8th MEETING OF THE S-100 WORKING GROUP

Recommended Template of Data Quality chapter of S-1xx Data Product Specifications

Agenda Item 10.4a

S-100WG-8, Singapore, 13 - 17 November 2023

X.1 INTRODUCTION TO DATA QUALITY

International Hydrographic Organization

Data quality allows users and user systems to assess fitness for use of the provided data. Data quality measures and the associated evaluation are reported as metadata of a data product. This metadata improves interoperability with other data products and provides usage by user groups that the data product was not originally intended for. The secondary users can make assessments of the data product usefulness in their application based on the reported data quality measures.

For <this Product Specification> the following Data Quality Elements have been included:

- Conformance to this Product Specification;
- Intended purpose of the data product;
- Completeness of the data product in terms of coverage;
- Logical Consistency;
- Positional Uncertainty and Accuracy;
- Thematic Accuracy;
- Temporal Quality;
- Aggregation measures;
- Validation checks or conformance checks including:

 General tests for dataset integrity;

 Specific tests for a specific data model.

X.2 COMPLETENESS

X.2.1 Commission

- Commission is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>.
- <This Product Specification> products must be tested with Commission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option b1:]** The product specification shall describe how Commission is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results. Or
- **[Or Option b2:]** In term of Commission, <This Product Specification> products shall at least populate **numberOfExcessItems** that indicates the number of items that should not have been present in the dataset, and **numberOfDuplicateFeatureInstances** that indicates the total number of exact duplications of feature instances within the data.

DQ_CompletenessCommission
Excess data present in a data set. [Per ISO 19115]

Public Attributes:

excessItem[0..1] : Boolean
This data quality measure indicates that an item is incorrectly present in the data. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that the item is in excess.

numberOfExcessItems[0..1] : Integer
This data quality measure indicates the number of items in the dataset, that should not have been in the dataset. [Adapted from ISO 19138]

This is an INTEGER count of the number of excess items.

rateOfExcessItems[0..1] : Real
This data quality measure indicates the number of excess items in the dataset in relation to the number of items that should have been present. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 5 measured values and 4 valid values then the ratio is 5/4 and the reported rate = 1.25.

numberOfDuplicateFeatureInstances[0..1] : Integer
This data quality measure indicates the total number of exact duplications of feature instances within the data. This is a count of all items in the data that are incorrectly extracted with duplicate geometries. [Adapted from ISO 19138]

This is an integer representing the error count.

Source: S-100 Part 4c Metadata - Data Quality

X.2 COMPLETENESS

X.2.2 Omission

- Omission is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>.
- <This Product Specification> products must be tested with Omission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option b1:]** The product specification shall describe how Omission is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option b2:]** In term of Omission, <This Product Specification> products shall at least populate **numberOfMissingItems** that is the total number of missing items.

DQ_CompletenessOmission
This data absent from a data set. [Per ISO 19115]

Public Attributes:

missingItem[0..1] : Boolean
This data quality measure is an indicator that shows that a specific item is missing in the data. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is missing.

numberOfMissingItems[0..1] : Integer
This data quality measure indicates the count of all items that should have been in the dataset and are missing. [Adapted from ISO 19138]

This is an INTEGER count of the number of missing items.

rateOfMissingItems[0..1] : Real
This data quality measure indicates the number of missing items in the dataset in relation to the number of items that should have been present. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 3 measured values and 5 values are required the ratio is 3/.5 and the reported rate = 0.6.

Source: S-100 Part 4c Metadata - Data Quality

X.3 LOGICAL CONSISTENCY

International Hydrographic Organization

X.3.1 Conceptual Consistency

- **[Option1:]**Conceptual Consistency isn't applicable for <this Product Specification>.
- **[Or Option2:]**Conceptual Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 1.
- <This Product Specification> products must be tested with Conceptual Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Conceptual Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Conceptual Consistency, <This Product Specification> products shall at least populate **numberOfInvalidSurfaceOverlaps** that is the total number of erroneous overlaps within the data.

Source: S-100 Part 4c Metadata - Data Quality

DQ_ConceptualConsistancy

Adherence to the rules of a Conceptual Schema. [Per ISO 19115]

Public Attributes:

conceptualSchemaNonCompliance[0..1] : Boolean
This data quality measure is an indication that an item is not compliant to the rules of the relevant Conceptual Schema. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is not compliant with the rules of the Conceptual Schema.

conceptualSchemaCompliance[0..1] : Boolean
This data quality measure is an indication that an item complies with the rules of the relevant Conceptual Schema. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is in compliance with the rules of the Conceptual Schema.

