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# Standard for the U.S. Geological Survey Historical Topographic Map Collection

Techniques and Methods 11–B3
Version 2, July 2014

U.S. Department of the Interior
U.S. Geological Survey

**COVER.** *Cartographers in the Field*. This Depression-era oil painting, created by Hal Shelton in 1940, depicts mapping techniques used in the early days of cartography, including an alidade and stadia rod for determining distances and elevations and a plane-table for sketching contour lines. This 4-by-6 foot painting is on display in the U.S. Geological Survey (USGS) library in Menlo Park, California. Photograph by Terry Carr, USGS.

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By Gregory J. Allord, Kristin A. Fishburn, and Jennifer L. Walter

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**U.S. Department of the Interior**
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**U.S. Department of the Interior**
SALLY JEWELL, Secretary

**U.S. Geological Survey**
Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2014

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# Conversion Factors

Inch/Pound to SI

| Multiply | By | To obtain |
|---|---|---|
| | Length | |
| inch (in.) | 2.54 | centimeter (cm) |
| inch (in.) | 25.4 | millimeter (mm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| | Area | |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |

SI to Inch/Pound

| Multiply | By | To obtain |
|---|---|---|
| | Length | |
| centimeter (cm) | 0.3937 | inch (in.) |
| millimeter (mm) | 0.03937 | inch (in.) |
| meter (m) | 3.281 | foot (ft) |
| kilometer (km) | 0.6214 | mile (mi) |
| | Area | |
| square kilometer ($km^2$) | 0.3861 | square mile ($mi^2$) |

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27), unless stated otherwise.

A U.S. Survey Foot is defined as: 1 meter = 39.37 inches. Dividing 39.37 inches by 12 (12 inches per foot), the resulting conversion factor is 1 meter = 3.280833333 U.S. Survey Feet (reference *www.ngs.noaa.gov/faq.shtml*).

## Abbreviations

| | |
|---|---|
| CSDGM | Content Standard for Digital Geospatial Metadata |
| CSV | comma-separated variable |
| DPI | dots per inch |
| DRG | digital raster graphic |
| FGDC | Federal Geographic Data Committee |
| GCNDB | Geographic Cell Names Database (part of GNIS) |
| GDAL | Geospatial Data Abstraction Library |
| GeoPDF | portable document format with a geospatial extension produced by TerraGo Technologies, Inc., software |
| GIS | geographic information system |
| GNIS | Geographic Names Information System |
| HTMC | Historical Topographic Map Collection |
| HTML | hyper text markup language |
| ISO | International Organization for Standardization |
| JPEG | joint photographic experts group |
| KML | keyhole markup language |
| MB | megabyte |
| NAD27 | North American Datum of 1927 |
| NGP | National Geospatial Program |
| NMAS | National Map Accuracy Standards |
| OGC | Open Geospatial Consortium |
| PDF | portable document format |
| PPI | pixels per inch |
| RGB | red green blue (image color channels) |
| TIFF | tagged image file format |
| TNM | *The National Map* |
| USGS | U.S. Geological Survey |
| XML | extensible markup language |

# Standard for the U.S. Geological Survey Historical Topographic Map Collection

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## Introduction

This document defines the digital map product of the U.S. Geological Survey (USGS) Historical Topographic Map Collection (HTMC). The HTMC is a digital archive of about 190,000 printed topographic quadrangle maps published by the USGS from the inception of the topographic mapping program in 1884 until the last paper topographic map using lithographic printing technology was published in 2006. The HTMC provides a comprehensive digital repository of all scales and all editions of USGS printed topographic maps that is easily discovered, browsed, and downloaded by the public at no cost. Each printed topographic map is scanned "as is" and captures the content and condition of each map. The HTMC provides ready access to maps that are no longer available for distribution in print. A new generation of topographic maps called "US Topo" was defined in 2009. US Topo maps, though modeled on the legacy 7.5-minute topographic maps, conform to different standards (see Cooley and others, 2011, for more information on the US Topo product). For more information on the HTMC, see the project Web site at: *http://nationalmap.gov/historical/*.

