



National Mapping Program Technical Instructions

Part 1

General

Standards for
Raster Feature Separates
Version 1.0

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1. GENERAL

This part of the standard provides a general description of raster feature separates.

Several terms used in this standard are defined in appendix 1-A.

1.1 PRODUCT DEFINITION

The term "raster feature separate" (RFS) is used throughout this document to describe a raster image of a feature separate of a U.S. Geological Survey (USGS) topographic or planimetric map. The term "feature separate" historically refers to the original mylar map materials used to print USGS topographic maps, but in recent years it has also been used for scanned versions of the mylar materials. Although the vast majority of USGS feature separates exist as mylar only, it is possible to have a feature separate that exists in raster form only or in both raster and mylar.

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1.2 OBJECTIVES

The USGS is the lead Federal agency for the collection and distribution of base cartographic data. In addition to technical product specifications, this standard contains information about the collection, processing, and quality control of RFS data.

USGS RFSs are public domain data and may be freely copied and redistributed.

1.3 PRODUCT DESCRIPTION

The original materials for a USGS 7.5-minute quadrangle are various types of mylar negatives. Most of these materials are scribe-coats--mylar sheets coated with a thin pliable layer of paint. During original map compilation (approximately 1945 to 1990 for the 7.5-minute map series), the paint was scraped off with precision scribing instruments to produce a hand-crafted negative.

The organization of these materials was driven first by the 7.5-minute format of the maps and second by the color characteristics of the maps. Traditional USGS maps are printed with five colors of ink (black, red, brown, green, and blue). The white paper makes a sixth color, and purple was added in the 1960s as a seventh. Light shades of these colors are simulated with lithographic screens.

All the features on one feature separate are of the same color, but all features of the same color are not always on one separate. Over the years, conventions and production guidelines evolved for what features should be grouped together on a separate, but these relationships were never formally standardized. The average quadrangle has about 8 feature separates, but it is not unusual for there to be as many as 20.

The mylar separates are saved in USGS archives. Although the mylar is fairly durable, it does not last forever. As quadrangles are reprinted and revised, the mylar sheets are photographically duplicated. Unfortunately, each generation of copying degrades the image quality slightly. Some layers of some quadrangles are on their sixth or seventh generation, with visible deterioration in the linework.

In the late 1980s, digital drafting tools began to replace scribing in map revision. Today a map revision typically begins

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with scanning the feature separates of the old map. The resulting raster separates are updated in computer-aided drafting (CAD) environments. The primary outputs of the revision are RFSs that can be combined to make press negatives to print a new map or raster color composites (RCCs) to make a digital raster graphic (DRG).

The USGS has always sold copies of the mylar feature separates, and there is now a growing demand for RFSs. Even without this demand, there is still a need to standardize the format, packaging, and archive methods of RFSs to preserve historical materials.

The relationships between raster map material and other quadrangle-based graphic entities are illustrated in figure 1-1. Appendix 1-B is a data dictionary for the figure.

The general characteristics of RFSs are as follows:

- o The entire map separate is contained in the RFS. This includes the map collar, legend, and any overedge or insets.
- o Scan resolution is 1,000 dots per inch (dpi) or higher.
- o RFSs preserve the horizontal accuracy of the source map but do not improve it.
- o RFSs display as black-on-white positive images. Color images are represented by the raster color separate (RCS) and RCC entities in figure 1. Specifications for these data have not yet been developed, though prototype datasets can be made in existing production systems.

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- An RFS map set is the collection of RFS files needed to make a DRG or the press plates for a paper map. The RFS images of such a set must register exactly to each other.
- The physical format of RFS images is the tagged image file format (TIFF), version 6.0.
- The image inside the map neatline may be georeferenced or may be left ungeoreferenced at the data producer's option. If the image is georeferenced, appropriate data are stored in the TIFF file according to the GeoTIFF standard, version 1.0 or later. If the image is not georeferenced, the map projection and geometry of the source materials are implicitly preserved in the image.
- The archive format described in this document includes limited cartographic metadata. These metadata are not sufficient to meet Federal Geographic Data Committee (FGDC) requirements. Enhancing this standard to describe a saleable USGS product would require defining a mechanism for delivering FGDC metadata. This is a fairly difficult problem because of the many-to-many relationships between map separates and revision data sources.
- The physical format of an RFS is similar to the format of a DRG. There are some differences in the color palette organization and in the content of ASCII TIFF tags and GeoKeys.