numberOfNonCompliantItems[0..1] : Integer
This data quality measure is a count of all items in the dataset that are noncompliant to the rules of the Conceptual Schema. If the Conceptual Schema explicitly or implicitly describes rules, these rules have to be followed. Violations against such rules, for example; can be invalid placement of features within a defined tolerance, duplication of features and invalid overlap of features. [Adapted from ISO 19138]

This is an integer count.

numberOfInvalidSurfaceOverlaps[0..1] : Integer
This data quality measure is a count of the total number of erroneous overlaps within the data. Which surfaces may overlap and which must not is application dependent. Not all overlapping surfaces are necessarily erroneous. When reporting this data quality measure the types of feature classes corresponding to the illegal overlapping surfaces have to be reported as well. [Adapted from ISO 19138]

The allowable topological levels are described in the IHO/DGIWG joint profile of ISO 19107 Geographic Information Spatial Schema. Which particular topological structure may be used with a specific dataset is defined in the Product Specification for that type of data product, for example "Chain Node Topology" for IHO S-101.

This is an error count.

nonComplianceRate[0..1] : Real
This data quality measure indicates the number of items in the dataset that are noncompliant to the rules of the Conceptual Schema in relation to the total number of these items that are expected to be in the dataset. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 5 items that are non compliant and there are 100 of the items in the dataset then the ratio is 5/100 and the reported rate = 0.05.

complianceRate[0..1] : Real
This data quality measure indicates the number of items in the dataset that are in compliance with the rules of the Conceptual Schema in relation to the total number of these items that are expected to be in the dataset. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 95 items that are compliant and there are 100 of the items in the dataset then the ratio is 95/100 and the reported rate = 0.95.

X.3 LOGICAL CONSISTENCY

International Hydrographic Organization

X.3.2 Domain Consistency

- Domain Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 5.
- <This Product Specification> products must be tested with Domain Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option b1:]** The product specification shall describe how Domain Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option b2:]** In term of Domain Consistency, <This Product Specification> products shall at least populate **numberOfNonconformantItems** that is a count of all items in the dataset that are not in conformance with their value domain.

DQ_DomainConsistancy

Adherence of the values to the value domains. [Per ISO 19115]

Public Attributes:

valueDomainNonConformance[0..1] : Boolean

This data quality measure is an indication that an item is not in conformance with its value domain. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is not in conformance with its value domain.

valueDomainConformance [0..1] : Boolean

This data quality measure is an indication that an item is conforming to its value domain. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item conforming to its value domain.

numberOfNonconformantItems[0..1] : Integer

This data quality measure is a count of all items in the dataset that are not in conformance with their value domain. [Adapted from ISO 19138]

This is an integer count.

valueDomainConformanceRate[0..1] : Real

This data quality measure indicates the 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. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 95 items that are in conformance and there are 100 of the items in the dataset then the ratio is 95/100 and the reported rate = 0.95.

valueDomainNonConformanceRate[0..1] : Real

This data quality measure indicates the number of items in the dataset that are not in conformance with their value domain in relation to the total number of items in the dataset. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 5 items that are in conformance and there are 100 of the items in the dataset then the ratio is 5/100 and the reported rate = 0.05.

Source: S-100 Part 4c Metadata - Data Quality

X.3 LOGICAL CONSISTENCY

International Hydrographic Organization

X.3.3 Format Consistency

- Format Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 10a/10b/10c.
- <This Product Specification> products must be tested with Format Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option b1:]** The product specification shall describe how Format Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option b2:]** In term of Format Consistency, <This Product Specification> products shall at least populate **physicalStructureConflictsNumbe**r that is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset.

DQ_FormatConsistancy

Degree to which data is stored in accordance with the physical structure of the data set. [Per ISO 19115]

Public Attributes:

physicalStructureConflicts[0..1] : Integer

This data quality measure is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset. [Adapted from ISO 19138]

This is an integer count.

physicalStructureConflictRate[0..1] : Real

This data quality measure indicates the 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. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 3 items that are in conflict and there are 100 of the items in the dataset then the ratio is 3/100 and the reported rate = 0.03.

Source: S-100 Part 4c Metadata - Data Quality

X.3 LOGICAL CONSISTENCY

X.3.4 Topological Consistency

- **[Option1:]**Topological Consistency isn't applicable for <this Product Specification>.
- **[Or Option2:]**Topological Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 7.
- <This Product Specification> products must be tested with Topological Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Topological Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Topological Consistency, <This Product Specification> products shall at least populate **rateOfFaultyPoint CurveConnections** that is the number of faulty link-node connections in relation to the number of supposed link-node connections, **numberOfMissingConnectionsUndershoots** that is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots, **numberOfMissing ConnectionsOvershoots** that is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots, **numberOfInvalidSlivers** that is a count of all items in the dataset that are invalid sliver surfaces, **numberOfInvalidSelfIntersects** that is a count of all items in the dataset that illegally intersect with themselves, and **numberOfInvalidSelfOverlap** that is all items in the dataset that illegally self-overlap.

