



Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE)

SDSFIE Quality (SDSFIE-Q)

**Revision 4
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For:
The Assistant Secretary of Defense (Energy, Installations, and Environment)
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Executive Summary

The Assistant Secretary of Defense for Energy, Installations, and Environment (ASD(EI&E)), has issued this Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) Quality (SDSFIE-Q) standard as part of the governance of installation geospatial information and services (IGI&S) under the authority granted in DoDI 8130.01. The IGI&S Governance Group (IGG) developed this standard to foster coordinated and integrated approaches for IGI&S across the Department.

SDSFIE-Q specifies over-arching guidance for how the Department of Defense (DoD) will implement a tiered approach to quality, including data quality processes, measures, and metrics for vector, raster, and geospatial services developed and used by the installation geospatial information and services (IGI&S) community. This standard does not include a required schema or data model; therefore, it is not registered in the DoD IT Standards Registry (DISR) as a traditional IT standard would be. Instead, SDSFIE-Q defines a framework for IGI&S data quality, with enterprise-level and Component-level elements. SDSFIE-Q is based on the ISO 19157 conceptual model of quality for geographic data (ISO 19157 is a normative reference for several DISR-mandated geospatial standards related to the SDSFIE family of standards). When implemented, the intent of SDSFIE-Q is to ensure that IGI&S data and services align with IGI&S mission requirements, conform to DISR mandates, and are understandable, trusted, and interoperable in accordance with DoDI 8130.01.

SDSFIE-Q describes processes needed to ensure quality data management or data collection and maintenance at a Department-wide level. It identifies the important elements that should be covered in IGI&S Program-level quality management plans (or guidance).-These elements can also be used as measures to evaluate the completeness of the Components' guidance and conformance to the framework prescribed herein. The document outlines a formal process for defining measures to assess the quality and completeness of data, as well as the reporting of metrics associated with these data quality measures, using the SDSFIE Metadata (SDSFIE-M) standard and other applicable methods.

Adherence to the data quality guidance and processes detailed in this document is required any time IGI&S data or services are created, updated, maintained, or shared. SDSFIE-Q also includes specific data quality processes, measures, and metrics that apply individually to IGI&S vector data (SDSFIE-V), raster data (SDSFIE-R), or services, as applicable.

Revision History

Description	Date	Version
SDSFIE-Q Final Approved	12 Dec 2016	
SDSFIE-Q Rev 1 Draft Major changes include: Revised SDSFIE-R section Raster Metrics Aggregates and Repositories Section OV-5 and BEA operational activities	1 May 2018	Rev1
SDSFIE-Q Rev 1 WG Final Draft Major changes include: Revised metrics creation and approval process Addition of “application” scope Addition of RBJ Guidance Revised DCS Example	3 Jul 2018	Rev1
SDSFIE-Q Rev 1 Final Approved	12 Sep 2018	Rev1
SDSFIE-Q Rev 2 Final Major changes include: Addition of SDSFIE-S Section Updates to the DCS General Guidance Revised DCS Example	12 Mar 2020	Rev2
SDSFIE-Q Rev 3 Draft Major changes include: Removal of DCS General Guidance, Metadata Examples, and SDSFIE Contract Language Removal of implementation guidance language that was moved to the SDSFIE-Q Implementation Guidance Administrative edits: Update to ASD(EI&E) Revised services section	5 Apr 2023	Rev3
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SDSFIE-Q Rev 4 Draft Revised Quality Metric tables to discontinue metrics that use incorrectness metrics, e.g., 5% minimum Reorder Metric Tables in numerically sequential order Substitute Quality Evaluation Tool for RBJ Update References and Acronyms	3 Apr 2025	Rev4

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Part 1: Overview of SDSFIE-Q

1 Introduction

The Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) are a family of installation geospatial information and services (IGI&S) standards, guidance, and frameworks that include models and specifications. In short, they define a Department of Defense (DoD)-wide set of semantics intended to maximize interoperability of geospatial information and services for installation, environment, and civil works missions. The SDSFIE family consists of six parts, defined in the SDSFIE Governance Plan Revision 5. The SDSFIE Quality standard (SDSFIE-Q) is one of the parts of SDSFIE. It delineates an IGI&S data quality framework for vector, raster, and geospatial services, incorporating both enterprise-level and Component-level elements used by the IGI&S community, as specified in DoDI 8130.01.

SDSFIE-Q does not include a required schema or data model; therefore, it is not registered in the DoD IT Standards Registry (DISR) as a traditional IT standard would be. Instead, SDSFIE-Q defines a framework for IGI&S data quality, with enterprise-level and Component-level elements. SDSFIE-Q is based on the ISO 19157 conceptual model of quality for geographic data (ISO 19157 is a normative reference for several DISR-mandated geospatial standards which are related to the SDSFIE family of standards¹). When implemented, the intent of SDSFIE-Q is to ensure that IGI&S data and services align with IGI&S mission requirements, conform to DISR mandates, and are understandable, trusted, and interoperable in accordance with DoDI 8130.01.

SDSFIE-Q includes a formal process for defining measures to assess the quality and completeness of data, as well as the reporting of metrics associated with these data quality measures using the SDSFIE Metadata (SDSFIE-M) standard and other applicable means. Adherence to the data quality guidance and processes outlined in this document is required whenever IGI&S data or services are created, updated, maintained, or shared. SDSFIE-Q also includes data quality processes, measures, and metrics that specifically apply to IGI&S vector data (SDSFIE-V), raster data (SDSFIE-R), and services. SDSFIE-Q is designed to align with all data standards established or accepted for use by the IGI&S community.

This document is organized into four parts:

- Part 1: Quality guidance for all IGI&S data and services. Part 1 consists of two main concepts:
 - An overview of the foundational concepts of ISO 19157 that shape SDSFIE-Q. (section 2)
 - The SDSFIE-Q Framework. (section 3)
- Part 2: Quality guidance specific to vector datasets—SDSFIE-V. (section 4)
- Part 3: Quality guidance specific to raster datasets—SDSFIE-R. (section 5)
- Part 4: Quality guidance specific to aggregates (e.g., CIP) and repositories (e.g., ADS). (section 6)
- Part 5: Quality guidance specific to services. (section 7)

1.1 Purpose

The purpose of this document is to establish overarching guidance for how DoD will implement a tiered approach to quality, including data quality processes, measures, and metrics for vector, raster, and geospatial services. This guidance is designed to ensure that the IGI&S community provides trusted, authoritative, and accurate geospatial data and services to the DoD for informed decision-making.

¹ The NMF/NMIS 2.x form the basis of SDSFIE-M and the quality model used by these standards are an implementation of the concepts in ISO 19157. Thus the ISO 19157 conceptual model is used as a basis for SDSFIE-Q in order to align with these concepts and schemas in NMF/NMIS and SDSFIE-M.

Implementing SDSFIE-Q is necessary to meet the requirements of DoDI 8320.02, which states that data will be made visible, accessible, understandable, trusted, and interoperable throughout their lifecycle for all authorized users.

1.2 Authority

In accordance with DoDI 8130.01, this standard applies to the management of DoD installations and environment to support military readiness in the Active, Guard, and Reserve Components with regard to facility construction, sustainment, and modernization including the operation and sustainment of military test and training ranges as well as the US Army Corps of Engineers Civil Works community. Its applicability for other interested organizations is suggested but not mandatory.

DoDI 8130.01 grants authority to the ASD (EI&E) to develop, manage, and publish IGI&S standards, and it requires that these standards be coordinated through the Geospatial Intelligence Standards Working Group (GWG). SDSFIE-Q is conformal with ISO 19157, the current spatial data quality standard referenced by other geospatial data standards mandated for DoD use by the GWG and the Joint Enterprise Standards Committee (JESC). In accordance with the procedures outlined in DoDI 8130.01, the ASD(EI&E) mandated the use of SDSFIE-Q as the standard for IGI&S across the DoD.

1.3 Scope

This standard is intended to be enterprise-level guidance. It consists of a quality management framework comprising elements to be implemented at the Department (enterprise) level, the DoD Component level, and organizational levels below these (as directed by the appropriate organizational level). This framework includes a set of processes, quality measures, and corresponding metrics (e.g., minimum standards) for spatial data quality. These are intended to guide and constrain the spatial data quality management policy, guidance, and plans issued by the Components' IGI&S Programs. This plan describes compliance with documented standards, database referential integrity, and data quality reporting elements. It outlines management processes to define and document clear metrics and guidance for data quality.

The SDSFIE-Q Implementation Guidance (SQIG) document should be used in conjunction with SDSFIE-Q. The SQIG further describes the processes needed to ensure quality data management, data collection, and data maintenance at a Department-wide level. It identifies the important elements that should be covered in IGI&S Program-level quality management plans (or guidance). These elements can also be used as measures to evaluate the completeness of the Components' guidance and conformance to the framework prescribed herein.

1.4 References

DoD CIO EA Memo, *DoD Chief Information Officer Memorandum, Department of Defense Information Enterprise Architecture*, Version 2.0, 10 Aug 2012

DoDD 5105.60, *National Geospatial-Intelligence Agency (NGA)*, 29 Jul 2009, as amended

DoDI 8130.01, *Installation Geospatial Information and Services (IGI&S)*, Change Notice 3, 04 Aug 2020

DoDI 8320.02, *Sharing Data, Information, and Technology (IT) Services in the Department of Defense*, Change Notice 1, 24 Jun 2020

DoDI 8320.03, *Unique Identification (UID) Standards for Supporting the DoD Information Enterprise*, Change Notice 3, 25 Oct 2021

ISO 19115-1, ISO 19115-1, *Geographic information –Metadata -- Part 1: Fundamentals*, Apr 2014, 01 Apr 2014

ISO 19157:2013, *Geographic Information–Data Quality*, Edition 1, 06 Dec 2013

OASD(EI&E) SDSFIE Governance, *OASD(EI&E) Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) Governance Plan*, Revision 5, 19 Aug 2024

OASD(EI&E) SDSFIE-M, *Spatial Data Standards for Facilities, Infrastructure, and Environment - Metadata*, Revision 5, 12 Dec 2022

OASD(EI&E) SDSFIE-Q, *SDSFIE-Q—Spatial Data Standards for Facilities, Infrastructure, and Environment, Revision 4*, 30 Mar 2025

OASD(EI&E) SDSFIE-R, *Spatial Data Standards for Facilities, Infrastructure, and Environment -Raster*, Revision 1, 13 May 2024

OASD(EI&E) SDSFIE-V, *Spatial Data Standards for Facilities, Infrastructure, and Environment -Vector*, Revision 6, 17 Dec 2021

1.5 Acronyms

ADS	Authoritative Data Source
APSR	Accountable Property System of Record
ASD(EI&E)	Assistant Secretary of Defense for Energy, Installations, and Environment
ASD(S)	Assistant Secretary of Defense for Sustainment
CIP	Common Installation Picture
CIO	Chief Information Officer
DCG	Data Collection Guide
DCS	Data Content Specification
DISDI	Defense Installations Spatial Data Infrastructure
DISR	DoD IT Standards Registry
DLS	Data Layer Specification
DoD	Department of Defense
DoDM	DoD Manual
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DODIN	Department of Defense Information Network
DUSD(I&E)	Deputy Under Secretary of Defense for Installations and Environment
EI&E	Energy, Installations, and Environment
GEOINT	Geospatial Intelligence
GIO	Geospatial Information Officer
GWG	Geospatial Intelligence Standards Working Group
HQ	Headquarters
I&E	Installations and Environment
IGG	IGI&S Governance Group
IGI&S	Installation Geospatial Information and Services
ISO	International Standards Organization
JESC	Joint Enterprise Standards Committee
NGA	National Geospatial-Intelligence Agency
NMF	National System for Geospatial-Intelligence (NSG) Metadata Foundation
NMIS	NSG Metadata Implementation Specification
NSG	National System for Geospatial-Intelligence
OSD	Office of the Secretary of Defense
QAP	Quality Assurance Plan
QET	Quality Evaluation Tool
RACI	Responsible, Approval, Consulted, Informed
RAM	Responsibility Assignment Matrix
RPIR	Real Property Inventory Requirements
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment

SDSFIE-M	Spatial Data Standards for Facilities, Infrastructure, and Environment – Metadata
SDSFIE-Q	Spatial Data Standards for Facilities, Infrastructure, and Environment–Quality
SDSFIE-R	Spatial Data Standards for Facilities, Infrastructure, and Environment–Raster
SDSFIE-V	Spatial Data Standards for Facilities, Infrastructure, and Environment–Vector
SMIS	SDSFIE Metadata Implementation Specification
SQIG	SDSFIE Quality Implementation Guidance

1.6 Document Maintenance

This document will be reviewed and updated as needed, with each action documented in the revision history. When changes occur, the version number will be updated to the next increment and the date, owner making the change, and change description will be recorded.

1.7 Terms and Definitions

Accessible

Data and services can be accessed via the Department of Defense Information Network (DODIN) by users and applications in the enterprise. Data and services are made available to any user or application except where limited by law, policy, security classification, or operational necessity. [DoD CIO Memorandum]

Accuracy

Closeness of agreement between a test result or measurement result and the true value. [ISO 3534-2:2006]

Aggregate

A data quality scope used to evaluate metrics applied to a dataset that is aggregated from other datasets.

