National Mapping Program
Technical Instructions

Part 6
Digital Orthophoto Quadrangles

Standards for the Preparation of Digital Geospatial Metadata

U.S. Department of the Interior
U.S. Geological Survey
National Mapping Division

Standards for the Preparation of Digital Geospatial Metadata
Part 6: Digital Orthophoto Quadrangles

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Standards for the Preparation of Digital Geospatial Metadata
Part 6: Digital Orthophoto Quadrangles

1. IDENTIFICATION INFORMATION

Identification information provides basic information about the data set, including the title, geographic area covered, currentness, and rules for acquiring or using the data. Required elements of metadata are those necessary for identification of the data set and include citation, description, time period of content, status, spatial domain, keywords, access constraints, and use constraints. The identification information is a mandatory element of the data set metadata.

1.1 CITATION

The citation is the recommended reference to be used for the data set. The citation information is composed of the following:

originator - name of an organization or individual that developed the data set

publication date - the date when the data set is published or otherwise made available for release

title - the name by which the data set is known

geospatial data presentation form - mode in which the geospatial data are represented. This element usually identifies types of cartographic data in hardcopy form; no reference is made to digital files or media in this element.

publication information - publication detail for published data sets. For NMD data sets, the publisher is always the U.S. Geological Survey and the publication place always appears as Reston, Va

publication place - name of the city (and State) where the data set was published or released

publisher - name of the individual or organization that published the data set

1.1.1 Example

Identification_Information:
Citation:
Citation_Information:
Originator: *U.S. Geological Survey*
Publication_Date: the date (year or year and month) the image was archived in the Sales Data Base (SDB); format YYYY or YYYYMM
Title: the Geographic Cell Names Data Base designation for the DOQ
Geospatial_Data_Presentation_Form: remote-sensing image
Publication_Information:
Publication_Place: *Reston VA*
Publisher: *U.S. Geological Survey*

1.2 DESCRIPTION

This element consists of an abstract, the purpose of the data set, and any optional supplemental information.

abstract - a brief narrative summary of the data set

purpose - a summary of the intentions with which the data set was developed

supplemental information - additional optional information about the data set (included as needed)

1.2.1 Example

Abstract:
A digital orthophoto quadrangle (DOQ) is a raster image of

remotely sensed data in which displacement in the image caused by sensor orientation and terrain relief has been removed. A DOQ combines the image characteristics of a photograph with the geometric qualities of a map. The primary DOQ is a 1-meter ground sample distance, quarter-quadrangle (3.75-minutes of latitude by 3.75-minutes of longitude) image cast on the Universal Transverse Mercator Projection (UTM) on the North American Datum of 1983 (NAD83). The geographic extent of the DOQ is equivalent to a quarter-quad plus overedge. The overedge ranges from a minimum of 50 meters to a maximum of 300 meters beyond the extremes of the primary and secondary corner points. The overedge is included to facilitate tonal matching for mosaicking and for placing the NAD83 and secondary datum corner ticks. The normal orientation of data is by lines (rows) and samples (columns). Each line contains a series of pixels ordered from west to east, with the order of the lines from north to south. An uncompressed gray-scale DOQ is formatted with a variable length ASCII header followed by a series of 8-bit image data lines. For gray-scale DOQ's, the radiometric image brightness values are stored as 256 gray levels ranging from 0 to 255. The metadata provided with the digital orthophoto contain a wide range of descriptive information, including source information, production system and dates, and data to assist with displaying and georeferencing the image.

Purpose:

DOQ's serve a variety of purposes, from interim maps to field references for earth science investigations and analysis. The DOQ is useful as a layer of a geographic information system and as a tool for revising digital line graphs and topographic maps.

1.3 TIME PERIOD OF CONTENT

This element may be a single date/time, multiple dates/times, or a range of dates/times and a currentness reference.

single date/time - the means of encoding a single date and time
calendar date - the year representing the latest date of

information in the data set

currentness reference - the basis on which the content currentness is determined; for example, ground condition

1.3.1 Example

Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: the date (year, month, and day) of the photographs (in the case of mosaicked images, the oldest date of the input source images is used); format YYYYMMDD
Currentness_Reference: *ground condition*

1.4 STATUS

This element includes the progress, maintenance, and update frequency information.

progress - the state of the data set

maintenance and update frequency - the frequency with which changes and additions are made to the data set after the initial data set is completed