X.3 LOGICAL CONSISTENCY

International Hydrographic Organization

DQ_TopologicalConsistency

Measures of the topological consistency of geometric representations of features. [Adapted from ISO 19138]

Note: in ISO 19115, this is "Correctness of the explicitly encoded topological characteristics of a dataset", but ISO 19138 states that the measures "will not serve as measures of the consistency of explicit descriptions of topology using the topological objects specified in ISO 19107", and S-100 does not explicitly encode geometry.

Public Attributes:

numberOfFaultyPointCurveConnections[0..1] : Integer

This data quality measure is a count of the number of faulty point-curve connections in the dataset. A point curve connection exists where different curves touch. These curves have an intrinsic topological relationship that has to reflect the true constellation. For example, two point-curve connections exist when there should only be one. [Adapted from ISO 19138]

This is an integer count.

rateOfFaultyPointCurveConnections[0..1] : Real

This data quality measure indicates the number of faulty link-node connections in relation to the number of supposed link-node connections. This data quality measure gives the erroneous point-curve connections in relation to the total number of point-curve connections. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 2 items that are faulty link-node connections and there are 100 of the connections in the dataset then the ratio is 2/100 and the reported rate = 0.02.

numberOfMissingConnectionsUndershoots[0..1] : Integer

This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots. [Adapted from ISO 19138]

This is an integer count.

numberOfMissingConnectionsOvershoots[0..1] : Integer

This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots. [Adapted from ISO 19138]

This is an integer count.

numberOfInvalidSlivers[0..1] : Integer

This data quality measure is a count of all items in the dataset that are invalid sliver surfaces. A sliver is an unintended area that occurs when adjacent surfaces are not digitized properly. The borders of the adjacent surfaces may unintentionally gap or overlap to cause a topological error. [Adapted from ISO 19138]

This is an integer count.

numberOfInvalidSelfIntersects[0..1] : Integer

This data quality measure is a count of all items in the dataset that illegally intersect with themselves. [Adapted from ISO 19138]

This is an integer count.

numberOfInvalidSelfOverlaps[0..1] : Integer

This data quality measure is a count of all items in the dataset that illegally self-overlap. [Adapted from ISO 19138]

This is an integer count.

Source: S-100 Part 4c Metadata - Data Quality

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

X.4.1 Absolute or External Accuracy

- **[Option1:]** Absolute or External Accuracy isn't applicable for <this Product Specification>.
- **[Or Option2:]** Absolute or External Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Absolute or External Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a. 1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Absolute or External Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Absolute or External Accuracy, <This Product Specification> products shall at least populate **RMSError** that indicates the standard deviation, where the true value is not estimated from the observations but known a priori.

Recommendations for Absolute or External Accuracy are as follow:

Maximum RMSE (horizontal) = E / 10000

Maximum RMSE (vertical) = Vint / 6

Where:

E = Denominator of intended scale of mapping

Vint = Normal contour line interval

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

X.4.2 Vertical Position Accuracy

- **[Option1:]**Vertical Position Accuracy isn't applicable for <this Product Specification>.
- **[Or Option2:]**Vertical Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Vertical Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Vertical Position Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Vertical Position Accuracy, <This Product Specification> products shall at least populate **linearMapAccuracy3Sigma** that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value lies with a probability of 95%.

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

International Hydrographic Organization

X.4.3 Horizontal Position Accuracy

- **[Option1:]**Horizontal Position Accuracy isn't applicable for <this Product Specification>.
- **[Or Option2:]**Horizontal Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Horizontal Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Horizontal Position Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Horizontal Position Accuracy, <This Product Specification> products shall at least populate **circularError95** that indicates the radius describing a circle in which the true point location lies with the probability of 95%.

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

Source: S-100 Part 4c Metadata - Data Quality

International Hydrographic Organization

DQ_AbsoluteExternalPositionalAccuracy

Closeness of reported coordinative values to values accepted as or being true. [Per ISO 19115]

Public Attributes:

meanValuePositionalUncertainties[0..1] : Real

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. [Adapted from ISO 19138]

meanExcludingOutliers[0..1] : Real

Mean value of the positional uncertainties, excluding outliers. 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. [Adapted from ISO 19138]

numberOfPositionalUncertaintiesAboveThreshold[0..1] : Integer

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. [Adapted from ISO 19138]

rateOfPositionalErrorsAboveThreshold[0..1] : Real

Number of positional uncertainties above a given threshold for a set of positions in relation to the total number of measured positions. The errors are defined as the distance between the measured position and what is considered as the corresponding true position. [Adapted from ISO 19138]

covarianceMatrix[0..1] : Real Matrix

Symmetrical square matrix with variances of point coordinates on the main diagonal and covariances between these coordinates as off diagonal elements. [Adapted from ISO 19138]

linearErrorProbable[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 50%. [Adapted from ISO 19138]

standardLinearError[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 68.3%. [Adapted from ISO 19138].

linearMapAccuracy2Sigma[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 90%. [Adapted from ISO 19138].

linearMapAccuracy3Sigma[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 95%. [Adapted from ISO 19138].

linearMapAccuracy4Sigma[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 99%. [Adapted from ISO 19138].

nearCertainityLinearError[0..1] : Real

Half length of the interval defined by an upper and lower limit in which the true value lies with probability 99.8%. [Adapted from ISO 19138].

