CHAPTER 3

GEOGRAPHIC INFORMATION SYSTEMS

Article.

1. GIS; State Government Standards and Guidelines.
2. GIS Data.

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ARTICLE 1

GIS; STATE GOVERNMENT STANDARDS AND GUIDELINES

Section.

3-101. GIS software.

State agencies shall coordinate all purchases of GIS software and software maintenance through the Office of the CIO. The Office of the CIO will provide guidance to agencies on GIS software that is compatible with the state's enterprise GIS environment.

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History: Adopted on November 8, 2018.
URL: https://nitc.nebraska.gov/standards/3-101.pdf

3-102. NebraskaMAP portal.

All agency geospatial data and GIS web applications that are available to the public shall be made accessible through the NebraskaMAP portal.

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History: Adopted on November 8, 2018.
URL: https://nitc.nebraska.gov/standards/3-102.pdf

ARTICLE 2

GIS DATA

Section.

3-201. Geospatial metadata standard.

[Section 3-201 appears after this cover page in a legacy format.]

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History: Adopted on September 23, 2005. Amended on July 14, 2016.
URL: https://nitc.nebraska.gov/standards/3-201.pdf

1.0 Standard

All state agencies and entities that receive state funding used, directly or indirectly, for geospatial data development or maintenance shall ensure that geospatial data it collects, produces, maintains, or purchases and which is used for policy development, implementation, or compliance review is documented with metadata compliant with the latest version of the ISO 19115:2003 group of metadata standards for geographic information. Metadata created for datasets using Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata or other standards will need to be translated, updated, or recreated using the ISO 19115 standards.

1.1 Steps/Timeline for Implementation

a. State agencies and other applicable state funded entities shall institute procedures for complying with standard for new geospatial data development or acquisition upon adoption of standard by the NITC.

b. State agencies and other applicable state funded entities shall complete initial listing of existing, applicable geospatial data holdings within three months of the adoption of standard by NITC.

c. State agencies and other applicable state funded entities shall complete minimum documentation of existing, applicable geospatial data holdings within six months of the adoption of standard by NITC. More information about minimum requirements are identified in Appendix I. Metadata Categories and Definitions.

d. State agencies and other applicable state funded entities shall complete ISO 19115-compliant metadata documentation of existing and applicable geospatial data holdings within 12 months of the adoption of standard by NITC. Complete metadata categories and definitions are located in Appendix I.

1.2 Maintenance

The reporting of maintained metadata is important to assure correct documentation and support for intended uses of the data. Entities responsible for creating geospatial data will need to assure metadata is updated and maintained on an ongoing basis and in a timely manner. When modifications to the spatial or attribute data is completed the metadata information will also need to be updated. If necessary, these changes will need to be provided to the appropriate entity(s) responsible for performing quality control and maintenance of the metadata.

1.2.1 Reporting Errors and Handling Updates

The reporting of errors need to be directed to the primary contact identified in the metadata in a timely manner. Updated spatial and attribute information in the data will also need to be redistributed. The date field in the metadata when the last record was modified will also need to be updated to ensure proper records management and communication with others in the workflow.

2.0 Purpose and Objectives

The purposes of this standard is to preserve the public's investment in geospatial data, to save public resources by avoiding unnecessary duplication of expensive geospatial data acquisition, to minimize errors through inappropriate application of geospatial data, and to facilitate harmonious trans-agency public policy decision-making and implementation through the use of shared geospatial data.

2.1 Background

Broadly defined, geospatial data is any data that includes locational or positional information about features in the dataset. Geospatial data provides the data foundation for applications of Geographic Information System (GIS) technology.

The development and maintenance of geospatial data is usually the most expensive component in the implementation of GIS technology. In most cases, this high initial investment is justifiable because of the powerful capabilities of the technology and the fact that, if appropriately maintained, the data will be useful for a very long period, and in many cases, for a wide range of applications.

Most geospatial datasets include numerous attributes and parameters that relate to data variables, methodologies and assumptions. Knowledge and understanding of the implications of these variables is a key to the appropriate utilization of that data. Without appropriate documentation, this specialized knowledge usually resides only in the memory of the GIS specialist(s) who developed the original data. Because of the power of the GIS technology, geo-spatial analysis is increasingly being used to develop and implement a wide range of public policy. In many cases, these public policy applications endure long past the availability of the GIS-specialist(s) who developed one or more of the original geospatial datasets upon which the public policy and its subsequent implementation are based. Without appropriate documentation of attributes and parameters of a geospatial dataset assumptions and variables, it may be difficult for an agency to determine the appropriate use of a dataset after the GIS specialist who originally created the data is no longer available. Without this documentation, it may also be difficult to appropriately maintain the dataset and therefore maintain the value of the original public investment in the data. In the case of a legal challenge to a public policy or its implementation, for which geospatial data application is integral, it may be difficult to defend that application if the original data developer is no longer available and the dataset was not appropriately documented.

Due to the relatively high costs of developing and maintaining many geospatial datasets, it is important that public investments in this data are undertaken in a manner to maximize the long-term return on these public investments. Appropriately documenting a dataset is one way to ensure a dataset's long-term usability. It is also a key to enabling the use of that dataset for multiple applications by multiple users. Without documentation, it is difficult for other users within the same agency, in other state agencies, or other public entities at various levels of government to be confident they are appropriately utilizing a geospatial dataset.

One of the great strengths of GIS technology is the ability to integrate and analyze disparate data based on its common or adjacent location. GIS has evolved to be a mainstream technology, used for a very wide range of applications, highly integrated with other information technology, and employed by users with a wide range of technical expertise and knowledge. As GIS has evolved, users now routinely access geospatial data, via the Internet, from multiple sources and integrate that data with other geospatial data and make public policy decisions based on analysis of the interaction of those datasets. Only when a geospatial dataset is adequately documented is it prudent to incorporate that data into a GIS analysis.

To address this wide range of concerns and needs for geospatial data documentation, the Federal Geographic Data Committee (FGDC) has worked with a wide spectrum of geospatial data users to develop a national standard for documenting geospatial data. The FGDC has endorsed and are transitioning users from the Content Standard for Digital Geospatial Metadata (CSDGM) to the ISO Metadata Standards.

2.2 Objectives

This standard requiring the documentation of geospatial data with standardized metadata has the following objectives:

2.2.1 Preserve public investment in data collection/development beyond the tenure or availability of the original data developer.

2.2.2 Preserve the background geospatial information used to justify and make public policy decisions and preserve the information needed to guide appropriate implementation of those decisions beyond the tenure of a particular data developer.

2.2.3 Save public resources by facilitating the sharing of expensive geospatial data among public agencies or sub-divisions of agencies and avoid the costly duplication of developing similar geospatial datasets.

2.2.4 Minimize problems and potential liability that might be caused by the inappropriate use of undocumented geospatial data.

2.2.5 Facilitate harmonious, trans-agency public policy decision-making and implementation by enabling multiple agencies and levels of government to access and appropriately use common geospatial datasets and thereby make it more likely that intersecting public policy decisions, across levels of government, will be based on the same information.

3.0 Definitions

Content Standard for Digital Geospatial Metadata - A comprehensive national metadata standard developed and adopted by the Federal Geographic Data Committee (FGDC) under the authority of Executive Order 12906, "Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure," which was signed on April 11, 1994, by President William Clinton. Section 3, Development of a National Geospatial Data Clearinghouse, paragraph (b) states: "Standardized Documentation of Data, ... each agency shall document all new geospatial data it collects or produces, either directly or indirectly, using the standard under development by the FGDC, and make that standardized documentation electronically accessible to the Clearinghouse network." This standard is the data documentation standard referenced in the executive order. Since its initial development, this metadata content standard has undergone revision as deemed necessary by the FGDC, and will like undergo further revisions in the future.

Geospatial Data **-** A term used to describe a class of data that has a geographic or spatial nature. The data will usually include locational information (latitude/longitude or other mapping coordinates) for at least some of the features within the database/dataset.

ISO 19115:2003 **–** International Standards Organization (ISO) defines the schema required for describing geographic information and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data. It is applicable to: the cataloguing of datasets, clearinghouse activities, and the full description of datasets; and geographic datasets, dataset series, and individual geographic features and feature properties. It defines: mandatory and conditional metadata sections, metadata entities, and metadata elements; the minimum set of metadata required to serve the full range of metadata applications (data discovery, determining data fitness for use, data access, data transfer, and use of digital data); optional metadata elements - to allow for a more extensive standard description of geographic data, if

required; and a method for extending metadata to fit specialized needs. It is applicable to digital data, its principles can be extended to many other forms of geographic data such as maps, charts, and textual documents as well as non-geographic data.

Metadata - Data describing a GIS database or data set including, but not limited to, a description of a data transfer mediums, format, and contents, source lineage data, and any other applicable data processing algorithms or procedures.

4.0 Applicability

4.1 State Government Agencies

State agencies that have the primary responsibility for geospatial data development, maintenance, or purchasing data which is used for policy development, implementation, or compliance review for a particular jurisdiction(s) or geographic area (e.g. for counties for which it has assumed the primary role) are required to comply with the standards as described in this standard. Those state agencies with oversight responsibilities in this area are required to ensure that their oversight guidelines, rules, and regulations are consistent with these standards.

4.2 State Funded Entities

Entities that are not State agencies but receive State funding, directly or indirectly, for geospatial data development (i.e. Legislative appropriations, Enhanced Wireless 911 Fund, Infrastructure Fund, etc.) are required to comply with this standard.

4.3 Other

Other entities, such as city and local government agencies that receive state funds for geospatial data development, maintenance, or purchasing geospatial data which is used for policy development, implementation, or compliance review are required to comply with this standard.

