygons). A geospatial data set must have accurate topology if it is to be used for analysis and geoprocessing with other data sets.

Transverse Mercator

A map projection that is the basis of the New Jersey State Plane Coordinate System. On a Transverse Mercator projection, the central meridian (the central north-south straight line) is the line of true scale. This makes the projection appropriate for areas with long north-south extent and narrow east-west extent (USGS, 1997).

USGS

Acronym for United States Geological Survey.

Vector Data

Geospatial data composed of discrete features represented by points, lines and polygons.

Vector Data Sets

Geospatial data sets in vector format (see vector data).

Vertices, Vertex

One of a set of ordered x,y coordinate pairs that defines the shape of a line or polygon feature (ESRI, OGD).

View Scale

The scale at which geospatial data are viewed. In GIS the view scale can change dynamically as the GIS user zooms in or zooms out on the map view.

Weed, Weeding

Also referred to as thinning. The process of removing unneeded vertices from line work stored in a geospatial data set. A vertex is needed to define a change in the position or shape of a line. If a vertex, or vertices, does not indicate a change in the geometry of the line, then it is superfluous and can be "weeded" out or deleted. Weeding is useful because many extra vertices needlessly increase the complexity and file size of a vector data set.

Weed Tolerance

A distance setting that prevents a new vertex being added with that distance. A threshold setting that automatically removes unnecessary vertices (see entry for Weed).

World File

A file, used in conjunction with a raster layer, such as aerial or satellite imagery that provides geospatial information for the corresponding layer. In the case of a TIFF file, a world file would be a small text file with the same name as the raster layer, but with a TWF file extension.

XML

Acronym for Extensible Markup Language. XML was developed by the W3C, a standardized general purpose markup language for designing text formats that facilitates the interchange of data between computer applications. XML is a set of rules for creating standard information formats using customized tags and sharing both the format and the data across applications (ESRI OGD).

XY Coordinate System

A geographic reference system for indicating locations on the surface of the earth from as a measurement from an origin along two axes-- a horizontal axis (x), and a vertical axis (y). On a map, x,y coordinates are used to represent features at the location they are found on the earth's spherical surface (ESRI OGD).

XY Tolerance

A setting for data creation or editing that sets the minimum distance that is possible between coordinates before they would collapse into one coordinate. Usually the XY tolerance is a very small distance to prevent features from moving when editing or during geoprocessing tasks.

Z Coordinate System

In an x,y coordinate system, the z value records the location in a third dimension, usually elevation or depth.

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