RMSError[0..1] : Real

Standard deviation where the true value is not estimated from the observations but known apriori. [Adapted from ISO 19138].

circularStandardDeviation[0..1] : Real

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

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Radius describing a circle in which the true point location lies with the probability of 39.4%. [Adapted from ISO 19138].

circularErrorProbable[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 50%. [Adapted from ISO 19138].

circularMapAccuracyStandard[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 90%. [Adapted from ISO 19138].

circularError95[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 95%. [Adapted from ISO 19138].

circularNearCertaintyError[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 99.8%. [Adapted from ISO 19138].

RMSErrorPlanimetry[0..1] : Real

Radius of a circle around a given point in which the true value lies with true value P. [Adapted from ISO 19138].

CMASError[0..1] : Real

The absolute horizontal accuracy of the data's coordinates expressed in terms of circular error at 90% probability given that a bias is present, per the equation in table D.48 in ISO 19138. [Adapted from ISO 19138].

ACE_CE90[0..1] : Real

The absolute horizontal accuracy of the data's coordinates expressed in terms of circular error at 90% probability given that a bias is present, per the equation in table D.49 in ISO 19138. [Adapted from ISO 19138].

uncertaintyEllipse[0..1] : Record

A 2D ellipse with the two main axes indicating the direction and magnitude of the highest and lowest uncertainty of a 2D point. The data values are a record of real numbers corresponding to "phi" the bearing of the major semi-axis, and "a" and "b" the length of the two axes, per the equations in Table D.50 of ISO 19138. [Adapted from ISO 19138].

confidenceEllipse[0..1] : Record

A 2D ellipse with the two main axes indicating the direction and magnitude of the highest and lowest uncertainty of a 2D point. The data values are a record of real numbers corresponding to "phi" the bearing of the major semi-axis, and "a" and "b" the length of the two axes, per the equations in Table D.51 of ISO 19138 and a significance level parameter. [Adapted from ISO 19138].

Source: S-100 Part 4c Metadata - Data Quality

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

X.4.4 Relative or Internal Accuracy

- **[Option1:]**Relative or Internal Accuracy isn't applicable for <this Product Specification>.
- **[Option2:]**Relative or Internal Accuracy is applicable for <this Product Specification> or the data quality scope of <this Product Specification>and follow the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Relative or Internal Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a. 1:]** Data should only be published if it passes a particular test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Relative or Internal Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Relative or Internal Accuracy, <This Product Specification> products shall populate one or both of the **relativeVerticalError** that indicates an evaluation of the random errors of one relief feature to another in the same data set or on the same map/chart, and **relativeHorizontalError** that indicates an evaluation of the random errors in the horizontal position of one feature to another in the same data set or on the same map/chart.

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

International Hydrographic Organization

DQ_RelativeInternalPositionalAccuracy

Closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true. [Per ISO 19115]

Public Attributes:

relativeVerticalError[0..1] : Real

An evaluation of the random errors of one relief feature to another in the same data set 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. [Adapted from ISO 19138]

relativeHorizontalError[0..1] : Real

An evaluation of the random errors in the horizontal position of one feature to another in the same data set or on the same map/chart. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

X.4.5 Gridded Data Positional Accuracy

- **[Option1:]**Gridded Data Position Accuracy isn't applicable for <this Product Specification>.
- **[Or Option2:]**Gridded Data Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Gridded Data Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- Gridded positional accuracy is defined by the precision of the positional reference used to specify its location within its spatial projection. These positional references are contained within the spatial metadata of the <this Product Specification> grid. Nodes within a grid have an absolute position with no horizontal error with vertical values that are calculated for that position by the processes and procedures used by each data producer during the creation of the <this Product Specification> grid. Appropriate selection of both the origin reference points and positional resolution are important and are another factor in gridded positional accuracy.
- In term of Gridded Data Position Accuracy, <This Product Specification> products shall at least populate **RMSErrorPlanimetry** that indicates the radius of a circle around the given point, in which the true value lies with probability P.