1.4.1 Example

Progress: *complete*
Maintenance_and_Update_Frequency: *irregular*

1.5 SPATIAL DOMAIN

This element shows the areal coverage of the data set. The limits are given in latitude-longitude values in decimal degrees. For data sets that include a complete band of latitude around the Earth, the west bounding coordinate is assigned the value of minus (-)180.0 and

the east bounding coordinate is assigned the value 180.0. Data sets with overedge coverage are referenced to the nominal tile coordinates in the NDCDB.

bounding coordinates - the latitude and longitude values for the data set in the following order:

west bounding coordinate: the westernmost longitude of the data set
east bounding coordinate: the easternmost longitude of the data set
north bounding coordinate: the northernmost latitude of the data set
south bounding coordinate: the southernmost latitude of the data set

1.5.1 Example

Spatial_Domain:
Bounding _Coordinates: (do not include overedge)
West_Bounding_Coordinate: western longitude in decimal degrees
East_Bounding_Coordinate: eastern longitude in decimal degrees
North_Bounding_Coordinate: northern latitude in decimal degrees
South_Bounding_Coordinate: southern latitude in decimal degrees

1.6 KEYWORDS

Keywords are words or phrases summarizing an aspect of the data set. This element is composed of theme, place, stratum, and temporal keywords. The NMD uses only the theme and place subelements.

theme - subjects covered by the data set

theme keyword thesaurus - reference to a formally registered thesaurus or similar authoritative source of theme keywords;

theme keyword - common-use word or phrase used to describe the

content of the data set and the type of digital data

place - geographic locations covered by the data set

place keyword thesaurus - reference to a formally registered thesaurus or a similar authoritative source of place keywords

place keyword - the geographic name of a location covered by a data set; usually US and the two-letter State abbreviation. No reference is used for Canada and Mexico because digital data outside the United States are not archived as part of the data set.

1.6.1 Example

Theme:
Theme_Keyword_Thesaurus: none
Theme_Keyword: *DOQ*
Theme_Keyword: *digital orthophoto*
Theme_Keyword: *digital orthophotoquad*
Theme_Keyword: *aerial photograph*
Theme_Keyword: *rectified photograph*
Theme_Keyword: *rectified image*
Theme_Keyword: *orthophoto*
Theme_Keyword: *quarter-quadrangle orthophoto*
Theme_Keyword: *1-meter orthophoto*
Theme_Keyword: *2-meter orthophoto*
Theme_Keyword: *3.75- x 3.75-minute orthophoto*
Theme_Keyword: *7.5- x 7.5-minute orthophoto*
Place:
Place_Keyword_Thesaurus:
U.S. Department of Commerce, 1977, Countries, dependencies, areas of special sovereignty, and their principal administrative divisions Federal Information Processing Standard 10-3):Washington, D.C., National Institute of Standards and Technology.

Place_Keyword: *US*
Place_Keyword_Thesaurus:
U.S. Department of Commerce, 1987, Codes for the identification of the States, the District of Columbia and the outlying areas of the United States, and associated areas (Federal Information Processing Standard 5-2): Washington, D.C., National Institute of Standards and Technology
Place_Keyword: the two-letter designation for the State

1.7 ACCESS CONSTRAINTS

Access constraints are the restrictions and legal prerequisites for accessing the data set, including constraints to protect privacy or intellectual property or limitations on obtaining the data set.

1.7.1 Example

Access_Constraints: *none*

1.8 USE CONSTRAINTS

This element sets out the restrictions and legal prerequisites for using the data set after access is granted.

1.8.1 Example

Use_Constraints:
None. Acknowledgment of the U.S. Geological Survey would be appreciated for products derived from these data.

1.9 DATA SET CREDIT

This element provides recognition of those who contributed to the data set.

1.9.1 Example

Data_Set_Credit: include other Federal or State agencies, cooperators, or partnerships that contribute to the production of the data set

1.10 NATIVE DATA SET ENVIRONMENT

This element provides a description of the data set in the producer's processing environment, including items such as the name and version of the software, the computer operating system, file name including host-, path- and filenames, and the data set size.

1.10.1 Example

Native_Data_Set_Environment: include the software name and version, computer operating system name, and the uncompressed file size, including header, in bytes

2. DATA QUALITY INFORMATION

Data quality information provides a general assessment of the quality of the data set. Recommendations on information to be reported and tests to be performed are found in "Spatial Data Quality," chapter 1, part 3, *in* U.S. Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, D.C., National Institute of Standards and Technology.