5.0 Responsibility

5.1 NITC

The NITC shall be responsible for adopting minimum technical standards, guidelines, and architectures upon recommendation by the technical panel. Neb. Rev. Stat. § 86-516(6)

5.2 State Agencies

Each state agency will be responsible for ensuring that geospatial data developed, maintained, or purchased and which is used for policy development, implementation, or compliance review will be documented consistent with this standard. The State of Nebraska, Office of the CIO (OCIO) GIS Shared Services will be responsible for assuring that metadata is completed and the data is registered and available for distribution through NebraskaMAP.

5.3 Granting Agencies and Entities

State granting or fund disbursement entities or agencies will be responsible for ensuring geospatial metadata documentation requirements are included in requirements and regulations related to fund disbursements.

5.4 Other

Local government agencies that have the primary responsibility and authority for developing geospatial datasets with state appropriated funds will be responsible for ensuring that those sub-sections defined in Section 1 will be incorporated in the overall data development efforts and publishing of metadata prior to distribution.

6.0 Authority

6.1 NITC GIS Council

According to Neb. Rev. Stat. § 86-572(2), the GIS Council shall: Establish guidelines and policies for statewide Geographic Information Systems operations and management (a) The acquisition, development, maintenance, quality assurance such as standards, access, ownership, cost recovery, and priorities of data bases; (b) The compatibility, acquisition, and communications of hardware and software; (c) The assessment of needs, identification of scope, setting of standards, and determination of an appropriate enforcement mechanism; (d) The fostering of training programs and promoting education and information about the Geographic Information Systems; and (e) The promoting of the Geographic Information Systems development in the State of Nebraska and providing or coordinating additional support to address Geographic Information Systems issues as such issues arise.

7.0 Related Documents

7.1 Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (FGDC-STD-001-1998). http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/base-metadata/index_html

7.2 Federal Geographic Data Committee (FGDC) Geospatial ISO Metadata Standards Transition. http://www.fgdc.gov/metadata/geospatial-metadata-standards

7.3 ISO 19115:2003(E) North American Profile (NAP) Metadata Standards. National Oceanic and Atmospheric Administration (NOAA). January 2012.

7.4 International Standards Organization (ISO). ISO 19115:2003. http://www.iso.org

7.5 Technical Support Guides at NebraskaMAP.gov. Guides to translate existing metadata to the new standard, required core elements, and workbook for ISO standards.

Appendix I – Metadata Categories and Definitions

This document provides categories and definitions of metadata information required for State of Nebraska geospatial data layers. The minimum and complete metadata requirements and timelines for completion involve the following:

- **Minimum**, completed within six months of data origination
  (Minimum fields are indicated with a **bold** (**M)** throughout this document.)

  Minimum: A subset of the ISO 19115-compliant metadata used primarily for the purposes of cataloging and enabling the use of automated search tools to find and access available geospatial data. Does not fully document the dataset's variables, assumptions or development process that is commonly needed to guide appropriate use.

- Complete Metadata, optional categories, recommended to be completed within 12 months

  Complete Metadata: Remainder of ISO 19115-compliant metadata beyond minimum as indicated throughout this document.

1. Overview

   a. Item Description
      i. **(M) Title -** ***The name by which the resource is known.***
      ii. Thumbnail - *A small graphic file stored that graphically identifies the resource.*
      iii. Tags - *A set of terms that can be used to search for the resource.*
      iv. Summary(Purpose) - *A summary of the intentions with which the resource was developed.*
      v. **(M) Description (Abstract) -** ***A brief narrative summary of the resources content.***
      vi. Credits - *A recognition of those who created or contributed to the resource.*
      vii. Use Limitation - *Describes limitations affecting the fitness of use of the resource.*
      viii. Appropriate Scale Range - *The range of scales at which this resource should be used.*

   b. Topics & Keywords
      i. **(M) ISO topic categories -** ***Identifies the primary ISO themes associated with the resources content.***

Utilities & Communication	**Military & Intelligence**	**Boundaries**	**Farming**
Atmospheric Sciences	**Economy**	**Elevation**	**Biota**
Environment	**Geoscientific**	**Health**	**Society**
Imagery & Base Maps	**Structure**	**Inland Waters**	**Transportation**
Planning & Cadastral	**Oceans**	**Location**	

      ii. Content Type - *Indicates how you can access a shared copy of the resource.*
      iii. Keywords - *Keywords that associate the resource with a subject or topic.*

   c. Citation
      i. **(M) Title –** ***Title of the map that describes the manner in which the resource is represented. Could represent years and general idea of extent such as county or city.***
      ii. Presentation Form - *Indicates the form in which the resource is provided.*

iii. **(M) Date - *Date when the resource was created, published or revised.***

d. Citation Contacts
   i. Name - *The name of a person associated with the resource.*
   ii. Organization - *The name of an organization associated with the resource.*
   iii. Position - *The name of a role or position associated with the resource.*
   iv. Role - *Identifies the association between the responsible party and the resource.*

2. Metadata

a. Details
   i. **(M) File Identifier - *A unique identifier for the metadata. Typically a GUID, or country code.***
   ii. Parent Identifier - *Unique identifier of the dataset to which this metadata is a subset.*
   iii. Dataset URI - *The Uniform Resource Identifier (URI) of the resource.*
   iv. Function - *Identifies the function available at the specified URI for this resource.*
   v. **(M) Date - *The date when the metadata was created or updated.***
   vi. **(M) Language - *The primary language of the information provided in the metadata.***
   vii. **(M) Country - *The country of the location.***
   viii. Character Set - *The character encoding used for the metadata. Typically UTF-8.*
   ix. Hierarchy Level - *The hierarchical scope to which the metadata applies.*

b. Contacts
   i. **(M) Name - *The name of a person associated with the resource metadata.***
   ii. **(M) Organization - *The name of an organization associated with the resource metadata.***
   iii. **(M) Position - *The name of a role or position associated with the resource metadata.***
   iv. **(M) Role - *Identifies the association between the responsible party and the resource metadata.***

      Roles can include: Resource Provider, Custodian, Owner, User, Distributor, Originator, Point of Contact, Principal Investigator, Processor, Publisher, Author, Collaborator, Editor, Mediator, Rights Holder

   v. **(M) Address – *The address for the point of contact.***
   vi. **(M) Phone – *The primary phone number for the point of contact.***

c. Maintenance
   i. **(M) Update Frequency - *The frequency with which the metadata is updated.***
   ii. Next Update - *The scheduled revision date.*
   iii. Scope - The scope of data for which this maintenance information applies.
   iv. Contact - *Contact information for the individual associated with metadata maintenance.*
   v. Maintenance Note - *Describes the specific requirements for maintaining the metadata.*

d. Constraints
   i. General - *Describes limitations affecting the fitness of use of the metadata.*
   ii. Legal - *Restrictions, limitations, or warnings on using the metadata. (If applicable)*
   iii. Security - *Identifies any handling restrictions on the metadata. (if applicable)*

3. Resource

    a. Details
        i. Status - *The status of the resource. (Ex - Under Development, Ongoing, Completed, etc.)*
        ii. Credit - *A recognition of those who created or contributed to the resource.*
        iii. Language - *The language of the information used within the data.*
        iv. Country - *The country of the location.*
        v. Spatial Representation Type - *Identifies the method used to spatially represent geographic information. (Ex - Vector, Raster, Tin, etc.)*
        vi. Scale/distance Resolution - *Level of detail provided by the resource, expressed as the scale of a comparable hardcopy map or chart.*
        vii. Browse Graphic - *File name of the graphic that provides an illustration of the resource.*
        viii. Processing Environment - *Describes the data's processing environment, including the software and operating system used, and the file name and size.*
        ix. Supplemental Information - *Provides additional descriptive information about the resource.*

    b. Service Details
        i. Name - *A name identifying the type of service provided by the resource. (Ex - WFS)*
        ii. Codespace - *Identifies the authority (Ex - 1.0.0 or 1.1.0)*
        iii. Access Properties
            1. Fees - *Describes any fees or terms for obtaining resource.*
            2. Availability Date/Period - *The date and time when the resource will be available.*
            3. Ordering Instructions - *Describes instructions, terms, and services provided by the distributor.*

    c. Extents
        i. Description - *Describes the extent of the resource. (Ex - Nebraska)*
        ii. **(M) Bounding box - *Extents expressed in decimal degrees longitude and latitude.***
        iii. Temporal Period - *The start and end time period associated with the resources content.*

    d. Points of Contact
        i. Name - *The name of a person associated with the resource.*
        ii. Organization - *The name of an organization associated with the resource.*
        iii. Position - *The name of a role or position associated with the resource.*
        iv. Role - *Identifies the association between the responsible party and the resource.*

    e. Maintenance
        i. Update Frequency - *The frequency with which the resource is updated.*
        ii. Next Update - *The scheduled revision date.*
        iii. Scope- The scope of data for which this maintenance information applies.
        iv. Contact - *Contact information for the individual associated with resource maintenance.*
        v. Maintenance Note - *Describes the specific requirements for maintaining the resource.*

    f. Constraints
        i. General - *Describes limitations affecting the fitness of use of the resource.*
        ii. Legal - *Restrictions, limitations, or warnings on using the resource. (If applicable)*
        iii. Security - *Identifies any handling restrictions on the resource. (if applicable)*

    g. Spatial Reference

i. **(M) Dimension -** ***Horizontal, vertical or temporal.***
ii. **(M) Code -** ***An alphanumeric value that identifies an authoritative reference (WKID)***
iii. **(M) Code Space -** ***An alphanumeric value that identifies an authoritative reference (Ex - EPSG)***
iv. **(M) Version -** ***An numeric value that identifies an authoritative reference (Ex - 8.2.6)***
v. **(M) Authority Citation**
    1. **Title -** ***The name by which the cited resource is known (Ex- NAD_1983_StatePlane_Nebraska_FIPS_2600_Feet)***
    2. **Date -** ***The date the cited resource was created, published or revised.***