Recommendations for Gridded Data Position Accuracy are as follow:

Maximum RMSE (horizontal) = GSD / 6

Maximum RMSE (vertical) = GSD / 3

Where:

GSD = Ground Sampling Distance

X.4 POSITIONAL UNCERTAINTY AND ACCURACY

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DQ_GriddedDataPositionalAccuracy

Closeness of gridded data position values to values to values accepted as or being true. [Per ISO 19113]

Public Attributes:

circularStandardDeviation[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 39.4%. [Adapted from ISO 19138]

circularErrorProbable[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 50%. [Adapted from ISO 19138]

circularMapAccuracyStandard[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 90%. [Adapted from ISO 19138]

circularError95[0..1] : Real

Radius describing a circle in which the true point location lies with the probability of 95%. [Adapted from ISO 19138]

- **circularNearCertaintyError[0..1] : Real**

  Radius describing a circle in which the true point location lies with the probability of 99.8%. [Adapted from ISO 19138]

RMSErrorPlanimetry[0..1] : Real

Radius of a circle around a given point in which the true value lies with true value P. [Adapted from ISO 19138]

CMASError[0..1] : Real

The absolute horizontal accuracy of the data's coordinates expressed in terms of circular error at 90% probability given that a bias is present, per the equation in table D.48 in ISO 19138. [Adapted from ISO 19138]

ACE_CE90[0..1] : Real

The absolute horizontal accuracy of the data's coordinates expressed in terms of circular error at 90% probability given that a bias is present, per the equation in table D.49 in ISO 19138. [Adapted from ISO 19138]

uncertaintyEllipse[0..1] : Record

A 2D ellipse with the two main axes indicating the direction and magnitude of the highest and lowest uncertainty of a 2D point. The data values are a record of real numbers corresponding to "phi" the bearing of the major semi-axis, and "a" and "b" the length of the two axes, per the equations in Table D.50 of ISO 19138. [Adapted from ISO 19138]

confidenceEllipse[0..1] : Record

A 2D ellipse with the two main axes indicating the direction and magnitude of the highest and lowest uncertainty of a 2D point. The data values are a record of real numbers corresponding to "phi" the bearing of the major semi-axis, and "a" and "b" the length of the two axes, per the equations in Table D.51 of ISO 19138 and a significance level parameter. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.5 THEMATIC ACCURACY

International Hydrographic Organization

X.5.1 Thematic Classification Correctness

- Thematic Classification Correctness is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Thematic Classification Correctness checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option b1:]**The product specification shall describe how Thematic Classification Correctness is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option b2:]** In term of Thematic Classification Correctness, <This Product Specification> products shall at least populate **miscalculationRate** that is the number of incorrectly classified features in relation to the number of features that are supposed to be there.

DQ_ThematicClassificationCorrectness

Comparison of the classes assigned to features or their attributes to a universe of discourse. [Per ISO 19113]

For example, ground truth or reference dataset.

Public Attributes:

numberOfIncorrectlyClassifiedItems[0..1] : Integer

This data quality measure is a count of the number of incorrectly classified features. [Adapted from ISO 19138]

This is an integer count.

miscalculationRate[0..1] : Real

This data quality measure indicates the number of incorrectly classified features in relation to the number of features that are supposed to be there. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 1 items that are classified incorrectly and there are 100 of the items in the dataset then the ratio is 1/100 and the reported rate = 0.01.

misclassificationMatrix[0..1] : Integer Matrix

This data quality measure is a matrix of integer numbers that indicates the number of items of class (i) classified as class (j). The misclassification matrix is a quadratic matrix with n columns and n rows where n denotes the number of classes under consideration. MCM (i,j) = (# items of class (i) classified as class (j). The diagonal elements of the misclassified matrix contain the correctly classified items, and the off diagonal items contain the number of misclassified errors. [Adapted from ISO 19138]

relativeMiscalculationMatrix[0..1] : Real Matrix

This data quality measure is a matrix of real numbers that indicates the number of items of class (i) classified as class (j) divided by the number of items of class (i) * 100 represented as a percentage. The misclassification matrix has n columns and n rows where n denotes the number of classes under consideration. RMCM (i,j) = (# items of class (i) classified as class (j) / number of items of class (i)) *100. [Adapted from ISO 19138]

kappaCoefficient[0..1] : Real

This data quality measure is real number coefficient to quantify the proportion of agreement of assignments to classes by removing misclassifications. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.5 THEMATIC ACCURACY

X.5.2 Non-Quantitative Attribute Accuracy

- **[Option1:]**Non-Quantitative Attribute Accuracy isn't applicable for <this Product Specification>.Thematic accuracy of <this Product Specification> data is wholly quantitative.
- **[Or Option2:]**Non-Quantitative Attribute Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Non-Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Non-Quantitative Attribute Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** The accuracy of non-quantitative attributes can be correct or incorrect. <This Product Specification> products shall at least populate **numberOfIncorrectAttributeValues** that is a count of all attribute values where the value is incorrect.

