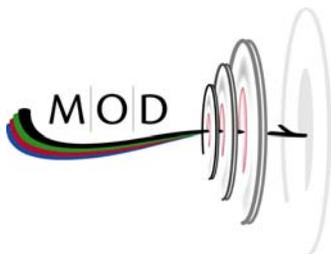


# FEMA DFIRM Verification Check Standard

Version 2.1

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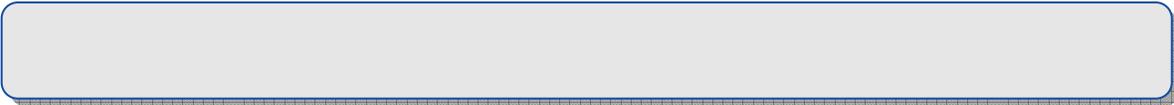




# FEMA DFIRM Verification Check Standard

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## 1. DFIRM Acceptable Formats

FEMA is currently updating their Guidelines and Specifications for Mapping Partners Appendix L: Guidance for Preparing DFIRM Databases to include ESRI's Geodatabase Format and removes the MapInfo Interchange and ESRI Export File (E00s) formats. The Detailed Logic Descriptions contained in this document refer directly to the E00 format checks. With the E00 format being retired with the Appendix L update, all the logic descriptions are expected to remain the same with only the technological implementation of these logic checks to potentially change to support the Geodatabase format. Appendix L currently has a Microsoft Access (MS Access) specification, and this is the specification that FEMA intends to utilize for the implementation of the Geodatabase format. This requirements document will be updated to fully define the Geodatabase specification once FEMA has officially acknowledged the ESRI Geodatabase (expected FY2008) as their new acceptable DFIRM deliverable format.

## 2. Detailed Logic Descriptions

The Detailed Logic Descriptions that follow explain the code behind each Auto Screen check. Each element of the description is defined below:

**Heading:** A brief description of the condition being checked.

**QC Category:** The categorical tasks the check falls under.

**Function:** A description of the items that the function checks and under what conditions it will pass.

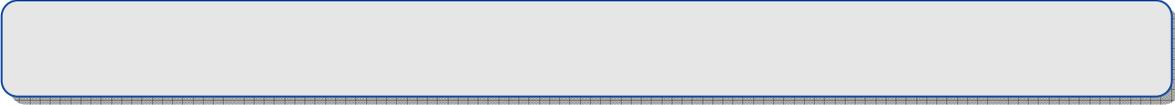
**Error Type:** The item defines whether the issue is an "Error" or a "Warning."

**Error Warning:** A description of the logic that is used in the code to conduct the check.

**Reference:** A citation to Appendix K or L and the database domain table, where applicable.

### 2.1. Metadata Check

The Metadata Check task verifies that a metadata file has been submitted with the DFIRM database. The task checks for valid metadata file formats, which include ASCII text or XML format. It also checks for the proper naming convention for the metadata file. After successfully locating the presence of a metadata file, the task checks the metadata file for the existence of references to DFIRM tables, source citation, publication date, and coordinate system information.



The Metadata Check performs validation on the following:

- Metadata Existence
- DFIRM Table
- Source Citation
- Metadata Filename and Publication Date
- Coordinate System Information
  - Horizontal Datum
  - Vertical Datum
  - Bounding Coordinates
  - Projection

### 2.1.1. Metadata Existence

#### *2.1.1.1 A metadata file must exist in the DFIRM database submission*

**Reference:** Appendix L. L.3.8 Metadata, page L-54

*To facilitate the use of these data and the transfer of data files between users, a metadata file shall accompany all digital data submittals. Only one metadata file is required for each Flood Map Project. However, in this file, the assigned Mapping Partner must distinguish between the different origins of the various datasets included. The metadata file shall follow the Content Standard for Digital Geospatial Metadata (version 2.0), FGDC-STD-001-1998. Details of this standard are available at [www.fgdc.gov](http://www.fgdc.gov). A sample metadata file for Preliminary and Final DFIRM databases is presented in Section L.8 of this Appendix.*

**Error Type:** “Error”

**Statement:**

- If:
  - there is a metadata file included with the DFIRM database submission in .txt or .xml format
- Then:
  - Check is passed – program will move to next check
- Else:

- An error will be returned as:
  - “Error 1001: **Missing metadata file**”
- And Auto Screen will not continue with any further checks

### 2.1.2. DFIRM Table

#### *2.1.2.1 The metadata file must include a list of at least one DFIRM table*

**Reference:**

This check references a database domain table named TBL\_QC\_TABLES, which is provided in Appendix I of this document. The domain table is based on table names listed out in Appendix L, pages L-18 to L-19.

**Error Type:** “Error”

**Error message:** “Error 1002: Metadata does not list DFIRM layers or tables – refer to Section 5, Entity and Attribute Information of the DFIRM metadata profile for guidance on populating this metadata element.”

### 2.1.3. Source Citation

#### *2.1.3.1 The metadata must include source citation information*

**Reference:**

Appendix L pages L-401 to L-410 shows a metadata example for Preliminary and Final DFIRM databases. Appendix L pages L-26 and L-27 clarifies the content you use for the source citation abbreviation.

**Error Type:** “Error”

**Error message:** “Error 1207: Source citations are missing from metadata or do not match domain. Refer to Section 2.5, Lineage of the DFIRM metadata profile for guidance on populating this metadata element.”

### 2.1.4. Metadata Filename and Publication Date

#### *2.1.4.1 The metadata filename and publication date must meet DFIRM standards*

**Reference:** See Appendix L, L.3.8 Metadata, pages L-54 and L-55 See Appendix L, pages L-401 to L-410

**Statement:**

- If:
  - the community code in the Oracle database equals “countywide” and the CID cited in the metadata file name contains a valid FIPS number and a “C”
- Or:
  - the community code in the Oracle database does not equal “countywide” and the CID cited in the metadata file contains a valid numeric CID without a “C”
- Then:
  - Check is passed – program will move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1224: **Metadata does not follow DFIRM standards**”

**Function:** Auto Screen checks the publication date and the CID alphanumeric code cited in the metadata file. The publication date is checked but no warning will be returned if it is absent.

**Error Type:** “Error”

**Error message:** “Error 1224: Metadata filename does not meet DFIRM standards. Refer to Notes Section of the DFIRM metadata profile for guidance on correctly naming your metadata file.”

## 2.1.5. Coordinate System Information

### 2.1.5.1 Metadata must provide horizontal datum information

**Reference:** Page L-407 in Appendix L has the following example

*Geodetic\_Model:*

*Horizontal\_Datum\_Name: North American Datum 1983*

*Ellipsoid\_Name: Geodetic Reference System 80*

*Semi-major\_Axis: 6378206.4*

*Denominator\_of\_Flattening\_Ratio: 294.98*

**Statement:**

- If:
  - the horizontal datum is included in the metadata file
- Then:
  - Check is passed – program will move to next check
- Else:
  - An error will be returned as:
    - “Error 1032: **Horizontal Datum in the metadata was not populated**”

**Function:** Auto Screen checks the metadata file for the inclusion of horizontal datum information.

**Error Type:** “Error”

**Error message:** “Error 1032: Horizontal Datum in the metadata was not populated. Refer to Section 4.1, Horizontal Coordinate System Definition of the DFIRM metadata profiles for guidance on populating this metadata element.”

### *2.1.5.2 Metadata must provide vertical datum information*

**Reference:** Page L-408 of Appendix L has the following example:

*Vertical\_Coordinate\_System\_Definition:*

*Altitude\_System\_Definition:*

*Altitude\_Datum\_Name: North American Vertical Datum of 1988*

*Altitude\_Resolution: 0.03*

*Altitude\_Distance\_Units: feet*

*Altitude\_Encoding\_Method: Attribute Values*

**Statement:**

- If:
  - the vertical datum is included in the metadata file
- Then:
  - Check is passed – program will move to next check
- Else:
  - An error will be returned as:
    - “Error 1033: **Vertical Datum in the metadata was not populated**”

**Function:** Auto Screen checks the metadata for the inclusion of vertical datum information.

**Error Type:** “Error”

**Error message:** “Error 1033: Vertical Datum in the metadata was not populated. Refer to Section 4.2, Vertical Coordinate System Definition of the DFIRM metadata profiles for guidance on populating this metadata element.”

### *2.1.5.3 Metadata must provide bounding coordinates*

**Reference:** See Appendix L: pages L-401 for the following example :

*Spatial\_Domain:  
Bounding\_Coordinates:  
West\_Bounding\_Coordinate: -84.125  
East\_Bounding\_Coordinate: -84.25  
North\_Bounding\_Coordinate: 30.5  
South\_Bounding\_Coordinate: 30.625*

**Statement:**

- If:
  - the south bounding coordinates are included in the metadata file
- If:
  - the east bounding coordinates are included in the metadata file
- If:
  - the north bounding coordinates are included in the metadata file
- If:
  - the west bounding coordinates are included in the metadata file
- Then:
  - Check is passed – program will move to next check
- Else:
  - An error will be returned as:
    - **“Error 1047: The Spatial\_Domain Bounding\_Coordinates in the metadata was not populated”**
  
- If any one of the four If conditions fail, then Auto Screen will not continue with any further checks

**Function:** Auto Screen checks the metadata file for the study area’s bounding coordinates. These values should be displayed as minimum (lower left) and maximum (upper right) coordinates that form the boundaries of the DFIRM data.

**Error Type:** “Error”

**Error message:** “Error 1047: The Spatial\_Domain Bounding\_Coordinates in the metadata were not populated. Refer to Section 1.5.1, Bounding Coordinates of the DFIRM metadata profiles for guidance on populating this metadata element.”

## 2.1.5.4 Metadata must include projection information

**Reference:** See Appendix L: pages L-407 and L-408 for the following example:

```
Grid_Coordinate_System:  
  Grid_Coordinate_System_Name: Universal Transverse Mercator  
  Universal_Transverse_Mercator:  
  UTM_Zone_Number: 16
```

**Statement:**

- If:
  - the projection information is included in the metadata file
- Then:
  - Check is passed – program will move to next check
- Else:
  - An error will be returned as:
    - “Error 1048: **Projection information in the metadata was not populated**”
  - And Auto Screen will not continue with any further projection checks and will continue to the File Import Check

**Function:** Auto Screen checks the metadata file for the study’s projection information.

**Error Type:** “Error”

**Error message:** “Error 1048: Projection information in the metadata was not populated. Refer to Section 4.1.2, Planar of the DFIRM metadata profiles for guidance on populating this metadata element.”

## 2.2. File Import Check

The File Import Check task verifies that there is a corresponding ESRI ArcInfo Export file (E00) for all of the DFIRM tables listed in the metadata. The task imports all of the valid files and reports an error if a file fails to import.

### 2.2.1. E00 completeness and validity check

**QC Category:** File Import

**Function:** Auto Screen checks for the existence of an E00 file for each required standard DFIRM database table and any additional tables listed in the metadata file.

**Statement:**

- If:
  - An E00 file is included in the DFIRM submission for each required standard DFIRM database table and any additional tables listed in the metadata file, and
  - Each E00 file included in the DFIRM submission can be successfully imported
- Then:
  - Correct – Move to next check

**Error Type:** “Error”

**Upon failing first condition:** “Error 1010a: Your submission is missing the following layers or tables: Table 1, Layer 1, ... . Or your metadata file may reference layers or tables you did not submit for Quality Assurance.”