h. Spatial Data Representation
    i. Grid Spatial, Georectified, Georeferenceable, Vector or Indirect

i. Content Information
    i. Coverage description- *Identifies the information conveyed by the raster data.(if applicable)*
    ii. Image description - *Identifies the information conveyed by the raster data.(if applicable)*
    iii. Feature Catalogue - *Describes OGC catalogue compliance, name, codespace, language and country. (if applicable)*

j. Quality
    i. Scope Level - *Describes the specific data to which the data quality information applies.*
    ii. Level Description - *Identifies the instance to which the information applies*.
    iii. Extent - Describes the extent of the resource.
    iv. Report
        1. Report Type - *Identifies the characteristic of the data whose quality was measured.*
        2. Dimension - *Identifies the axis to which the spatial quality information applies.*
        3. Description - *A description of the evaluation method.*
        4. Evaluation Method - *Identifies the type of method used to evaluate the quality of the data.*

k. Lineage
    i. Statement -*Provides a general description of the resource's lineage.*
    ii. Data Source - *A detailed description of the source.*
    iii. Process Step -
        1. **(M) Description -** ***Describes the event, transformation, or process that occurred while maintaining the resource, including any parameters or tolerances that were used*****.**
        2. Rationale - *Describes why the process step occurred.*
        3. **(M) Date -** ***Identifies the date when the process step occurred.***
        4. Processor - *The name of a person or organization associated with the process step.*

l. Distribution
    i. **(M) Distribution Format**
        1. **(M) Format Name -** ***The name of the data transfer format.***
        2. **(M) Format Version -** ***The version of the data transfer format (if applicable)***
    ii. Distributor
        1. Contact- *The name of a person or organization that is the distributor.*
        2. Ordering Process - *Fees and availability and instructions.*

3. Distribution Format - *Format name and version.*
4. Digital transfer options- *Units and transfer size, or online resource.*

m. Fields
   i. **(M) Label -** ***The name of the resource.***
      1. Entity Type
         a. Object - *An indication of the resource's type. (Ex. Table, feature class)*
         b. Count - *The number of objects contained by the resource.*
         c. **(M) Definition -** ***A description of the features contained by the dataset.***
         d. **(M) Definition Source -** ***The authority that provided the definition.***
      2. **(M) Attribute** ***(for each column)***
         a. **(M) Label -** ***The name of the field. This must match the name of a column of data in the resource.***
         b. **(M) Definition -** ***The description of the data contained by the field.***
         c. **(M) Definition Source -** ***The authority that provided the description of the field.***
         d. **(M) Type -** ***Indicates the data type used to store values in this field.***
         e. **(M) Width -** ***The number of bytes that will be used to store the data in this column for one row.***
      3. **(M) Domain**
         a. **(M) Value -** ***Describes one of the repeating values that may occur in the field.***
         b. **(M) Definition -** ***A description of the value or code stored in this field.***
         c. **(M) Source -** ***The authority that provided the description of the value.***
   ii. Overview
      1. Summary - *A detailed summary of the information provided by the data.*
      2. Citation - *A reference to the document that provides a complete description of the features, fields, and values that are provided by the resource.*

n. References
   i. Aggregate - *Citation for the aggregate information.*
   ii. Portrayal Citation - *The name by which the cited resource is known.*
   iii. Application Schema Information - *Citation for the schema.*

o. Geoprocessing History

3-202. Land record information and mapping standard.

[Section 3-202 appears after this cover page in a legacy format.]

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History: Adopted on January 27, 2006. Amended on March 1, 2011.
URL: https://nitc.nebraska.gov/standards/3-202.pdf

1. Standard

These standards/guidelines are primarily focused on those public entities responsible for maintaining property parcel maps for their particular jurisdiction. The last line following each standard or guideline refers to the type(s) of agency or entity to which that standard/guideline applies and whether it is a standard (adherence required) or guideline (adherence voluntary) for each type of entity.

1.1 Data

Local government multipurpose GIS/LIS (Geographic Information System/Land Information System) and their associated geospatial data layers should be based on the North American Datum (NAD) 83 and the North American Vertical Datum (NAVD) 88. Any existing systems developed based on other datums should consider conversion to these datum.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.2 Projection

The Nebraska (State) Plane Coordinate System, NAD 83, should be used as the primary map projection system for the recording of positions in local land-data systems in Nebraska. Selection of any other projection should be done reluctantly and only after most careful consideration. The plane coordinate values for a point on the earth's surface may be expressed in either meters or feet.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.3 Geodetic Control

GIS/LIS systems developed with the goal of providing a multipurpose cadastre for local government use should be referenced to a local geodetic reference framework that is properly connected to the National Spatial Reference System (NSRS).

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.4 Public Land Survey System Control

1.4.1 PLSS Geodetic Framework

For all land in Nebraska that is subdivided according to the Public Land Survey System (PLSS), the geodetic reference framework for the cadastre should be the section corners of the PLSS for each section.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.4.2 Locate, Monument, and GPS Primary Corners

At a minimum, local government entities developing a geospatial land information system should initially invest in a precision Global Positioning System (GPS) survey to locate, re-monument as necessary, and obtain the geographic coordinates of the major boundary defining corners that legally define the boundaries of their county jurisdiction(s). These precision GPS survey coordinates for the boundary defining corners should be collected and integrated as framework data into the land information system. This effort should be coordinated with officials from the adjacent county(ies) to ensure agreement on the location of the shared corners.

State Agencies: Standard
State Funded Entities: Standard
Other: Guideline

1.4.3 Progressive Monumentation

In addition, each county (or municipality) that is planning to develop a GIS/LIS-based cadastre program should also consider initiating a progressive program to locate and/or re-monument, as necessary, and collect geographic coordinates on other PLSS corners according to the legally established procedures and properly connect them to the National Spatial Reference System to obtain geodetic coordinates.

State Agencies: Guideline
State Funded Entities: Guideline
Other: Guideline

1.5 PLSS Base Map

Local governments considering the development of a multipurpose GIS, should consult with the Nebraska State Surveyor's Office to locate and access the best available data on the Public Land Survey System (PLSS) for their geographic area. To assist the State Surveyors Office in maintaining a repository of the best available PLSS data, local governments participating in the Nebraska Land Information System Program should share any enhanced PLSS data, for their geographic area, with the State Surveyors Office so that it might be integrated into the PLSS repository database.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.6 Ortho-base (Aerial Layer) or Base Maps

Both a Public Land Survey System base map and an orthophoto (surface features) imagery base map should be used to provide the geospatial reference framework upon which a local government multipurpose land information system is developed. Both base maps should be tied to the National Spatial Reference System and have a level of spatial accuracy appropriate to the range of applications planned for a given area. Jurisdictions should acquire new imagery of urban areas at least every five years and of rural areas at least every ten years. Jurisdictions experiencing rapid or slow growth may need to adjust this timetable (IAAO 2009).

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.7 Map Scale and Spatial Accuracy

1.7.1 Minimum Horizontal Accuracy Standard

Public entities developing a GIS/LIS program should conduct data collection and development in a manner to achieve at least the minimum level of horizontal spatial accuracy consistent with the National Horizontal Map Accuracy Standards corresponding to a 1:12,000 (1"= 1,000') scale map (90% of the "well defined" horizontal locations must be within ±33.3 ft. of their real world location).

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.7.2 Additional Accuracy Considerations

Beyond this minimum horizontal map accuracy, public entities are encouraged to consider the following recommended map scales and their corresponding National Horizontal Map Accuracy Standards in determining the positional accuracy needed for base maps in the development of a local government GIS/LIS:

Relative Size of Property Parcels	Map Scale	Nat'l Horizontal Map Accuracy Standard	Equivalent Metric Scale
Urban areas	1:600 (1" = 50') 1:1,200 (1" = 100'	±1.7 ft. ±3.3 ft.	1:500 1:1,000
Large urban & suburban	1:2,400 (1" = 200')	±6.7 ft.	1:2,500
Rural areas	1:4,800 (1" = 400') 1:9,600 (1" = 800') 1:12,000 (1"= 1,000')	±13.3 ft. ±26.7 ft. ±33.3 ft.	1:5,000 1:10,000 1:10,000

State Agencies: Guideline
State Funded Entities: Guideline
Other: Guideline

1.8 Legal Lot and Parcel Layers

Data on two interrelated types of land subdivision (i.e. legally subdivided lots and ownership tracts) are necessary to provide the foundation for a wide variety of local government GIS/LIS applications that involve land subdivision and/or ownership.

a. The legal lot feature or layer consists of legal land subdivisions. These are aliquot portions of the PLSS, filed subdivision plats and irregular tracts defined by filed deeds.

b. The parcel feature or layer defines ownership tracts of land. These tracts may group multiple legal lots into one taxable account and that typically represents the boundaries of a landowner's property. These data features or layers include locational coordinates for points representing property corners, lines between property corners representing property boundaries and closed polygons representing the property area.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.9 Parcel Identifiers

a. Each county/region should adopt a system of unique, permanent feature identifiers (PID) that provide the link between each graphic land ownership parcel polygon and the attribute information (ownership, size, situs address, value, etc.) related to that specific land ownership property parcel.

b. A county/region PID system must be designed in a manner such that a unique, statewide PID can be defined and maintained for each property parcel by using the county FIPS code (Federal Information Processing Standards Publications) as a prefix to the county/region's PID system.

c. To maintain this unique one-to-one association between a specific property parcel and its related attribution information, new PIDs should be assigned whenever a property parcel is altered by either splitting it into two or more parcels or by combining two or more parcels to form a new parcel. The previous PIDs should not be used for these new modified parcels, but the historical PID associations should be maintained through a parent/child PID reference table.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.10 Spatial Data Format

A broad range of state and regional applications require property parcel information. Many of these applications require the combining of data across jurisdictional boundaries. To facilitate these applications, the property parcel spatial (graphic) data should be either maintained in a manner that allows it to be readily integrated into a spatial relational database format or be capable of being exported into a common geographic data format (i.e., shapefile), while including the parcel identifiers.