The domain of the HTMC is topographic quadrangle maps in the scale range of 1:10,000 to 1:250,000. This range excludes many published USGS maps, even some topographic maps that are part of small-scale series or that have nonquadrangle extents. Additionally, the HTMC project does not include county maps, State base maps, geologic maps, and many other series that are not topographic quadrangle maps.

A digital file representing the original paper historical topographic map is produced for each historical map in the HTMC domain. The digital map is georeferenced (tied to a known Earth coordinate system) and is in georeferenced PDF (GeoPDF), a portable document format (PDF), with a geospatial extension. The GeoPDF map is the primary HTMC product at this time (2014) intended for public distribution and general use. The GeoPDF map allows for basic map analyses, such as distance or area calculations and coordinate readouts, provided appropriate software is used to view the map (any conforming PDF viewing or editing software and a free plug-in toolbar that takes advantage of the geospatial extensions). The GeoPDF map also provides zoom, pan, and printing capabilities (printing the entire map or any desired portion of the map). It makes the historical paper topographic map available to the public free of charge in a format that does not require specialized software or expertise to use.

Although this standard is primarily driven by the GeoPDF format, the USGS reserves the right to distribute the historical topographic maps in other file formats. Future updates to the standard may include such definitions.

### Applicability

This document is an update of the HTMC Standard published in 2011 (Allord and Fishburn, 2011). This standard is applicable to all HTMC GeoPDF map products scanned and georeferenced from 2009 to 2014 (approximately 190,000 paper topographic maps). The standard is also applicable to any additional historical paper topographic maps added to the HTMC after 2014.

### Related Specification

This standard is a companion document to the "Specification for the Historical Topographic Map Collection" (Allord and others, unpub. data, 2014). The HTMC specification contains the detailed requirements for producing HTMC GeoPDF maps, whereas this HTMC standard defines the high-level format and structural requirements for the HTMC GeoPDF map product.

### Maintenance Authority

The USGS National Geospatial Program (NGP) is the maintenance authority for this document and other standards and specifications for *The National Map* (TNM). Submit questions and comments concerning this document through the National Geospatial Program Standards and Specifications Web site at *http://nationalmap.gov/standards/* or email *nmpstds@usgs.gov*.

## Background

John Wesley Powell gained authorization from the U.S. Congress to begin systematic topographic mapping of the United States in December 1884. The USGS created and printed topographic maps using traditional cartographic methods and lithographic processes up until 2006 (U.S. Geological Survey, 2010a,b). Topographic maps were originally produced to support minerals exploration, but they quickly became popular with many other disciplines and with the general public because of their usefulness for viewing and studying the Nation's vast landscape (U.S. Geological Survey, 2010a,b).

Technological capability in the early days constrained broad distribution of maps, and although there were map libraries for published paper maps, they were lending libraries, not archives. Nor was a catalog developed or published to document a list of all maps produced since 1884. Over time, some maps have been lost from USGS libraries, and therefore, no single complete set of USGS historical maps is known to exist. Part of the challenge of this project is to find those maps that are not readily available in USGS map warehouses and archives. The USGS is working closely with the Library of Congress to discover maps in its archives collection. There are many interested parties that may be able to donate historical USGS maps that cannot be found elsewhere, including local libraries, university geological collections and libraries, and State geological surveys. Map contributions can be made by contacting the USGS via *http://nationalmap.gov/historical*.

Advances in geographic information system (GIS) technology motivated the USGS to produce a scanned, georeferenced map series in the mid-1990s that could be easily integrated into a GIS. These digital raster graphics (DRGs) initially were produced from 1995 to 1998 in partnership with Land Information Technology Company, Ltd. About 1,000 new DRGs were added during the next several years. The objective of this program was to scan and georeference the most recently published version of the USGS standard maps for the 7.5-minute, 30×60-minute, and 1×2-degree series (U.S. Geological Survey, 2001a,b).