**Upon failing second condition:** “Error 1010b: The following file(s) failed to import: file 1, file 2, ...”

## 2.3. File Completeness Check

The File Completeness Check task inspects the DFIRM data submission to ensure that all of the required DFIRM data formats and tables are included. Valid DFIRM data formats include ESRI ArcInfo Export files (E00), ESRI Shapefiles, and MapInfo Interchange files (MIF). The File Completeness task also checks that the DFIRM tables have the correct names and that all required DFIRM tables are included.

The File Completeness check performs validation on the following:

- DFIRM File Formats
- DFIRM Table Names
- Required DFIRM Tables

### 2.3.1. DFIRM File Formats

#### *2.3.1.1 DFIRM database submission must include ESRI Export Files (E00), ESRI Shapefiles, and MapInfo Interchange (MIF) files for all layers*

**Function:** Auto Screen checks that a MIF, SHP, and E00 file exists for every required table in the standard DFIRM database and for all files listed in the metadata. Note: At the preliminary stage only E00 files are required. (Refer to Appendix II: QC Table names)

**QC Category:** File Completeness Check

**Error Type:** “Error”

**Error message:** “Error 1005: Your DFIRM submission is missing the following files: file 1, file 2, file 3, ... . Or your metadata file lists layers or tables you did not submit for QA.”

## 2.3.2. DFIRM Table Names

### 2.3.2.1 *All table names listed in the metadata must follow DFIRM specifications*

**Reference:**

Appendix II of this document shows the proper table naming conventions. Appendix II is built in compliance with Appendix L pages L-270 to L-400.

**Function:** Auto Screen checks all table names listed in the metadata for proper Appendix L naming conventions. (Refer to Appendix II: QC Table names)

**QC Category:** File Completeness

**Error Type:** “Error”

**Error message:** “Error 1008: The names of the following tables do not follow the DFIRM specifications: file 1, file 2, file 3, ...”

## 2.4. Projection Check

The Projection Check task inspects the DFIRM data submission to ensure that the datum and projection information in the metadata meets Appendix L specifications. The task checks the horizontal and vertical datum, projection, and projection zones against Appendix L specifications. Every layer of the DFIRM is checked to ensure that a projection is defined. In addition, the task checks for consistency between the datum and projection information in the metadata and the STUDY\_INFO table. Also, a spatial check is conducted to ensure that all of the features in the DFIRM data fall within the area defined by the bounding coordinates.

The Projection Check performs validation on the following:

- Datum
- Projection
- Projection Zone
- Bounding Coordinates

## 2.4.1. 3.4.1 Datum

### 2.4.1.1 *The horizontal datum in the metadata meets Appendix L specifications*

**Reference:** The following is found on page L-143 in Appendix L:

*Horizontal Datum. Valid entries for this attribute include North American Datum of 1927 or North American Datum of 1983 (NAD83). This is the horizontal datum used for the printed FIRM. The horizontal datum describes the reference system on which the horizontal coordinate information shown on the FIRM is based. NAD83 is the preferred horizontal datum.*

**Function:** Auto Screen checks the horizontal datum cited in the metadata file against a set of valid entries, which are cited below.

**Statement:**

**Statement:**

- If:
  - The metadata has a cited projection of
    - North American Datum 1983
      - or
    - North American Datum of 1983
      - or
    - NAD83
- Then:
  - Correct – Move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1034: **The metadata may not contain a correct horizontal datum**”

**QC Category:** Projection Check

**Error Type:** “Warning”

**Error message:** “Warning 1034: The QA system could not match the horizontal datum value in your metadata to the list of acceptable values. If you feel you have received this warning in error, please contact MIPHelp.”

### 2.4.1.2 *The vertical datum in the metadata meets Appendix L specifications*

**Reference:** The following is found on page L-143 in Appendix L:

*The vertical datum describes the reference surface from which elevation on the map is measured. Normally, this would be North American Vertical Datum of 1988 for new studies.*

**Statement:**

- If:
  - The metadata has a cited projection of
    - National Geodetic Vertical Datum of 1929
      - or
    - National Geodetic Vertical Datum 1929
      - or
    - National Geodetic Vertical Datum of 1929 (NGVD29)
      - or
    - NGVD29
      - or
    - North American Vertical Datum of 1988
      - or
    - North American Vertical Datum 1988
      - or
    - North American Vertical Datum of 1988 (NAVD88)
      - or
    - NAVD88
- Then:
  - Correct – Move to next check
- Else:
  - A warning will be returned as:
    - **“Warning 1071: The vertical datum in the metadata does not match one or more of the spatial tables”**

**QC Category:** Projection Check

**Error Type:** “Warning”

**Error message:** “Warning 1071: The QA system could not match the vertical datum value in your metadata to the list of acceptable values. If you feel you have received this warning in error, please contact MIPHelp.”

### 2.4.1.3 *The horizontal datum cited in the metadata should match the horizontal datum defined in each layer of the DFIRM database*

**Reference:** For examples of correct citing of the vertical datum and horizontal datum in the metadata, see Appendix L, pages L-407 and L-408:

*Geodetic\_Model:*

*Horizontal\_Datum\_Name: North American Datum 1983*

*Ellipsoid\_Name: Geodetic Reference System 80*

*Semi-major\_Axis: 6378206.4*

*Denominator\_of\_Flattening\_Ratio: 294.98*

*Vertical\_Coordinate\_System\_Definition:*

*Altitude\_System\_Definition:*

*Altitude\_Datum\_Name: North American Vertical Datum of 1988*

*Altitude\_Resolution: 0.03*

*Altitude\_Distance\_Units: feet*

*Altitude\_Encoding\_Method: Attribute Values*

**Function:** Auto Screen checks the horizontal datum cited in the metadata against the horizontal datum defined for each ArcInfo spatial layer to verify consistency between the metadata and the DFIRM database.

**Statement:**

- If:
  - The horizontal datum cited in the metadata is the same as the horizontal datum defined for the ArcInfo spatial layers
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1204: **Either H\_DATUM or V\_DATUM in STUDY\_INFO does not match the metadata**”

**QC Category:** Projection Check

**Error Type:** “Warning”

**Error message:** “Warning 1204: The horizontal datum cited in your metadata record does not match the horizontal datum defined for your DFIRM layers”

## 2.4.2. Projection

### *2.4.2.1 The metadata file must cite either a Universal Transverse Mercator or State Plane Projection or Lambert Conformal Conic*

**Reference:** Appendix L, pages L-143 states:

*The preferred projection is Universal Transverse Mercator (UTM). If a State Plane coordinate system and associated projection is used, this field should include the name of the projection, the state and the zone (e.g., Lambert Conformal Conic, Virginia North Zone).*

**Function:** Auto Screen checks the metadata file for a projection definition of either Universal Transverse Mercator (UTM) or State Plane or Lambert Conformal Conic.

**Statement:**

- If:
  - The metadata has a cited projection of
    - Universal Transverse Mercator
      - or
    - UTM
      - or
    - State Plane Coordinate System 1983
      - or
    - State Plane Coordinate System
      - or
    - Lambert Conformal Conic
- Then:
  - Correct –Move to next check
- Else:
  - A warning will be returned as:
    - **“Warning 1049: The projection in metadata was not in Universal Transverse Mercator or State Plane”**

**QC Category:** Projection Check

**Error Type:** “Warning”

**Error message:** “Warning 1049: The QA system could not match the map projection value in your metadata record to the list of acceptable values. If you feel you have received this warning in error, please contact MIPHelp.”

### 2.4.2.2 All DFIRM database layers must have a projection defined

**Statement:**

- If:
  - All imported ArcInfo Export files have a defined projection
- Then:
  - Correct –Move to next check
- Else:
  - An error will be returned as:
    - “Error 1045: **The spatial layer does not have projection information**”

**QC Category:** Projection Check

**Function:** Auto Screen checks that a projection is defined for each ArcInfo file.

**Error Type:** “Error”

**Error message:** “Error 1045: The following spatial layer(s) does not have projection information: layer1, layer2, ...”

### 2.4.3. Projection Zone

#### 2.4.3.1 A projection zone is cited in the metadata

**Reference:** See Appendix L, pages L-356

*The preferred projection is Universal Transverse Mercator (UTM). If a State Plane coordinate system and associated projection is used, this field should include the name of the projection, the state and the zone (e.g., Lambert Conformal Conic, Virginia North Zone).*

**Function:** The QC system compares the projection information defined for each E00 spatial layer against a list of acceptable values cited in the logic condition below.

**Statement:**

- If:
  - The E00 spatial layers have a defined projection of:
    - Lambert
      - or
    - StatePlane
      - or

- UTM
- Then:
  - Correct – Move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1202: Metadata record does not have UTM or State Plane Projection Zone defined. Please refer to Section 4.1.2, Planar of the DFIRM metadata profiles for guidance on populating this metadata element.”

### *2.4.3.2 The projection zone cited in the metadata must match the projection zone defined in each ArcInfo spatial DFIRM file*

**Reference:** On page L-267 of Appendix L you see the following example for the projection zone, listed as the UTM\_Zone\_Number:

```
Spatial_Reference_Information:  
  Horizontal_Coordinate_System_Definition:  
    Planar:  
      Grid_Coordinate_System:  
        Grid_Coordinate_System_Name: Universal Transverse  
Mercator  
      Universal_Transverse_Mercator:  
        UTM_Zone_Number: 16
```

**QC Category:** Projection Check

**Error Type:** “Error”

**Logic Statement:**

- If:
  - The defined projection in the metadata is not Lambert or Transverse Mercator
    - and
  - The projection zone cited in the metadata file corresponds to the projection zone of each ArcInfo (E00) spatial layer
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:

**Error message:** “Error 1203: The projection zone value in the metadata does not match with the projection zone value in the following DFIRM layers: layer1, layer2, ...”

## 2.4.4. Bounding Coordinates

### 2.4.4.1 *Spatial features should fall within the area defined by the bounding coordinates in the metadata*

#### **Reference:**

Page L-401 of Appendix L shows an example of bounding co-ordinates in the metadata:

*Spatial\_Domain:*

*Bounding\_Coordinates:*

*West\_Bounding\_Coordinate: -84.125*

*East\_Bounding\_Coordinate: -84.25*

*North\_Bounding\_Coordinate: 30.5*

*South\_Bounding\_Coordinate: 30.625*

**Function:** Auto Screen validates that all ArcInfo spatial layers fall within the area defined by the bounding coordinates which are cited in the metadata. Auto Screen compares the maximum and minimum bounding values in the ArcInfo layer against the maximum and minimum bounding coordinates defined in the metadata to verify consistency between the metadata and the DFIRM database.

#### **Statement:**

- If:
  - All ArcInfo (E00) spatial layers fall within the area defined by the bounding coordinates cited in the metadata
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1042: **Spatial features fall outside the defined metadata bounding box**”

**QC Category:** Projection Check

**Error Type:** “Error”

**Error message:** “Error 1042: The following layers have features that fall outside the bounding coordinates defined in the metadata: layer1, layer2, ...”

## 2.5. Attribute Check

The Attribute Check task inspects the coding for several required fields to ensure it is valid. It also checks for consistency in the coding of fields from different tables that are supposed to match.