State Agencies: Standard
State Funded Entities: Standard
Other: Guideline

1.11 Metadata

All geospatial land record databases, and their associated attribute databases should be documented with Federal Geographic Data Committee (FGDC) compliant metadata outlining how the data was

derived, attribute field definitions and values, map projections, appropriate map scale, contact information, access and use restrictions, etc.

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

1.11.1 NebraskaMAP Metadata

The NebraskaMAP (http://NebraskaMAP.gov) is a state sponsored GIS web-based portal for finding and accessing a wide variety of GIS/geospatial data related to the geographic area of Nebraska. Many of the NebraskaMAP functions required metadata. All developers of Nebraska-related GIS data are encouraged to use the site to either upload existing metadata and/or use the online tools available on the site to create metadata for your GIS/geospatial land record information and mapping. Before metadata can be either created or uploaded on the site, a brief user registration is necessary.

State Agencies: Guideline
State Funded Entities: Guideline
Other: Guideline

1.12 Attribute Data

To provide the foundation necessary for a wide variety of local government applications, non-graphic, attribute data should be organized within the GIS/LIS, which describes individual property parcels relative to their basic parcel characteristics, tenure, value, history, buildings and units within the parcel, and tax status. In most cases, much of this attribute data will already exist in separate databases within a variety of local agencies and should be referenced to the graphic property parcel via the unique PID. To meet a range of state and regional applications that require property parcel information, the following types of property parcel data should be maintained and be available in a manner that allows it to be harvested, translated, and integrated into a statewide property parcel attribute dataset. These attribute values may be maintained in one or more separate relational databases that are referenced by a unique PID and not directly integrated into a GIS.

PID#: Parcel identifier (county FIPS code plus local government PID)
Situs Address: Address of parcel (may be multiple fields)
Owner Address: Address of property owner (may be multiple fields)
Township: Township #
Section: Section #
Range: Range #
Range Direction: East or West
Legal Description: Narrative legal description of parcel
Assessed Value: Total assessed value of property (land and improvements)
Land Value: Assessed value of land
Area (Deeded): Area of parcel according to the deed
Property Class: (Res, Ag, Com, Rec., Ind.)
Property Sub-class : i.e., Ag (Dryland, Irrigated, Grassland/Pasture, Waste)
Ownership type: Federal, State, County, Private, Tribal, Exempt, Other and Unknown

Tax District: County ID plus Tax Dist. #
School District : State number definition
Landuse : Actual landuse with NPAT defined general categories
Property Parcel Type: NPAT defined categories: (i.e., Single Family, Multi-Family, Commercial, Industrial, Agriculture, Recreational, Mineral Interest-Nonproducing, Mineral Interest-Producing, State Assessed, or Exempt)
Status : NPAT defined categories: (Improved, Unimproved, or IOLL)
Location: NPAT defined: (Urban, Sub-urban, Rural)
City Size: 1st class, 2nd class, primary, metro, or village
Source Document: Sales/transfer reference or document (book & page & date)
Sales Date: Most recent sales/transfer date
Sales Value: Most recent sales value

State Agencies: Standard
State Funded Entities: Standard
Other: Standard

2. Purpose and Objectives

The purpose of these standards and guidelines is to help realize the maximum long-term return on and overall utility of the public's investment in the modernization of how Nebraska's land records are maintained and distributed.

2.1 Background

Land records and land ownership records are public records that are used by wide cross-section of our society and its institutions. Ready access to current and accurate land records is critical to our state's overall economy and the efficient functioning of many of its public and private institutions.

Historically land records have been maintained on paper records and paper maps. This made it very difficult and costly to update and keep current records and maps in areas where there was significant turnover in property ownership. Paper records and maps also made it difficult to share land record information outside of the physical office where they were maintained. Paper records and maps also made it difficult to conduct analyses of broader land ownership and land valuation patterns. Computerization in general, and GIS/geospatial technologies in particular, have revolutionized how land and land ownership records can be maintained, analyzed, shared, and distributed.

Modern computerized land records and maps make it relatively easy to update and keep current land records and maps. Computerization and GIS/geospatial technologies now routinely enable easy, reliable access to land records and maps via the Internet to a wide variety of users. Land records in computerized relational databases and GIS parcel maps have provided a wide array of new information management tools that can be used to integrate land records with other data and analyze and display land ownership, land valuation and other broader land-related patterns. Among other uses, these tools help ensure that all property is on the tax rolls and that the property is taxed equally.

Modern computerized land records and maps can provide a wide array of potential benefits to a wide array of users. However, to realize many of these benefits, it is important that when these databases and maps are originally developed they follow a minimal set of standards and guidelines that support

this potential broad array of applications and benefits. In many instances, it is not this broader array of potential uses that is the immediate stimulus, which causes a local or state agency to undertake a modernization of its land records and maps. Therefore, these standards and guidelines serve the function of raising the awareness of these potential future applications and the related need to incorporate minimal standards beyond those needed for immediate applications.

These standards and guidelines are intended to help ensure that modernized land records are developed on a solid technical foundation. A foundation, which will enable both the original developing agency, and other interested entities, to build on this initial investment and maintain and enhance the data and enable it to be utilized for multi-purposes by multiple users. These standards and guidelines are also intended to facilitate partnerships between local, state, and federal entities to support the development and maintenance of modernized land records.

2.2 Objectives

These standards and guidelines to guide the modernization of land records in Nebraska have the following objectives:

2.2.1

Provide guidance to state and local officials as they work, either in-house or with private contractors, to develop and/or acquire computerized, geospatial data related to land records and maps and thereby increase the likelihood that the data acquired and/or developed will be suitable for the range of intended applications and likely future applications.

2.2.2

Improve public policy development and implementation by helping to make land records more current and readily accessible and by making available to land record management applications the wide range of analytical tools available through GIS/geospatial technology.

2.2.3

Enhance coordination and program management across jurisdictional boundaries by insuring that modernized land records and maps can be readily integrated across jurisdictional boundaries for regional applications (e.g., school districts, NRDs, emergency response, etc.) or statewide applications.

2.2.4

Save public resources by facilitating the sharing of computerized land records among public agencies or sub-divisions of agencies by incorporating data standards and following guidelines which will make it more likely that the computerized land records developed by one entity will also be suitable to serve the multiple needs of other entities and thereby avoid the costly duplication of developing and maintaining similar land records.

2.2.5

Make land records and land ownership maps more readily accessible to the wide range of potential users.

2.2.6

Facilitate harmonious, trans-agency public policy decision-making and implementation by enabling multiple agencies and levels of government to access and appropriately use common geospatial datasets and thereby make it more likely that intersecting public policy decisions, across levels of government, will be based on the same information.

2.2.7

Lay the foundation for facilitating intergovernmental partnership to the modernization of land records by defining standards and guidelines that increase the likelihood that computerized land records will meet the needs of multiple users.

3. Definitions

Attribute Data : Properties and characteristics of property parcel or other spatial data entities.

Datum: A Geodetic Reference System is the true technical name for a datum. A datum is a combination of an ellipsoid, which specifies the size and shape of the earth, and a base point from which the latitude and longitude of all other points are referenced.

Entity: Any object about which an organization chooses to collect data.

Geodetic Control: A set of surveyed monuments used to define a spatial reference system and used to register map sheets and transform coordinates for a particular project.

Geographic Information System (GIS): A system of computer hardware, software, and procedures designed to support the compiling, storing, retrieving, analyzing, and display of spatially referenced data for addressing planning and management problems. In addition to these technical components, a complete GIS must also include a focus on people, organizations, and standards.

Geospatial Data: A term used to describe a class of data that has a geographic or spatial nature. The data will usually include locational information (latitude/longitude or other mapping coordinates) for at least some of the features within the database/dataset.

Global Positioning System (GPS): GPS is a method for identifying locations on earth using triangulation calculations of satellite positions. Originally created by the United States Military, it has since found numerous commercial applications.

Land Information System (LIS): A special type of GIS that manages and analyzes data related to land ownership (e.g., tax parcels, urban infrastructure, property assessment). A GIS used for municipal or county level applications is typically structured as an LIS.

Map Scale: The scale of a map is the ratio between a distance on the map and the corresponding distance on the earth, with the distance on the map typically expressed as 1. Thus, a scale of 1:100,000 means 1 inch on the map equals 100,000 inches (approximately 1.6 miles) on the earth. Large scale maps depict a small area and show more detail. Small scale maps depict a large area and show less detail.

Metadata: Data describing a GIS database or data set including, but not limited to, a description of a data transfer medium-, format, and contents, source lineage data, and any other applicable data processing algorithms or procedures.

Monumentation of PLSS Corners: Monumentation in surveying refers to the practice of marking known horizontal and vertical control points with permanent structures such as concrete pedestals and metal plaques. Once surveyed and marked, these monuments can be used for further surveying and for the alignment of land-parcel boundaries and infrastructure.

National Spatial Reference System (NSRS): A consistent national coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the Nation, and how these values change with time. Consequently, it ties spatial data to geo-referenced positions.