Authoritative Data Source (ADS)

A recognized or official data source with a designated mission statement, source, or product to publish reliable and accurate data for subsequent use by customers. An authoritative data source may be the functional combination of multiple separate data sources. [DoDD 8320.03]

Common Installation Picture (CIP)

The distinct minimum set of geospatial features and imagery necessary to provide a foundational map depicting DoD installations and sites. The purpose of the CIP is to provide a readily available, standardized map background to serve as the basis for planning and execution of ASD(S) responsibilities and functions. [DoDI 8130.01]

Conformance

Fulfillment of specified requirements. [ISO 19105]

Conformance Quality Level

Threshold value or set of threshold values for data quality results used to determine how well a dataset meets the criteria set forth in its DCS or user requirements. [ISO 19157]

Correctness

Correspondence with the universe of discourse. [ISO 19157]

Data Content Specification (DCS)

Detailed description of a dataset or dataset series together with additional information that will enable it to be created, supplied to, and used by another party. [ISO 19131]

Note: The above definition is for a data product specification. In SDSFIE-Q, data product specifications are called data content specifications.

Data Quality Basic Measure

Generic data quality measure used as a basis for creating specific data quality measures. [ISO 19157]

Note: Data quality basic measures are abstract data types. They cannot be used directly when reporting data quality.

Data Quality Element

A component describing a particular aspect of the quality of geographic data.

Data Quality Result

The output of a data quality evaluation.

Data Quality Scope

Specifies the extent, spatial and/or temporal, and/or common characteristic(s) that identify the data on which data quality is to be evaluated.

Data Quality Unit

The combination of a scope and one or more data quality elements.

Dataset

Identifiable collection of data. [ISO 19115]

Data Steward

An organization within an authoritative source that is responsible for collecting and maintaining authoritative data.

Direct Evaluation Method

Method for evaluating the quality of a dataset by inspecting the items within it. [ISO 19157]

Feature

Abstraction of real-world phenomena. [ISO 19101]

Feature Attribute

Characteristic of a feature. [ISO 19101]

Feature Type

Class of features having common characteristics. [ISO 19156]

Installation Geographic Information and Services (IGI&S)

The subset of GI&S activities that apply to the management of DoD installations and environment to support military readiness in the Active, Guard, and Reserve Components with regard to facility construction, sustainment, and modernization, including the operation and sustainment of military test and training ranges, and which support DoD business enterprise priorities as defined in the DoD business enterprise architecture (BEA). IGI&S supports and is enabled by geospatial engineering and general engineering, as defined in Joint Publication 3-34. [DoDI 8130.01]

Interoperability

The ability of systems, units, or forces to provide data, information, materiel, and services to and accept the same from other systems, units, or forces and to use the data, information, materiel, and services so exchanged to enable them to operate effectively together. IT and National Security Systems interoperability includes both the technical exchange of information and the end-to-end operational effectiveness of that exchange of information as required for mission accomplishment. More than just

information exchange, it includes systems, processes, procedures, organizations, and missions over the lifecycle and must be balanced with information assurance. [DoDI 8130.01]

Measure

A description of the type of evaluation being assessed to determine a data quality result.

Metric

A specific, measurable indicator that addresses data quality compliance.

Note: Metrics are created when measures are assigned a scope.

Metadata

Information describing the characteristics of data, data or information about data, or descriptive information about an entity's data, data activities, systems, and holdings. For example, discovery metadata allows data assets to be found using enterprise search capabilities. Metadata can be structural (specifying the format structure), semantic (specifying the meaning), or descriptive (providing amplifying or interpretive information) for data, information, or IT services. [DoDI 8130.01]

Metaquality

Information describing the quality of data quality. [ISO 19157]

Quality

Degree to which a set of inherent characteristics fulfills requirements. [ISO 19157]

Repository

A repository is a collection of datasets that is stored and maintained in a location (e.g., enterprise database(s), system, server, etc.). A repository should include well-defined, curated content.

Standalone Quality Report

Free text document providing fully detailed information about data quality evaluations, results, and measures used. [ISO 19157]

Trusted

Users and applications can determine and assess the suitability of the source because the pedigree, security level, and access control level of each data asset or service is known and available. [DoD CIO Memorandum]

Understandable

Users and applications can comprehend the data, both structurally and semantically, and readily determine how the data may be used for their specific needs. [DoD CIO Memorandum]

Visible

The property of being discoverable. All data assets (intelligence, non-intelligence, raw, and processed) are advertised or "made visible" by providing metadata, which describes the asset. [DoD CIO Memorandum]

2 ISO 19157 Components of a Quality Framework

The data quality concepts defined in *ISO 19157:2013, Geographic Information–Data Quality*, provide the foundation for the structure of SDSFIE-Q. SDSFIE-Q conforms to the ISO 19157 conceptual model of quality for geographic data. This model defines components for measuring, evaluating, and reporting data quality based on the ISO 19157 data quality elements. Figure 1 (below), from ISO 19157 (Figure 1), provides an overview of these components. This section will describe each ISO quality framework component, providing the background necessary to understand the IGI&S Quality Management Framework introduced in section 3.

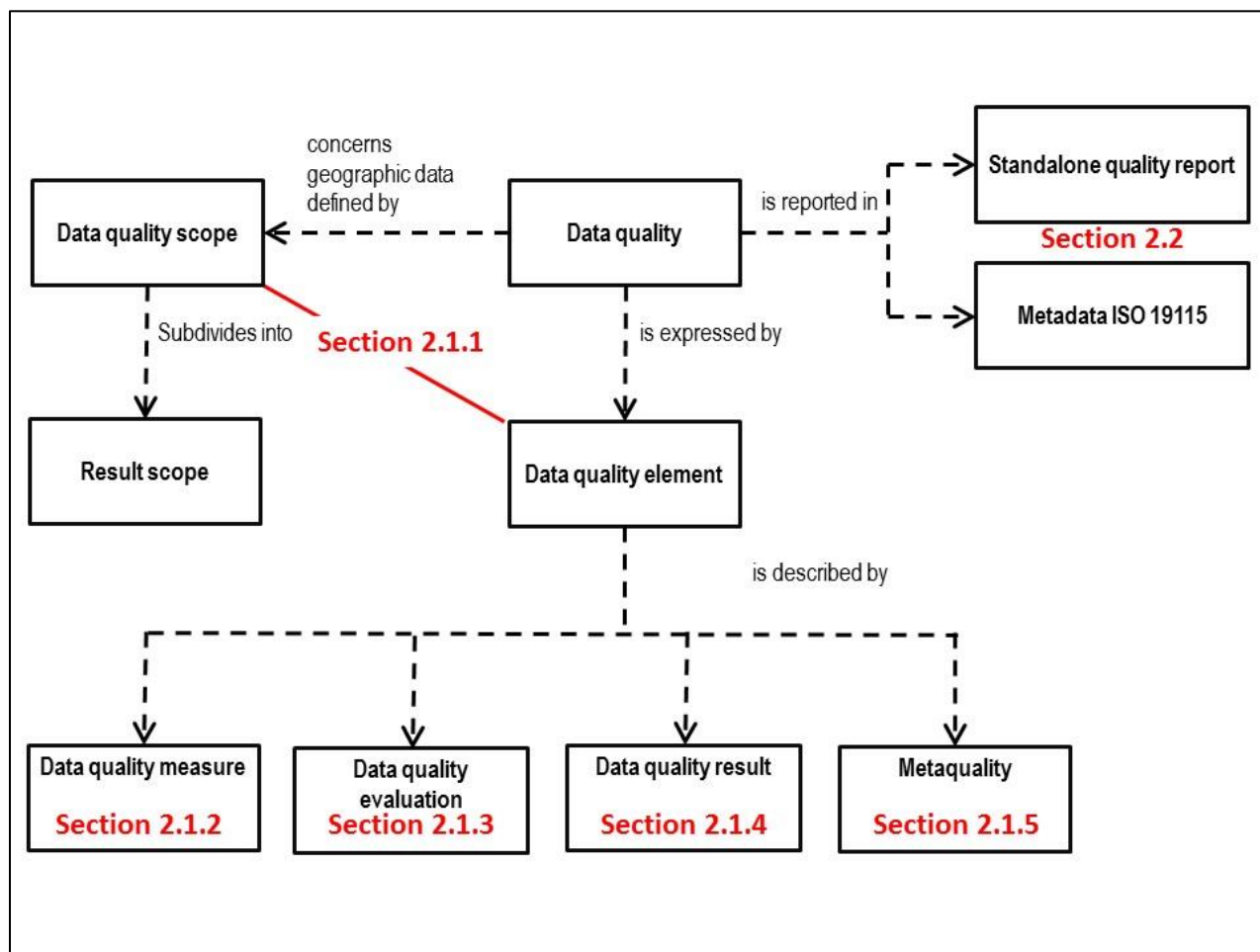


Figure 1: ISO 19157 Components of a Quality Framework

2.1 ISO 19157 Data Quality Evaluation Process

As shown in Figure 2 (ISO 19157 Figure 12) below, the data quality evaluation process consists of establishing data quality units, defining measures, determining the proper evaluation method, and reporting the evaluation results in metadata. Data quality should be evaluated when data is created or updated, to determine compliance with a data content specification or to determine compliance with user requirements.

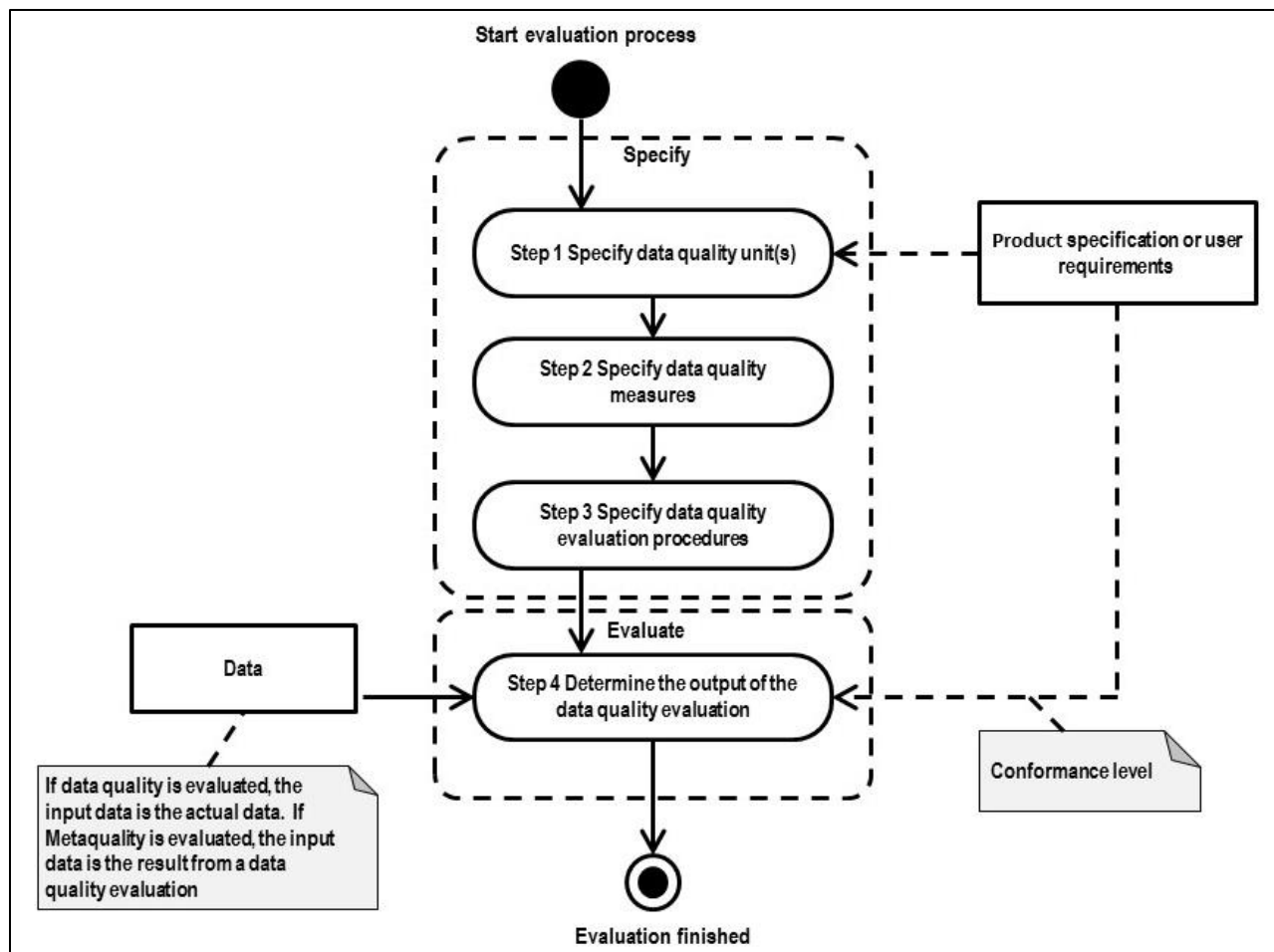


Figure 2: ISO 19157 Data Evaluation Process
(ISO 19157 Figure 12)

2.1.1 Data Quality Units

According to ISO 19157, there are two aspects of data quality: scope and a defined data quality element. The scope and data quality element pair is referred to as the data quality unit. A data quality unit must be defined before determining measures and evaluation methods (see Figure 2, Step 1). Figure 3 below provides examples of data quality units.