2.1 ATTRIBUTE ACCURACY

Attribute accuracy is an assessment of the accuracy of the identification of entities and assignment of attribute values in the data set.

attribute accuracy report - the explanation of the accuracy of the identification of the entities and assignments of values in the data set and a description of the test used

2.1.1 Example

Attribute_Accuracy_Report:

During photographic reproduction of the source photographs, limited analog dodging is performed to improve image quality. Analog dodging consists of holding back light from certain areas of the sensitized photographic material to avoid overexposure. The diapositive is inspected to ensure clarity and radiometric uniformity. Diapositive image brightness values are collected with a minimum of image quality manipulation. Image brightness values may deviate from the brightness values of the original images because of image value interpolation during the scanning and rectification processes.

Radiometry is verified by visual inspection of the digital

orthophoto quadrangle with the original unrectified image to determine if the digital orthophoto has the same or better image quality as the original unrectified input image. Slight systematic radiometric differences can be detected between adjacent DOQ files; these are due primarily to differences in source photograph capture dates and sun angles along flight lines when the aerial photographs were taken. These differences can be observed in an image's general lightness or darkness when it is compared to adjacent DOQ file coverages.

2.2 LOGICAL CONSISTENCY REPORT

This element provides an explanation of the fidelity of the relationships in the data set and the tests used.

2.2.1 Example

Logical_Consistency_Report:
All DOQ header data and image file sizes are validated using USGS software before being archived. This validation procedure ensures correct physical format and field values for header elements. Logical relationships between header elements are tested.

2.3 COMPLETENESS REPORT

This element provides information about omissions, selection criteria, generalization, definitions, and other rules used to derive the data set. Use the appropriate description depending on the revision status of the data set.

2.3.1 Example

Completeness_Report:
DOQ images are visually inspected for completeness to ensure that no gaps or image misplacements exist in the 3.75' image area or in overedge coverage. DOQ images can be derived by mosaicking

multiple images to ensure complete coverage. DOQ's are cloud free within the 3.75' image area. Some clouds may, very infrequently, appear in the overedge coverage. National Aerial Photography Program (NAPP) source photography is leaf-off in deciduous vegetation regions. Coastal areas and international boundary regions may have areas without images (void areas) in parts of the 3.75' coverage. Slivers of void areas in the outside edges of a DOQ may result also from image transformation from other planimetric systems to the Universal Transverse Mercator (UTM). These void areas have a radiometric value of either zero (black) or 128 (uniform gray).

The data set field content of each DOQ header element is validated to ensure completeness before archiving.

The area of coverage for a standard USGS digital orthophoto is either a quarter-quadrangle (3.75 minutes of latitude by 3.75 minutes of longitude plus overedge) or quadrangle (7.5 minutes of latitude by 7.5 minutes of longitude plus overedge).

The USGS requires image overedge to provide overlap coverage between adjoining DOQ's to facilitate edge matching and mosaicking. That overedge extent is approximately 300 (±30) meters beyond the extremes of the primary and secondary datum corner points for the standard digital orthophoto quadrangle.

However, some Federal, State and local agencies, and private entities not associated with the National Digital Orthophoto Program (NDOP) may provide DOQ's to the USGS under cooperative agreement programs.

To meet the requirements of the NDOP and include other sources of DOQ's, the geographic extent for DOQ's shall beas follows:

For DOQ's produced under NDOP funding agreements: 300 (±30) meters minimum beyond the extremes of the primary and secondary

datum corner points.

For DOQ's produced under other cooperative agreements: a minimum of 50 meters beyond the primary and secondary horizontal datum corner point extremes.

The resulting digital orthophoto is a rectangle whose size may vary in relation to adjoining digital orthophotos.

2.4 POSITIONAL ACCURACY

The element provides an assessment of the accuracy of the positions of spatial objects in horizontal position.

horizontal positional accuracy - an estimate of accuracy of the horizontal positions of the spatial objects

horizontal positional accuracy report - an explanation of the accuracy of the horizontal coordinate measurements and a description of the tests used.