DQ_NonQuantitativeAttributeAccuracy

Correctness of non-quantitative attribute. [Per ISO 19115]

Public Attributes:

numberOfIncorrectAttributeValues[0..1] : Integer

This data quality measure is count of the total number of erroneous attribute values within the relevant part of the dataset. It is a count of all attribute values where the value is incorrect. [Adapted from ISO 19138]

rateOfCorrectAttributeValues[0..1] : Real

This data quality measure indicates the number of correct attribute values in relation to the total number of attribute values. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 97 correct attribute values and there are 100 attribute values in total in the dataset then the ratio is 97/100 and the reported rate = 0.97.

rateOfIncorrectAttributeValues[0..1] : Real

This data quality measure indicates the number of attribute values where incorrect values are assigned in relation to the total number of attribute values. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

For example, if there are 3 incorrect attribute values and there are 100 attribute values in total in the dataset then the ratio is 3/100 and the reported rate = 0.03

Source: S-100 Part 4c Metadata - Data Quality

X.5 THEMATIC ACCURACY

X.5.3 Quantitative Attribute Accuracy

- **[Option1:]**Quantitative Attribute Accuracy isn't applicable for <this Product Specification>.Thematic accuracy of <this Product Specification> data is wholly non-quantitative.
- **[Or Option2:]**Quantitative Attribute Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Quantitative Attribute Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** The accuracy of quantitative attributes can be measured in terms of uncertainty intervals. <This Product Specification> products shall at least populate **attributeValueUncertainty3Sigma** that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%.

DQ_QuantitativeAttributeAccuracy
Accuracy of a quantitative attribute. [Per ISO 19115]

Public Attributes:

attributeValueUncertaintyMean[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 50%. [Adapted from ISO 19138]

attributeValueUncertainty1Sigma[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 68.3%. [Adapted from ISO 19138]

attributeValueUncertainty2Sigma[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 90%. [Adapted from ISO 19138]

attributeValueUncertainty3Sigma[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19138]

attributeValueUncertainty4Sigma[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 99%. [Adapted from ISO 19138]

attributeValueUncertainty5Sigma[0..1] : Real
This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 99.8%. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.6 TEMPORAL QUALITY

X.6.1 Temporal Consistency

- **[Option1:]**Temporal Consistency isn't applicable for <this Product Specification>.
- **[Or Option2:]**Temporal Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Temporal Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test**. [Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- In term of Temporal Consistency, <This Product Specification> products shall populate **chronologicalOrder** that indicate that an event is incorrectly ordered against the other events.

DQ_TemporalConsistancy

Correctness of ordered events or sequences, if reported. [Per ISO 19115]

Public Attributes:

chronologicalOrder[0..1] : Boolean

This data quality measure indicates that an event is incorrectly ordered against the other events.

This is a Boolean where TRUE indicates that the event is incorrectly ordered. [Adapted from ISO 19157].

Source: S-100 Part 4c Metadata - Data Quality

X.6 TEMPORAL QUALITY

X.6.2 Temporal Validity

- **[Option1:]**Temporal Validity isn't applicable for <this Product Specification>.
- **[Or Option2:]**Temporal Validity is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Temporal Validity checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]**The product specification shall describe how Temporal Validity is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Temporal Validity, <This Product Specification> products shall at least populate **numberOfNonConformantItems** that is a count of all items in the dataset that are not in conformance with their value domain.

X.6 TEMPORAL QUALITY

DQ_TemporalValidity

Validity of data with respect to time. [Per ISO 19115]

Public Attributes:

valueDomainNonConformance[0..1] : Boolean

This data quality measure is an indication that an item is not in conformance with its value domain. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is not in conformance with its value domain.

valueDomainConformance[0..1] : Boolean

This data quality measure is an indication that an item is conforming to its value domain. [Adapted from ISO 19138]

This is a Boolean where TRUE indicates that an item is conforming to its value domain.

numberOfNonConformantItems[0..1] : Integer

This data quality measure is a count of all items in the dataset that are not in conformance with their value domain. [Adapted from ISO 19138]

This is an integer count.

valueDomainConformanceRate[0..1] : Real

This data quality measure indicates the 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. [Adapted from ISO 19138]

This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.

valueDomainNonConformanceRate[0..1] : Real

This data quality measure indicates the number of items in the dataset that are not in conformance with their value domain in relation to the total number of items in the dataset. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.6 TEMPORAL QUALITY

X.6.3 Temporal Accuracy

- **[Option1:]**Temporal Accuracy isn't applicable for <this Product Specification>.
- **[Or Option2:]**Temporal Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.
- <This Product Specification> products must be tested with Temporal Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- **[Option 2b.1:]** The product specification shall describe how Temporal Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Temporal Accuracy, <This Product Specification> products shall at least populate **attributeValueUncertainty3Sigma** that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%.