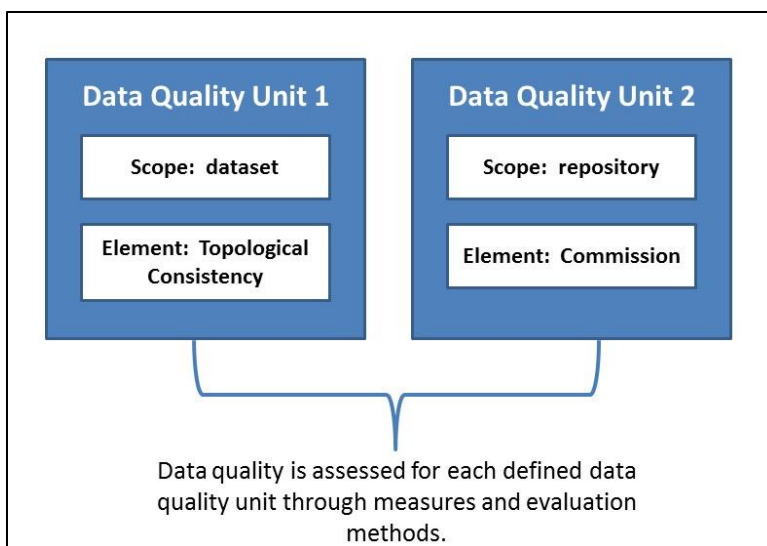


Figure 3: Data Quality Units

2.1.1.1 Data Quality Scope

The data quality scope identifies the extent (spatial, temporal, subset with defined characteristics, etc.) of the data that will be evaluated. Scope is reported in the DQ_Scope element. The MD_ScopeCode constrains it.² Table 1 below lists the scope codes applicable to SDSFIE-Q and SDSFIE-M.

Table 1: Metadata Codes for Data Quality Scope (from ISO 19115)

MD_ScopeCode	Definition
dataset	information applies to the dataset
service	information applies to a capability which a service provider entity makes available to a service user entity through a set of interfaces that define a behavior, such as a use case
metadata	information applies to metadata
document	information applies to a document
repository	information applies to a repository
aggregate	information applies to an aggregate resource
application	information resource hosted on a specific set of hardware and accessible over a network

2.1.1.2 ISO 19157 Data Quality Elements

Once a scope is defined, a data quality element must be specified. The data quality element describes the specific aspect of data quality that is being evaluated. ISO 19157 divides data quality elements into six categories: completeness, logical consistency, positional accuracy, thematic accuracy, temporal accuracy, and usability. The following sections define these data quality elements in accordance with ISO 19157.

² Scope is constrained in metadata by the MD_ScopeCode element in ISO 19115:2003, which is the ISO standard for metadata.

2.1.1.2.1 Completeness

Completeness is defined as the presence and absence of features, their attributes, and relationships. Completeness is comprised of the following elements:

- Commission—data that is excess or additional data beyond what is required.
- Omission—data that is absent or missing from the data layer.

2.1.1.2.2 Logical Consistency

Logical Consistency is defined as the adherence to the ruleset for the data structure, attribution, and relationships. Logical Consistency consists of:

- Conceptual consistency—adherence to rules of the conceptual schema.
- Domain consistency—adherence of values to the value domains.
- Format consistency—degree to which data is stored in accordance with the physical structure of the dataset.
- Topological consistency—correctness of the explicitly encoded topological characteristics of a dataset.

2.1.1.2.3 Positional Accuracy

Positional Accuracy is defined as the accuracy of the position of features within a designated spatial reference system. Positional accuracy includes both absolute and relative accuracy. Positional accuracy consists of the following data quality elements:

- Absolute or external accuracy—the closeness of reported coordinate values to values accepted as true.
- Relative or internal accuracy—the closeness of the relative positions of features in a dataset to their respective relative positions accepted as true.

2.1.1.2.4 Thematic Accuracy

Thematic Accuracy is defined as the accuracy or correctness of attributes, the classifications of features, and their relationships. Thematic Accuracy consists of:

- Classification correctness—correctness of the classes of features or attributes.
- Non-quantitative attribute correctness—correctness of an attribute.
- Quantitative attribute accuracy—accuracy of an attribute compared to a known value.

2.1.1.2.5 Temporal Quality

Temporal Quality is defined as the quality of the temporal aspect of the data layer. Temporal Quality addresses the following elements:

- Accuracy of a time measurement—closeness of reported time measurements to true values.
- Temporal consistency—correctness of the order of events.
- Temporal validity—validity of data with respect to time.

2.1.1.2.6 Usability

The usability element is based on user requirements and is therefore less structured than the other elements. Usability can describe quality information about a dataset's suitability for a particular application, or conformance to a set of requirements. For SDSFIE-Q, usability is defined as the adherence to a data content specification.

2.1.2 Measures

A measure is a description of the type of evaluation being assessed to determine a data quality result. A measure will be evaluated for a specific data quality unit. Data quality measures can be derived from a *basic measure* (see Step 2 in Figure 2). A *basic measure* is a generic data quality measure used as a basis for creating specific data quality measures. *Basic measures* are used for count-related and general statistical measures that share commonalities. Appendix A contains a summarized list of measures and their corresponding *basic measures*, where applicable, as identified in ISO 19157 Annex G. Examples of measures include:

- Rate of missing items
- Number of duplicate feature instances
- Conceptual schema compliance
- Number of invalid self-intersect errors
- Number of incorrectly classified features

When creating measures that are not included in ISO 19157 Annex G, the user should structure the new measures using the standard *basic measures*.

When measures are associated with a specific data quality unit (scope and element), they are referred to as metrics within this document (see section 3.3.4)

2.1.3 Evaluation Methods

An evaluation method is the procedure used to evaluate the defined measure for a data quality unit (see Step 3 in Figure 2). As described in ISO 19157, data may be assessed using direct, indirect, or aggregation-based methods.

1. Direct evaluation requires a full inspection or sampling of the data, either with or without external reference data. The results of a direct evaluation will normally be quantitative. External direct evaluation indicates that external reference data is used for the evaluation. Internal direct evaluation indicates no external data was referenced.
2. Indirect evaluation involves using inherent knowledge along with existing information, such as the source and date, to determine the quality of the data. Indirect evaluation is not recommended for SDSFIE-Q since the results may be subjective, inconsistent, and non-repeatable.
3. Data quality results may be aggregated or derived from the results of existing evaluations. These results can be aggregated from different scopes and data quality elements to provide an aggregated result.

2.1.4 Results

The output of a data quality evaluation is a result (see Step 5 in Figure 2). Each data quality element evaluated can have multiple results for a dataset. ISO 19157 identifies the following types of results:

- **Quantitative Result**—A single value or multiple values based on the measure being evaluated.
- **Conformance Result**—Used when the results of a data quality evaluation are compared with a known conformance quality level. The conformance quality level should be specified in a data content specification or user requirements.
- **Descriptive Result**—A textual statement describing the subjective data quality evaluation result. Descriptive results are not recommended for SDSFIE-Q since the results are based on a subjective, inconsistent, and non-repeatable evaluation method.
- **Coverage Result**—The result of a data quality evaluation, organized as a coverage.

2.1.5 Metaquality

Metaquality is used to evaluate the results of a data quality evaluation, or to compare results from multiple data quality evaluations. Metaquality can evaluate confidence, representativity, or homogeneity of a dataset or multiple datasets.

2.2 *ISO 19157 Data Quality Reporting*

Reporting the results of a data quality evaluation provides users with information to determine the overall quality of a dataset, including compliance with data content specifications or satisfaction of other user requirements. The results of a data quality evaluation will be reported in metadata using the DQ_DataQuality element. A stand-alone data quality report may also be required if the data quality results are aggregated or derived. The stand-alone report should be used to provide additional details that cannot be expressed in the metadata.

3 The SDSFIE-Q Framework

Quality management for IGI&S data and services is based on the ISO 19157 components of data quality management, as discussed in the previous section. The SDSFIE-Q framework consists of: roles and responsibilities (including specific data quality management activities); and a workflow of operational activities. The following sections describe the roles, responsibilities, and activities.

3.1 Defined Roles

Most SDSFIE-Q roles and responsibilities flow from the authorities described in section 1.2, specifically from DoDI 8130.01. The roles identified in data quality management are as follows:

Table 2: SDSFIE-Q Roles

IGI&S Governance Group (IGG)	The IGG is responsible for establishing data quality guidance to promote the adoption and refinement of SDSFIE-Q. The IGG will maintain the metadata content standard and provide guidance for using the metadata standard to describe data quality. The IGG will create guidance for and review Component quality management plans in accordance with SDSFIE-Q.
OASD(EI&E) Geospatial Information Officer (GIO)	The role of the GIO is established in DoDI 8130.01. Specific responsibilities involve leadership and support of the IGG regarding data quality processes and quality management plans, leadership of the data quality working group, and coordination with the DoD GEOINT Manager. The GIO is also responsible for publishing data content specifications at the OSD level in coordination with the Data Quality Working Group.
Component IGI&S Programs	The DoD Component IGI&S Programs are responsible for coordinating and directing the creation, maintenance, and distribution of IGI&S data at the Component level. Component IGI&S Programs will develop Component-level data quality metrics and guidance through quality management plans and data content specifications.
SDSFIE Quality Working Group	The IGG created the SDSFIE Quality Working Group to establish enterprise processes and management structures for evaluating data quality. SDSFIE Quality Working Group responsibilities include: • Formulate an enterprise approach to IGI&S data quality. • Develop a quality management framework that can be integrated with IGI&S Program management processes. • Identify IGI&S requirements for data quality and establish measures and processes to evaluate data maturity and compliance.
Authoritative Data Source (ADS) Manager	A person, office, or organization responsible for maintaining the IGI&S ADS for each installation. The ADS Manager role is Component-specific. Refer to Component guidance for more information about how the role is implemented.
Policy Proponents	A policy proponent is a DoD organization that has responsibility for enterprise data requirements and guidance. A policy proponent is typically at the Component headquarters or OSD level. Policy proponents are not normally responsible for creating and maintaining spatial data.

Data Requirements Proponents	An agency, department, activity, or organization that has primary responsibility for material or subject matter expertise in its area of interest and has lead responsibility for coordinating the collection, coverage, and stewardship, including maintenance and update, of a specific spatial data theme or mission dataset. Data proponents are not typically directly in the line of authority for the IGI&S Programs, but create and maintain spatial data. Relations must be developed with data proponents so that the data they create is compliant with enterprise spatial data requirements. Data requirement proponents are responsible for providing clear data requirements and specifications for data.
DoD Contract Office (Project-Based)	The government official responsible for generating and approving contract arrangements for creation and maintenance of project-based IGI&S data. The contract officer shall ensure that contracts for the generation of IGI&S data include contract language requiring adherence to DoD standards and DCS requirements and shall also ensure that all deliverables are reviewed to confirm that standards and specifications are met.
IGI&S Program Analysts	IGI&S Program Analysts are either DoD-contracted or government personnel responsible for creating and maintaining IGI&S data. IGI&S Program Analysts may be under the direct control of an IGI&S program, but they may also be controlled by other business lines or mission areas (e.g., public works, environmental, etc.). These analysts must ensure that products adhere to standards and specifications (e.g., DCS).
Users	Data users are those persons who need to discover spatial data resources, develop content, or make information release decisions. Spatial data end-use can be constrained by certain quality considerations, and end users bear responsibilities associated with these considerations in their end use, such as: • Consulting metadata to know specific constraints on data being used. • Understanding the implications of spatial data constraints on decision-making. • Reviewing data content products before they are released.

These roles and associated responsibilities, which correspond to the operational activities described in Figure 4, are outlined in Table 3 using a responsibility assignment matrix (RAM), also known as a RACI matrix. A RACI matrix describes the participation by various roles in completing tasks or deliverables for a project or business process.³

³ Margaria, Tiziana (2010). Leveraging Applications of Formal Methods, Verification, and Validation: 4th International Symposium on Leveraging Applications, Isola 2010, Heraklion, Crete, Greece, October 18–21, 2010, Proceedings, Part 1. Springer. p. 492. ISBN 3-642-16557-5.

RACI is an acronym derived from the four key responsibilities used in this document⁴:

Responsible (R)—Roles that have a significant responsibility in performing the objective, as well as government roles that have responsibility over an objective.

Approval (A)—Roles that have review and approval authority. There may be several levels of review in the same objective.

Consulted (C)—Roles that collaborate and consult at some point during the process but do not have approval authority.

Informed (I)—Roles that are socialized concerning the activities or artifacts but do not have approval, review, nor consulting responsibilities.

⁴ Note that the set selected for this document is most commonly used for decision-making. The "A" is often used to mean "Accountable", but, in our case "Approval" is a better choice.