The Attribute Check task performs field validation for the following:

- Coding
- Consistency

### 2.5.1. Coding

#### *2.5.1.1 The primary key for optional spatial tables should not be null QC*

*Category: Attribute Check*

#### **Reference:**

See page L-50 in Appendix L:

*Each DFIRM database table has a primary key field defined. This field is normally the table name followed by “\_ID”. The Mapping Partner that creates the digital data must populate these fields. Normally features in each table will be numbered sequentially using this field, although the Mapping Partner may choose another method provided it is logical, documented, consistently implemented, and results in a unique ID value for each spatial feature.*

*In the table documentation in Section L.7, each field name is followed by a letter code as follows:*

- *R – Required for all records*
- *A – Required if applicable to spatial feature described Plus, each field has a second code:*
  - *S – A component of the Standard DFIRM Database*
  - *E – A component of the Enhanced DFIRM Database*

*For required fields, Null values are not permitted. In the event that the correct information cannot be obtained for a required field, the Project Officer may allow the mapping partner to substitute a value that indicates that the affected field was intentionally not populated. Any use of not populated values must be documented and explained in the metadata. The value to use for not populated data for each field type is as follows:*

- *Character – “NP”*

- *Numeric* – -8888
- *Date* – 88880808
- *True.False* – “U”

*For a field that is required when applicable, but does not apply, the value must be Null (i.e. the field must be left empty, not set to zero). The Mapping Partner shall use the value zero only when an attribute has the specific value of zero. Because of limitations in some of the GIS formats used by FEMA, a true Null value can not be used for some fields. The value to use for “Null” fields for each field type is as follows:*

- *Character* – Null (or “”, the empty string)
- *Numeric* – -9999
- *Date* – 99990909
- *True.False* – Null (or “”, the empty string)

**Function:** Auto Screen checks spatial files for the following:

1. The optional tables cited in the metadata file exist in the DFIRM database.
2. The primary key field is populated.

The primary key field is not NULL, empty or blank

**Statement:**

- If:
  - NULL is not allowed
- Then:
  - If an optional table exists
- And:
  - the Primary Key exists
- Or:
  - The value is other than NULL, empty or blank
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - **“Warning 1028: The field value is required but was not populated for optional tables”**

### *2.5.1.2 The primary key for non-spatial tables should not be null*

### Reference:

See page L-50 and L-51 in Appendix L:

*Each DFIRM database table has a primary key field defined. This field is normally the table name followed by “\_ID”. The Mapping Partner that creates the digital data must populate these fields. Normally features in each table will be numbered sequentially using this field, although the Mapping Partner may choose another method provided it is logical, documented, consistently implemented, and results in a unique ID value for each spatial feature.*

*In the table documentation in Section L.7, each field name is followed by a letter code as follows:*

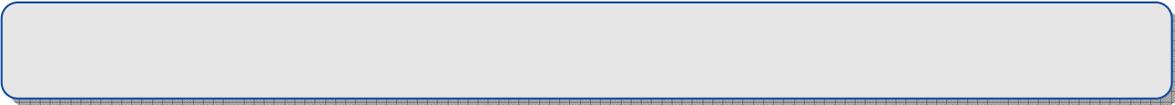
- *R – Required for all records*
- *A – Required if applicable to spatial feature described Plus, each field has a second code:*
  - *S – A component of the Standard DFIRM Database*
  - *E – A component of the Enhanced DFIRM Database*

*For required fields, Null values are not permitted. In the event that the correct information cannot be obtained for a required field, the Project Officer may allow the mapping partner to substitute a value that indicates that the affected field was intentionally not populated. Any use of not populated values must be documented and explained in the metadata. The value to use for not populated data for each field type is as follows:*

- *Character – “NP”*
- *Numeric – -8888*
- *Date – 88880808*
- *True.False – “U”*

*For a field that is required when applicable, but does not apply, the value must be Null (i.e. the field must be left empty, not set to zero). The Mapping Partner shall use the value zero only when an attribute has the specific value of zero. Because of limitations in some of the GIS formats used by FEMA, a true Null value can not be used for some fields. The value to use for “Null” fields for each field type is as follows:*

- *Character – Null (or “”, the empty string)*
- *Numeric – -9999*
- *Date – 99990909*
- *True.False – Null (or “”, the empty string)*



**Statement:**

First stage of check for non-spatial tables:

- If:
  - NULL is not allowed
- Then:
  - If a required table exists
- And:
  - the Primary Key exists
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1029: **The field value is required but was not populated**”

Second stage of check for non-spatial tables:

- If:
  - The table is non-spatial
- Then:
  - If the field is not NULL, empty or blank
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1029: **The field value is required but was not populated**”

**Function:** Auto Screen checks non-spatial files for the following:

1. The required non-spatial tables cited in the metadata file exist in the DFIRM submission.
2. Required tables contain a primary key.
3. The primary key field is not NULL, empty or blank.

**QC Category:** Attribute Check

*2.5.1.3 The field values of required tables must match values in the corresponding domain or lookup tables*

**Reference:**

Auto Screen checks the values for the required fields from each required DFIRM table against the following domain tables, which are compliant with *Appendix L, L9 Domain Tables, pages L-411 to L-453*.

See Appendix X: Domain Tables:

TBL\_D\_AREA\_UNITS  
TBL\_D\_CBRS\_TYP  
TBL\_D\_CHAN\_REP  
TBL\_D\_DISCHARGE\_UNITS  
TBL\_D\_EROS\_METHOD  
TBL\_D\_FLOODWAY  
TBL\_D\_FREQUENCY  
TBL\_D\_GAGE  
TBL\_D\_HYDRA  
TBL\_D\_HYDRO  
TBL\_D\_H\_DATUM  
TBL\_D\_JURIS\_TYP  
TBL\_D\_LABEL\_TYP  
TBL\_D\_LENGTH\_UNITS  
TBL\_D\_LN\_TYP  
TBL\_D\_LOMC\_STAT  
TBL\_D\_METHOD  
TBL\_D\_NM\_TYP  
TBL\_D\_NODES  
TBL\_D\_PANEL\_TYP  
TBL\_D\_RD\_STAT  
TBL\_D\_RUNUP\_MDL  
TBL\_D\_SCALE  
TBL\_D\_SHR\_ROUGH  
TBL\_D\_SHR\_TYP  
TBL\_D\_SOURCE\_CITATION  
TBL\_D\_STORMS  
TBL\_D\_STRUCT\_TYP  
TBL\_D\_SURGE\_MDL  
TBL\_D\_TF  
TBL\_D\_TIME\_UNITS  
TBL\_D\_TRANS\_TYP  
TBL\_D\_UNITS  
TBL\_D\_VELOCITY\_UNITS  
TBL\_D\_VOLUME\_UNITS  
TBL\_D\_VZONE  
TBL\_D\_V\_DATUM  
TBL\_D\_WATER\_TYP

TBL\_D\_WAVE\_MDL  
TBL\_D\_ZONE

**Statement:**

- If:
  - The required tables are included in the DFIRM submission
- And:
  - The required fields are included in these required tables
- And:
  - That the field values match the associated domain or lookup tables values
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning1030: **Attribute value does not match value in the domain or lookup table**”

**Function:** Auto Screen checks that the required field values in the required tables match specifications in the corresponding domain or lookup tables.

**QC Category:** Attribute Check

*2.5.1.4 In the L\_MTI\_LOMC table the field values for the LOMC status (LOMC\_STAT) must meet DFIRM specifications*

**Reference:** Pages L-378 and L-379 of Appendix L state:

*LOMC\_STAT R S Status of the LOMC. Valid entries for this field include the following: ‘superseded’, ‘revalidated’, ‘incorporated’, or ‘redetermined’*

*Only revalidated LOMCs are still in effect after a panel has been revised. All others must be superseded, redetermined or incorporated into the new FIRM. Therefore, a final DFIRM Database will only include revalidated LOMCs.*

**Statement:**

- If:
  - The submission is final
- And:
  - The coded value in the LOMC\_STAT field should be Revalidated

- Or:
- If:
  - The submission is draft or preliminary
- Then:
  - The coded value in the LOMC\_STAT field should be “Superseded”, “Revalidated”, “Incorporated”, or “Redetermined”
- Else:
  - A warning will be returned as:
    - “Warning 1209: **LOMC\_STAT in the L\_MT1\_LOMC table does not match DFIRM specifications**”

**Function:** Auto Screen conducts two different checks depending on the submission status:

1. For final submissions, the LOMC\_STAT value should equal “Revalidated”
2. For draft and preliminary submissions, the LOMC\_STAT value should equal “Superseded”, “Revalidate”, “Incorporated”, or “Redetermined”

**QC Category:** Attribute Check

Note: this check does not have any case sensitive requirements, it allows all upper, all lower, and clc.

### 2.5.2. Consistency

#### *2.5.2.1 The value in the vertical datum (V\_DATUM) field of the STUDY\_INFO should match the vertical datum cited in the metadata*

**Statement:**

- If:
  - The value in the V\_DATUM field of the Study\_Info table matches the vertical datum cited in the metadata
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning1031: **The vertical datum in the STUDY\_INFO table does not match the datum in the metadata**”

**Function:** Auto Screen checks the value in the V\_DATUM field of the Study\_Info table against the vertical datum cited in the metadata to ensure consistency between the DFIRM data and the metadata.

**QC Category:** Attribute Check

**Error Type:** “Warning”

**Error message:** “Warning1031: The vertical datum in the STUDY\_INFO table does not match the vertical datum in the metadata record”

**2.5.2.2** *The value in the PROJECTION field of the Study\_info table should match the projection cited in the metadata.*

**Statement:**

- If:
  - The value in the PROJECTION field of the Study\_Info table matches the projection cited in the metadata
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1037: **The projection in the STUDY\_INFO table does not match the projection in the metadata**”

**Function:** Auto Screen checks the value in the PROJECTION field of the Study\_Info table against the projection cited in the metadata file to check for consistency between the DFIRM data and the metadata file.

**2.5.2.3** *The value in the projection zone (PROJ\_ZONE) field of the Study\_info table should match the projection zone cited in the metadata.*

**Statement:**

- If:
  - The value in the PROJ\_ZONE field of the Study\_Info table matches the projection zone cited in the metadata
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1038: **The projection Zone in the STUDY\_INFO table does not match the Projection Zone in the metadata**”

**Function:** Auto Screen checks the value in the PROJ\_ZONE field of the Study\_Info table against the projection zone cited in the metadata file to ensure consistency between the DFIRM data and the metadata file.

### *2.5.2.4 The value for the horizontal datum (H\_DATUM) field in the Study\_info table should match the horizontal datum cited in the metadata file*

**QC Category:** Attribute Check

**Function:** Auto Screen checks the value in the PROJ\_ZONE field of the Study\_Info table against the projection zone cited in the metadata file to check for consistency between the DFIRM data and the metadata file.

**Error Type:** “Warning”

**Statement:**

- If:
  - The value in the PROJ\_ZONE field of the Study\_Info table matches the projection zone cited in the metadata
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:

**Error message:** “Warning 1038: **The projection Zone in the STUDY\_INFO table does not match the Projection Zone in the metadata**”

### *2.5.2.5 The values in the state name (STATE\_NM) and county name (CNTY\_NAME) fields of the Study\_info table should match a domain table*

**Reference:** Page L-355 in Appendix L states:

*State Name. This attribute contains the state name for the study and is shown in the title block of the hardcopy FIRM.*

*County Name. This is the county (or county equivalent) name that the study falls within. The name should include the county or county equivalent descriptor (e.g. Washington County or Iberia Parish). The county name is also shown in the title block section of the hardcopy FIRM.*

Appendix VII of this document contains the TBL\_CNTY\_XREF table that is used for this check

**Statement:**

- If:
  - The value in the STATE\_NM and the CNTY\_NAME fields in the Study\_Info table matched the values in the Oracle database
- Then:
  - Correct – Please move to next check

- Else:
  - A warning will be returned as:
    - “Warning 1109: **The county FIPS entered during the submission does not match the county FIPS associated with the county name in the Study\_Info table**”

**Function:** Auto Screen conducts the following checks:

1. It obtains the value in the STATE\_NM and the CNTY\_NAME fields of the Study\_Info table, and
2. compares the values to the TBL\_CNTY\_XREF domain table

**QC Category:** Attribute Check

**Error Type:** “Warning”

**Error message:** “Warning 1109: The county and/or state name in the Study\_Info table does not match the list of approved names. Please review the STATE\_NM and the CNTY\_NAME fields for accuracy. If you feel you have received this warning in error, please contact MIPHelp.”