2.4.1 Example

Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
The DOQ horizontal positional accuracy and the assurance of that accuracy depend, in part, on the accuracy of the data inputs to the rectification process. These inputs consist of the digital elevation model (DEM), aerotriangulation control and methods, the photograph source camera calibration, scanner calibration, and aerial photographs that meet National Aerial Photography Program (NAPP) standards. The vertical accuracy of the verified USGS format DEM is equivalent to or better than a USGS level 1 or 2 DEM, with a root mean square error (RMSE) of no greater than 7.0 meters. Field control is acquired by third-order class 1 or better survey methods

sufficiently spaced to meet National Map Accuracy Standards (NMAS) for 1:12,000-scale products.

Aerial cameras have current certification from the USGS, National Mapping Division, Optical Science Laboratory. Test calibration scans are performed on all source photograph scanners.

Horizontal positional accuracy is determined by the Orthophoto Accuracy (ORACC) software program for DOQ data produced by the National Mapping Division. The program determines the accuracy by finding the line and sample coordinates of the passpoints in the DOQ and fitting these to their ground coordinates to develop a root mean square error (RMSE). From 4 to 9 points are checked. As a further accuracy test, the image line and sample coordinates of the DEM corners are transformed and compared with the actual X,Y DEM corner values to determine if they are within the RMSE. Additional information on this testing procedure can be found in U.S. Department of the Interior, U.S. Geological Survey, 1993, Technical Instructions, ORACC Users Manual (draft): Reston, Va.

DOQ's produced by cooperators and contractors use similarly approved RMSE test procedures.

Adjacent DOQ's, when displayed together in a common planimetric coordinate system, may exhibit positional discrepancies across common DOQ boundaries. Linear features, such as streets, may not be continuous. These edge mismatches, however, still conform to positional horizontal accuracy within the NMAS.

The USGS, National Mapping Division, periodically conducts field investigations to validate the reliability of DOQ positional accuracy.

Quantitative_Horizontal_Positional_Accuracy_Assessment:
Horizontal_Positional_Accuracy_Value: use the RMSE for the DOQ
Horizontal_Positional_Accuracy_Explanation:
U.S. Bureau of the Budget, 1947, United States National Map Accuracy Standards

2.5 LINEAGE

This element contains information about how the data set was constructed, including the events, parameters, and source data.

source information - list of sources and a short discussion of the information contributed by each

source citation - reference for a source data set(includes the source citation abbreviation, originator, publication date, title, geospatial data presentation form, and publication information)

source scale denominator - the denominator of the representative fraction for the map scale

type of source media - medium of the source data set

source time period of content - time period(s) for which the source data set corresponds to ground condition (includes single or multiple date(s)/time(s) and calendar date)

source citation abbreviation - short-form alias for the source citation

source contribution - brief statement identifying the information contributed by the source to the data set

process step - information about a single event

process description - an explanation of the event and related

parameters.

source used citation abbreviation - the source citation abbreviation (alias) of each data set used in the processing step

process date - the date the event was completed

2.5.1 Example

Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator: *U.S. Geological Survey*
Publication_Date: unknown or the date (year or year and month) the DEM was archived; format YYYY or YYYYMM
Title: the Geographic Cell Names Data Base designation for the source 7.5-minute DEM quadrangle
Publication_Information:
Publication_Place: *Reston VA*
Publisher: *U.S. Geological Survey*
Type_of_Source_Media: *cartridge tape*
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: the date (year and month or year, month, and day) of the source photography for photogrammetrically derived DEMs, the date (year or year and month) of contour compilation source, or unknown; format YYYY, YYYYMM, or YYYYMMDD
Source_Currentness_Reference: *ground condition*
Source_Citation_Abbreviation: *DEM1*
Source_Contribution: *elevation data in the form of an ortho-DEM regridded to user-specified intervals and bounds*
Source_Information:

Source_Citation:
Citation_Information:
Originator: *U.S. Geological Survey*
Publication_Date: the date (year or year and month) the photograph is available to the public for purchase; that is, when the DEM is entered in the SDB; format YYYY or YYYYMM
Title: aerial photo frame ID
Geospatial_Data_Presentation_Form: *remote-sensing image*
Publication_Information:
Publication_Place: *Reston, VA*
Publisher: *U.S. Geological Survey*
Source_Scale_Denominator: *40000*
Type_of_Source_Media: *stable base material*
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: date (year and month or year, month, and day) of photography; format YYYYMM or YYYYMMDD
Source_Currentness_Reference: *ground condition*
Source_Citation_Abbreviation: *PHOTO1*
Source_Contribution: *Stable-base aerial photography film provides most of the images for DOQ's. Film may be panchromatic black-and-white NAPP (or NAPP-like) or color-infrared (CIR) NAPP (or NAPP-like).*
Source_Information:
Source_Citation:
Citation_Information:
Originator: *U.S. Geological Survey*
Publication_Date: *unpublished material*
Title: *project ground and photo control*
Publication_Information:
Publication_Place: *Silver Spring, MD*
Publisher: *National Geodetic Survey (NGS)*
Type_of_Source_Media: *various media*
Source_Time_Period_of_Content:

Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: *unknown*
Ending_Date: *unknown*
Source_Currentness_Reference: *ground condition*
Source_Citation_Abbreviation: *CONTROL_INPUT*
Source_Contribution: *horizontal and vertical control used to establish positions and elevations for reference and correlation purposes*
Source_Information:
Source_Citation:
Citation_Information:
Originator: *U.S. Geological Survey*
Publication_Date: *unpublished material*
Title: *report of calibration*
Publication_Information:
Publication_Place: *Reston, VA*
Publisher: *U.S. Geological Survey*
Type_of_Source_Media: *disc, paper*
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: *unknown*
Ending_Date: *unknown*
Source_Currentness_Reference: date of the calibration of the camera associated with the source photography
Source_Citation_Abbreviation: *CAMERA_INPUT*
Source_Contribution: *camera calibration parameters*
Process_Step:
Process_Description:
The production procedures, instrumentation, and hardware and software used in the collection of standard USGS DOQ's vary depending on systems used at the contract, cooperator, or USGS production sites. The majority of DOQ data sets are acquired through Government contract. The process step describes, in

general, the process used in the production of standard USGS DOQ data sets.

The rectification process requires, as input, a user parameter file to control the rectification process, a digital elevation model (DEM1) gridded to user-specified bounds, projection, zone, datum and X-Y units, a scanned digital image file (PHOTO1) covering the same area as the DEM, ground X-Y-Z point values (CONTROL_INPUT) and their conjugate photograph coordinates in the camera coordinate system, and measurements of the fiducial marks (CAMERA_INPUT) in the digitized image.

The camera calibration report (CAMERA_INPUT) provides the focal length of the camera and the distances in millimeters from the camera's optical center to the camera's eight fiducial marks. These marks define the frame of reference for spatial measurements made from the photograph. Ground control points (CONTROL_INPUT) acquired from ground surveys or developed in aerotriangulation are third-order class 1 or better and meet National Map Accuracy Standards (NMAS) for 1:12,000-scale. Ground control points are in the Universal Transverse Mercator or the State Plane Coordinate System on NAD83. Horizontal and vertical residuals of aerotriangulated tie-points are equal to or less than 2.5 meters. Standard aerotriangulation passpoint configuration consists of nine ground control points, one near each corner, one at the center near each side, and one near the center of the photograph. The conjugate positions of the ground control points on the photograph are measured and recorded in camera coordinates.

The raster image file (PHOTO1) is created by scanning an aerial photograph film diapositive with a precision image scanner. An aperture of approximately 25 to 32 microns is used, with an aperture no greater than 32 microns permitted. Using 1:40,000-scale photographs, a 25-micron scan aperture equates to a ground resolution of 1-meter. The scanner

converts the photographic image densities to gray-scale values ranging from 0 to 255 for black-and-white photographs. Scan files with ground resolution less than 1 meter or greater than 1 meter but less than 1.28 meters are resampled to 1 meter.

The principal elevation data source (DEM1) is a standard DEM data set from the National Digital Cartographic Data Base (NDCDB). DEM's that meet USGS standards are also produced by contractors to fulfill DOQ production requirements and are subsequently archived in the NDCDB. All DEM data are equivalent to or better than USGS DEM standard level 1. The DEM used in the production of DOQ's generally has a 30-meter grid post spacing and possesses a vertical RMSE of 7 meters or less. A DEM covering the extent of the photograph is used for the rectification. The DEM is traversed from user-selected minimum to maximum X-Y values, and the DEM X-Y-Z values are used to find pixel coordinates in the digitized photograph using the transformations mentioned above. For each raster image cell subdivision, a brightness or gray-scale value is obtained using nearest neighbor, bilinear, or cubic convolution resampling of the scanned image. The pixel processing algorithm is indicated in the header file. An inverse transformation relates the image coordinates referenced to the fiducial coordinate space back to scanner coordinate space. For those areas for which a 7.5-minute DEM is unavailable and relief differences are less than 150 feet, a planar-DEM (slope-plane substitute grid) may be used.