Table 3: Data Quality RACI Chart

	IGI&S Governance Group (IGG)	OASD(EI&E) Geospatial Information Officer (GIO)	Component IGI&S Programs	SDSFIE Quality WG	ADS Manager	Policy Proponents	Data Requirements Proponents	DoD Contract Office (Project-Based)	IGI&S Program Analysts	Users
Quality Management Activities										
Define Geospatial Requirements										
Develop Quality Management Plans	A	A	R,A	C	C	C	C	I	I	I
*Develop Data Content Specifications	A	R	R	C	C	C	C	I	I,C	I
Specify SDSFIE Quality Contract Language	I	I	C	I	C	C	C	A,R	I	I
*Define Quality Metrics	A	R	R,A	R,C	R	C	C	I	I	I
Create Geospatial Information										
*Create and Acquire Data	A	R	R	C	R	I	R	R	R	I
*Create Metadata	A	R	R	C	I	C	R	R	R	I
Validate Geospatial Information										
Evaluate Data Quality	I	I	R,A	I	R	I	I	R	R	I
*Report Quality Results	A	R	R	C	R				R	I
Maintain Geospatial Information (Cleansing)										
*Cleanse Data	I	R	R	C	I	I	R	R	R	I
Obtain Resources for Cleansing	I	R	R	C	I	I	R	R	C	
Provide Geospatial Information										
*Determine Releasability	I	R	R	I	I	R	C	R	R	I
*Make Data Accessible and Discoverable (includes providing geospatial data, services, visualization services, and analysis)	I	R	R	I	R	I	R	R	R	I
Provide Feedback	C	C	R,A	C	C	R	R	R	R	R

Note: Responsibilities with an asterisk (*) denote objectives that will happen at OSD level and Component level, and thus may have different responsibilities for a given role at each level

3.2 Quality Management Workflow

Figure 4 is an OV-5 Operational Activity diagram. It details the workflow of quality management activities for the IGI&S data lifecycle, from requirements gathering to completeness. These activities correspond to Quality Management Activities on the RACI matrix (Table 2). Each operational activity is discussed in further detail in the following sections:

- Define Geospatial Requirements (section 3.3)
- Create Geospatial Information (section 3.3.4.3)
- Validate Geospatial Information (section 3.5)
- Maintain Geospatial Information (Cleansing) (section 3.6)
 - Obtain Resources (section 3.6.1.1)
- Provide Geospatial Information (section 3.7)
 - Provide Geospatial Data and Geospatial Data Services (section 0)
 - Provide Geospatial Visualization Services (section 3.7.2.2)
 - Provide Geospatial Analytical Services (section 3.7.2.3)

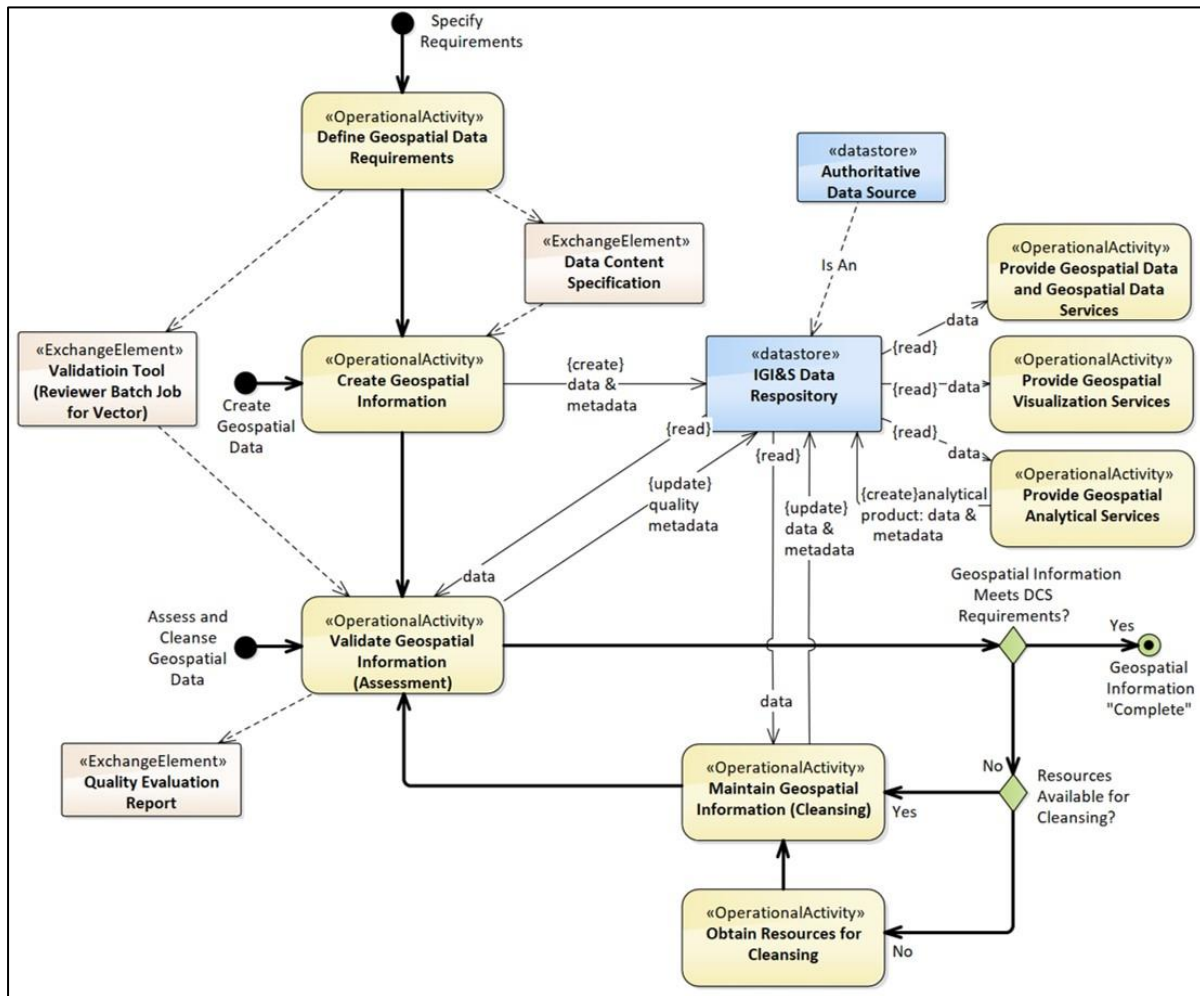


Figure 4: IGI&S Quality Management Operational Activity Diagram

3.3 Quality Management Activity: Define Geospatial Requirements

Quality Management tools are methods used to define geospatial requirements and execute quality control and assurance through guidance, contract language, data content specifications (DCS), and metrics. The following quality management actions are identified in SDSFIE-Q:

- Develop Quality Management Plans (section 3.3.1)
- Develop Data Content Specification (DCS) (section 3.3.2)
- Specify SDSFIE Quality Contract Language (section 3.3.3)
- Define Quality Metrics (section 3.3.4)

3.3.1 Quality Management Plans

Each DoD Component shall develop a quality management plan to ensure consistency and quality of IGI&S data and services. The quality management plan shall guide all levels of the Component in the implementation of SDSFIE-Q, providing mission-specific guidance, metrics, or other direction as needed. Refer to the SQIG for details about what should be included in the quality management plan.

Component quality management plans will be reviewed and validated by the IGG through the *document approval process* defined in the SDSFIE Governance Plan (section 3.4.1) to ensure they are consistent with DoD policy and IGG guidance or processes.

3.3.2 Data Content Specification (DCS)

OSD and Component IGI&S Programs shall create DCSs for IGI&S vector data. A DCS (alternatively known as a Quality Assurance Plan (QAP), Data Layer Specification (DLS), Data Collection Guide (DCG), or Entity Specification Directive (ESD)) documents the format and quality expectations for a geospatial data layer (or set of layers). The quality criteria in the DCS shall be used to direct and control quality during the generation, collection, or maintenance of geospatial features. The DCS shall also specify metrics and data quality evaluation procedures for each layer. See section 4.3 for DCS format, content, and quality reporting guidance.

Refer to the DCS General Guidance (SQIG Annex F) for DCS content requirements.

3.3.3 SDSFIE Quality Contract Language

Data quality is inextricably linked with data production or procurement. Whenever IGI&S data or services are procured, DoD activities should use contract language that specifies the data collection and maintenance expectations in acquisition-binding terms.

Refer to the SQIG (Annex F) for SDSFIE quality contract language examples and guidelines for how to cite SDSFIE standards in DoD contracts pertaining to IGI&S.

3.3.4 Define Quality Metrics

The IGG, Component IGI&S Programs, and ADS Managers are responsible for identifying and establishing data quality metrics based on policy drivers and business requirements. Metrics are specific, measurable indicators that address data quality compliance. Metrics are created when measures (as defined by ISO 19157) are assigned a corresponding scope, as shown in the example in Figure 5 below. In this example, the number of buildings reported in the Component's Accountable Property System of Record (APSR) is compared to the number of buildings included in the feature type for building. The data unit consists of the dataset scope and the omission data quality element. The rate of missing items is being measured, which is based on the error rate basic measure. Since the measure is associated with a scope, a metric is created: the percentage of buildings reported to the APSR that lack a corresponding geospatial representation.

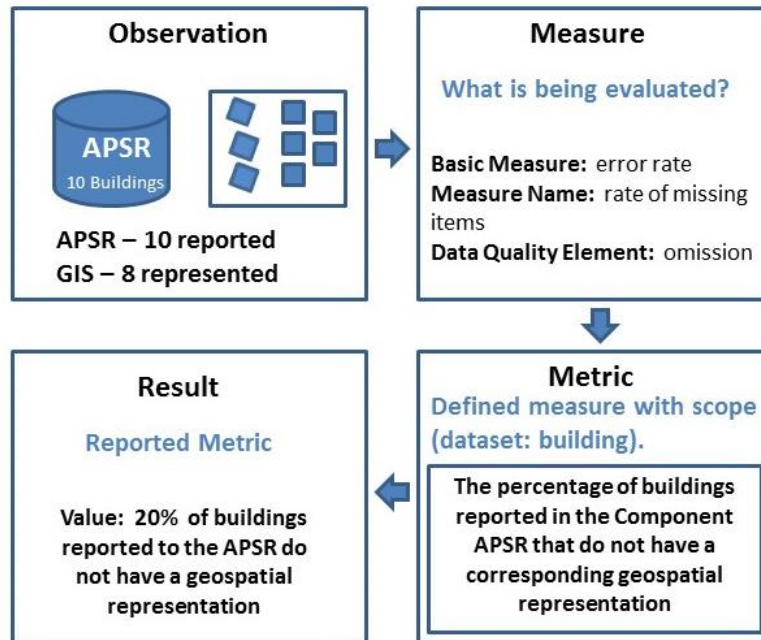


Figure 5: Quality Measures vs. Quality Metrics

The IGG will establish data quality metrics for common IGI&S data and services. A list of these metrics, including their scope, measures, and evaluation methods, is included in Appendix B. These metrics are grouped based on reporting level (e.g., Component, OSD). Components may identify additional IGI&S data and service metrics, not specified in SDSFIE-Q, that are unique to the Component, such as those required for Component headquarters reporting. Components may include these additional metrics in their Component-level quality management plan. A summarized list of standard measures established in ISO 19157, including the associated basic measure (where applicable), is included in Appendix A. This list should be used for reference when creating new metrics.

3.3.4.1 IGI&S Data Quality Scope

When creating metrics and reporting data quality results, the data quality scope must be identified. The types of metrics defined for IGI&S data are dependent on these identified scope levels. The data quality scope of the data quality unit defines the extent of the data being evaluated. This is normally equivalent to the scope of the metadata record. However, the data quality scope must be at the same or lower hierarchy as the scope of the metadata record. In SDSFIE-Q, the data quality result scope will always be identical to the data quality scope, due to the limitations of the standard procedures and tools for collecting metadata. Table 3 lists the data quality scopes and corresponding administration levels established in SDSFIE-Q. Components may establish additional scopes in their quality management plans and DCSs, such as “feature” and “attribute” that are not included in this list.

The following scopes, listed in hierarchical order, are defined for IGI&S data:

- **Repository:** The repository scope is used to measure quality of any IGI&S data store (e.g., ADS) as a whole. See Part 4 for reporting requirements for repositories.
- **Aggregate:** The aggregate scope is used to measure quality of an aggregated dataset (e.g., CIP, Component CIP) that may be extracted from a data repository. See Part 4 for reporting requirements for aggregates.
- **Dataset (Vector):** The dataset scope is used for vector datasets comprised of a single or multiple feature types. The dataset scope will not be used when measuring the overall quality of CIP datasets and IGI&S data repositories. See Part 2 for reporting requirements for vector data.

- **Dataset (Raster):** The dataset scope may also be used to measure data quality for raster data. See Part 3 for raster data reporting requirements.
- **Service:** Data quality measured for web services shall be reported as a “service” in DQ_Scope.
- **Application:** Data quality measured for applications shall be reported as an “application” in DQ_Scope
- **Document:** Data quality measured for supporting documentation, such as a standalone data quality report or a Component quality management plan, will be reported as a “document” in DQ_Scope.
- **Metadata:** When reporting the quality of metadata associated with IGI&S data and services, the “metadata” scope should be used.