*2.5.2.6 The study prefix (STUDY\_PRE) field value should correspond to the countywide true/false (CW\_TF) coding in the Study\_info table*

**Reference:** Page L-355 in Appendix L states:

***Political Jurisdiction Type.** This attribute contains entries such as ‘Unincorporated Areas’ or ‘All Jurisdictions’ or ‘and Incorporated Areas’. This field is applicable when the type of map is ‘Unincorporated Areas’ or ‘All Jurisdictions’ or ‘and Incorporated Areas’. For a single jurisdiction map, this field is NULL. If there are data in this attribute, it is also shown in the title block section of the hardcopy FIRM.*

***Countywide, true/false.** This attribute is true if the hardcopy FIRM includes all incorporated areas and any unincorporated areas of the county. Enter “T” for true or “F” for false.*

**Statement:**

- If:
  - The coded value in the CW\_TF field is F
- And:
  - The coded value in the JURIS\_TYP field is NULL
- Or:
- If:
  - the coded value in CW\_TF is T

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- And:
  - The coded value in the JURIS\_TYP field is “UNINCORPORATED AREAS” or “ALL JURISDICTIONS” or “AND INCORPORATED AREAS”
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1120: The value in field JURIS\_TYP should be UNINCORPORATED AREAS or ALL JURISDICTIONS or AND INCORPORATED AREAS or Null for Non-Countywide Submittals”

**QC Category:** Attribute Check

**Error Type:** “Warning”

**Statement:**

- If:
  - The coded value in the CW\_TF field is F
- And:
  - The STUDY\_PRE field is null, Then
  - A warning will be returned as:

**Error message:** “Warning 1208: The field STUDY\_PRE should be populated for Non-countywide DFIRMs.”

### 2.6. Field Check

The Field Check task ensures that all of the required fields in the DFIRM database tables exist. In addition, the task checks for the appropriate field type, width, and decimal places for each relevant DFIRM database table.

The Field Check task performs field validation for the following:

- Required Fields
- Field Type
- Field Width
- Decimal Places

## 2.6.1. Required Fields

### 2.6.1.1 Required fields must exist for each DFIRM database table

**Reference:**

The software references the lookup table, TBL\_QC\_FIELDS. This table is provided in Appendix III of this report. The TBL\_QC\_FIELDS look up table contains field names and is based on information available in Appendix L, Chapter L.7, *Database Table Structure Requirements for Preliminary and Final Digital Flood Insurance Rate Map Databases*. This chapter is located on pages L-270 to L-400.

**Statement for MIF, Shapefiles, E00, and non-spatial files:**

- If:
  - the submitted tables contain all required fields as specified by Appendix L
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1020: Missing required field”

**Function:** The QC system has two functions:

1. Compares the submitted fields against the list of required fields from Appendix L.
2. If the required field exists, then the DFIRM submission passes this check.

**QC Category:** Field Check

**Error Type:** “Error”

**Error message:** “Error 1020: The following errors were found in your submission:<Table Name> missing required <Field Name> field;...”

## 2.6.2. Field Type

### 2.6.2.1 The fields of each DFIRM database table must have the appropriate field type

**Reference:**

The software references the lookup table, TBL\_QC\_FIELDS. This table is provided in Appendix III of this report. The TBL\_QC\_FIELDS look up table contains field types and is based on information available in Appendix L, Chapter L.7, *Database Table Structure Requirements for Preliminary and Final Digital Flood Insurance Rate Map Databases*. This chapter is located on pages L-270 to L-400.

**Function:** Auto Screen has two tasks for this check:

1. It checks the field type format for every required field in the DFIRM database to verify it is one of three types: character, date, or decimal.
2. If a table is present but empty, it will pass this check.

**Statement for MIF:**

- If:
  - a field type is CHAR, DATE, DECIMAL
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1021: **Wrong field type**”

**Statement for Shapefiles, E00, and non-spatial files:**

- If:
  - the DFIRM submission field type matches Appendix L
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1021: **Wrong field type**”

**QC Category:** Field Check

**Error Type:** “Error”

**Error message:** “Error 1021: : <Field Name> in <Table Name> has incorrect field type;...”

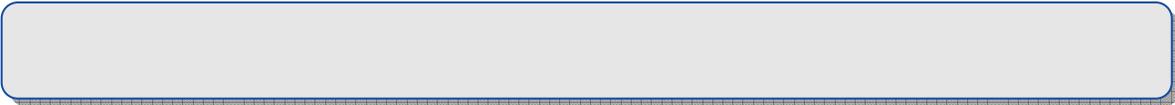
### 2.6.3. Field Width Please note: I believe this “ERROR” has been changed to a “WARNING”.

#### 2.6.3.1 *The fields of each DFIRM database table must have the appropriate input field width*

**Reference:**

The software references the lookup table, TBL\_QC\_FIELDS. This table is provided in Appendix III of this report. The TBL\_QC\_FIELDS look up table contains field widths and is based on information available in Appendix L, Chapter L.7, *Database Table Structure Requirements for Preliminary and Final Digital Flood Insurance Rate Map Databases*. This chapter is located on pages L-270 to L-400.

**Function:** Auto Screen has two functions:

- 
1. It checks the field input width for every required field in the DFIRM database to verify it is one of three types: character, date, or decimal.
  2. If a table is present but empty, it will pass this check.

**Statement for MapInfo Interchange files (MIF):**

- If:
  - a field type is DECIMAL
- And:
  - the field width is defined in the Oracle database
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1023: **Wrong input field width**”

**Statement for Shapefiles:**

- If:
  - the field length matches Appendix L specifications
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1023: **Wrong input field width**”

**Statement for ArcInfo Export Files (E00) and non-spatial files:**

- If:
  - the field width matches Appendix L specifications
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1023: **Wrong input field width**”

**QC Category:** Field Check

**Error Type:** “Error”

**Error message:** “Error 1023: <Field Name> in <Table Name> has incorrect input field width;...”

## *2.6.3.2 The required fields of each DFIRM database table must have the appropriate output field width*

**QC Category:** Field Check

**Error Type:** “Error”

**Error message:** “Error 1024: <Field Name> in <Table Name> has incorrect output field width;...”

## 2.6.4. Decimal Places

### *2.6.4.1 The fields of each DFIRM database table must have the appropriate decimal place values*

**Reference:**

The software references the lookup table, TBL\_QC\_FIELDS. This table is provided in Appendix III of this report. The TBL\_QC\_FIELDS look up table contains output field widths and is based on information available in Appendix L, Chapter L.7, *Database Table Structure Requirements for Preliminary and Final Digital Flood Insurance Rate Map Databases*. This chapter is located on pages L-270 to L-400.

**Function:** Auto Screen has two functions:

1. It checks the field output width for every required field in the DFIRM database to verify that it is Appendix L compliant.
2. If a table is present but empty, it will pass this check.

**Statement for non-spatial files and E00 files:**

- If:
  - A field has the correctly defined Appendix L field output width
- Then:
  - Correct – move to next check
- Else:
  - An error will be returned as:
    - “Error 1024: Wrong output field width”

**QC Category:** Field Check

**Error Type:** “Error”

**Error message:** “Error 1025: <Field Name> in <Table Name> has incorrect decimal place values;...”

## 2.7. Topology Check

The Topology Check task checks the DFIRM database to ensure that a table exists for each DFIRM layer. It also checks the spatial properties of the features within the DFIRM layer to ensure that the features have proper topology.

The Topology Check task performs validation for the following:

- Table existence
- Topology

### 2.7.1. Table Existence

#### *2.7.1.1 Spatial features must have a corresponding table*

**Function:** Auto Screen checks each ArcInfo DFIRM database layer to verify that spatial layers have an attribute table.

**Statement:**

- If:
  - Every ArcInfo spatial DFIRM database layer has an attribute table
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1040: **Topologic feature does not have an attribute table**”

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1040: Spatial feature <LAYER NAME> does not have an attribute table;...”

## 2.7.2. Topology

### 2.7.2.1 *Spatial Features must have correct topology*

**Function:** Auto Screen checks every ArcInfo spatial DFIRM database layer is built correctly.

**Statement:**

- If:
  - Every ArcInfo spatial DFIRM database layer is built correctly
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1041: Spatial feature <LAYER NAME> was not built appropriately;...”

### 2.7.2.2 *ArcInfo DFIRM layers must have the correct geometry (point, line, or polygon)*

**Reference:**

The check references the following two domain tables in the appendix of this document:

- Appendix II TBL\_QC\_TABLES, field: FEATURE\_TYPE\_ID
- Appendix V TBL\_ESRI\_SHAPETYPE, field: ESRI\_VALUE

**Function:** Auto Screen checks all ArcInfo spatial DFIRM database layers for the correct geometry, such as point, line, or polygon. The QC system compares the geometry of each ArcInfo layer against a domain table that references all DFIRM tables with their associated feature type and a domain table that defines all possible geometry types.

**Statement:**

- If:
  - All ArcInfo spatial DFIRM database layers have the correct feature classes defined
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1215: **Geometry type is wrong**”

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1215: Geometry type for <LAYER NAME> is wrong;...”

### *2.7.2.3 Polygon features must not self intersect*

**Reference:** Page L-47 of Appendix L states:

*Vectors may not cross other vectors within the same theme and all intersecting vectors must end at intersections.*

**Function:** Auto Screen checks all required polygon spatial tables in ArcInfo format for self intersecting polygons.

**Statement:**

- If:
  - The right and left polygons do not match
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1216: **Polygon appears to be invalid – Self Intersected Polygon**”

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1216: Polygon <ID> in <LAYER NAME> appears to be invalid – Self Intersected Polygon;...”

### *2.7.2.4 Polyline features should not intersect*

**Reference:** Page L-47 of Appendix L states:

*Vectors may not cross other vectors within the same theme and all intersecting vectors must end at intersections.*

**Statement:**

- If:
  - The E00 files have no self intersecting polylines

- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1220: **Self Intersected Polyline**”

**QC Category:** Topologic Features Check

**Function:** Auto Screen checks all ArcInfo files for self intersecting polyline features by running the ArcObjects method, Simplify, to create a second table of polyline feature records. The two sets of data are compared and if the number of records between the two tables is different then an error is returned.

**Error Type:** “Error”

**Error message:** “Error 1220: <LAYER NAME> has self intersected polylines;...”

### *2.7.2.5 Polygon features should be properly built from lines*

**Reference:**Page L-47 of Appendix L states:

**Function:** Auto Screen checks all ArcInfo files for incorrectly built polygons by creating a second table of polygon feature records. The two sets of data are compared and if the number of records between the two tables is different then an error is returned.

**Statement:**

- If:
  - No topology errors are returned after building and comparing a second set of polygons
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1223: **Polygon coverage may not be built properly**”

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1223: Polygon coverage <LAYER NAME> may not be built properly;...”