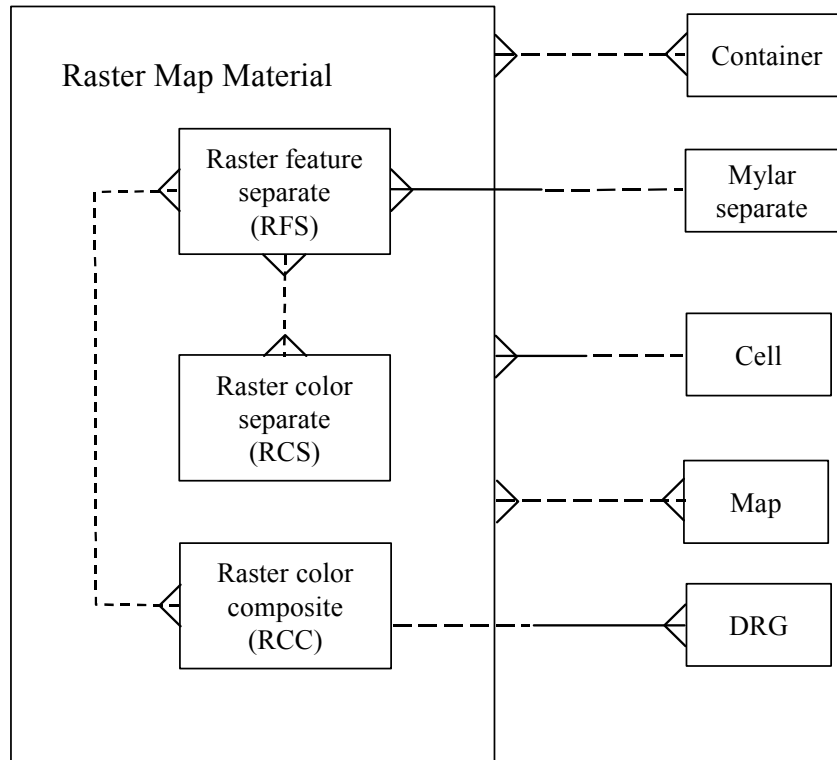


Figure 1-1
Relationships between raster map material and other quadrangle-based graphic entities.

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Appendix 1-A: Definitions

APPENDIX 1-A
Definitions

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Appendix 1-A: Definitions

CELL = A geographic quadrangle bounded by lines of latitude and longitude. A 7.5-minute cell (for example) may have multiple products associated with it, including many feature separates. Overedge areas and inset maps, though part of a map product, are not part of the standard cell.

COLOR MAP = An RGB lookup table that describes how data values map to colors. Pixel values are indexes into this lookup table.

COLOR SLOT = Positions in the TIFF color map. For an RFS, the color map contains 256 slots numbered 0 through 255, although only slots 1 and 2 are used. (Note: This term is not used in the base TIFF standard.)

COMPRESSION = Used in this document to refer to any of the data compression methods supported by the TIFF standard.

CS = Coordinate system.

.d and .h = Number suffixes to indicate decimal and hexadecimal numbers respectively. For example, (262.d, 106.h) represent the same number, the first in base 10 and the second in base 16. In this standard, such number pairs are used to cross-reference TIFF and GeoTIFF tags.

GEOREFERENCE = To establish the relationship between an image coordinate system and a ground coordinate system.

HALFTONE = A technique of representing shading with dots produced by photographing the object from behind a fine screen.

INSETS = Land areas, usually islands, that are printed inside a map neatline even though they are not part of the cell's geographic domain.

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Appendix 1-A: Definitions

MAP COLLAR/RFS COLLAR = The area of the map that lies outside the neatlines. The collar contains the map title, scale, grid coordinate values, and map metadata.