Table 4: Data Quality Scope Codes for IGI&S Data

Administration Level	Data Quality Scope	IGI&S Data Type ⁵	Use Description
Component HQ	repository	V,R,S	To create metrics and report data quality for the ADS as a whole
Component HQ	dataset (raster)	R	To create metrics and report data quality for raster datasets created by the Component
Component HQ	dataset (vector)	V	To create metrics and report data quality for individual feature types (CIP, non-CIP, ADS layers, and ad hoc datasets). To create metrics and report data quality for non-CIP or ADS vector datasets comprised of more than one feature type.
Component HQ	service	S	To create metrics and report data quality for Component services
Component HQ	application	S	To create metrics and report data quality for Component-developed applications
Component HQ	metadata	V,R,S	To create metrics and report data quality for metadata
Component HQ	document	V,R,S	To create metrics and report data quality for a Component document (Component quality management plans, DCS)
Component HQ	aggregate	V	To create metrics and report data quality for the Component CIP as a whole
OSD	dataset (vector)	V	To create metrics and report data quality for individual CIP layers or feature types in non-CIP ad hoc vector datasets
OSD	service	S	To create metrics and report data quality for services

⁵ IGI&S Data Types include: Vector (V), Raster (R), Services (S)

Administration Level	Data Quality Scope	IGI&S Data Type ⁵	Use Description
OSD	metadata	V,R,S	To create metrics and report data quality for metadata
OSD	aggregate	V	To create metrics and report data quality for the CIP as a whole

3.3.4.2 Process for Establishing and Submitting Metrics

The IGG shall determine which metrics are included in SDSFIE-Q. The IGG will review and revise metrics as needed.

As sustainment business requirements or other drivers for IGI&S quality are identified, IGG members may request new metrics for inclusion in SDSFIE-Q, following the IGG *consensus process* (outlined in the SDSFIE Governance Plan, Revision 4, section 3.4.2). To propose a new metric, the submitter must provide a request to the IGG, including the following information:

- **Description of Metric:** What data quality element is being measured, what measure and basic measure are used, how often, by whom, and reported to whom?
- **Scope:** The part of the standard (i.e., vector, raster, or services) and the scope of the data (see section 3.3.4.1) to which the metric applies.
- **Applicability:** The administrative level (i.e., Component, OSD) to which the metric applies.
- **Justification:** The business requirement(s) driving the recommendation. The submitter should specify either the OSD policy driver or the Component requirement.

3.3.4.3 Process for Review and Approval of Metrics

The SDSFIE Quality working group will provide approval recommendations for each submitted revision request, which the IGG Chair will use to determine the proper course of action. The following recommendations may be made:

- To accept an SDSFIE-Q revision.
- To implement the revision at the Component level.
- To reject the revision.

If the outcome is an SDSFIE-Q revision, the DISDI Program will incorporate the changes into a revised document. The IGG members will review and comment on the updated document in accordance with the *document approval process* (established in the SDSFIE Governance Plan, Revision 4, section 3.4.1). Once IGG consensus is reached, a new version of SDSFIE-Q will be recommended for approval by the ASD(S).

3.4 Quality Management Activity: Create Geospatial Information

Data generation includes all activities associated with creating or acquiring geospatial data and metadata resources. Data can be created or obtained using internal or contracted resources. Completed data and metadata will be stored in the IGI&S data repository, in accordance with DoD Component guidance.

3.4.1 Create and Acquire Data

Spatial data products can be created, generated, or acquired in many ways. Examples include collection by analysts in the field, heads-up digitizing, the result of analysis performed on another data layer, or purchase. DCSs should be consulted to properly create and acquire data in accordance with defined geospatial requirements and standards.

3.4.2 Create Metadata

All IGI&S data and services should be properly documented with SDSFIE-M compliant metadata in accordance with the SDSFIE-M Implementation Guidance. Metadata shall be populated when data is created (or acquired). Metadata shall be reviewed and updated, as necessary, when data is maintained. For data quality reporting guidance using metadata, refer to section 3.5.2.

3.5 Quality Management Activity: Validate Geospatial Information

After IGI&S data is created or obtained, it should be assessed to determine if it meets requirements and conforms with standards and data quality guidance. The results of this evaluation should be reported in metadata and used to determine if data cleansing is needed.

3.5.1 Evaluate Data

IGI&S data should be routinely assessed through validation and defined data quality evaluation processes, which will evaluate metrics established in SDSFIE-Q, DCSs, and in Component quality management plans. These processes will identify deficiencies that should result in action plans to correct these deficiencies. DoD Components or OSD may require the use of automated tools for assessment. Refer to Component-level guidance for Component-specific tool requirements.

3.5.2 Report Quality Results—Metadata

Component IGI&S Programs and ADS Managers are responsible for consolidating and reporting data quality evaluation results to Component headquarters or OSD. This information shall be reported by populating data quality metadata elements defined by SDSFIE-M. A data quality report may also be produced; however, it will not replace the metadata reporting requirement.

SDSFIE Metadata (SDSFIE-M) is the metadata specification for all IGI&S data and shall be adhered to per the SDSFIE-M Implementation guidance. Data quality metadata (DQ_DataQuality) and the standalone report are not mandatory for all IGI&S data but may be required depending on the IGI&S data type (vector, raster, or services) or dataset being evaluated. Refer to SDSFIE-M section 6.4 for a detailed description of the data quality metadata elements.

Refer to section 2.4.1 of the SQIG for specific requirements for populating quality results in metadata and SQIG Appendix B for metadata examples.

3.5.2.1 SDSFIE-Q Metrics Registry

All metrics established in SDSFIE-Q are assigned an SDSFIE-Q metric identifier (e.g., IGG3, DCS25). This identifier correlates to the scope, ISO standard measure (where applicable), evaluation method, and acceptable quality level for each metric. When reporting a data quality result for a metric in the metadata, the SDSFIE-Q metric ID must be recorded in MD_Identifier:code. Using the SDSFIE-Q metric ID eliminates the need to populate multiple metadata elements and standardizes the reporting method.

The SDSFIE-Q metric IDs will be generated and stored in an accessible online registry in accordance with SDSFIE-M. These IDs are currently provided in Appendix B, as well as other supporting SDSFIE-Q documentation (e.g., SQIG DCS General Guidance (Annex F)).

3.6 Quality Management Activity: Maintain Geospatial Information

Maintaining geospatial information involves reviewing results of a quality evaluation and updating the data. The data steward is responsible for ensuring that the data is maintained at an interval established by the Component IGI&S Program.

3.6.1 Cleanse Data

When a dataset is validated against IGI&S standards and requirements (e.g., DCSs), corrective actions may be identified. If the data does not meet established data quality requirements, the dataset may be cleansed (corrected) and reevaluated before updating the IGI&S data repository.

3.6.1.1 Obtain Resources for Cleansing Data

If the data steward is unable to allocate resources to cleanse the data, then they will need to obtain resources before completing this step. The metadata of the uncleaned dataset should reflect the results of the data quality evaluation.

3.7 Quality Management Activity: Provide Geospatial Information

The Component IGI&S Programs are not always the end users of their spatial data. In accordance with DoD policy, spatial data should be made visible, accessible, understandable, trusted, and interoperable throughout their lifecycles for all authorized users (to the maximum extent allowed by law or DoD policy). The following end-use actions are identified:

- Determine Releasability (section 3.7.1)
- Make Data Visible and Accessible (section 3.7.2)
 - Provide Geospatial Data and Geospatial Data Services (section 0)
 - Provide Geospatial Visualization Services (section 3.7.2.2)
 - Provide Geospatial Analytical Services (section 3.7.2.3)
- Request Feedback (section 3.7.3)

3.7.1 Releasability

Component IGI&S Programs will develop and disseminate guidance for spatial data storage, handling, and release according to information assurance and OPSEC policy (see references cited in DoDI 8130.01 regarding handling of controlled unclassified IGI&S, such as DoDD 5205.02E, DoDI 5030.59, Volume 4 of DoD Manual (DoDM) 5200.01, and DoDI 5230.24). Data users are responsible for understanding and adhering to applicable storage, handling, and release guidance.

3.7.2 Accessibility

Components have a responsibility to make spatial data available and discoverable, as well as provide the end user with information about the data quality. Components shall ensure that data and services are available to all authorized users, in accordance with OPSEC policy. Data and metadata can be discovered through Component IGI&S Portals, map viewers, websites, or via web map services.

3.7.2.1 Provide Geospatial Data and Geospatial Data Services

Components shall provide geospatial data and data services (e.g., web feature service) for DoD business missions (e.g., geospatial data to support Real Property Asset Management) and their geospatial Family of Systems.

3.7.2.2 Provide Geospatial Visualization Services

Components shall provide visualization applications and services for DoD business missions (e.g., web map services, map viewers) and create geospatial information products. Deliverables may include hardcopy and/or electronic non-editable maps, presentation figures, and graphics to support DoD activities like master planning (e.g., land use maps) and soldier support activities (e.g., training and range management).

3.7.2.3 Provide Geospatial Analytical Services

Components may be required to use IGI&S data to conduct geospatial and geostatistical analyses (e.g., wind farm siting analysis, proximity analysis) in support of DoD activities.

3.7.2.4 Reporting Accessibility

Reporting metrics for accessibility requires an analysis of how the data or services are being used and by whom. Data and services are made accessible to users in various ways. Some examples include a direct request from the Component IGI&S Program, direct download through a website function or access to a web map service (hosted by the Component IGI&S Program or other authorized sources).

Discoverability metrics should be reported by assessing the number of users who download, view, or access the data within a one-year period. When authorized organizations rehost IGI&S data or services, the rehosting organization should provide the Component with an estimated number of users. Recommended methods for estimating usage information include:

- The number of users who requested the data directly from the Component IGI&S Program.
- The number of users who requested access to a service directly from the Component IGI&S Program.
- The number of authorized users who have active accounts and access to a Component map viewer.
- The number of connections (both new and existing) made to a map viewer.
- The number of connections (both new and existing) that are established with a service.
- The estimated number of users accessing the data or service through an authorized host.
- The number of hits to a website within a specified time period.

3.7.3 Feedback

User feedback is a valuable tool for maintaining data quality. This means that data must first be accessible and understandable to users, then users must be given mechanisms by which to comment on the quality and completeness of the data. Component IGI&S Programs shall have a feedback mechanism in place to capture end-user comments and questions. Examples of feedback mechanisms include a website function, an attribute built into a database, a standardized change request form, or comments received via a help desk email or phone number. Users of the data at all administration levels are responsible for providing feedback.

The following metrics for Feedback will be evaluated in SDSFIE-Q:

- Pass or Fail: The Component has a user feedback mechanism (email feedback, customer surveys, etc.) for all data discovery methods

See Appendix B for the full list of IGG Data Quality Metrics

The following metrics for Accessibility will be evaluated in SDSFIE-Q:

- Pass or Fail: The Component has an enterprise level map viewer
- Pass or Fail: The Component has a process and mechanisms for data requests and data delivery
- The percentage of CIP data layers not visible on the Component enterprise map viewer
- The percentage of CIP data layers not accessible through a web map service
- The percentage of data layers not available to fulfill a validated request
- The number of data requests for each CIP layer within a one year period
- The number of users viewing each CIP layer annually
- The number of users accessing or downloading each CIP layer within a one year period

See Appendix B for the full list of IGG Data Quality Metrics

Part 2: SDSFIE-V Data Quality Guidance

4 SDSFIE-V Introduction

SDSFIE- V is the vector IGI&S data model. This includes the current SDSFIE Specification Document, as well as the current “Gold” Logical Data Model and all Component HQ-level Adaptation Logical Data Models. SDSFIE-V data quality shall be evaluated for compliance with OSD requirements, DCSs, and Component quality management plans. Part 2 of this document describes data quality assessment, guidance, and reporting requirements that are specific to vector data. Guidance for evaluating overall data quality results for aggregated datasets, such as CIP, Component CIP, and IGI&S data repositories, is covered in Part 4: Aggregated Dataset Data Quality Guidance.

4.1 IGI&S Vector Datasets

Vector data used in IGI&S Programs exists in several forms: CIP, Component CIP, additional data that conforms to the SDSFIE-V standard, data that is included in the Component IGI&S data repository that is not SDSFIE-V compliant, and data that is created or acquired for a specific purpose or project. Vector datasets that are required for upward reporting must adhere to more stringent collection and quality requirements than datasets that are project-specific.

4.1.1 Common Installation Picture (CIP)

The CIP dataset is a collection of aggregated Component IGI&S geospatial data and metadata. The purpose of the CIP is to provide a readily available, standardized map background to serve as the basis for planning and execution of sustainment missions, as described in DoDI 8130.01. Typical CIP layers include real property, master planning, infrastructure, environmental, and military range and training data.

4.2 SDSFIE-V Quality Metrics

To evaluate IGI&S vector data quality, OSD and Components shall establish metrics for IGI&S vector datasets based on processes established in section 3.3.4.2. The required metrics for each CIP layer may vary depending on collection requirements, OSD and Component policy, or data usage. For this reason, the DCS for each CIP layer will describe the required metrics. When reporting metrics for individual layers, Components should use the dataset scope.

4.3 SDSFIE-V Data Content Specifications (DCS)

Members of the IGG are expected to develop their own DCS documents (QAPs, DLSSs, DCGs, or ESDs) to standardize the collection and maintenance of IGI&S data. A DCS also provides essential information needed to properly structure metadata records, including well-defined metrics and corresponding evaluation methods. The DISDI Program will create a DCS at the OSD level for each data layer in SDSFIE-V Gold.