### *2.7.2.6 The number of polygon and label point features must be the same*

**Statement:**

- If:
  - The number of polygon features and label point features within a single ArcInfo layer are the same
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1217: **Polygon needs one label point to be consistent with ESRI coverage model**”

**Function:** Auto Screen checks that the polygon features and the number of label point features are the same.

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1217: Polygon <ID> in <LAYER NAME> needs one label point to be consistent with ESRI coverage model;...”

### *2.7.2.7 Polygons should have only one label point*

**Statement:**

- If:
  - Each E00 polygon has one, and only one, label point
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1231: **Polygon label error**”

**Function:** The QC system checks all E00 files to verify that each polygon feature has only one label point. The ARC command LABELERRORS is run to return errors for polygons that have either no label points or more than one label point.

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1231: Polygon <ID> in <LAYER NAME> has no label point or has multiple label points;...”

### *2.7.2.8 Polygon features should be greater than 40 units in area*

**Reference:** Page L-29 in Appendix L states:

*Area spatial features for a given theme must cover the entire study area without overlaps, under laps or sliver polygons between adjacent polygons.*

**Statement:**

- If:
  - A polygon feature is larger than 40 units in area
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1218: Polygon is very small and could be an error”
    -

**Function:** The QC system checks polygon features to verify all polygon features are greater than 40 units in area.

**QC Category:** Topologic Features Check

**Error Type:** “Warning”

**Error message:** “Warning 1218: Polygon <ID> in <LAYER NAME> is very small and should be evaluated for removal from the data set;...”

### *2.7.2.9 Polyline features cannot be zero length*

**Reference:** Page L-47 of Appendix L states:

*Uncoded polygons are not permitted, including “sliver” polygons that result from poor digitizing methods.*

**Statement:**

- If:
  - The E00 files contain no zero length polyline features
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1225: **Zero Length Polyline**”

**Function:** Auto Screen checks for the existence of zero length polyline features in the ArcInfo files.

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1225: Polyline <ID> in <LAYER NAME> has Zero Length and should be removed from data set;...”

#### *2.7.2.10 Polyline features should intersect with a node*

**Reference:** Pages L-47 and L-48 of Appendix L states:

- *Lines must begin and end at nodes.*
- *Lines must connect to each other at nodes.*
- *Lines must not extend through nodes.*

**Statement:**

- If:
  - All the ArcInfo polyline features intersect with a node
- Then:
  - Correct – Please move to next check
- Else:
  - An warning will be returned as:
    - “Warning 1230: **Arcs intersect without a node**”

**Function:** Auto Screen checks all ArcInfo files to verify that all polyline intersections contain a node. The ARC command, INTERSECTERR, is run to return errors for lines that intersect without nodes.

**QC Category:** Topologic Features Check

**Error Type:** “Warning”

**Error message:** “Warning 1230: **Arcs in <LAYER NAME> intersect without a node;...**”

#### *2.7.2.11 Features should not have dangling nodes*

**QC Category:** Topologic Features Check

**NOTE: This check will only be run on line feature classes with corresponding polygon layers.**

**Reference:** Page L-29 in Appendix L states:

*Files must be free of discontinuities such as overlapping lines, gaps, "turn backs," dangling lines and duplicate elements.*

**Statement:**

- If:
  - There are no dangling or pseudo nodes in the ArcInfo file
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1229: **Dangling Node**”

**Function:** Auto Screen checks features in the ArcInfo files to verify there are no dangling nodes in the DFIRM database files. The ARC command NODEERRORS is run for dangling nodes and not for pseudo nodes.

**Error Type:** “Warning”

**Error message:** “Warning 1229: <LAYER NAME> contains dangling nodes;...”

### *2.7.2.12 Each record in a spatial table has corresponding geometry*

**Statement:**

- If:
  - Each record in a table has a corresponding spatial feature
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1226: **The feature was not attach to geometry object**”

**Function:** Auto Screen checks that each record in a table has a corresponding spatial feature.

**QC Category:** Topologic Features Check

**Error Type:** “Error”

**Error message:** “Error 1226: Feature <ID> in <LAYER NAME> is not attached to a geometry object;...”

## 2.8. QC Rule Check

The QC Rule Check task identifies coding errors in the DFIRM database tables by checking specific records against a set of logical rules, which are defined in Appendix IV TBL\_QC\_RULES table. The task checks for dependency coding where a specific value for one field record must correspond to a specific value or set of specific values in another field. The task also verifies that null values are coded properly and numeric values fall within the proper ranges.

The QC Rule Check task performs validation for the following DFIRM tables:

- S\_CBRS
- S\_FIRM\_PAN
- S\_FLD\_HAZ\_AR
- S\_POL\_AR

### 2.8.1. S\_FIRM\_PAN

*2.8.1.1 The value in the state FIPS (ST\_FIPS) field should be consistent with a domain table of ST\_FIPS values*

**Statement:**

- If:
  - The value in the ST\_FIPS field of the FIRM\_PAN table is consistent with the ST\_FIPS number from a DFIRM database
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1106: **The field ST\_FIPS does not match the value in field State\_Nm of table Study\_info**”

**Function:** Auto Screen verifies that the ST\_FIPS value in the S\_FIRM\_PAN table matches a set of domain values for state FIPS codes.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1106: The value for ST\_FIPS in S\_FIRM\_Pan is invalid”

*2.8.1.2 The PCOMM and PANEL fields of the S\_FIRM\_PAN table should be coded with four digit numeric characters*

Reference: Page L-286 of Appendix L states:

### *PCOMM*

*Community or County Identification Number. This is the 3rd through the 6th digits of the panel number. For community based maps this corresponds to the Federal Emergency Management Agency (FEMA) Community Identification number. For countywide maps this is the county (or county equivalent) FIPS code with a “C”.*

### *PANEL*

*Panel Number. This is 7th through the 10th digits in the complete panel number. This is assigned by the scale of the map and the position within the community or county. The panel number scheme is described in detail in Appendix K of these Guidelines.*

#### **Statement:**

- If:
  - The PCOMM and PANEL fields of the S\_FIRM\_PAN table are populated with four-digit numeric values
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1082: **The field contains an invalid PCOMM or PANEL value in the S\_FIRM\_PAN table**”

**Function:** Auto Screen verifies whether there is a four-digit value in the PCOMM and PANEL fields of the S\_FIRM\_PAN table.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1082: The S\_FIRM\_PAN table contains an invalid PCOMM or PANEL value.”

### ***2.8.1.3 The SUFFIX field of the S\_FIRM\_PAN table must be coded with an alphabetic character***

**Reference:** Page L-286 in Appendix L states:

*Map Suffix. This is the final digit in the complete panel number. This is a letter suffix at the end of the panel number.*

**Statement:**

- If:
  - The SUFFIX is a character from a to z, or A to Z
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1083: **The field does not contain a valid SUFFIX**”

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1083: The S\_FIRM\_PAN table contains an invalid SUFFIX”

*2.8.1.4 The FIRM\_PANEL field of the S\_FIRM\_PAN table must be eleven alphanumeric characters*

**Reference:** Page L-286 in Appendix L states:

*FIRM Panel Number. This is the complete FIRM panel number, which is made up of ST\_FIPS, PCOMM, PANEL, and SUFFIX. This is the 11-digit FIRM panel number that is shown in the title block of the map.*

**Statement:**

- If:
  - The value in the FIRM\_PANEL field is coded with an eleven character alphanumeric value
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1085: **The FIRM\_PANEL field of the S\_FIRM\_PAN table should be populated with an 11-digit FIRM panel number (See Appendix L, L-286)**”

**Function:** Auto Screen verifies whether there is an eleven character alphanumeric value in the FIRM\_PANEL field of the S\_FIRM\_PAN table.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1085: The FIRM\_PANEL field of the S\_FIRM\_PAN table should be populated with an 11-digit FIRM panel number”

*2.8.1.5 The FIRM\_PANEL field should be coded with a value that is a combination of the ST\_FIPS, P\_COMM, PANEL, and SUFFIX fields.*

**Reference:** Page L-286 of Appendix L states:

*FIRM Panel Number. This is the complete FIRM panel number, which is made up of ST\_FIPS, PCOMM, PANEL, and SUFFIX. This is the 11-digit FIRM panel number that is shown in the title block of the map.*

**Statement:**

- If:
  - The value in the FIRM\_PANEL field of the S\_FIRM\_PAN table is a sequential combination of the ST\_FIPS, P\_COMM, PANEL, and SUFFIX field values
    - Or
  - The submission is a North Carolina study the value in the ST\_FIPS field must be included in the value coded in the FIRM\_PANEL field
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - **“Warning 1086: The field FIRM\_PANEL was not constructed with the correct combination (sequence) of values derived from four neighboring fields: ST\_FIPS PCOMM PANEL and SUFFIX”**

**Function:** Auto Screen verifies whether the FIRM\_PANEL field of the S\_FIRM\_PAN table is equal to a combination of the values populated in the ST\_FIPS, P\_COMM, PANEL, and SUFFIX fields in this sequence. North Carolina studies must include the ST\_FIPS value in the FIRM\_PANEL field.

## 2.8.2. S\_FLD\_HAZ\_AR

### 2.8.2.1 *The AR\_REVERT field must be populated when the FLD\_ZONE field is populated with “AR”*

**Reference:** Page L-292 in Appendix L states:

*If the area is Zone AR, this field would hold the zone that the area would revert to if the AR zone were removed. This field is only populated if the corresponding area is Zone AR. Acceptable values for this field are listed in the D\_Zone table.*

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “AR” and the AR\_REVERT field is populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1051: **Reverted flood zone is defined. But the study area is not in an AR zone**”

**Function:** Auto Screen checks that the AR\_REVERT field of the S\_FLD\_HAZ\_AR table is populated when the FLD\_ZONE field is populated with the value “AR”.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1051: Polygon <ID> has a mis-match between the AR\_REVERT and FLD\_ZONE fields;...”

### 2.8.2.2 *Flood zones A, AE, AH, AO, AR, V or VE must be designated as a Special Flood Hazard Area*

**Reference:** Page L-291 in Appendix L states:

***Special Flood Hazard Area.** If the area is within SFHA this field would be True. This field will be true for any area that is coded for any A or V zone flood areas. It should be false for any X or D zone flood areas. Enter “T” for true or “F” for false.*

**Statement:**

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- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “A” or “AE” or “AH” or “AO” or “AR” or “V”, or “VE” and the SFHA\_TF field is coded as “T”
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1052: **The study area is in either A AE AH AO AR V or VE zone. But the area is not defined as a Special Flood Hazard Area (SFHA)**”

**Function:** Auto Screen checks all records coded as “A”, “AE”, “AH”, “AO”, “AR”, “V”, or “VE” in the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table to verify that each record is coded as “T” in the special flood hazard area true/false (SFHA\_TF) field.

**QC Category:** QC Rule Check

**Function:** Auto Screen checks all records coded as “A”, “AE”, “AH”, “AO”, “AR”, “V”, or “VE” in the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table to verify that each record is coded as “T” in the special flood hazard area true/false (SFHA\_TF) field. Domain includes Zone A99.