X.6 TEMPORAL QUALITY

DQ_AccuracyOfATimeMeasurement

Correctness of the temporal references of an item (reporting of error in time measurement). [Per ISO 19115]

Public Attributes:

attributeValueUncertaintyMean[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 50%. [Adapted from ISO 19138]

attributeValueUncertainty1Sigma[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 68.3%. [Adapted from ISO 19138]

attributeValueUncertainty2Sigma[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 90%. [Adapted from ISO 19138]

attributeValueUncertainty3Sigma[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19138]

attributeValueUncertainty4Sigma[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 99%. [Adapted from ISO 19138]

attributeValueUncertainty5Sigma[0..1] : Real

This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 99.8%. [Adapted from ISO 19138]

Source: S-100 Part 4c Metadata - Data Quality

X.7 AGGREGATION

- **[Option1:]**Aggregation isn't applicable for <this Product Specification>.
- **[Or Option2:]**Aggregation is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>. The aggregated Data Quality result provides a result if the dataset has passed conformance to the Data Product Specification.
- <This Product Specification> products must be tested with Aggregation checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.
- <This Product Specification> product shall include a standalone quality report which provides full information on the original results (with evaluation procedures and measures applied), the aggregated result, and the aggregation method. The dataset or exchange set metadata that is distributed with the exchange set will describe only the aggregated result with a reference to the original results described in the standalone quality report.
- **[Option 2b.1:]**The product specification shall describe how Aggregation is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.
- **[Or Option 2b.2:]** In term of Aggregation, <This Product Specification> products shall at least populate **DataProductSpecificationPassed** that is a Boolean indicating that all requirements in the referred data product specification are fulfilled, and **DataProductSpecificationFailRate** that is a number indicating the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements.

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X.7 AGGREGATION

DQ_Aggregation

Several requirements are set up for a product to conform to the specification. [Adapted from ISO 19157]

Public Attributes:

dataProductSpecificationPassed[O..1]: Boolean

This data quality measure indicates that all requirements in the referred data product specification are fulfilled. [Adapted from ISO 19157].

dataProductSpecificationFailCount[O..1]: Integer

This data quality measure indicates that the number of data product specification requirements that are not fulfilled by the current product/dataset. [Adapted from ISO 19157].

dataProductSpeclficationPassCount[O..1]: Integer

This data quality measure indicates that the number of data product specification requirements that are fulfilled by the current product/dataset. [Adapted from ISO 19157].

dataProductSpecificationFailRate[O..1]: Real

This data quality measure indicates that the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements. [Adapted from ISO 19157].

dataProductSpecificationPassRate[O..1]: Real

This data quality measure indicates that the number of data product specification requirements that are fulfilled by the current product/dataset in relation to the total number of data product specification requirements. [Adapted from ISO 19157].

Source: S-100 Part 4c Metadata - Data Quality

X.8 QUALITY MEASURE ELEMENTS

No.	Data quality element and sub element	Definition	DQ measure / description	Evaluation scope	Scope in <this Product Specification>
1	Completeness / Commission	Excess data present in a dataset, as described by the scope.	numberOfExcessItems / This data quality measure indicates the number of items in the dataset, that should not have been present in the dataset.	dataset/dataset series	
2	Completeness / Commission	Excess data present in a dataset, as described by the scope.	numberOfDuplicateFeatureInstances / This data quality measure indicates the total number of exact duplications of feature instances within the data.	dataset/dataset series	
3	Completeness / Omission	Data absent from the dataset, as described by the scope.	numberOfMissingItems / This data quality measure is an indicator that shows that a specific item is missing in the data.	dataset/dataset series/spatial object type	
4	Logical Consistency / Conceptual Consistency	Adherence to the rules of a conceptual schema.	numberOfInvalidSurfaceOverlaps / This data quality measure is a count of the total number of erroneous overlaps within the data. Which surfaces may overlap and which must not is application dependent. Not all overlapping surfaces are necessarily erroneous.	spatial object / spatial object type	
5	Logical Consistency / Domain Consistency	Adherence of the values to the value domains.	numberOfNonconformantItems / This data quality measure is a count of all items in the dataset that are not in conformance with their value domain.	spatial object / spatial object type	
6	Logical Consistency / Format Consistency	Degree to which data is stored in accordance with the physical structure of the data set, as described by the scope	physicalStructureConflictsNumber / This data quality measure is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset.	dataset/dataset series	
7	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	rateOfFaultyPointCurveConnections / This data quality measure indicates the number of faulty link-node connections in relation to the number of supposed link-node connections. This data quality measure gives the erroneous point-curve connections in relation to the total number of point-curve connections.	spatial object / spatial object type	