A DCS is a detailed description of a dataset or data layer together with additional information that will enable it to be created, supplied to, and used by other organizations. Component DCSs must be established for all data layers, as described in Component quality management plans. An example DCS is included in Annex G of the SDSFIE Quality Implementation Guidance for reference.

4.3.1 DCS General Guidance

The DCS General Guidance document (SQIG: Annex F) defines data collection requirements, metadata requirements, data handling procedures, releasability requirements, and feedback mechanisms applicable to all feature types in SDSFIE-V Gold or registered Adaptations thereof. This document also includes data

The following metrics for DCSs will be evaluated in SDSFIE-Q:

- The percentage of data layers that are required for collection by a Component headquarters that do not have a DCS
- The percentage of data layers required for the CIP that do not have a DCS
- The percentage of data layers in SDSFIE-V Gold that do not have a DCS

See Appendix B for the full list of IGG Data Quality Metrics

collection guidance that applies to subsets of SDSFIE-V data (e.g., CIP or real property feature types). The DCS General Guidance document shall be used in conjunction with feature type-specific DCSs. The DCS General Guidance document also includes metrics and evaluation methods that will be used to assess data quality for IGI&S data. Mandatory metrics that apply to all CIP feature types or all real property feature types are identified in the DCS General Guidance document. Each feature type-specific DCS includes additional mandatory metrics for that feature type.

4.3.2 DCS Validation

The DISDI Program will develop rule expression language for each CIP layer to enforce compliance with DCS requirements. The Component will be able to validate its data against the DCS requirements prior to a CIP submission. Components may also develop validation tools to assist with adherence to quality management plans and Component DCSs.

4.4 SDSFIE-V Data Quality Documentation: SDSFIE Metadata

All IGI&S vector data shall have current and complete metadata. It is the responsibility of the organization creating or maintaining an IGI&S dataset to ensure that current and complete metadata exists.

IGI&S vector data that is not part of the CIP shall adhere to the SDSFIE-M standard and SDSFIE-M Implementation Guidance with no additional requirements. The scope metadata element (DQ_Scope) from SDSFIE-M shall be populated based on the scopes identified in section 3.3.4.1. One of the following elements must be populated: the lineage element (LI_Lineage) or one or more data quality reporting elements (DQ_Element) from SDSFIE-M.

4.4.1 CIP Metadata Requirements

IGI&S CIP data layers shall adhere to additional metadata requirements to accurately document data quality. For CIP layers, the DCS for each layer will define which data quality reporting elements (DQ_Element) are mandatory.

For data quality reporting elements (DQ_Element) to be correctly populated, the DCS for each IGI&S layer mandated for collection shall include well-defined metrics and corresponding evaluation methods for applicable data quality reporting elements. The metrics shall be mapped to the appropriate data quality element so that the quality of the data layer can be consistently reported in the metadata.

Data quality results for CIP layers shall be reported as both conformance results (DQ_ConformanceResult) and quantitative results (DQ_QuantitativeResult). A conformance result is determined by comparing a CIP layer against a DCS. The DCS and the explanation of the result must be cited in the metadata, along with an indication of whether or not the layer passed the evaluation. Quantitative results are the values obtained from applying data quality measures defined in the DCS.

Part 3: SDSFIE-R Data Quality Guidance

5 SDSFIE-R Introduction

SDSFIE-R is the IGI&S standard for raster data. This includes the SDSFIE-R document and its annex, the Raster Standards Compendium. SDSFIE-R identifies community-recommended practices and format preferences for all forms of raster data (raster maps, raster imagery, elevation, etc.) based on specific use cases identified by the IGI&S community. The quality of IGI&S raster data obtained by the Components shall be evaluated for compliance with OSD requirements and Component quality management plans. Part 3 of this document describes data quality assessment, guidance, and reporting requirements that are specific to raster data.

IGI&S raster data quality key elements shall focus on whether the imagery/raster dataset meets the minimum resolution, horizontal accuracy, and currency requirements established in SDSFIE-R for each use case. The quality assessment of IGI&S elevation data (e.g., LiDAR) will also include adherence to minimum vertical accuracy and point density requirements.

5.1 Raster Acquisition

DoD Components may obtain raster data using several different methods, such as contracting an outside party to collect the data, collecting the data internally, or purchasing the data from a vendor. Each method requires a different approach to data quality.

- **Contracting an Outside Party:** If the DoD Component or installation contracts a company to collect raster data, the Component should specify the data quality and metadata collection requirements through contract language (see SQIG Appendix C)
- **Collecting the Data Internally:** If the DoD Component or installation collects the raster data internally, they are required to meet the minimum standards for resolution and accuracy identified in SDSFIE-R and report this information in metadata, in accordance with SDSFIE-M.
- **Purchasing or Acquiring the Data from an Outside Vendor:** If the DoD Component or installation acquires raster data from an outside vendor, the Component is responsible for evaluating the quality of the data to ensure it meets the minimum standards identified in SDSFIE-R.

The following metrics for raster metadata will be evaluated in SDSFIE-Q:

- The percentage of raster datasets that have SDSFIE-M compliant metadata records
- The percentage of DoD sites covered by raster datasets that meet the minimum recommended resolution stated in SDSFIE-R
- The percentage of DoD sites covered by raster datasets that meet the minimum recommended accuracy stated in SDSFIE-R.

See Appendix B for the full list of IGG Data Quality Metrics

5.2 SDSFIE-R Quality Metrics

To evaluate IGI&S raster data quality, OSD and the DoD Components shall establish recommended metrics for each use case established in SDSFIE-R, as well as higher-level metrics for overall Component raster data holdings. Components should use these metrics as a guideline for evaluating data quality. The complete list of raster quality metrics is included in Appendix B.

5.3 SDSFIE-R Data Quality Documentation: SDSFIE Metadata

All IGI&S raster data that is acquired or generated should have current and complete metadata. It is the responsibility of the organization creating the raster dataset to ensure that current and complete metadata exists for that layer.

Raster data created by an IGI&S Program shall adhere to the SDSFIE-M standard and implementation guidance, with no additional requirements. DQ_Scope shall be populated based on the scopes identified

in section 3.3.4.1. For raster data, the data quality scope value will be “dataset.” In accordance with SDSFIE-M, either the lineage element (LI_Lineage) or one or more data quality reporting elements (DQ_Element) shall be populated.

Data quality results for raster data will be reported in either DQ_ConformanceResult or DQ_QuantitativeResult. Raster data quality can also be represented as a coverage result (QE_CoverageResult), which is the result of a data quality measure organizing the measured values as a coverage.

Part 4: Quality Guidance for Aggregates and Repositories

6 Aggregate and Repository Introduction

IGI&S data (vector, raster) may be combined into collections of datasets. In SDSFIE-Q, these combined datasets can have a scope code of either repository (e.g., IGI&S data repository) or aggregate (CIP, Component CIP, etc.). This section will discuss data quality evaluation requirements for repositories and aggregates.

6.1 Repository

A repository is a collection of datasets that is stored and maintained in a location (e.g., enterprise database(s), system, server, etc.). A repository should include well-defined, curated content. For example, the installation ADS is a data repository. Metrics that measure the quality and completeness of the repository as a whole will be evaluated at the repository scope. Data quality results reported at the aggregate or dataset level may also be derived or aggregated for the repository.

Components are responsible for defining the contents of an IGI&S data repository and establishing data quality validation processes. A repository may include IGI&S data that is created or acquired through contracts or projects not directly executed by the IGI&S Programs. Therefore, it is important that each Component develop processes by which such data can be standardized, normalized, and validated for conformance with all applicable standards. Ideally, this validation should occur before the data is accepted into the repository; however, it can also occur at a later stage. Quality evaluations should also be performed when repository content is maintained or updated.

6.1.1 Authoritative Data Source (ADS) Repository

An ADS is an example of an IGI&S data repository. The requirement for an ADS for each installation is established in DoD policy (DoDI 8130.01). Additional ADS requirements are documented in the ADS Implementation Guidance, which provides more specifics on how Components shall establish and maintain ADS content and quality.

6.2 Aggregate

An aggregate is a collection of ephemeral datasets that may have been extracted from a data repository. Data and services that are compiled at the OSD or Component HQ level (i.e., CIP dataset) or are necessary for Component or IGG reporting processes shall be reported using the aggregate data quality scope. Metrics that measure the quality of the aggregated dataset as a whole will be reported at this scope. Quality results reported at the dataset scope could be rolled up to the aggregate scope. An aggregate dataset may be

The following metrics for IGI&S data repositories will be evaluated in SDSFIE-Q:

- The percentage of required datasets that exist in the repository (as defined by the Component)
- The percentage of repository datasets that passed 95% of required validation checks.
- The percentage of repository datasets that have SDSFIE-M compliant metadata records
- The percentage of repository datasets that do not have metadata with at least one data quality reporting element populated

See Appendix B for the full list of IGG Data Quality Metrics

The following metrics for the aggregated CIP dataset will be evaluated in SDSFIE-Q:

- The percentage of data layers required for the CIP that were submitted by each Component
- The percentage of reported Real Property assets that do not have a geospatial representation in the CIP
- The percentage of CIP layers that passed 95% of validation checks required by the DCSs
- The percentage of CIP data layers that have SDSFIE-M compliant metadata records
- The percentage of CIP layers that do not have metadata with at least one data quality reporting element populated

See Appendix B for the full list of IGG Data Quality Metrics

combined into a single database or exist within multiple databases.

6.2.1 Common Installation Picture (CIP) Aggregate

The layers included in the CIP dataset are aggregated at both the Component HQ level and the OSD level, and, therefore, additional data quality requirements apply. Metrics for the CIP dataset will be evaluated at the OSD level.

6.3 Metrics for Aggregated Datasets

OSD and Component IGI&S Programs shall develop metrics that measure the quality of IGI&S data repositories, CIP, and Component CIP. A list of these metrics is included in Appendix B.

6.4 Data Quality Documentation for Aggregates and Repositories

All IGI&S repositories and aggregates shall have current and complete metadata, including the quality metadata elements. The organization that creates and maintains an IGI&S data repository, and the aggregate datasets derived from it, should ensure that current and complete metadata exist.

6.4.1 Aggregating Data Quality Evaluation Results

According to ISO 19157, aggregation is the process of combining quality results from data quality evaluations based on different data quality elements or scopes. An aggregation of data quality results from different scopes can be used to derive results from multiple datasets into an aggregated result as summarized metadata.

For example, an installation would collect data and report the data quality results at the dataset scope. When the data is rolled up to the Component CIP, the results from each installation are aggregated into data quality results for the combined dataset.

If this data is also part of the CIP, OSD will aggregate the data quality results of all Component data.

Part 5: Services Data Quality Guidance

7 Services Introduction

Components may be required to share IGI&S data, layers, and maps with other DoD stakeholders (individuals or systems) through web services and application services. Examples of services include Web Map Services (WMS), Web Feature Services (WFS), Esri REST Image Services, and Esri REST Map Services.

When sharing services, Components should document the metadata in a manner that enables users to access, ingest, and assess the quality of the service.

At a minimum, Components should document the endpoint URL for a service and ensure that the service adheres to a standard implementation specification (e.g., OGC Web Map Service version 1.1). Guidelines for documenting this information in metadata are located in the SDSFIE-M Implementation Guidance (SMIG). As stated in the SMIG, metadata for services may be documented as part of the metadata for the dataset or as a standalone metadata record.

To fully document the quality of a service in metadata, Components should create a standalone metadata record for the service. However, standalone service metadata records are not often created in a typical workflow.

Appendix B contains non-mandatory metrics that Components may use to document the quality of a service in metadata.

Appendix A: ISO 19157 Data Quality Standard Measures

The table below lists standardized data quality measures and provides a summarized version of Annex D in ISO 19157. These measures should be referenced when establishing new data quality metrics.