**Error Type:** “Error”

**Error message:** “Error 1052: Polygon <ID> has a mis-match between the FLD\_ZONE and SFHA\_TF fields;...”

### *2.8.2.3 The flood zones “AE”, “AR”, “AH” and “VE” should either have a S\_BFE feature line or the STATIC\_BFE field populated in S\_FLD\_HAZ\_AR table*

**Reference:** Page L-272 of Appendix L states:

*The Base Flood Elevation (BFE) table is required for any digital data where BFE lines will be shown on the corresponding Flood Insurance Rate Map (FIRM). Normally if there are any riverine AE zones, BFE lines are required.*

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is populated with “AE”, “AR”, “AH” and “VE” and,
  - The STATIC\_BFE field of the S\_FLD\_HAZ\_AR table is populated with a value greater than 0

- Or
    - A feature from the S\_BFE table falls within the flood zone
  - Then:
    - Correct – Please move to next check
  - Else:
    - An error will be returned as:
      - “Error 1054: S\_FLD\_HAZ\_AR polygon has no associated BFE Line or Static BFE. Could also be area where should be populated with Floodway”

**Function:** If the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table has values of “AE”, “AR”, “AH” and “VE”, Auto Screen verifies whether a S\_BFE line feature makes contact with the flood zone, or whether there is a value greater than zero in the the field STATIC\_BFE field.

**QC Category:** QC Rule Check

**Error Type:** “Warning”

**Error message:** “Warning 1054: S\_FLD\_HAZ\_AR polygon <ID> has no associated BFE Line or Static BFE.”

#### *2.8.2.4 All X and D flood zones cannot be designated as a Special Flood Hazard Area*

**Reference:** Page L-291 in Appendix L states:

Special Flood Hazard Area. If the area is within SFHA this field would be True. This field will be true for any area that is coded for any A or V zone flood areas. It should be false for any X or D zone flood areas. Enter “T” for true or “F” for false.

**Function:** Auto Screen checks all records coded as “X” or “D” in the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table and verifies that each record is coded as “F” in the SFHA\_TF field.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “X, D, 1 PCT Future Conditions, any 0.2 PCT zones, ANI, and Open Water” and the SFHA\_TF field is coded as “F”

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- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:

**Error message:** “Error 1053: Polygon <ID> has a mis-match between the FLD\_ZONE and SFHA\_TF fields;...”

### *2.8.2.5 An AO flood zone cannot have a STATIC\_BFE value*

**Reference:** Pages L-291 and L-292 in Appendix L states:

***Static Base Flood Elevation.** For areas of constant Base Flood Elevation (BFE), the BFE value is shown beneath the zone label rather than on a BFE line. In this situation the same BFE applies to the entire polygon. This is normally occurs in lakes or coastal zones. This field is only populated where a static BFE is shown on the FIRM.*

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “AO” and the STATIC\_BFE field is coded as an integer < “0” or not blank
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1057: **The study area is in an AO zone and contains a STATIC\_BFE**”

**Function:** Auto Screen checks the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table for all records coded as “AO” and verifies that each record is coded with a value < “0” and is not blank.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1057: Polygon <ID> is an AO zone and contains a STATIC\_BFE;...”

### *2.8.2.6 Only AO zones have depth values*

**Reference:** Pages L-292 in Appendix L states:

*Depth Value for Zone AO Areas. This is shown beneath the zone label on the FIRM. This field is only populated if a depth is shown on the FIRM.*

**Statement:**

- If:
  - The DEPTH field of the S\_FLD\_HAZ\_AR table is populated with a value > “0”, not the value “-9999” and the FLD\_ZONE field is coded as “AO”
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1061: **The study area has a DEPTH. But it is not an AO zone**”

**Function:** Auto Screen checks if the DEPTH field of the S\_FLD\_HAZ\_AR table is populated with a value that is not equal to “-9999” and verifies that the FLD\_ZONE field is populated as “AO”.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1061: Polygon <ID> has a DEPTH, but it is not an AO zone;...”

*2.8.2.7 Flood zone AO should have a DEPTH value between 1 foot and 3 feet*

Page L-292 in Appendix L states:

*Depth Value for Zone AO Areas. This is shown beneath the zone label on the FIRM. This field is only populated if a depth is shown on the FIRM.*

**Function:** Auto Screen checks the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table for all records coded as “AO” and verifies that each record is coded with a value between 1 and 3, or ‘-9999’ in the DEPTH field.

**QC Category:** QC Rule Check

## Function

**Error Type:** “Error”

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “AO” and the value in the VELOCITY field is  $\leq 0$  and the DEPTH field is  $>0$  and  $<3$ ”
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:

Error message: “Error 1055: Polygon <ID> is an AO zone and has a mis-match between the DEPTH and VELOCITY fields;...”

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1060: Polygon <ID> has field VELOCITY populated but it is not an AO zone;...”

### *2.8.2.8 The VELOCITY field should be populated if the flood zone is AO*

**QC Category:** QC Rule Check

**Reference:** Pages L-292 in Appendix L states:

*Velocity Measurement. This is shown beneath the zone label on the FIRM for alluvial fan areas (certain Zone AO areas). This value represents the velocity of the flood flow in this area. This field is only populated when a velocity is shown on the FIRM.*

**Statement:**

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “AO” and the VELOCITY field is not populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1059: **The study area is in an AO zone but the field of VELOCITY is not populated.**”

**Function:** Auto Screen checks the FLD\_ZONE field of the S\_FLD\_HAZ\_AR table for all records coded as “AO” and verifies that the VELOCITY field is coded as an integer > “0” or the value “-9999”.

**Error Type:** “Error”

- If:
  - The FLD\_ZONE field of the S\_FLD\_HAZ\_AR table is coded as “AO” and the VELOCITY field is populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1059: Polygon <ID> is an AO zone but the VELOCITY field is not populated;...”

**2.8.2.9** *The VEL\_UNITS field should only be populated when the VELOCITY is populated with a value greater than zero*

**Function:** Auto Screen checks that the VELOCITY field of the S\_FLD\_HAZ\_AR table and if the VELOCITY field is coded as a value > “0” then the VEL\_UNITS field must be populated.

**Statement:**

- If:
  - The VELOCITY field of the S\_FLD\_HAZ\_AR table is populated with a value > “0” and the VEL\_UNITS field is populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1063: Polygon <ID> has a mis-match between the VELOCITY and VEL\_UNITS fields;...”

**2.8.2.10** *If the STATIC\_BFE field is populated, then the DEPTH field should not be populated and vice versa*

**Function:** Auto Screen checks the STATIC\_BFE and DEPTH fields of the S\_FLD\_HAZ\_AR table to verify that both fields are not coded with a value > “0” for the

same record. The STATIC\_BFE and DEPTH fields are populated as “-9999” unless applicable.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Statement:**

- If:
  - The STATIC\_BFE field of the S\_FLD\_HAZ\_AR table is coded as “-9999” and the DEPTH field is coded as “-9999”
- Or
  - The DEPTH field of the S\_FLD\_HAZ\_AR table is coded with a value > “0” and the STATIC\_BFE field is coded as “-9999”
- Or
  - The DEPTH field of the S\_FLD\_HAZ\_AR table is coded as “-9999” and the STATIC\_BFE field is coded with a value  $\geq$  “0”
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:

**Error message:** “Error 1064: Polygon <ID> has values for STATIC\_BFE and DEPTH when only one may be populated, the other must contain -9999;...” ”

### *2.8.2.11 The V\_DATUM field of the S\_FLD\_HAZ\_AR table should only be populated if the STATIC\_BFE field is populated*

**Reference:** Page L-192 of Appendix L states:

*Vertical Datum. The vertical datum indicates the reference surface from which the flood elevations are measured. Normally this would be North American Vertical Datum of 1988 for new studies. This field is only populated if the STATIC\_BFE field is populated. Acceptable values for this field are listed in the D\_V\_Datum table.*

**QC Category:** QC Rule Check

**Error Type:** “Warning”

**Statement:**

- If:
  - The STATIC\_BFE field is populated, and

- The STATIC\_BFE field in the S\_FLD\_HAZ\_AR table has a value  $\geq$  “0” and the V\_DATUM field is populated
  - Or
- The STATIC\_BFE field in the S\_FLD\_HAZ\_AR table has a value  $<$  “0” and the V\_DATUM field is not populated
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:

**Error message:** “Warning 1200: For polygon <ID>, Both fields V\_DATUM and STATIC\_BFE must be populated or both fields V\_DATUM and STATIC\_BFE must be null;...”

*2.8.2.12 The LEN\_UNIT field of the S\_FLD\_HAZ\_AR table must only be populated if the STATIC\_BFE or DEPTH field is populated*

**Function:** If the LEN\_UNIT field in the S\_FLD\_HAZ\_AR table is populated, Auto Screen verifies that the STATIC\_BFE or DEPTH fields are populated. If the LEN\_UNIT field is not populated, Auto Screen verifies that the STATIC\_BFE and DEPTH fields are not populated.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Statement:**

- If:
  - The STATIC\_BFE field of the S\_FLD\_HAZ\_AR table is coded as a value  $\geq$  “0” and LEN\_UNIT field is populated
    - Or
  - The DEPTH field of the S\_FLD\_HAZ\_AR table is coded as a value  $>$  “0” and LEN\_UNIT field is populated
    - Or
  - The STATIC\_BFE field of the S\_FLD\_HAZ\_AR table is coded as a value  $<$  “0” and LEN\_UNIT field is not populated
    - Or
  - The DEPTH field of the S\_FLD\_HAZ\_AR table is coded as a value  $<$  “0” and LEN\_UNIT field is not populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:

**Error message:** “Error 1201: For polygon <ID>, Both fields UNITS and STATIC\_BFE must be populated or both fields UNITS and STATIC\_BFE must be null;...”

### *2.8.2.13 Source Citation should match with metadata description*

**Statement:**

- If:
  - The SOURCE\_CIT field of each submitted spatial table is similar to the codes in an Oracle look up table
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1129: **The source citation doesn't match with metadata description**”

**And:**

- If:
  - The source citation information exists in the metadata file
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1129: **The source citation doesn't match with metadata description**”

**Function:** Auto Screen verifies:

1. The value of the SOURCE\_CIT field of each submitted spatial table matches a value from a domain table.
2. The source citation information exists in the metadata file.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1129: The source citation for <Layer Name> doesn't match with metadata description”

### 2.8.3. S\_LABEL\_PT

#### *2.8.3.1 The value in the DEGREES field should be a numeric value between 0 and 359*

**Reference:** Page L-320 in Appendix L states:

*The degrees of rotation required for the placement of a feature label onto a Flood Insurance Rate Map panel. The rotation angle of the text measured in degrees. The angle is zero for unrotated horizontal text and increases in a counterclockwise direction to 359. Text rotated clockwise has a negative value between 0 and -359.*

**Statement:**

- If:
  - The value in the DEGREES field of the S\_LABEL\_PT table is a value between -359 and 359
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1102: **The DEGREES field in the S\_LABEL\_PT is not a valid degree value**”

**Function:** Auto Screen verifies there is a value between -359 and 359 in the DEGREES field of the S\_LABEL\_PT table.

#### 2.8.4. S\_PLSS\_AR

*2.8.4.1 The value in the SECT\_NO field should be a numeric value between 1 to 36*

**Function:** Auto Screen verifies whether the value in the SECT\_NO field of the S\_PLSS\_AR table is between 1 and 36.

**QC Category:** QC Rule Check

**Error Type:** “Warning”

**Statement:**

- If:
  - The value in the SECT\_NO field of the S\_PLSS\_AR table is a numeric value between 1 and 36
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:

**Error message:** “Warning 1091: SECT\_NO should be an integer between 1 and 36”

### 2.8.4.2 *The last character in the value of the RANGE field in the S\_PLSS\_AR table should be “E” or “W”*

**Reference:** Page L-314 of Appendix L states:

*Range Number. This is the range number assigned to the PLSS area shown. This attribute would also include the designation of E (east) or W (west) as part of the data. For example, 21W would be an acceptable value. This field is applicable whenever the SECT\_NO does not equal zero.*