Nebraska Plane Coordinate System: Nebraska Plane Coordinate System means the system of plane coordinates for designating the geographic position of points on the surface of the earth, within the State of Nebraska, which have been established by the National Ocean Service/National Geodetic Survey, or its successors. The Nebraska Plane Coordinate System is a Lambert conformal conic projection of the North American Datum of 1983, having standard parallels at north latitudes 40 degrees 00 minutes and 43 degrees 00 minutes along which parallels the scale shall be exact. The origin of coordinates is at the intersection of the meridian 100 degrees 00 minutes west of Greenwich and the parallel 39 degrees 50 minutes north latitude. This origin is given the coordinates. N = 0 meters and E = 500,000 meters. (Neb. Rev. Stat. § 76-2502)

Orthophoto: An aerial photo that has been corrected to eliminate the effects of camera tilt and relief displacement. The ground geometry is recreated as it would appear from directly above each and every point. Digital orthophotos can be created by scanning the original photograph and applying a process called differential rectification to each pixel in the image. In creating digital orthophotos, it is also possible to remove the effects of tangential displacement.

Parcel Identifier (PID): A unique number identifying a specific property on the assessment and tax rolls and used as a cross reference between graphic/mapping data and tabular attribute data.

Projection: A system to portray all or part of the earth, which is an irregular sphere, on a planar, or flat surface.

Public Land Survey System (PLSS): The Public Land Survey System (PLSS) is a way of subdividing and describing land in the United States. All lands in the public domain are subject to subdivision by this rectangular system of surveys (townships, ranges, sections, quarter-sections, etc.), which is regulated by the U.S. Department of the Interior, Bureau of Land Management.

Shapefile: A Shapefile is an ESRI digital vector (non-topological) storage format for storing geometric location and associated attribute information that can be generated by a wide variety of GIS software packages.

Spatial Accuracy: The accuracy of a map in representing the geographic location of an object relative to its true location on the surface of the Earth based on geographic coordinates.

4. Applicability

4.1 State Government Agencies

State agencies that have the primary responsibility for maintaining land ownership records and property parcel maps for a particular jurisdiction(s) or geographic area (e.g. Nebraska Dept. of Property

Assessment and Taxation for counties for which it has assumed the primary assessment role) are required to comply with those sub-sections identified as a "Standard" for "State Agencies" in Section 1. Those state agencies with oversight responsibilities in this area are required to ensure that their oversight guidelines, rules, and regulations are consistent with these standards.

4.2 State Funded Entities

Entities that are not State agencies but receive State funding, directly or indirectly, for property parcel mapping and/or property tax assessment and have the primary responsibility for maintaining property parcel maps for a particular jurisdiction or geographic area are required to comply with those sub-sections identified as a "Standard" for "State Funded Entities" in Section 1.

4.3 Other

Other entities, such as local government agencies (e.g. County Assessor, County Register of Deeds, municipalities) that have the primary responsibility for developing and maintaining land ownership records and property parcel maps are required to comply with those sub-sections identified as a "Standard" for "Other" in Section 1.

5. Responsibility

5.1 NITC

The NITC shall be responsible for adopting minimum technical standards, guidelines, and architectures upon recommendation by the technical panel. (Neb. Rev. Stat. § 86-516(6))

5.2 State Agencies

The Nebraska Department of Property Assessment and Taxation will be responsible for ensuring that its rules and regulations relative to land ownership records and property parcel (tax) mapping include those subsections in Section 1 that are identified as a "Standard" for "Other" and are consistent overall with those standards.

5.3 Granting Agencies and Entities

State granting or fund disbursement entities or agencies will be responsible for ensuring that these standards are included in requirements and regulations related to fund disbursements as they relate to land (property parcel) records or property parcel mapping.

5.4 Other

Local government agencies that have the primary responsibility for land ownership records and property parcel mapping will be responsible for ensuring that those sub-sections defined for "Other" as a "Standard" in Section 1 will be incorporated in land record modernization and geospatial data development efforts and contracts.

3-203. Lidar standard.

The commission adopts by reference the most recent version of the Lidar Base Specification (LBS) standards released by the U.S. Geological Survey (USGS) [https://www.usgs.gov/ngp-standards-and-specifications/lidar-base-specification-online] for elevation acquisition using lidar.

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History: Adopted on October 28, 2014. Amended on November 10, 2022.
URL: https://nitc.nebraska.gov/standards/3-203.pdf

3-204. Imagery standard.

[Section 3-204 appears after this cover page in a legacy format.]

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History: Adopted on October 28, 2014. Amended on July 25, 2019.
URL: https://nitc.nebraska.gov/standards/3-204.pdf

1.0 Standard

1.1 Description

This standard provides requirements necessary for the creation, development, delivery, and maintenance of aerial imagery acquisition to support a statewide Nebraska Imagery Program. There are multiple uses for imagery and data acquisition is expensive and requires preplanning. These standards are set at a minimum such that the majority of applications and needs are met across the state.

It is important to collect ortho-rectified imagery so that ground features can be measured and other data layers can be created from the data source which has a strong relationship to ground control. The data required for ortho-rectification include orientation parameters for the source image(s) and a digital elevation model (DEM) of the geographic area to be covered by the imagery. Ortho-rectification corrects for tip and tilt of the aircraft and displacement in the photograph caused by changes in the ground elevation.

Generally, the development of ortho-rectified imagery requires the acquisition of overlapping photography of the same geography and some combination of surveyed ground control and airborne (Global Positioning System) GPS collection at the time of photography. A photogrammetrist performs image correlation techniques and aero-triangulation on the resulting block of photographs to establish the orientation parameters of the individual image. Using a most recent DEM source or new LiDAR DEM provides the base for which the new imagery is rectified. These operations make ortho-rectified imagery more expensive than uncorrected aerial photography, but also make it far more accurate and useful.

Ultimately, accurate base maps can be derived from ortho-rectified imagery because the image has been geometrically corrected such that the scale is uniform. Streets and roads, curbs, manholes, water edge, tree inventories, fire hydrants, and numerous other features can be accurately mapped from the imagery. This also allows for accurate measurements of features and relationships between features, directly on the photograph.

The standard provides a consistent structure for data producers and users to ensure compatibility of datasets within the same framework layer and when used between other Nebraska Spatial Data Infrastructure (NESDI) framework layers such as survey and geodetic control and LiDAR.

This standard does not restrict or limit additional buy-ups of imagery data and services. These standards are meant to be a minimum set of standards and are subject to be updated based on technology enhancements, necessary workflow changes, and other data requirements. Other imagery data that is available at specifications that are above the minimum standard will be evaluated on a case-by-case basis.

The standard is not intended to be a substitute for an implementation design. These standards can be used at local, state and federal level to ensure interdisciplinary compatibility and interoperability with other framework layers. These standards integrate with existing standards such as the American Society for Photogrammetry and Remote Sensing (ASPRS) and other NITC related standards.

1.2 Acquisition and Processing

1.2.1 Flight Specifications

Proper planning and pre-flight requirements are necessary steps prior to acquiring imagery. This includes consideration of temporal requirements, proper flight planning, and ensuring that the characteristics of the sensors used in acquisition of imagery meet these requirements.

1.2.1.1 Temporal Requirements

Time of Day: Imagery will need to be acquired during minimal shadow conditions. Image acquisition shall occur when the sun angle is equal to or greater than 30-degrees.

Time of Year: All imagery shall be collected during the late-Winter / early-Spring flying season during leaf-off conditions for deciduous vegetation in Nebraska. Exceptions can be made on a case-by-case basis for certain applications requiring leaf-on imagery.

1.2.1.2 Flight Plans

Flight line orientation for all flight lines shall be in a cardinal direction, either north-south or east-west orientation when feasible. Flight plans must be approved prior to imagery acquisition. Information will need to be provided including project boundary, flight line numbers, flight line locations, and recommended ground control locations. If a frame sensor is used, exposure numbers should be included as well. For quality assurance purposes, the vendor shall submit copies of flight logs as part of the preliminary imagery deliverables.

1.2.1.3 Sensor Characteristics

The entire mission in a given year must be flown with sensors having the same specifications. The system shall use square pixels (ground footprint) at all times during processing. The technique of using aggregated detectors resulting in a rectangular pixel before blending with other channels shall not be used. The aerial camera shall be a precision aerial mapping camera equipped with a low distortion, high resolution lens. Camera characteristics shall be such that the aerial photographs taken can be satisfactorily used with the vendor’s proposed photogrammetric compilation equipment and environment. Calibration certificates for all systems to be used for acquisition will need to be provided.

1.2.1.4 Sun Angle

The images should be acquired only during the portion of the day when the sun angle exceeds the minimum of 30 degrees. To expedite acquisition within the photo periods, different sun angles may be permitted, provided the image does not have excessive shadows that preclude interpretation and data collection.

1.2.2 Ground Control

Ground control needs to be established of sufficient density and accuracy to meet the accuracy requirements of the ortho-rectified imagery.

Ground controls points used for aerial triangulation should be at least three times better than the expected accuracy of aerial triangulation solution. For example, in order to produce an orthophoto with an $RMSE_r$ of 15cm, the aerotriangulation results should have an $RMSE_{xyz}$ of 7.5 cm and the ground control used should have $RMSE_{xyz}$ of 2.5 cm. The control shall be sufficient to supplement the airborne GPS and Inertial Measurement Unit (IMU) in order to meet the required product accuracies.

For all photogrammetric data sets, the accuracy of the aerial triangulation or INS orientation (if used for direct orientation of the camera) should be at least twice the accuracy of derived products, as evaluated at higher accuracy check points using stereo photogrammetric measurements. Ground control and blind quality control points shall be required for softcopy aero- triangulation and ortho-photography generation to meet the accuracies specified.