X.8 QUALITY MEASURE ELEMENTS

8	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfMissingConnectionsUndershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots.	spatial object / spatial object type	
9	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfMissingConnectionsOvershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots.	spatial object / spatial object type	
10	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSlivers / This data quality measure is a count of all items in the dataset that are invalid sliver surfaces. A sliver is an unintended area that occurs when adjacent surfaces are not digitized properly. The borders of the adjacent surfaces may unintentionally gap or overlap to cause a topological error.	dataset / dataset series	
11	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSelfIntersects / This data quality measure is a count of all items in the dataset that illegally intersect with themselves.	spatial object / spatial object type	
12	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSelfOverlap / This data quality measure is a count of all items in the dataset that illegally self-overlap.	spatial object / spatial object type	
13	Positional Accuracy / Absolute or External Accuracy	Closeness of reported coordinative values to values accepted as or being true.	RMSError / Standard deviation, where the true value is not estimated from the observations but known a priori.	spatial object / spatial object type	
14	Positional Accuracy / Vertical Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	linearMapAccuracy3Sigma / Half length of the interval defined by an upper and lower limit in which the true value lies with probability 95%.	spatial object / spatial object type	

X.8 QUALITY MEASURE ELEMENTS

15	Positional Accuracy / Horizontal Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	circularError95 / Radius describing a circle in which the true point location lies with the probability of 95%.	spatial object / spatial object type	
16	Positional Accuracy / Relative or Internal Accuracy	Closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true.	relativeVerticalError/ An evaluation of the random errors of one relief feature to another in the same data set 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. [Adapted from ISO 19157]	spatial object / spatial object type	
17	Positional Accuracy / Relative or Internal Accuracy	Closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true.	relativeHorizontalError/ An evaluation of the random errors in the horizontal position of one feature to another in the same data set or on the same map/chart. [Adapted from ISO 19157]	spatial object / spatial object type	
18	Positional Accuracy / Gridded Data Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	RMSErrorPlanimetry / Radius of a circle around the given point, in which the true value lies with probability P.	spatial object / spatial object type	
19	Temporal Quality / Temporal Consistency	Correctness of ordered events or sequences, if reported.	chronologicalOrder/ This data quality measure that indicate that an event is incorrectly ordered against the other events. [Adapted from ISO 19157]	dataset/dataset series/spatial object type	
20	Temporal Quality / Temporal Validity	Validity of data with respect to time	numberOfNonConformantItems/ This data quality measure is a count of all items in the dataset that are not in conformance with their value domain. [Adapted from ISO 19157]	dataset/dataset series/spatial object type	
21	Temporal Quality / Temporal Accuracy	Correctness of the temporal references of an item (reporting of error in time measurement)	attributeValueUncertainty3Sigma/ This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19157]	dataset/dataset series/spatial object type.	

X.8 QUALITY MEASURE ELEMENTS

22	Thematic Accuracy / Thematic Classification Correctness	Comparison of the classes assigned to features or their attributes to a universe of discourse.	miscalculationRate / This data quality measure indicates the number of incorrectly classified features in relation to the number of features that are supposed to be there. [Adapted from ISO 19157] This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio. For example, if there are 1 items that are classified incorrectly and there are 100 of the items in the dataset then the ratio is 1/100 and the reported rate = 0.01.	dataset/dataset series/spatial object type	
23	Thematic Accuracy / Non-Quantitative Attribute Accuracy	Correctness of non-quantitative attribute.	numberOfIncorrectAttributeValues / This data quality measure is count of the total number of erroneous attribute values within the relevant part of the dataset. It is a count of all attribute values where the value is incorrect. [Adapted from ISO 19157]	dataset/dataset series/spatial object type	
24	Thematic Accuracy / Quantitative Attribute Accuracy	Accuracy of a quantitative attribute.	attributeValueUncertainty3Sigma / This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19157]	dataset/dataset series/spatial object type	
25	Aggregation Measures / AggregationMeasures	In a data product specification, several requirements are set up for a product to conform to the specification.	DataProductSpecificationPassed / This data quality measure is a boolean indicating that all requirements in the referred data product specification are fulfilled.	dataset/dataset series/spatial object type	
26	Aggregation Measures / AggregationMeasures	In a data product specification, several requirements are set up for a product to conform to the specification.	DataProductSpecificationFailRate / This data quality measure is a number indicating the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements.	dataset/dataset series/spatial object type	

ACTION REQUIRED OF DQWG

The S-100WG is invited to:

a. **Note** the information provided;
b. **Approve to** include the template as the revision proposal for Appendix D of S-100 Part 11.