**Statement:**

- If:
  - The RANGE field in the S\_PLSS\_AR table is populated with a numeric value and followed by the character “E” or “W”
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1089: **The RANGE field of the S\_PLSS\_Ar table should be a number followed by an E or W (See Appendix L, L-314)**”

**Function:** Auto Screen verifies whether there is a numeric value followed by the character “E” or “W” in the RANGE field of the S\_PLSS\_AR table.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1089: The RANGE field of the S\_PLSS\_Ar table should be a number followed by an E or W”

### 2.8.4.3 *The last character of the value populating the TWP field in the S\_PLSS\_AR table should be “N” or “S”*

**Reference:**

Page L-314 of Appendix L states:

*Township. This is the township number assigned to the PLSS area shown. This attribute would also include the designation of N (north) or S (south) as part of the data. For example, 14S would be an acceptable value. This field is applicable whenever the SECT\_NO does not equal zero.*

**Statement:**

- If:
  - The TWP field in the S\_PLSS\_AR table is populated with a numeric value and followed by the character “N” or “S”
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1090: **SECTION should be a number followed by an N or S**”

**Function:** Auto Screen verifies whether there is a numeric value followed by the character “N” or “S” in the TWP field of the S\_PLSS\_AR table.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1090: TWP should be a number followed by an N or S”

## 2.8.5. S\_PLSS\_LN

### *2.8.5.1 The fields, E\_Range, W\_Range, N\_TWP, and S\_TWP must all be populated if one is populated*

**Reference:** Page L-371 in Appendix L states:

*Users must be able to identify section, township and range information on the printed maps.*

**Statement:**

- If:
  - All of the following fields of the S\_PLSS\_LN table are populated: E\_RANGE, W\_RANGE, N\_TWP, and S\_TWP
    - or
  - None of the following fields of the S\_PLSS\_LN table are populated: E\_RANGE, W\_RANGE, N\_TWP, and S\_TWP
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1095: **There must also be a E\_RANGE or no values in N\_TWP or S\_TWP**”

**Function:** Auto Screen checks if the E\_RANGE, W\_RANGE, N\_TWP, and S\_TWP fields of the S\_PLSS\_LN table are populated. All 4 fields must be populated if any of the 4 fields are populated. These fields are only populated for lines that divide one township from another.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1095: The S\_PLSS\_LN layer is missing township or range information”

### 2.8.6. S\_POL\_AR

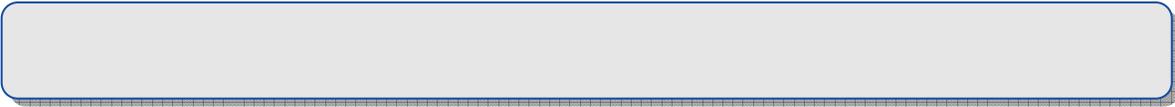
#### 2.8.6.1 Check the Community Number (COMM\_NO) field of S\_POL\_AR table

**Reference:** Page L-321 of Appendix L states:

*Community Number. This is the four-digit number assigned by FEMA to each community for tracking purposes under the NFIP. On newer Flood Insurance Rate Maps (FIRMs) the state FIPS and the community number appear below the community name where it is shown in the body of the map. For single jurisdiction FIRMs, this is the 3rd through the 6th digits of the panel number. This number can be obtained from the community status book that can be viewed at [www.fema.gov/msc](http://www.fema.gov/msc). Areas under Federal jurisdiction such as National Parks, National Forests, military bases, etc. do not have community numbers assigned by FEMA. These areas should have a value of FED in the COMM\_NO field. Areas under state jurisdiction such as state parks and wildlife reservations should have a value of ST in the COMM\_NO field. For any other jurisdictions where local community does not have the authority to administer the NFIP and FEMA does not assign a community number, the COMM\_NO field should contain OTHR.*

**Statement:**

- If:
  - The COMM\_NO field of the S\_POL\_AR table is coded with a value between 1 and 4 characters in length
    - or
  - The COMM\_NO field of the S\_POL\_AR table is coded as “000C”



- or
- The COMM\_NO field of the S\_POL\_AR table is coded as “othr”
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:
    - “Error 1084: **The field should be populated with a six-digit number value**”

**Function:** Auto Screen verifies whether there is a value of one to four characters, “000C” or “OTHR” in the COMM\_NO field of the S\_POL\_AR table.

**QC Category:** QC Rule Check

Function: Auto Screen verifies whether there is a value of one to four characters, “000C” or “OTHR” in the COMM\_NO field of the S\_POL\_AR table. Add “ST” and “FED” to the list of acceptable values.

**Error Type:** “Error”

**Error message:** “Error 1084: Polygon <ID> in S\_POL\_AR contains an invalid COMM\_NO value;...”

**2.8.6.2 The Community Identification Number (CID) field in the S\_Pol\_AR table should be a value composed of the ST\_FIPS and COMM\_NO field values.**

**Reference:** Page L-321 of Appendix L states:

*Community Identification Number. This is the six-digit community number assigned by FEMA. It is created by combining the state FIPS code with the COMM\_NO. If the jurisdiction does not have a community number assigned by FEMA, the CID is created by combining the state FIPS code with the abbreviation contained in the COMM\_NO field (FED, ST, or OTHR).*

**Statement:**

- If:
  - The value in the CID field of the S\_POL\_AR table is a combination of the ST\_FIPS and COMM\_NO field values
- Then:
  - Correct – Move to next check
- Else:
  - An error will be returned as:

- “Error 1087: **The field CID was not constructed with the correct combination (sequence) of values derived from two neighboring fields: ST\_FIPS and COMM\_NO**”

**Function:** Auto Screen determines whether the value of the CID field of the S\_POL\_AR table is a combination of the ST\_FIPS and COMM\_NO field values.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1087: For polygon <ID> in S\_POL\_AR, the field CID was not constructed with the correct combination (sequence) of values derived from two neighboring fields: ST\_FIPS and COMM\_NO;...”

### *2.8.6.3 County FIPS (CO\_FIPS) field must be populated properly*

**Reference:** Page L-320 in Appendix L states:

*County Federal Information Processing Standard (FIPS) Code. This is the three-digit county FIPS code. This is a standard numbering system that is used by the Federal government. Defined in FIPS Pub 6-4.*

**Statement:**

- If:
  - The CO\_FIPS field of the S\_POL\_AR table is populated
- And:
  - The coded value exists in a domain table
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1100: **Area has a CO\_FIPS value not consistent with the rest of the submission (i.e. County FIPS does not match Study Info County Name)**”

**Function:** Auto Screen verifies that values of the the CO\_FIPS field in the S\_POL\_AR table matches a value in the TBL\_COUNTY\_XREF domain table.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1100: Polygon <ID> in S\_POL\_AR contains an invalid CO\_FIPS code;...”

**2.8.6.4** *The State FIPS (ST\_FIPS) value in the S\_POL\_AR table should be consistent with the state FIPS assigned to the state cited in the STATE\_NM field*

**Reference:** Page L-320 in Appendix L states:

*State FIPS. This is the two-digit code that corresponds to the state FIPS code. This is a standard numbering system that is used by the Federal government. Defined in FIPS Pub 6-4. These two numbers correspond to the first two digits of the panel number.*

**Statement:**

- If:
  - The value in the ST\_FIPS field of the POL\_AR table is validated by a domain of values
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1101: **ST\_FIPS from S\_POL\_AR must match STATE in STUDY\_INFO**”

**Function:** Auto Screen verifies whether the value in the ST\_FIPS field of the S\_POL\_AR table matches a value in a table of state FIPS codes.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1080: Polygon <ID> in S\_POL\_AR has an invalid State FIPS value;...”

**2.8.7. S\_TRANSPORT\_LN**

**2.8.7.1** *The FEAT\_NM3 field should not be populated when the FEAT\_NMI or FEAT\_NM2 fields are not populated*

### Statement:

- If:
  - FEAT\_NM1, FEAT\_NM2 and FEAT\_NM3 in the TRANSPORT\_LN table are populated
    - or
  - FEAT\_NM3 in the TRANSPORT\_LN table is not populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1104: **The field FEAT\_NM3 is populated but FEAT\_NM1 and/or FEAT\_NM2 is no**”

**Function:** Auto Screen checks the FEAT\_NM3 field of the TRANSPORT\_LN table for a populated value. If a value exists in the FEAT\_NM3 field Auto Screen verifies the FEAT\_NM1 and FEAT\_NM2 fields are populated.

**QC Category:** QC Rule Check

**Error Type:** “Warning”

### Statement:

- If:
  - FEAT\_NM1 is populated
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:

**Error message:** “Warning 1104: For line <ID>, the field FEAT\_NM1 is not populated;...”

### 2.8.8. S\_XS

**2.8.8.1** *The XS\_LN\_TYP should be populated as “LETTERED” or “NOT LETTERED”*

**Reference:** Page L-351 states:

Cross-Section Line Type. This attribute should contain ‘LETTERED’ for cross sections that are shown on the hardcopy FIRM. If the cross section will not be shown on the hardcopy FIRM, this attribute should contain ‘NOT LETTERED’ to indicate that the

cross section is part of the backup data for the study, but is not shown on the FIRM.

**Statement:**

- If:
  - The XS\_LN\_TYP field of the S\_XS table is coded as “LETTERED”
    - or
  - The XS\_LN\_TYP field of the S\_XS table is coded as “NOT LETTERED”
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1128: **The field XS\_LTR is incorrect. See XS\_LN\_TYP to see if cross section should have a letter**”

**Function:** Auto Screen checks the XS\_LN\_TYP field of the S\_XS table to verify the XS\_LN\_TYP field is coded as “LETTERED” or NOT LETTERED”.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1128: Cross section <ID> has an invalid XS\_LN\_TYP;...”

## 2.8.9. L\_Comm\_Info

### 2.8.9.1 *The REPOS\_ADR2 field should not be populated if the REPOS\_ADR1 field is empty*

**Reference:**

Page L-365 in Appendix L state:

*REPOS\_ADR1*

*First line of the mailing or street address for the map repository. The map repository is the office the community has designated as responsible for maintaining copies of all the flood hazard information the Federal Emergency Management Agency (FEMA) publishes for the community. The public may view copies of the current effective information at the map repository. This information is also displayed in the FIRM legend or index. For example, this line might read ‘Division of Community and Economic Development’.*

*REPOS\_ADR2*

*Second line of the mailing or street address for the map repository. This information is also displayed in the FIRM legend or index. For*

*example, this line might read '226 W. Fourth Street'. This field is applicable if the map repository address requires more than one line.*

### **REPOS\_ADR3**

*Third line of the mailing or street address for the map repository. This information is also displayed in the FIRM legend or index. For example, this line might read 'Suite 200'. This field is applicable if address requires additional space.*

#### **Statement:**

- If:
  - The REPOS\_ADR2 field is populated and the REPOS\_ADR1 field is populated
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1125: **The second line of the repository address exists but REPOS\_ADDR1 does not**”

**Function:** If the the REPOS\_ADR2 field in the L\_Comm\_info table is populated, Auto Screen verifies whether there is a value in the REPOS\_ADR1 field.