Rectification Process: The photo control points and focal length are iteratively fitted to their conjugate ground control points using a single photo space resection equation. The camera location and orientation in the form of a rotation matrix is obtained from this mathematical fit. This rotation matrix can then be used to find the photograph or camera coordinates of any other ground X-Y-Z point. Next, a two-dimensional fit is made between the measured fiducial marks on

the digitized photograph and their conjugate camera coordinates. Transformation constants are developed from the fit, and the camera or photograph coordinates are used in reverse to find their conjugate pixel coordinates on the digitized photograph.

The DEM is traversed from user-selected minimum to maximum X-Y values and the DEM X-Y-Z values are used to find pixel coordinates in the digitized photograph using the transformations mentioned above. For each raster image cell subdivision, a brightness or gray-scale value is obtained using nearest neighbor, bilinear, or cubic convolution resampling of the scanned image. An inverse transformation relates the image coordinates referenced to the fiducial coordinate space back to scanner coordinate space.

Quality Control: All data are inspected according to a quality control plan. DOQ contractors must meet DOQ standards for attribute accuracy, logical consistency, data completeness, and horizontal positional accuracy. During the initial production phase, all rectification inputs and DOQ data sets are inspected for conformance to standards. After a production source demonstrates high quality, detailed visual inspections are reduced. All DOQ's are tested for physical format standards.

Source_Used_Citation_Abbreviation: *DEM1, PHOTO1, CONTROL_INPUT, CAMERA_INPUT*

Process_Date: the date (year and month) the DOQ was produced

3. SPATIAL DATA ORGANIZATION INFORMATION

Spatial data organization information identifies the mechanism used to represent spatial information in a data set. This category of metadata describes point, vector, and raster objects. The elements dealing with direct spatial references are required. Elements dealing with indirect spatial references are applicable only to certain DLG-3 categories. Point, vector, and raster object information is considered optional in the "Content Standards for Digital Geospatial Metadata" but is used by the USGS to provide further information to data users.

3.1 DIRECT SPATIAL REFERENCE METHOD

This element defines the type of data in the data set. Data types are point, vector, and raster.

3.1.1 Raster Object Information

This element provides the types and numbers of raster spatial objects in the data set.

raster object type - raster spatial objects used to reference locations in the data set. NMD uses pixel for image data and grid cell for elevation data.

row count - the maximum number of raster objects along the ordinate (y) axis in rectangular data sets; must be greater than 0

column count - the maximum number of raster objects along the abscissa (x) axis in rectangular data sets; must be greater than 0

3.1.1.1 Example

Direct_Spatial_Reference:
Direct_Spatial_Reference_Method: *raster*

Raster_Object_Information:
Raster_Object_Type: *pixel*
Row_Count: use the number of lines shown in the DOQ header
Column_Count: use the number of samples shown in the DOQ header

4. SPATIAL REFERENCE INFORMATION

Spatial reference information describes the reference frame for and the means of encoding coordinates in the data set.

4.1 HORIZONTAL COORDINATE SYSTEM DEFINITION

The horizontal coordinate system definition provides the reference frame or system from which linear or angular distances are measured to locate the position a point occupies in the data set. The element provides information about the latitude/longitude resolution, map projection, and horizontal datum.

planar - the quantities of distances, or distances and angles, that define the position of a point on a reference plane to which the surface of the Earth has been projected

grid coordinate system - a plane-rectangular coordinate system usually based on, and mathematically adjusted to, a map projection so that geographic positions can be readily transformed to and from plane coordinates. Systems used by the NMD include Universal Transverse Mercator (UTM) and State Plane Coordinate System (SPCS) with zone identification.

planar coordinate information - information about the coordinate system developed on the planar surface

planar coordinate encoding method - the means used to represent horizontal positions; the NMD uses coordinate pairs for point and vector data and uses rows and columns for grid coordinate system data sets

coordinate representation - the method of recording the position of a point by measuring its distance from perpendicular reference axes for coordinate pairs or row and column methods; values for the abscissa and ordinate resolution are given in planar distance units of measure

(meters for data sets in coordinate pairs and grid coordinate systems and arc-seconds for data sets in geographic coordinate systems)

planar distance units - units of measure used for distances

geodetic model - parameters for the shape of the Earth; parameters include horizontal datum name (North American Datum of 1927 or North American Datum of 1983), ellipsoid name, semi-major axis, and the denominator of the flattening ratio