Table 5: ISO 19157 Data Quality Standard Measures

Element Name	ISO Measure Identifier	Measure Name	Basic Measure	Measure Definition	Value type
Commission	1	excess item	error indicator	indication that an item is incorrectly present in the data	Boolean
Commission	2	number of excess items	error count	number of items within the dataset or sample that should not have been present	Integer
Commission	3	rate of excess items	error rate	number of excess items in the dataset or sample in relation to the number of items that should have been present	Real
Commission	4	number of duplicate feature instances	error count	total number of exact duplications of feature instances within the data	Integer
Omission	5	missing item	error indicator	indicator that shows that a specific item is missing in the data	Boolean
Omission	6	number of missing items	error count	count of all items that should have been in the dataset or sample and are missing	Integer
Omission	7	rate of missing items	error rate	number of missing items in the dataset or sample in relation to the number of items that should have been present	Real
Conceptual Consistency	8	conceptual schema non-compliance	error indicator	indication that an item is not compliant with the rules of the relevant conceptual schema	Boolean
Conceptual Consistency	9	conceptual schema compliance	correctness indicator	indication that an item complies with the rules of the relevant conceptual schema	Boolean
Conceptual Consistency	10	number of items not compliant with the rules of the conceptual schema	error count	count of all items in the dataset that are not compliant with the rules of the conceptual schema	Integer
Conceptual Consistency	11	number of invalid overlaps of surfaces	error count	total number of erroneous overlaps within the data	Integer
Conceptual Consistency	12	non-compliance rate with respect to the rules of the conceptual schema	error rate	number of items in the dataset that are not compliant with the rules of the conceptual schema in relation to the total number of these items supposed to be in the dataset	Real
Conceptual Consistency	13	compliance rate with the rules of the conceptual schema	correct items rate	number of items in the dataset in compliance with the rules of the conceptual schema in relation to the total number of items	Real
Domain Consistency	14	value domain non-conformance	error indicator	indication of whether an item is not in conformance with its value domain	Boolean
Domain Consistency	15	value domain conformance	correctness indicator	indication that an item is conforming to its value domain	Boolean
Domain Consistency	16	number of items not in conformance with their value domain	error count	count of all items in the dataset that are not in conformance with their value domain	Integer
Domain Consistency	17	value domain conformance rate	correct items rate	number of items in the dataset that are in conformance with their value domain in relation to the total number of items in the dataset.	Real
Domain Consistency	18	value domain non-conformance rate	error rate	number of items in the dataset that are not in conformance with their value domain in relation to the total number of items	Real
Format Consistency	119	physical structure conflicts	error indicator	indication that items are stored in conflict with the physical structure of the dataset	Boolean

Appendix A: ISO 19157 Data Quality Measures – Table 5

Element Name	ISO Measure Identifier	Measure Name	Basic Measure	Measure Definition	Value type
Format Consistency	19	number of physical structure conflicts	error count	count of all items in the dataset that are stored in conflict with the physical structure of the dataset	Integer
Format Consistency	20	physical structure conflict rate	error rate	number of items in the dataset that are stored in conflict with the physical structure of the dataset divided by the total number of items	Real
Topological Consistency	21	number of faulty point-curve connections	error count	number of faulty point-curve connections in the dataset	Integer
Topological Consistency	22	rate of faulty point-curve connections	error rate	number of faulty link node connections in relation to the number of supposed link node connections	Real
Topological Consistency	23	number of missing connections due to undershoots	error count	count of items in the dataset, within the parameter tolerance, that are mismatched due to undershoots	Integer
Topological Consistency	24	number of missing connections due to overshoots	error count	count of items in the dataset, within the parameter tolerance, that are mismatched due to overshoots	Integer
Topological Consistency	25	number of invalid slivers	error count	count of all items in the dataset that are invalid sliver surfaces	Integer
Topological Consistency	26	number of invalid self-intersect errors	error count	count of all items in the data that illegally intersect with themselves	Integer
Topological Consistency	27	number of invalid self-overlap errors	error count	count of all items in the data that illegally self-overlap	Integer
Absolute or external accuracy	28	mean value of positional uncertainties (1D, 2D, and 3D)	N/A	mean value of the positional uncertainties for a set of positions, where the positional uncertainties are defined as the distance between a measured position and what is considered as the corresponding true position	Measure
Absolute or external accuracy	128	bias of positions (1D, 2D and 3D)	N/A	bias of the positions for a set of positions where the positional uncertainties are defined as the deviation between a measured position and what is considered as the corresponding true position	Measure
Absolute or external accuracy	29	mean value of positional uncertainties excluding outliers (2D)	N/A	for a set of points where the distance does not exceed a defined threshold, the arithmetical average of distances between their measured positions and what is considered as the corresponding true positions	Measure
Absolute or external accuracy	30	number of positional uncertainties above a given threshold	error count	number of positional uncertainties above a given threshold for a set of positions. The errors are defined as the distance between a measured position and what is considered as the corresponding true position.	Integer
Absolute or external accuracy	31	rate of positional uncertainties above a given threshold	N/A	number of positional uncertainties above a given threshold for a set of positions in relation to the total number of measured positions.	Real
Absolute or external accuracy	32	covariance matrix	N/A	symmetrical square matrix with variances of point coordinates on the main diagonal and covariance between these coordinates as off-diagonal elements	Measure
Absolute or external accuracy	33	linear error probable	LE50 or LE50 (r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 50%	Measure
Absolute or external accuracy	34	standard linear error	LE68.3 or LE68.3(r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 68,3%	Measure
Absolute or external accuracy	35	linear map accuracy at 90% significance level	LE90 or LE90(r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 90%	Measure
Absolute or external accuracy	36	linear map accuracy at 95% significance level	LE95 or LE95(r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 95%	Measure

Appendix A: ISO 19157 Data Quality Measures – Table 5

Element Name	ISO Measure Identifier	Measure Name	Basic Measure	Measure Definition	Value type
Absolute or external accuracy	37	linear map accuracy at 99% significance level	LE99 or LE99(r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 99%	Measure
Absolute or external accuracy	38	near certainty linear error	LE99.8 or LE99.8(r)	half length of the interval defined by an upper and a lower limit, in which the true value lies with probability 99,8%	Measure
Absolute or external accuracy	39	root mean square error (RMSE)	N/A	standard deviation, where the true value is not estimated from the observations but known a priori	Measure
Absolute or external accuracy	40	absolute linear error at 90 % significance level of biased vertical data (Alternative 1–NATO)	N/A	absolute vertical accuracy of the data's coordinates, expressed in terms of linear error at 90% probability given that a bias is present	Measure
Absolute or external accuracy	41	absolute linear error at 90 % significance level of biased vertical data (Alternative 2)	N/A	absolute vertical accuracy of the data's coordinates, expressed in terms of linear error at 90% probability given that a bias is present	Measure
Absolute or external accuracy	42	circular standard deviation	CE39.4	radius describing a circle, in which the true point location lies with the probability of 39,4%	Measure
Absolute or external accuracy	43	circular error probable	CE50	radius describing a circle, in which the true point location lies with the probability of 50%	Measure
Absolute or external accuracy	44	circular error at 90% significance level	CE90	radius describing a circle, in which the true point location lies with the probability of 90%	Measure
Absolute or external accuracy	45	circular error at 95% significance level	CE95	radius describing a circle, in which the true point location lies with the probability of 95%	Measure
Absolute or external accuracy	46	circular near certainty error	CE99.8	radius describing a circle, in which the true point location lies with the probability of 99,8%	Measure
Absolute or external accuracy	47	root mean square error of planimetry (RMSEP)	N/A	radius of a circle around the given point, in which the true value lies with probability P	Measure
Absolute or external accuracy	48	absolute circular error at 90 % significance level of biased data (Alternative 2)	N/A	absolute horizontal accuracy of the data's coordinates, expressed in terms of circular error at 90% probability given that a bias is present	Measure
Absolute or external accuracy	49	absolute circular error at 90 % significance level of biased data	N/A	absolute horizontal accuracy of the data's coordinates, expressed in terms of circular error at 90% probability given that a bias is present	Measure
Absolute or external accuracy	50	uncertainty ellipse	N/A	2D ellipse with the two main axes indicating the direction and magnitude of the highest and the lowest uncertainty of a 2D point	Measure
Absolute or external accuracy	51	confidence ellipse	N/A	2D ellipse with the two main axes indicating the direction and magnitude of the highest and the lowest uncertainty of a 2D point	Measure
Relative or internal accuracy	52	relative vertical error	N/A	evaluation of the random errors of one relief feature to another in the same dataset or on the same map/chart. It is a function of the random errors in the two elevations with respect to a common vertical datum.	Measure
Relative or internal accuracy	53	relative horizontal error	N/A	evaluation of the random errors in the horizontal position of one feature to another in the same dataset or on the same map/chart	Measure
Accuracy of a time measurement	54	time accuracy at 68.3% significance level	LE68.3 or LE68.3(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 68,3%	Measure
Accuracy of a time measurement	55	time accuracy at 50% significance level	LE50 or LE50 (r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 50%	Measure

Appendix A: ISO 19157 Data Quality Measures – Table 5

Element Name	ISO Measure Identifier	Measure Name	Basic Measure	Measure Definition	Value type
Accuracy of a time measurement	56	time accuracy at 90% significance level	LE90 or LE90(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 90%	Measure
Accuracy of a time measurement	57	time accuracy at 95% significance level	LE95 or LE95(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 95%	Measure
Accuracy of a time measurement	58	time accuracy at 99% significance level	LE99 or LE99(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 99%	Measure
Accuracy of a time measurement	59	time accuracy at 99.8% significance level	LE99.8 or LE99.8(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the time instance lies with probability 99.8%	Measure
Temporal Consistency	159	chronological error	error indicator	indication that an event is incorrectly ordered against the other events	Boolean
Classification Correctness	60	number or incorrectly classified features	error count	number of incorrectly classified features	Integer
Classification Correctness	61	misclassification rate	error rate	number of incorrectly classified features relative to the number of features that should be there	Real
Classification Correctness	62	misclassification matrix	N/A	matrix that indicates the number of items of class (i) classified as class (j)	Integer
Classification Correctness	63	relative misclassification matrix	N/A	matrix that indicates the number of items of class (i) classified as class (j) divided by the number of items of class (i)	Real
Classification Correctness	64	kappa coefficient	N/A	coefficient to quantify the proportion of agreement of assignments to classes by removing misclassifications	Real
Non-quantitative attribute correctness	65	number of incorrect attribute values	error count	total number of erroneous attribute values within the relevant part of the dataset	Integer
Non-quantitative attribute correctness	66	rate of correct attribute values	correct items rate	number of correct attribute values in relation to the total number of attribute values	Real
Non-quantitative attribute correctness	67	rate of incorrect attribute values	error rate	number of attribute values where incorrect values are assigned in relation to the total number of attribute values	Real
Quantitative attribute accuracy	68	attribute value uncertainty at 68.3% significance level	LE68.3 or LE68.3(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 68,3 %	Measure
Quantitative attribute accuracy	69	attribute value uncertainty at 50% significance level	LE50 or LE50 (r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 50 %	Measure
Quantitative attribute accuracy	70	attribute value uncertainty at 90% significance level	LE90 or LE90(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 90 %	Measure
Quantitative attribute accuracy	71	attribute value uncertainty at 95% significance level	LE95 or LE95(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 95 %	Measure
Quantitative attribute accuracy	72	attribute value uncertainty at 99% significance level	LE99 or LE99(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 99 %	Measure
Quantitative attribute accuracy	73	attribute value uncertainty at 99.8% significance level	LE99.8 or LE99.8(r)	half length of the interval defined by an upper and a lower limit, in which the true value for the quantitative attribute lies with probability 99,8 %	Measure
Usability element	101	data product specification passed	correctness indicator	indication that all requirements in the referred data product specification are fulfilled	Boolean

Appendix A: ISO 19157 Data Quality Measures – Table 5

Element Name	ISO Measure Identifier	Measure Name	Basic Measure	Measure Definition	Value type
Usability element	102	data product specification fail count	error count	number of data product specification requirements that are not fulfilled by the current product/dataset	Integer
Usability element	103	data product specification pass count	correct items count	number of the data product specification requirements that are fulfilled by the current product/dataset	Integer
Usability element	104	data product specification fail rate	error rate	number of the data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements	Real
Usability element	105	data product specification pass rate	correct items rate	number of the data product specification requirements that are fulfilled by the current product/dataset in relation to the total number of data product specification requirements	Real

Appendix B: IGG Data Quality Metrics

Table 6: IGG Data Quality Metrics, below, describes the metrics established for SDSFIE-Q. The data quality concepts referenced in this table are described in greater detail in section 3.3 above. Metrics contain descriptive information that is necessary to complete a data quality evaluation; however, the table below does not contain metrics specific to individual feature types (except for discoverability metrics common across all feature types).

The SQIG (Annex F) and tailored DCS documents contain feature type-specific quality metric tables. These metrics should be used as a guideline for establishing Component-specific standardized metrics. Implementation guidance (e.g., DCS) determines which metrics are mandatory per OSD reporting guidance.

Notice To Users:

- This revision of SDSFIE-Q metric description and evaluation methods reflects *minimum correctness* acceptance levels, e.g., “95% minimum”. Prior versions specified maximum *incorrectness* acceptance levels, e.g., 5% maximum incorrectness level.
- Metrics highlighted in the blue table rows below indicate metaquality metrics, which are an aggregation of the results of other metrics (as detailed in the description).

A brief description of the corresponding SDSFIE-Q quality section reference is given below, where applicable:

1. **Category:** Describes the section of the SDSFIE-Q document that corresponds to the metric.
2. **IGI&S Data Type:** Describes the SDSFIE Part to which the metric applies (**Vector**, **Raster**, and/or **Service**).
3. **Reporting Level:** Describes the reporting scope of the metric (i.e., who is responsible for the data quality evaluation). The reporting level for each metric listed below is “Component,” “OSD,” or “OSD/Component.”
4. **Data Quality Units Scope:** Describes the scope code that will be used when reporting the data quality evaluation results in metadata. (see section 2.1.1.1 for a list of IGI&S data quality scopes)
5. **Data Quality Units Element:** Describes the data quality metadata element that is being evaluated. (see section 2.1.1.2)
6. **ISO Measure Identifier:** A code indicating the ISO standard measure from which the metric was derived.
Appendix A includes a table with all the ISO standard measures. Data Quality Metric tables are structured according to *ISO 19157 Data quality* measures to establish each **ISO Measure Identifier**. The label **ISO Measure ID** may be used as an abbreviation in other documents, but **ISO Measure Identifier** is the official ISO term. (see Appendix A)
7. **SDSFIE-Q Metric ID:** An alphanumeric code assigned to each metric established for SDSFIE-Q.
This identifier correlates to the scope, ISO standard measure (where applicable), evaluation method, and acceptable quality level for each metric. When reporting a data quality result for a metric in the metadata, the SDSFIE-Q metric ID must be recorded in MD_Identifier:code. (see section 3.5.2.1)

SDSFIE-Q Metric IDs typically follow the “IGG#” naming convention, except for metrics for individual SDSFIE-V feature types, which follow the “DCS#” naming convention (see DCS General Guidance for these metrics).