**QC Category:** QC Rule Check

**Error Type:** “Warning”

#### **Statement:**

- If:
  - The REPOS\_ADR1 field is populated
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:

**Error message:** “Warning 1125: Record <ID> in L\_COMM\_Info does not have an entry for REPOS\_ADR1;...”

### **2.8.9.2 The REPOS\_ST field should contain a complete and valid State Name**

#### **Reference:**

Page L-366 of Appendix L states:

*State portion of the mailing or street address for the map repository. This information is also displayed in the FIRM legend or index. The*

*full name of the state should be provided. For example, this line might read 'ILLINOIS'.*

**QC Category:** QC Rule Check

**Function:** Auto Screen verifies that the state name in the REPOS\_ST field of the L\_Comm\_info table is valid.

**Error Type:** "Error"

**Statement:**

- If:
  - The value in the REPOS\_ST field of the L\_Comm\_Info table matches a state name in a look up table
- Then:
  - Correct – Move to next check
- Else:
  - A Error will be returned as:

**Error message:** "Error 1211: Record <ID> in L\_COMM\_Info table has an invalid value for REPOS\_ST;..."

### **2.8.10. Study\_info**

#### ***2.8.10.1 The CBRS\_PHONE field in the Study\_Info table should follow DFIRM specifications when the S\_CBRS table is included in the DFIRM database***

Page L-143 in Appendix L state:

*Coastal Barrier Resources System (CBRS) Phone number. This is the phone number for the contact person/office for the CBRS legislative area. Applies if the FIRM contains CBRS areas. Enter the phone number as a ten-digit numeric string with hyphens in the following format, 000-000-0000.*

**Statement:**

- If:
  - The S\_CBRS table exists in the DFIRM database, and
  - The CBRS\_PHONE field of the Study\_Info table is a value equal to 12 characters, and
  - The 4th and 8th characters in the CBRS\_PHONE field are "--" characters
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:

- “Error 1236: The CBRS\_PHONE format in the Study\_Info table is incorrect. It must use the 000-000-0000 format. ”

**Function:** If the S\_CBRS table exists in the DFIRM database, Auto Screen verifies that the CBRS\_PHONE field in the Study\_Info table follows this format: 000-000-0000.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:** “Error 1236: The CBRS\_PHONE format in the Study\_Info table is incorrect. It must use the 000-000-0000 format. ”

***2.8.10.2 The CBRS\_PHONE and CBRS\_REG fields should be populated if the S\_CBRS table is included in the DFIRM database***

**Reference:**

Page L-355 in Appendix L states:

***CBRS\_PHONE***

*Coastal Barrier Resources System (CBRS) Phone number. This is the phone number for the contact person/office for the CBRS legislative area. Applies if the FIRM contains CBRS areas. Enter the phone number as a ten-digit numeric string with hyphens in the following format, 000-000-0000.*

***CBRS\_REG***

*CBRS Coordinator’s region. This attribute contains the Fish and Wildlife Service (FWS) region within which the FIRM is located. Applies if the FIRM contains CBRS areas.*

*Statement:*

- If:
  - The S\_CBRS table exists in the DFIRM database, and
  - The CBRS\_PHONE field is not populated in the Study\_Info table and the DFIRM database submission includes a S\_CBRS table,
- Then:
  - An error will be returned as:
    - **“Error 1123: The CBRS\_PHONE field is populated in the Study\_Info table but the required S\_CBRS table was not found in the submission, or the S\_CBRS table was included but CBRS\_PHONE in the Study\_Info table was not populated.”**
- Else:
- If:
  - The S\_CBRS table exists in the DFIRM database, and
  - The CBRS\_REG field is not populated in the Study\_Info table and the DFIRM database submission includes a S\_CBRS table.
- Then:
  - *An error will be returned as:*



- “Error 1124: The **CBRS\_REG** field is populated in the **Study\_Info** table but the required **S\_CBRS** table was not found in the submission, or the **S\_CBRS** table was included but **CBRS\_REG** in the **Study\_Info** table was not populated.”
- Else:

Correct – Please move to next check

**Function:** If the **S\_CBRS** table exists in the **DFIRM** database, Auto Screen verifies that the **CBRS\_REG** and **CBRS\_PHONE** fields in the **Study\_Info** table are populated.

**QC Category:** QC Rule Check

**Error Type:** “Error”

**Error message:**

- “Error 1123: The **CBRS\_PHONE** field is populated in the **Study\_Info** table but the required **S\_CBRS** table was not found in the submission, or the **S\_CBRS** table was included but **CBRS\_PHONE** in the **Study\_Info** table was not populated.” or
- “Error 1124: The **CBRS\_REG** field is populated in the **Study\_Info** table but the required **S\_CBRS** table was not found in the submission, or the **S\_CBRS** table was included but **CBRS\_REG** in the **Study\_Info** table was not populated.”

### ***2.8.10.3 All true or false fields must be populated with “T”, “F”, or “U”***

**Statement:**

- If:
  - The field **ANI\_TF** of the **S\_POL\_AR** table is coded as “T” or “F” or ”U”,and
  - The field **OPP\_TF** of the **Study\_Info** table is coded as “T” or “F” or ”U”,and
  - The field **CW\_TF** of the **Study\_Info** table is coded as “T” or “F” or ”U”,and
  - The field **RTROFT\_TF** of the **Study\_Info** table is coded as “T” or “F” or”U”
- Then:
  - Correct – Please move to next check
- Else:
  - An error will be returned as:
    - “Error 1118: The **TRUE OR FALSE** field does not contain a **T For U** value”

**Function:** Auto Screen checks four fields ending with the characters “\_TF” in the **Study\_Info** and **S\_POL\_AR** tables to verify these fields are populated with the values “T”, “F”, or “U” for unknown. These are the only valid values for fields that are populated as True or False values.

Fields include:

ANI\_TF (S\_POL\_AR)  
OPP\_TF (Study\_Info)  
CW\_TF (Study\_Info)  
RTROFT\_TF (Study\_Info)

**QC Category:** QC Rule Check

**Error Type:** “Error”

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**Error message:** “Error 1118: Field <ID> in Table <ID> does not contain a T F or U value;...”

*2.8.10.4 3.8.11.3 The only printed panel true/false (OPP\_TF) field should have a value of “T” only when one printed panel exists*

**Reference:** Page L-356 in Appendix L states:

*Only Panel Printed. This field is True only if the study has only one printed panel. Enter “T” for true or “F” for false.*

**Statement:**

- If:
  - One panel record exists in the S\_FIRM\_PAN table and the OPP\_TF field in the Study\_Info table has a value of “T”
    - Or
  - The S\_FIRM\_PAN table has zero or more than one record and the OPP\_TF field in the Study\_Info table is coded as “F”
- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - “Warning 1122: Value in field OPP\_TF of STUDY\_INFO may be incorrect”

**Function:** Auto Screen verifies whether the value in the OPP\_TF field of the Study\_Info table is consistent with the number of panel features in the S\_FIRM\_PAN table.

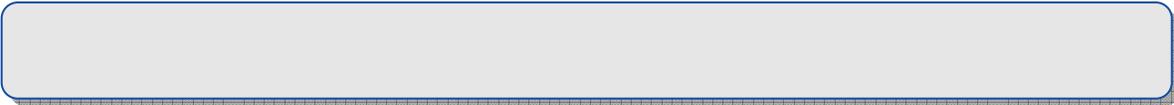
*2.8.10.5 3.8.11.4 The Largest Panel Number (LG\_PAN\_NO) field should accurately represent the Largest FIRM panel number in the DFIRM database*

**Reference:** Page L-355 in Appendix L states:

*Largest Panel Number. This is the highest panel number shown on the FIRM Index for the area mapped. This number is shown in the title block section of the hardcopy FIRM.*

**Statement:**

- If:
  - There is a value in the LG\_PAN\_NO field of the Study\_Info table
- And:
  - The value in the LG\_PAN\_NO field of the Study\_Info table is equal to the highest value cited in the PANEL field of the FIRM\_PAN table



- Then:
  - Correct – Please move to next check
- Else:
  - A warning will be returned as:
    - **“Warning 1121: The LG\_PAN\_NO does not match the highest PANEL in S\_FIRM\_Pan”**

**Function:** Auto Screen verifies whether:

1. There is a value in the LG\_PAN\_NO field of the Study\_Info table.
2. That value in the LG\_PAN\_NO field of the Study\_Info table is the same as the highest value in the PANEL field of the FIRM\_PAN table.

## 2.9. Automation of Current Manual Checks

These verification checks are currently being performed manually by a technician doing a visual inspection/verification of features shown on the georeferenced FIRM scan images and the DFIRM database. These are draft functional requirements that may need to be tweaked to achieve the non-functional performance requirements.

### *2.9.1.1 S\_FLD\_HAZ\_LN LN\_TYP attribute should be coded to contain the appropriate S\_FLD\_HAZ\_AR FLD\_ZONE attribute*

**Statement:**

- If:
  - S\_FLD\_HAZ\_AR SFHA\_TF attribute is coded to “T” and the bounding S\_FLD\_HAZ\_LN LN\_TYP is coded as: “Floodway, Limit of Floodway, Limit of Detailed Study, Limit of Study, 1 PCT Annual Chance Flood Hazard, End of Spatial Extent or Zone Break”
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - “Error 1201: The S\_FLD\_HAZ\_AR polygon <ID> attributed as a **Special Flood hazard Area is bound by an invalid S\_FLD\_HAZ\_LN LN\_TYP**”

### *2.9.1.2 S\_BFE should extend from the Special Flood Hazard Area (SFHA) boundary to SFHA boundary.*

**Reference:** Page L-272 in Appendix L states:

*The spatial elements representing BFE features are lines extending from Special Flood Hazard Area (SFHA) boundary to SFHA boundary. The BFE lines will have no visible gaps or overshoots between the SFHA boundary and the end of the BFE line at the publication scale of the DFIRM.*

**Statement:**

- If:
  - S\_BFE line is within +/- 25 feet of the SFHA boundary
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - “Error 1202: The S\_BFE line <ID> attributed does not extent **across the entire SFHA**”

### *2.9.1.3 S\_BFE should be a single line.*

**Reference:** Page L-272 in Appendix L states:

*Each BFE is represented by a single line.*

**Statement:**

- If:
  - S\_BFE line does not overlap or touch another S\_BFE line
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - **“Error 1203: The S\_BFE line <ID> overlaps or touches another S\_BFE line”**

### *2.9.1.4 S\_XS V\_Datum field should equal the V\_Datum field in the STUDY\_INFO table.*

**Statement:**

- If:
  - S\_XS V\_Datum field is equal to the V\_Datum field in the STUDY\_INFO table.
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - **“Error 1204: The S\_XS line <ID> V\_Datum attribute does not match the V\_Datum attribute in the STUDY\_INFO table”**

### *2.9.1.5 S\_BFE V\_Datum field should equal the V\_Datum field in the STUDY\_INFO table.*

**Statement:**

- If:
  - S\_BFE V\_Datum field is equal to the V\_Datum field in the STUDY\_INFO table.
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - **“Error 1204: The S\_BFE line <ID> V\_Datum attribute does not match the V\_Datum attribute in the STUDY\_INFO table”**

### *2.9.1.6 S\_FIRM\_PAN should have the PNP\_REASON field populated if the PANEL\_TYP is coded Countywide, Not Printed or Community Based, Not Printed*

- If:
  - S\_FIRM\_PAN PANEL\_TYP field is populated as Countywide, Not Printed or Community Based, Not Printed and the PNP\_REASON is field populated with a string
- Then:
  - Correct – Please move to next check
- Else:
  - A error will be returned as:
    - **“Warning 1205: The S\_FIRM\_PAN polygon <ID> has a potential incorrect combination of attributes for PANEL\_TYP and PNP\_REASON.”**