Both ground control and quality control points will be based on a county or project area size depending on the scope of the project to be flown. The control diagrams, indicating the anticipated vertical and horizontal accuracies, will be reviewed before imagery collection begins.

The availability and/or quality of any existing ground control will need to be determined prior to flight acquisition. Any new control established for a project area will be delivered including sketches, pictures of control locations, and an ISO 19115 compliant metadata file. Those responsible for evaluating ground control should not assume that control exists, but it could be beneficial to use existing control if possible.

1.2.2.1 Global Positioning Systems (GPS)

If additional ground control needs to be established, the ground control shall be established with survey grade instrumentation. The GPS control survey needs to be conducted with a licensed surveyor or engineer representing the quality control process. A plan will need to be provided to recommend and coordinate the placement of ground control target locations of a sufficient quantity and size to control the photogrammetric accuracy specifications. Any new ground control established must be tied to the Nebraska NAD83 horizontal datum. All ground control points must be documented as such so that they are easily located by other surveyors throughout the duration of the project.

The horizontal root-mean-square error (RMSE) of the airborne GPS control data shall not exceed 0.2m. The vertical RMSE of the Airborne GPS control shall not exceed 0.3m.

1.2.2.2 Digital Elevation Model (DEM)

Elevation data is necessary for ortho-rectifying imagery. A digital elevation model (DEM) shall be developed at a density level necessary to support the imagery ortho-rectification process.

The elevation data may come from various sources to build a DEM. Elevation data may be derived from LiDAR, photogrammetry or autocorrelation as long as it provides sufficient accuracy and precision to support imagery horizontal accuracy requirements. Preference is to use LiDAR where it is available in the state. The DEM shall consist of points spaced at regular intervals along a grid, points of significant high or low elevations, and ortho-photography specific breaklines at all significant terrain breaks. In cases, where breaklines are not available suitable breaklines will need to be created to support an elevation dataset. It is not necessary to capture break lines at all curbs, ditches, stream banks, or other similar minor terrain breaks. The DEM shall be free of artifacts and data voids. The vertical accuracy of the DEMs developed to support production of the ortho-rectified imagery shall be sufficient to guarantee the horizontal accuracy specified in these standards.

The U.S. Geological Survey's National Elevation Dataset (NED) has 1/3 arc-second digital elevation model (DEM) data. Unless an area is very flat, the NED should not be used for less than 12 inch resolution data where higher accuracy is required.

There is no guarantee that the available DEM will be adequate to meet the final product accuracy specifications. An updated DEM is necessary in order to support the ortho-rectification production specifications and accuracy standards. This may require the acquisition of LiDAR to complete this task.

Updates to the existing DEM need only support the ortho-rectification process and are not required to support contour modeling or other applications. The DEM data is not to be stored as a record (Z component) for each pixel of the ortho-rectified image.

1.2.3 Ground (Spatial) Resolution

The final imagery output needs to be at a minimum of 12 inch ground sample distance (GSD). GSD is referred to as spatial resolution. This orthoimagery should meet ASPRS Class II horizontal accuracy standards for digital Orthoimagery and 1:2,400 Digital Planimetric Data.

A scale that equivalents higher resolutions (i.e., 6 inch) can be acquired as long as it meets the respective scales and horizontal accuracies associated to its desired spatial resolution found in section 1.2.6.

1.2.4 Spectral Resolution

Imagery will need to be provided in four primary spectral bands at 12 bit including Red (R), Green (G) and Blue (B) and Infrared (IR). All color imagery shall be the equivalent of natural true color, to include 256 levels of value for each color band for RGB. The sensor or camera shall save the bands in the following order: Red, Green, Blue, and infrared.

1.2.5 Radiometric Resolution

The digital aerial images shall be clear and sharp in detail and of high radiometric quality. The sensor shall capture the images in an uncompressed “lossless” image format. The

sensor shall, at minimum, utilize 12 bits per pixel radiometric resolution. Up-sampling from a lower bit depth to a higher bit depth is not allowed (e.g. resampling 8 bit data to 12 bit data). Color balancing shall result in colors which appear natural to a human observer. Image contract and brightness shall be adjusted to minimize perceptible differences within and between adjacent images.

1.2.6 Horizontal Accuracy

Horizontal accuracy assessment will be required for both in absolute and relative conditions. The pixel size of the final digital orthoimagery is being considered for this assessment not the GSD of the raw image that is used to establish the horizontal accuracy class.

- Absolute requires the use of ground control points for testing purposes. These points, found in the image and coordinates from the ortho-rectified image, are compared to the published coordinates.
- Relative horizontal accuracy assessment involves the visual inspection of adjacent images for edge matching, and the comparison of the ortho-rectified image to planimetric data. The relative displacement would be quantified.
- Recommendations for achieving the horizontal accuracy assessment shall be provided prior to acquisition including the number of and the distribution of check points within the project. QC points should be included in flight and control layout prior to acquisition.

The final imagery output needs to meet horizontal accuracy requirements established by ASPRS Class II accuracy for a minimum 12 inch GSD as defined in the following table.

Horizontal Data Accuracy Class	**RMSEx and RMSEy**	**Orthophoto Mosaic Seamline Maximum Mismatch**	**Aerial Triangulation or INS-based RMSEx RMSEy and RMSEz**
I	Pixel size x 1.0	Pixel size x 2.0	Pixel size x 0.5
II	Pixel size x 2.0	Pixel size x 4.0	Pixel size x 1.0
III	Pixel size x 3.0	Pixel size x 6.0	Pixel size x 1.5
…			
N	Pixel size x N	Pixel size x 2N	Pixel size x 0.5N

When producing digital orthoimagery, the GSD as acquired by the sensor (and as computed at mean average terrain) should not be more than 95% of the final orthoimagery pixel size. In extremely steep terrain, additional consideration may need to be given to the variation of the GSD across low lying areas in order to ensure that the variation in GSD across the entire image does not significantly exceed the target pixel size.

The following table serves as a guide for three common ASPRS horizontal accuracy standards for planimetric maps intended for use at common map scales.

Orthophoto Pixel Size	Horizontal Data Accuracy Class	RMSEx or RMSEy (cm)	RMSEr (cm)	Orthophoto Mosaic Seamline Maximum Mismatch (cm)	Horizontal Accuracy at the 95% Confidence Level (cm)
7.5-cm (~3 in)	I	7.5	10.6	15.0	18.4
	II	15.0	21.2	30.0	36.7
	III	22.5	31.8	45.0	55.1
15-cm (~6 in)	I	15.0	21.2	30.0	36.7
	II	30.0	42.4	60.0	73.4
	III	45.0	63.6	90.0	110.1
30-cm (~12 in)	I	30.0	42.4	60.0	73.4
	II	60.0	84.9	120.0	146.9
	III	90.0	127.3	180.0	220.3

1.2.7 Projection and Datum

Imagery for the project will be referenced to the North American Datum of 1983 (NAD83) using the 2007 HARN adjustment, and the North American Vertical Datum of 1988 (NAVD 88) with the latest ellipsoid and Geoid09 adjustments. Imagery shall be oriented to the appropriate Nebraska State Plane using U.S. Feet.

1.2.8 Pixel Clarity

Pixel clarity is defined by pixel size and relation to the ground sample distance (GSD) of the specified pixel size. It is not recommended to resample from a coarser image to obtain a finer image resolution. The image can be resampled from a sharper image for a coarser image (i.e., obtaining an 18-inch pixel resolution from one foot).

1.2.9 Image Quality

Images shall be tonally balanced and image mosaics shall be uniform in contrast without abrupt variations between image tiles. Imagery shall be free of blemishes, and artifacts that obscure ground feature detail. Pixel resolution shall not be degraded by excessive image smear. Imagery shall have a tonal range that prevents the clipping of highlights or shadow detail from the image.

1.3.0 Environmental Conditions and Obstructions

To the extent possible, no clouds, snow, fog, haze, smoke, or other ground obscuring conditions shall be present at the time of the flights. Ground conditions are free of snow, flooding and excessive soil moisture. Streams and rivers should be within their normal banks, unless otherwise negotiated. Spectral reflectance from water must be minimized and should not obscure shoreline features. In no case will the maximum cloud cover exceed 5% per image.

1.3.1 Edge Effects

Sufficient end and side laps need to be taken into consideration to prevent any gaps in coverage and to provide all necessary coverage for accurate ortho-rectification and visual

interpretation. The crab shall not be in excess of three (3) degrees; and, tilt of the camera from verticality at the instant of exposure shall not exceed three (3) degrees.

1.3.2 Building Lean

Additional supplemental flight lines should be acquired in areas of tall buildings to limit building lean in city blocks. Recommended supplemental flight lines should be provided in preliminary flight layout for prior review and approval.

1.3 Data Format

The data format provided will need to be in uncompressed tiles in a GeoTIFF format that can be interpreted by commercial imagery and GIS software. Tile schemes will need to be provided at 5,000 feet x 5,000 feet. If mosaic imagery is suggested, the area of interest (AOI) or collection area (i.e., county, quadrangle, city, etc) will need to be provided. The mosaic imagery need to be compressed and provided as JPEG2000 with a compression ratio of 20:1.

1.4 Maintenance

Entities responsible for data acquisition and deliverables will need to assure data meets standards and are updated and maintained in a timely manner. After spatial and attribute updates and/or modifications are performed to the data it shall be submitted to the appropriate entity(s) responsible for performing quality control and maintenance of the data acquisition.

Maintenance of elevation data determines the suitability to support the greatest range of applications. Many projects require up-to-date, accurate and consistent elevation data and maintenance of this data is necessary to provide the maximum return on investment.