MAP SEPARATE = Traditionally, mylar scribe-coats, peel-coats, or ink drawings that make up the original map manuscripts. The term is also used to refer to exact photographic copies and derived composites of these materials. It is also used for scanned versions of the original materials.

MAP SET = See RFS map set.

METADATA = Information about the content, quality, lineage, and other characteristics of data. On a graphic map, metadata are printed in the map collar. An RFS contains small amounts of metadata in various TIFF and GeoTIFF tags.

NEATLINE = The latitude and longitude lines defining the extent of the mapped area. Usually, but not always, the same as the boundaries of the standard map cell.

NEW VERSION RFS = If the content of an existing RFS is updated or revised, the new RFS is called a new version RFS. The previous RFS is historical data.

OVEREDGE = Mapped areas that are outside the boundaries of a standard USGS map cell. For example, a 7.5-minute map may have a sliver of extra area to include a State border, or it may have a small piece of coastline beyond the standard neatline.

PALETTE-COLOR = One of the image types allowed by TIFF. This image type uses a color map, or lookup table. Pixel values are indexes into this full RGB color map.

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Appendix 1-A: Definitions

PCS = Projected coordinate system (used by the GeoTIFF standard to reference combinations of datums, projections, and grid systems).

REPLACEMENT RFS = If a technical error is found in an existing RFS and a new RFS is made to correct the error with no content revision, the new RFS is called a replacement RFS. The previous RFS is simply bad data.

RFS MAP SET = A collection of raster feature separates that were or will be used to create a published map or saleable DRG. RFSs within a map set are required to have certain characteristics in common with each other that need not be common between RFSs in different map sets.

SEPARATE = See map separate.

TRANSFORMATION = The conversion of image coordinates from one coordinate system to another. For the purposes of this standard, it is usually, but not always, the process of correctly aligning (x,y) image coordinates with (X,Y) Universal Transverse Mercator (UTM) coordinates.

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Appendix 1-B: Data Dictionary for Figure 1-1

APPENDIX 1-B
Data Dictionary for Figure 1-1

CELL = A geographic quadrangle defined by lines of latitude and longitude. A cell does not necessarily have any map or map materials associated with it.

CONTAINER = Media--such as CDs, tapes, or magnetic disks--that hold collections of raster map material (RMM). This is an abstract concept in the geospatial data architecture (GDA) database design. For the purposes of this document it can be thought of as arbitrary collections of RMM files.

DRG = Digital raster graphic--a raster color image of a USGS topographic quadrangle. DRGs are saleable products, defined in the Standards for Digital Raster Graphics.

MAP = A published paper topographic quadrangle. A map necessarily has RMMs (ignoring the case where the materials have been lost or accidentally destroyed), but it is possible to have RMMs that are associated with no published map if a map has been digitally revised and the raster materials archived before a new paper map is printed.

MYLAR SEPARATE = Existing analog map materials, usually from a map compilation that predates digital methods. The overwhelming majority of USGS feature separates currently exist only as mylar. The figure shows the normal case of an RFS being derived from an old analog separate. However, it is also possible for an analog separate to be generated from an RFS, which may be the more common case in the future. This case changes the relationship to a many-to-many.

RASTER COLOR COMPOSITE (RCC) = A color raster image of a topographic map, made by digitally combining RFSs. This image is an intermediate dataset between an RFS and a DRG. It is visually the same as a DRG but is not necessarily georeferenced and does not have finished metadata.

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Appendix 1-B: Data Dictionary for Figure 1-1

RASTER COLOR SEPARATE (RCS) = A combined negative of all features of like color, with lithographic screens to create lighter shades burned into the raster image. This negative is used to make a press plate for printing a new paper map. No RCS standard currently exists.

RASTER FEATURE SEPARATE (RFS) = The entity defined by this standards document.

RASTER MAP MATERIAL (RMM) = An abstract class of objects; RMM includes the subentities RFS, RCS, and RCC. All RMMs have similar physical-file and geometric characteristics.