The term *SDSFIE-Q Metric Identifier* may be used descriptively; however, **SDSFIE-Q Metric ID** is the preferred column label used in the tables.
8. **Metric Description:** The description of what the metric is evaluating. (See section 3.3.4)
9. **Suggested Evaluation Method:** The suggested or recommended method for evaluating each metric. (see section 3.4.2)
10. **Acceptable Quality Level:** The threshold required result to “Pass” each metric.

Table 6: IGG Data Quality Metrics

Category	IGI&S Data Type ⁶	Reporting Level	Data Quality Units Scope	Data Quality Units Element	ISO Measure Identifier	SDSFIE-Q Metric ID	Metric Description	Suggested Evaluation Method	Acceptable Quality Level
DCS	V	Component	aggregate	Omission	7	IGG1	The percentage of data layers that are required for collection by a Component HQ that have a DCS	Direct External: Comparison between the feature types in the Component SDSFIE-V Adaptation and the published Component DCSs	95% (minimum)
DCS	V	Component	aggregate	Omission	7	IGG2	The percentage of data layers required for the Component CIP that have a DCS	Direct External: Comparison between the feature types in the Component CIP and the published Component DCSs	95% (minimum)
DCS	V	OSD	aggregate	Omission	7	IGG3	The percentage of data layers required for the CIP that have a DCS	Direct External: Comparison between the feature types in the CIP and the published OSD DCSs	95% (minimum)
DCS	V	OSD	aggregate	Omission	7	IGG4	The percentage of data layers in SDSFIE-V Gold that have a DCS	Direct External: Comparison between the feature types in SDSFIE-V Gold and the published OSD DCSs	95% (minimum)
Raster	R	Component	dataset	Conceptual Consistency	9	IGG5	The raster dataset has an SDSFIE-M compliant metadata record	Direct Internal: Check of SDSFIE-M mandatory elements	PASS
CIP	V	OSD/ Component	aggregate	Conceptual Consistency	12	IGG6	The percentage of CIP data layers that have SDSFIE-M compliant metadata records	Direct Internal: Check of SDSFIE-M mandatory elements for each submitted CIP layer	95% (minimum)
CIP	V	OSD/ Component	aggregate	Omission	7	IGG7	The percentage of required CIP data layers that have metadata with at least one data quality reporting element populated	Direct Internal: Check of SDSFIE-M mandatory elements for each submitted CIP layer	95% (minimum)
CIP	V	OSD/ Component	aggregate	Omission	7	IGG8	The percentage of reported Real Property assets for the CIP that have a geospatial representation	Aggregation of DCS 8 result for each CIP Real Property layer	95% (minimum)
CIP	V	OSD/ Component	aggregate	Omission	7	IGG9	The percentage of required data layers included in the CIP	Direct External: Comparison of CIP submittal against the list of required CIP layers	95% (minimum)
CIP	V	OSD/ Component	aggregate	Conceptual Consistency	12	IGG10	The percentage of CIP data layers that are compliant with an approved SDSFIE-V adaptation	Direct Internal: Check to confirm that the CIP submittal has the correct schema	95% (minimum)
CIP	V	OSD/ Component	aggregate	N/A	N/A	IGG11	Which CIP layers have the most data quality errors?	Aggregation: Comparison of the results for metric DCS51 for each CIP layer	N/A
CIP	V	OSD/ Component	aggregate	N/A	N/A	IGG12	Which CIP layers have the least data quality errors?	Aggregation: Comparison of the results for metric DCS51 for each CIP layer	N/A
Accessibility	V	Component	aggregate	Omission	7	IGG13	The percentage of CIP data layers visible via a map viewer.	Direct External: Comparison between the layers visible on a map viewer and the list of required CIP layers	95% (minimum)

⁶ IGI&S Data Types include: Vector (V), Raster (R), Services (S)

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Category	IGI&S Data Type ⁶	Reporting Level	Data Quality Units Scope	Data Quality Units Element	ISO Measure Identifier	SDSFIE-Q Metric ID	Metric Description	Suggested Evaluation Method	Acceptable Quality Level
Accessibility	V,S	OSD/ Component	aggregate	Omission	7	IGG14	The percentage of CIP data layers accessible through a web map service	Direct External: Comparison between the layers accessible via a web map service and the list of required CIP layers	95% (minimum)
Accessibility	V	OSD/ Component	aggregate	Omission	7	IGG15	The percentage of data layers available to fulfill a validated request	Direct External: Comparison between the layers available by request and the feature types included in SDSFIE-V Gold or an approved Adaptation	95% (minimum)
Accessibility	V	OSD/ Component	aggregate	N/A	N/A	IGG16	Which CIP data layers are most widely distributed, requested, and/or viewed?	Aggregation: Comparison of the sum of metrics IGG20, IGG21, and IGG22 for each required CIP layer	N/A
Accessibility	V,R,S	OSD	repository	Omission	5	IGG17	The Component has an enterprise-level map viewer	Direct External: "Pass" if the Component has an enterprise map viewer	Pass
Accessibility	V,R,S	OSD	repository	Omission	5	IGG18	The Component has a process and mechanisms for data requests and data delivery	Direct External: Check for availability and accessibility of a data request process	Pass
Accessibility	V,R,S	OSD	repository	Omission	5	IGG19	The Component has a user feedback mechanism (email feedback, customer surveys, etc.) for all data discovery methods	Direct External: "Pass" if the Component has an established feedback mechanism for data, raster, and services	Pass
Accessibility	V,S	OSD/ Component	feature type	N/A	N/A	IGG20	The number of data requests for each CIP layer within a one-year period	See section 3.7.2.4	N/A
Accessibility	V,S	OSD/ Component	feature type	N/A	N/A	IGG21	The number of users viewing each CIP layer annually	See section 3.7.2.4	N/A
Accessibility	V,S	OSD/ Component	feature type	N/A	N/A	IGG22	The number of users accessing or downloading each CIP layer within a one-year period	See section 3.7.2.4	N/A
IGI&S Data Repository	V	OSD	repository	Omission	7	IGG23	The percentage of geospatial features representing Real Property assets in an IGI&S data repository that have been reconciled by the Component against the Component APSR	Direct External: Comparison of geospatial features against the assets reported to the Component APSR	95% (minimum)
IGI&S Data Repository	V,R,S	OSD	repository	Omission	5	IGG24	The Component has an established IGI&S data repository for vector, raster, and services	Direct External: "Pass" if the Component has established an IGI&S data repository for each installation	Pass
IGI&S Data Repository	V,R,S	Component	repository	Usability	101	IGG25	The Component IGI&S data repository has passed all required validation checks specified in Component guidance.	Direct Internal: Refer to Component guidance for validation requirements	Pass
IGI&S Data Repository	V	Component	repository	Omission	7	IGG26	The percentage of required data layers included in the Component IGI&S Data Repository.	Direct External: Comparison of the data layers in the Component repository in relation to the data layers required by Component guidance	95% (minimum)
IGI&S Data Repository	R	Component	repository	Conceptual Consistency	12	IGG27	The percentage of installations covered by imagery with a raster resolution compliant with SDSFIE-R standards	Direct External: Comparison of imagery footprints against DoD site boundaries. Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)

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IGI&S Data Repository	R	Component	repository	Conceptual Consistency	12	IGG28	The percentage of installations covered by imagery with a raster temporal accuracy compliant with SDSFIE-R standards	Direct External: Comparison of imagery footprints against DoD site boundaries. Direct External: Check to ensure temporal accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG29	The percentage of DoD sites covered by raster datasets that meet the minimum recommended resolution in SDSFIE-R	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG30	The percentage of DoD sites covered by raster datasets that meet the preferred recommended resolution in SDSFIE-R	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG31	The percentage of High-Resolution Satellite Imagery (HRSI) with a resolution < 50cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG32	The percentage of DoD sites covered by High-Resolution Satellite Imagery (HRSI) with a resolution < 33cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG33	The percentage of DoD sites covered by High-Resolution Satellite Imagery (HRSI) with a resolution < 50cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG34	The percentage of High-Resolution Satellite Imagery (HRSI) with a resolution < 33cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG35	The percentage of LiDAR data with a resolution of > 2 Points/ Square Meter	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG36	The percentage of LiDAR data with a resolution of > 4 Points/ Square Meter	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG37	The percentage of DoD sites covered by LiDAR data with a resolution of > 2 Points/ Square Meter	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG38	The percentage of DoD sites covered by LiDAR data with a resolution of > 4 Points/ Square Meter	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG39	The percentage of Multi-Spectral Satellite Imagery with a resolution of < 1m	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG40	The percentage of Multi-Spectral Satellite Imagery with a resolution of < 50cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG41	The percentage of DoD sites covered by Multi-Spectral Satellite Imagery with a resolution of < 1m	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG42	The percentage of DoD sites covered by Multi-Spectral Satellite Imagery with a resolution of < 50cm	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)

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Raster	R	Component	repository	Conceptual Consistency	12	IGG43	The percentage of Oblique Imagery with a resolution of < 12in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG44	The percentage of Oblique Imagery with a resolution of < 6in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG45	The percentage of DoD sites covered by Oblique Imagery with a resolution of < 12in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG46	The percentage of DoD sites covered by Oblique Imagery with a resolution of < 6in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG47	The percentage of Orthoimages with a resolution < 6 in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG48	The percentage of Orthoimages with a resolution < 3 in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG49	The percentage of DoD sites covered by Orthoimages with a resolution < 6 in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG50	The percentage of DoD sites covered by Orthoimages with a resolution < 3 in	Direct External: Check to ensure raster resolution meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG51	The percentage of DoD sites covered by raster datasets that meet the minimum recommended accuracy in SDSFIE-R	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG52	The percentage of LiDAR datasets that meet the recommended Nominal Point Density (NPD) by Vertical Accuracy Class in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG53	The percentage of LiDAR datasets that meet the recommended Nominal Point Spacing (NPS) by Vertical Accuracy Class in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG54	The percentage of DoD sites covered by LiDAR datasets that meet the recommended Nominal Point Density (NPD) by Vertical Accuracy Class in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG55	The percentage of DoD sites covered by LiDAR datasets that meet the recommended Nominal Point Spacing (NPS) by Vertical Accuracy Class in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG56	The percentage of Orthoimages with a horizontal accuracy that meets the "Highest accuracy" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)

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Raster	R	Component	repository	Conceptual Consistency	12	IGG57	The percentage of Orthoimages with a horizontal accuracy that meets the "Standard High Accuracy" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG58	The percentage of Orthoimages with a horizontal accuracy that meets the "Lower accuracy–visualization" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG59	The percentage of DoD sites covered by Orthoimages with a horizontal accuracy that meets the "Highest accuracy" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG60	The percentage of DoD sites covered by Orthoimages with a horizontal accuracy that meets the "Standard High Accuracy" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG61	The percentage of DoD sites covered by Orthoimages with a horizontal accuracy that meets the "Lower accuracy–visualization" level in SDSFIE-R.	Direct External: Check to ensure raster accuracy meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG62	The percentage of Installation Site Plans completed using raster data that meets SDSFIE-R recommendations for site planning (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG63	The percentage of Environmental Assessments completed using raster data that meet SDSFIE-R recommendations for EAs (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG64	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for feature extraction (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG65	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for feature classification (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG66	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for obstruction studies (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)

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Raster	R	Component	repository	Conceptual Consistency	12	IGG67	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for elevation mapping (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG68	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for hydrographic mapping and modeling (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG69	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for LOS studies (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Raster	R	Component	repository	Conceptual Consistency	12	IGG70	The percentage of DoD sites covered by raster data that meets SDSFIE-R recommendations for surface (3D) modeling (resolution, accuracy, file format, and update frequency)	Direct External: Check to ensure raster dataset meets minimum requirements specified in SDSFIE-R	95% (minimum)
Service	S	Component	Service	N/A	N/A	IGG71	Service Availability: The web service is available for a response.	Direct External: Periodically test the service to ensure that it responds	Pass
Service	S	Component	Service	N/A	N/A	IGG72	Response Time: The web service responds within a specified time limit.	Direct External: Periodically test the service to ensure that it responds within a specified time limit	Pass
Service	S	Component	Service	N/A	N/A	IGG73	The web service returns the correct dataset.	Direct External: Periodic, manual testing of the service to ensure that the data being shared is the expected result	Pass
Service	S	Component		N/A	N/A	IGG74	The web service hosts data with a specified currency.	Direct External: Periodic, manual checking of the source data to ensure that the web service hosts a current version of the dataset	Pass