1.4.1 Reporting Errors and Handling Updates

The reporting of errors need to be directed to the appropriate entity in a timely manner. Updated spatial and attribute information in the data will also need to be redistributed. The date field in the metadata when the last record was modified will also need to be updated to ensure proper records management and communication with others in the workflow.

1.5 Quality Control

A quality control process is required by a third-party to ensure the delivery of an image product that satisfies the requirements as defined by these standards. The quality of imagery acquisition is evaluated based on the overall functional correctness and completeness of the technical requirements that also include a horizontal accuracy test. In the event that data does not meet specific requirements of these standards, the imagery will be rejected and the vendor will be required to either reacquire or re-process data appropriately to meet these standards.

1.5.1 Horizontal Accuracy Test

A number of check points will need to be collected within each area of interest to verify the horizontal accuracy of the ortho-rectified production process. The check points must be completely independent of ground control used during aero-triangulation and data

production. The recommended number of check points based on the size of area will follow ASPRS guidelines.

1.5.2 Re-Flights

A plan for re-flights of areas will need to be provided in the event of image rejection during the quality control process, or where original imagery could not be collected because weather or ground cover conditions, or other factors outside the control of the vendor precluded collection at the scheduled time of the flyover. Mechanical or technical problems shall not be considered a legitimate reason for non-collection.

1.6 Integration with other Standards

1.6.1 Street Centerline Standards (NITC 3-205)

These minimum standards for imagery acquisition are designed to ensure the acquisition of imagery sufficient to meet the requirements for digitizing street centerlines as required in the Street Centerline Standards NITC 3-205.

1.6.2 Address Standards (NITC 3-206)

These minimum standards for imagery acquisition are designed to ensure the acquisition of imagery sufficient to meet the requirements for digitizing street centerlines as required in the Address Standards NITC 3-206.

1.7 Metadata

Complete and comprehensive metadata is required for the acquired imagery. The metadata will require detailing the characteristics and quality of submitted imagery files. Information needs to be provided to allow the user sufficient information so they can determine the data's intended purpose as well as how to access the data. The metadata requires a process description summarizing collection parameters such as: contact information, data source, scale, accuracy, projection, use restrictions, and imagery acquisition dates. The process description will also need to be included to describe methodology towards the deliverable products.

1.7.1 Federal Metadata

The ISO 19115:2003(E) North American Profile (NAP) Metadata Standards should be used when feasible and in every effort possible to assure high quality rigorous standards. Metadata will need to be supplied for each tile and be provided in an XML format. All imagery datasets, and their associated attribute databases should be documented with ISO 19115 compliant metadata. Supplemental metadata information includes the following: (1) tested horizontal accuracy statement, (2) lineage, including, but not limited to: flight height, photo acquisition dates (and re-flights if any), overlap, sidelap, number of flight lines, number of exposures, direction of flight lines, control, resolution, tiling scheme, file sizes, description of the process used to create digital orthophotos, source of DEM, and (3) spatial reference information: projection, ellipsoid, horizontal and vertical datum, and horizontal and vertical units.

1.7.2 State Metadata

These standards need to apply to Nebraska's metadata standards located within NITC 3-201 Geospatial Metadata Standard. All metadata from imagery files will need to be registered through the metadata portal at NebraskaMAP (http://NebraskaMAP.gov). All developers of Nebraska-related geospatial data are encouraged to use the site to either

upload existing metadata and/or use the online tools available on the site to create the metadata for imagery.

2.0 Purpose and Objectives

2.1 Purpose

The purpose of this standard is to provide the necessary requirements for the creation, development, delivery, and maintenance of aerial imagery data and services to support the Nebraska Spatial Data Infrastructure (NESDI). These standards will help ensure that imagery acquisition is consistent, accurate, publicly accessible, and cost-effective.

2.2 Objectives

These standards will guide the statewide imagery program having the following objectives:

2.2.1 Provide guidance and necessary workflows to state and local officials as they work, either in-house or with private vendors, to create, develop and maintain aerial imagery data and services. This can increase the likelihood that the data created will be suitable for the range of intended applications and likely future applications. The maintenance of aerial imagery data is necessary for the data to be current and accurate.

2.2.2 Enhance coordination and program management across jurisdictional boundaries by insuring that aerial imagery data can be horizontally integrated across jurisdictional and/or project boundaries, and other framework data layers for regional or statewide applications.

2.2.3 Save public resources by facilitating the sharing of aerial imagery data among public agencies or sub-divisions of agencies by incorporating data standards and following guidelines. Data that is developed by one entity can be done in a way that is suitable to serve the multiple needs of other entities. This avoids the costly duplication of developing and maintaining similar data in the state.

2.2.4 Make aerial imagery data current and readily accessible to the wide range of potential users through NebraskaMAP and other necessary resources.

2.2.5 Facilitate harmonious, trans-agency and public policy decision-making and implementation by enabling multiple agencies and levels of government to access and appropriately use current aerial imagery data. This can make it more likely that intersecting public policy decisions, across levels of government, will be based on the same information.

2.2.6 Lay the foundation for facilitating intergovernmental partnerships for the acquisition and development of high-quality aerial imagery data by defining standards that increase the likelihood that this data will meet the needs of multiple users.

2.2.7 Establish and promote the integration and interrelationships of aerial imagery data with related NESDI framework layers through geometric placement and attributes.

3.0 Definitions

Accuracy

Absolute - A measure of the location of features on a map compared to their true position on the face of the earth.

Relative - A measure of the accuracy of individual features on a map when compared to other features on the same map.

Band - A range of wavelengths of electromagnetic radiation.

Check Point – One of the surveyed points in the sample used to estimate the positional accuracy of the data set against an independent source of higher accuracy.

Confidence Level – The percentage of points within a data set that are estimated to meet the stated accuracy; i.e., accuracy reported at the 95% confidence level means that 95% of the positions in the data set will have an error with respect to true ground position that are equal to or smaller than the reported accuracy value.

Datum – A set of values used to define a specific geodetic system.

Digital Elevation Model - A digital cartographic representation of the elevation of the land at regularly spaced intervals in x and y directions, using z-values referenced to a common vertical datum. A DEM also assumes bare-earth terrain, void of vegetation and manmade features. The USGS DEMs archived in the National Elevation Dataset (NED) have different formats based on 1-arc-second, 1/3-arc-second, and 1/9-arc-second grid spacing.

Forward Lap or End Lap - The extent to which sequential exposures in a flight line overlap

Ground Sample Distance (GSD) – The linear dimension of a sample pixel's footprint on the ground. Within these standards GSD is used when referring to the collection GSD of the raw image, assuming near-vertical imagery. The actual GSD of each pixel is not uniform throughout the raw image and varies significantly with terrain height and other factors. The GSD is assumed to be the value computed using the camera focal length and camera height above average mean terrain.

Ground (spatial) resolution or pixel size – As used within these standards, pixel size is the ground size of a pixel in a digital ortho-rectified imagery product, after all rectifications and resampling procedures.

Horizontal Accuracy - The horizontal component of the positional accuracy of a data set with respect to a horizontal datum, defined at the 95% confidence level.

Image Correlation – Directly comparing hardcopy or softcopy images, or patches of pixels on conjugate digital images, or indirectly comparing information derived from the stereo images, to determine that points on stereo images (viewed from different perspectives) represent the same points on the imaged surface. Automated image correlation is a computerized technique to match the similarities of pixels in one digital image with comparable pixels in its digital stereo image in order to automate or semi-automate photogrammetric compilation. Automated image correlation provides an efficient method for generating DEMs photogrammetrically, but automated correlation normally results in Digital Surface Models (DSMs) instead of DEMs because such correlation generates elevations of rooftops, treetops and other surface features as imaged on the stereo photographs.

Inertial Measurement Unit (IMU) - An electronic device that measures and reports velocity, orientation, and gravitational forces, using a combination of accelerometers and gyroscopes, sometimes also magnetometers. IMUs work to detect changes in pitch, roll, and yaw of an aircraft. IMUs are typically used to maneuver aircraft, including unmanned aerial vehicles (UAVs), among many others, and spacecraft, including satellites and landers.

Leaf-Off / Leaf-On - Leaf-off and leaf-on refer to the presence or lack of the foliage of woody species. Leaf-off means that there is no foliage or a reduced amount of foliage on the tree or shrub species. Leaf-on imagery means that there is foliage on the tree or shrub species (or the species of interest). Sometimes it is beneficial to have leaf-off imagery so that you can see ground features more distinctly. This is helpful for mapping features such as buildings and roads, which may be obscured by tree foliage during the growing season. Leaf-off imagery is also used in forestry applications because the lack of leaves on some trees facilitates the classification of tree types. There are times when you might want leaf-on imagery, especially if the tree or shrub species has a distinctive spectral reflectance that can be distinguished from other vegetation. Leaf-on imagery is also used in agricultural applications to measure the quantity and health of crops. Many woody species may have similar spectral reflectance or structure that may benefit from either a leaf-off or leaf-on flyover.

Map or Cartographic Scale - The relationship between a given distance on the ground and the corresponding distance on a photograph or image. Scale is expressed in at least two different ways. Both are ratios. In the first, commonly used measuring systems are compared; for example 1" = 200' (one inch on the map equals 200 feet on the earth). In the second, the map unit is arbitrary; for example, 1:200 means that one of anything (an inch, a foot, a centimeter, etc.) on the map equals 200 of that same unit on the earth. (1"=200' is the same scale as 1:2400). Scale is presented in several ways: as a bar at the bottom of the map, as a ratio (1:200), or as an equation (1"=200').