4.1.1 Example

Horizontal_Coordinate_System_Definition:
Planar:
Grid_Coordinate_System:
Grid_Coordinate_System_Name: *Universal Transverse Mercator*
Universal_Transverse_Mercator:
UTM_Zone_Number: use the UTM zone for the data set
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: *0.9996*
Longitude_of_Central_Meridian: use the central meridian for the zone the data set falls in
Latitude_of_Projection_Origin: *0.0*
False_Easting: *500000*
False_Northing: *0.0*
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: *row and column*
Coordinate_Representation:
Abscissa_Resolution: ground sample distance of DOQ
Ordinate_Resolution: ground sample distance of DOQ
Planar_Distance_Units: *meters*

Geodetic_Model:
Horizontal_Datum_Name: *North American Datum 1983*
Ellipsoid_Name: *Geodetic Reference System 80 (GRS 80)*
Semi-major_Axis: *6378137*
Denominator_of_Flattening_Ratio: *298.257*

5. ENTITY AND ATTRIBUTE INFORMATION

This element provides information about the information content of the data set, including entities types, their attributes, and the domains from which attribute values can be assigned.

5.1 OVERVIEW DESCRIPTION

This element contains a summary of and citation to the detailed description of the information content of the data set. The NMD is using the summary overview description for digital products.

5.1.1 Entity and Attribute Overview

This element provides a detailed summary of the information contained in a data set, including the attribute codes and the format of the attribute code for DLG's. The summary for raster files specifies the size and range of acceptable values for the data set. For gridded data sets, this element specifies the size of the integer value and the range of acceptable values.

5.1.1.1 Example

Overview_Description:

Entity_and_Attribute_Overview:

For DOQ's from a panchromatic source, each pixel contains an 8-bit gray-scale value between 0-255. A value of 0 represents the color black, and a value of 255 represents the color white. All values between 0 and 255 are represented as a shade of gray varying from black to white. For color-infrared and natural color DOQ's, a digital number from 0 to 255 will also be assigned to each pixel and for each band in a three-band image represented by red, blue, and green (RBG). Areas where the rectification process is incomplete because of incomplete data (that is, lack of elevation data, gaps) are represented with the

numeric value of 0 or 128.

5.1.2 Entity and Attribute Detail Citation

This element provides the name of the actual reference standard for the attribute codes and includes an FTP anonymous site Internet address if the standards are available in soft copy.

5.1.2.1 Example

Entity_and_Attribute_Detail_Citation:
U.S. Department of the Interior, U.S. Geological Survey, 1996, Standards for Digital Orthophotos: Reston, Va.

6. DISTRIBUTION INFORMATION

This element provides information about the distributor and means of obtaining the data set. The NMD Data and Information Delivery activity is responsible for maintaining and updating the information in this section.

6.1 DISTRIBUTOR

This element provides information about the distributor from whom the data set can be obtained.

6.1.1 Example

Distributor:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
Earth Science Information Center, U.S. Geological Survey
Contact_Address:
Address_Type: *mailing address*
Address: *507 National Center*
City: *Reston*
State_or_Province: *Virginia*
Postal_Code: *20192*
Contact_Voice_Telephone: *1 800 USA MAPS*
Contact_Voice_Telephone: *1 800 872 6277*
Contact_TDD/TTY_Telephone: *703 648 4119*
Contact_Facsimile_Telephone: *703 648 5548*
Contact_Electronic_Mail_Address: *esicmail@usgs.gov*
Hours_of_Service: *0800-1600 Monday-Friday*
Contact_Instructions:
In addition to the ESIC at the address above there are other ESIC offices throughout the country. A full list of these offices is at
http://mapping.er.usgs.gov/esic/esic_index.html

6.2 RESOURCE DESCRIPTION

This element gives the name by which the distributor knows the data set.

6.2.1 Example

Resource_Description: *DOQ*

6.3 DISTRIBUTION LIABILITY

This element contains the statement of liability assumed by the distributor for the data set.

6.3.1 Example

Distribution_Liability:

Although these data have been processed successfully on a computer system at the U.S. Geological Survey (USGS), no warranty expressed or implied is made by the USGS regarding the utility of the data on any other system, nor shall the act of distribution constitute any such warranty. The USGS will warrant the delivery of this product in computer-readable format and will offer appropriate adjustment of credit when the product is determined unreadable by correctly adjusted computer input peripherals or when the physical medium is delivered in damaged condition. Requests for adjustment of credit must be made within 90 days from the date of this shipment from the ordering site.