Nebraska Spatial Data Infrastructure (NESDI) - A framework of geospatial data layers that have multiple applications, used by a vast majority of stakeholders, meet quality standards and have data stewards to maintain and improve the data on an ongoing basis. These layers are also consistent with the Federal National Spatial Data Infrastructure (NSDI).

Ortho-rectification - The process by which a photograph is prepared from a perspective photograph by removing displacements of points caused by tilt, relief and perspective.

Planimetric - Data about non topographic features on the earth surface that are represented only by their horizontal position.

Projection – A map projection flattens the earth, allowing for locations to be systematically assigned new positions so that a curved surface can be represented on a flat map.

Resolution – The smallest unit a sensor can detect or the smallest unit an ortho-rectified image depicts. The degree of fineness to which a measurement can be made.

Root Mean Square Error (RMSE) – The square root of the average of the set of squared differences between data set coordinate values and coordinate values from an independent source of higher accuracy for identical points.

RMSEr – The horizontal linear RMSE in the radial direction that includes both x- and y-coordinate errors.

RMSEx – The horizontal linear RMSE in the X direction (easting).

RMSEy - The horizontal linear RMSE in the Y direction (northing).

RMSEz - The vertical linear RMSE in the Z direction (elevation).

Side Lap **-** The extent to which the exposures of adjacent flight lines overlap, typical side lap for a block of aerial photography is 30%.

State Plane Coordinate System - The State Plane Coordinate System is a set of 124 geographic zones or coordinate systems designed for specific regions of the United States. It uses a simple Cartesian coordinate system to specify locations rather than a more complex spherical coordinate system (the geographic coordinate system of latitude and longitude). By thus ignoring the curvature of the Earth, "plane surveying" methods can be used, speeding up and simplifying calculations. The system is highly accurate within each zone (error less than 1:10,000). Outside a specific state plane zone, accuracy rapidly declines, thus the system is not useful for regional or national mapping.

4.0 Applicability

4.1 State Government Agencies

State agencies that have the primary responsibility for developing and maintaining aerial imagery data for a particular jurisdiction(s) or geographic area (e.g. for counties for which it has assumed the primary role) are required to comply with the standards as described in Section 1. Those state agencies with oversight responsibilities in this area are required to ensure that their oversight guidelines, rules, and regulations are consistent with these standards. The Nebraska Department of Roads has other imagery acquisition requirements for wetland and reconnaissance projects. They will continue to adhere to their independent photogrammetry requirements as suggested in the NDOR On-Call Digital Aerial Photography, Photogrammetric and Airborne LiDAR Services.

4.2 State Funded Entities

Entities that are not State agencies but receive State funding, directly or indirectly, for aerial imagery development and maintenance for a particular jurisdiction or geographic area are required to comply with the standards as described in Section 1.

4.3 Other

Other entities, such as city and local government agencies (e.g. County Engineer, assessors, and municipalities) that receive state funds have the primary responsibility for developing and maintaining aerial imagery data are required to comply with the standards as described in Section 1.

5.0 Responsibility

5.1 NITC

The NITC shall be responsible for adopting minimum technical standards, guidelines, and architectures upon recommendation by the technical panel. Neb. Rev. Stat. § 86-516(6)

5.2 State Agencies

The State of Nebraska, Office of the CIO (OCIO) GIS Shared Services will be responsible for assuring that metadata is completed and the data is registered and available for distribution through NebraskaMAP.

5.3 Granting Agencies and Entities

State granting or fund disbursement entities or agencies will be responsible for ensuring that these standards are included in requirements related to fund disbursements as they relate to aerial imagery.

5.4 Other

Local government agencies that have the primary responsibility and authority for aerial imagery acquisition will be responsible for ensuring that those sub-sections defined in Section 1 will be incorporated in the overall imagery data development efforts and contracts.

6.0 Authority

6.1 NITC GIS Council

According to Neb. Rev. Stat. § 86-572(2), the GIS Council shall: Establish guidelines and policies for statewide Geographic Information Systems operations and management (a) The acquisition, development, maintenance, quality assurance such as standards, access, ownership, cost recovery, and priorities of data bases; (b) The compatibility, acquisition, and communications of hardware and software; (c) The assessment of needs, identification of scope, setting of standards, and determination of an appropriate enforcement mechanism; (d) The fostering of training programs and promoting education and information about the Geographic Information Systems; and (e) The promoting of the Geographic Information Systems development in the State of Nebraska and providing or coordinating additional support to address Geographic Information Systems issues as such issues arise.

7.0 Related Documents

7.1 American Society for Photogrammetry and Remote Sensing (ASPRS), ASPRS Accuracy Standards for Digital Geospatial Data (2014).

7.2 FGDC Content Standard for Digital Geospatial Data Version 2 (FGDC-STD-001-1998).

7.3 ISO 19115:2003(E) North American Profile (NAP) Metadata Standards. National Oceanic and Atmospheric Administration (NOAA). January 2012.

Addendum 1: License/Subscription Imagery Standards

A1.0 Description. NITC imagery standard to address any imagery licensing or commercial off-the-shelf (COTS) imagery subscription funded with state funds. Since the imagery is not a custom collection, it needs to be best available. The imagery needs to be high enough quality to be able to derive accurate street centerlines and address points (for example, to be able to digitize centerlines and address points on 12" imagery).

A2.0 Standards. For any imagery solution that is subscription based or licensed model, the vendor must meet the following specifications.

- A2.1 Image resolution. Minimum standard of 12" or 30 cm.
- A2.2 Horizontal accuracy. Provide the horizontal accuracy expressed as RMSEr or CE90 and CE95. Must document if the imagery meets NENA standards (draft or published). Must provide documentation on how the horizontal accuracy was determined.
- A2.3 Environmental. Environmental specifications such as cloud cover and snow/ice, bit depth and sun angle, need to meet NITC imagery standard sections 1.2.1.1, 1.2.1.4, and 1.2.1.5 and be documented.
- A2.4 Metadata. Provide metadata on the imagery collection. Metadata needs to follow the NITC metadata standards or at a minimum FGDC compliant metadata. Metadata should accompany individual tile sets.
- A2.5 Projections. Define what the data project is. The most common for Nebraska is Web Mercator WGS84, Nebraska State Plane NAD 83 Feet or UTM NAD 83. Nebraska is covered by UTM Zones 13, 14 and 15. Most of the state is UTM 14. NITC imagery standard is reference in section 1.2.7.
- A2.6 Datum. Define the datum used. The datum should meet the NITC imagery standard referenced in section 1.2.7.

A3.0 Guidelines. The following are items to be considered for any contract or Request for Proposal (RFP) regarding subscription or licensed imagery.

- A3.1 Accessing the imagery.
  - A3.1.1 Is the imagery available to be downloaded or streamed?
  - A3.1.2 If downloaded, what is the timeframe that the imagery can be downloaded or provided on hard drives and the format?
  - A3.1.3 If the imagery is streamed, what format will the REST service be? (For example, WMS, WTMS or other format.) Is the REST service tiled?
  - A3.1.4 Is a viewer also provided? If so, are there associated costs?
  - A3.1.5 Can the imagery be downloaded through the REST service?
- A3.2 Cost, terms and restrictions of the license or subscription.
  - A3.2.1 Is there an option for a 4th band to achieve Color IR? If so, at what cost?
  - A3.2.2 Are there options for higher resolutions, such as 3", 6", 15cm, or other resolutions? If so, at what cost?
  - A3.2.3 What are licensing restrictions with the subscription? (For example, is the imagery available to state agencies, political subdivisions, and viewable to the public?) Can the imagery be used in mobile collection applications?
  - A3.2.4 What happens to the imagery and access to the imagery after the contract expires or is terminated?
  - A3.2.5 What happens to prior versions of imagery? (For example, may prior versions be made available to the public for free?)
  - A3.2.6 Can the vendor provide an evaluations sample of the imagery of Nebraska to review during an evaluation period?

3-205. Street centerlines.

(1) The commission adopts by reference the most recent version of sections 2, 3, and 3.1 of the NENA Standard for NG9-1-1 GIS Data Model released by the National Emergency Number Association [https://www.nena.org/page/ng911gisdatamodel] for GIS data that consists of street centerlines.

(2) The following are optional additional attributes for street centerlines:

From Road Level	FromLevel	O	P	1
To Road Level	ToLevel	O	P	1

FromLevel: Specifies the 'elevation' of a segment FROM node (start point). This field does not require actual elevation in terms of real-world measurements. The value is only used to determine whether a turn is allowed from one street to a street that intersects it in a 2-dimensional space, similar to floors in a building. Nodes at the lowest level would be assigned 0, with overlapping nodes representing additional level(s)/overpass(es) will be assigned the next sequential integer value accordingly.

ToLevel: Specifies the 'elevation' of a segment TO node (end point). This field does not require actual elevation in terms of real-world measurements. The value is only used to determine whether a turn is allowed from one street to a street that intersects it in a 2-dimensional space, similar to floors in a building. Nodes at the lowest level would be assigned 0, with overlapping nodes representing additional level(s)/overpass(es) will be assigned the next sequential integer value accordingly.

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History: Adopted on March 27, 2015. Amended on July 25, 2019 and November 10, 2022.
URL: https://nitc.nebraska.gov/standards/3-205.pdf

3-206. Address points.

The commission adopts by reference the most recent version of sections 2, 3, and 3.2 of the NENA Standard for NG9-1-1 GIS Data Model released by the National Emergency Number Association [https://www.nena.org/page/ng911gisdatamodel] for GIS data that consists of address points.

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History: Adopted on March 27, 2015. Amended on July 25, 2019 and November 10, 2022.
URL: https://nitc.nebraska.gov/standards/3-206.pdf