6.4 STANDARD ORDER PROCESS

This element details the common ways in which the data set can be obtained or received, and related instructions and fee information. It addresses data in digital form and provides digital transfer information, digital transfer options, offline and online ordering options, fees, and ordering instructions.

6.4.1 Example

Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: *USGS DOQ*
Format_Information_Content:
USGS uncompressed DOQ: The uncompressed DOQ is a raw binary file preceded by a metadata header that consists of keyword entries and blank entries to equal the length of a single or a multiple of a single line of image data. Each keyword entry in the header is 80 characters in length and terminated by an ASCII newline character included in the character count of the line.
Transfer_Size: use the data set size in megabytes rounded to the next higher .1 megabyte
Digital_Transfer_Option:
Offline_Option:
Offline_Media: *8mm cassette tape*
Recording_Capacity:
Recording_Density: *4.5 (high)*
Recording_Density: *2.3 (low)*
Recording_Density_Units: *gigabytes*
Recording_Format: *unlabeled, uncompressed Unix DD archive format; standard block size: 30,270, but can be provided at 2,048 or multiples of 2,048*
Offline_Option:
Offline_Media: *3480 cartridge tape*
Recording_Capacity:
Recording_Density: *250*
Recording_Density Units: *megabytes*
Recording_Format: *unlabeled, uncompressed Unix DD archive format*
Digital_Form:
Digital_Transfer_Information:

Format_Name: *JPEG*

Format_Information_Content:

The USGS compressed DOQ is an IJG JPEG-compressed file. JPEG is a lossy compression technique. Unlike uncompressed DOQ's, the compressed DOQ does not contain an attached header record because data compression corrupts ASCII text. A separate metadata file accompanies the compressed image file.

File_Decompression_Technique:

The algorithm used by the USGS for compressing DOQ's is IJG JPEG, Version 4.0. This is a lossy compression using a standard Q or quality factor of 30.

Transfer_Size: use the size of the compressed DOQ rounded to the next higher .1 megabyte

Digital_Transfer_Option:

Offline_Option:

Offline_Media: *CD-ROM*

Recording_Format: *ISO 9660*

Compatibility_Information:

This CD-ROM can be used with all computer operating systems that support CD-ROM as a logical storage device. All text files on this disc are in ASCII format. Data files are in ASCII or binary format

Fees:

Fees are subject to change. Call 1-800-USA-MAPS for current prices.

Ordering_Instructions:

The compressed data are distributed on CD-ROM, generally by county. However, some CD-ROM's may contain regions or partial counties and some counties may require multiple CD-ROM's. The presence of a DOQ in the NDCDB does not necessarily indicate that the file is available on a compressed, county-based CD-ROM.

7. METADATA REFERENCE INFORMATION

This element provides information on the currentness of the metadata information and the responsible party. The information includes metadata creation date, contact, and metadata standard and version. Metadata reference information is a mandatory element of the data set metadata.

7.1 METADATA DATE

This element gives the date that the metadata were created or last updated.

7.1.1 Example

Metadata_Date: the date (year or year and month) is the creation date for archive DOQ's for uncompressed images. When the DOQ's are written to CD-ROM, the metadata will be updated. The format for the date is YYYY or YYYYMM.

7.2 METADATA CONTACT

This element provides the name of the party responsible for the metadata information.

7.2.1 Example

Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: *U.S. Geological Survey*
Contact_Address:
Address_Type: *mailing address*
Address: *Building 3, Rm. 3128, MS 532*
Address: *345 Middlefield Road*
City: *Menlo Park*

State_or_Province: *CA*
Postal_Code: *94025-5130*
Contact_Voice_Telephone: *415 329 4309*
Contact_TDD/TTY_Telephone: *415 329 5092*
Contact_Facsimile_Telephone: *415 329 5130*
Contact_Electronic_Mail_Address: *wesi@ignatx.wr.usgs.gov*

7.3 METADATA STANDARD NAME

This element always refers to the FGDC standard in use at the time the data set metadata was created.

7.3.1 Example

Metadata_Standard_Name:
Content Standards for Digital Geospatial Metadata

7.4 METADATA STANDARD VERSION

This element is the version of the FGDC standard in use at the time the metadatawas created.

7.4.1 Example

Metadata_Standard_Version: *19940608*