The HTMC uses a higher resolution and more advanced color model than the DRGs and delivers the scanned maps in GeoPDF format. A more extensive set of metadata is captured and catalogued, and the HTMC project provides a permanent digital archive of historical maps that includes all printings and all series produced by the USGS.

## Product Overview

The general characteristics of the GeoPDF map file are as follows:

- A georeferenced, scanned map is produced in a GeoPDF format. The GeoPDF format makes the historical paper topographic map available to the public free of charge in a digital format that does not require specialized software or expertise to use.
- The digital maps are produced by scanning an entire paper map, including the complete map collar (containing elements such as legend, dates, sources, overedge data, and insets).
- Scan resolution is typically 600 pixels per inch (PPI) (some maps have been scanned at lower resolution, for example at 508 PPI, although no less than 400 PPI is accepted).
- Maps are scanned "as is," meaning no extraneous notes, marks, or paper background discolorations have been adjusted or removed.
- GeoPDF maps preserve the accuracy of the original map but do not improve it.[1]
- The area inside the map frame is georeferenced to the native datum and projected to the native projection of the original paper map. (A digital neatline restricts these coordinates from displaying over the map collar or over any overedge content, such as a small finger land mass extending beyond the bounding coordinates of the map frame.) The GeoPDF map file has also been altered to allow the user to markup the digital map with text, highlighting, or shapes using the comment/markup toolbar in Adobe Reader. The geographic locations of the markups can be exported into a different format, such as Environmental Systems Research Incorporated, Inc. (Esri) shapefiles or keyhole markup language (KML) files. This GeoPDF map function is called GeoMark enabling.
- The geographic extent of the digital map is defined according to the standard USGS topographic cells in the Geographic Cell Names Database (GCNDB), which is part of the Geographic Names Information System (GNIS).
- The GeoPDF map is produced using joint photographic experts group (JPEG) compression with a quality setting of 25 percent.
- The dots per inch (DPI) of the map image in the GeoPDF map is dependent on the map scale. The DPI of the scanned map image does not directly carryover to the GeoPDF.
- GeoPDF map file sizes are generally less than 20 megabytes (MB).

[1] Note: This statement only applies when the datum and projection used in the original paper map are known. This statement may not be true for cases where the datum of the original paper map was not available, was "NAD," or was "Clarke Spheroid of 1866." In these cases, a datum of NAD27 was used in georeferencing, which may or may not preserve the accuracy of the original map.

- GeoPDF file sizes range from 1.7 MB to 68.7 MB, with an average file size of 11.4 MB.
- An extensible markup language (XML) metadata file that complies with the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) (FGDC, 1998) is attached to the GeoPDF digital map.

## Files and Formats

### GeoPDF Map

The HTMC product defined by this standard is a GeoPDF digital map. The digital map represents the original paper historical topographic map and is distributed as a single-layered GeoPDF map (see fig. 1). A metadata file in XML format conforming to the FGDC's CSDGM (FGDC, 1998) is attached to the GeoPDF file. The GeoPDF map is a color image of the paper map georeferenced to the original datum of the historical map and re-projected to the projection of the original printed map.[2] This re-projection provides the user with a digital version of the historical map that can be printed in its original form. The georeferenced area is limited to the area inside the map frame (excludes the map collar), which allows for the seamless tiling of adjacent GeoPDF maps together.

In addition, the GeoPDF file has been altered to allow for the user to markup the GeoPDF map with text, highlighting, sticky notes, or shapes (points, lines, polygons) using the comment/markup toolbar in Adobe Reader. The markups can be saved to the GeoPDF file and also exported into KML or Esri shapefile formats, preserving the spatial location information.

[2] If the original datum of the printed map was not known, or was listed as "NAD" or "Clarke Spheroid of 1866," a datum of NAD27 was used in georeferencing (see appendix A for details on historical datums). If the original projection of the map was not known, the polyconic projection was used to re-project the map with the central meridian at the center of the quadrangle because this projection, and slight variations, was used almost exclusively for large-scale mapping in the United States until the 1950s.

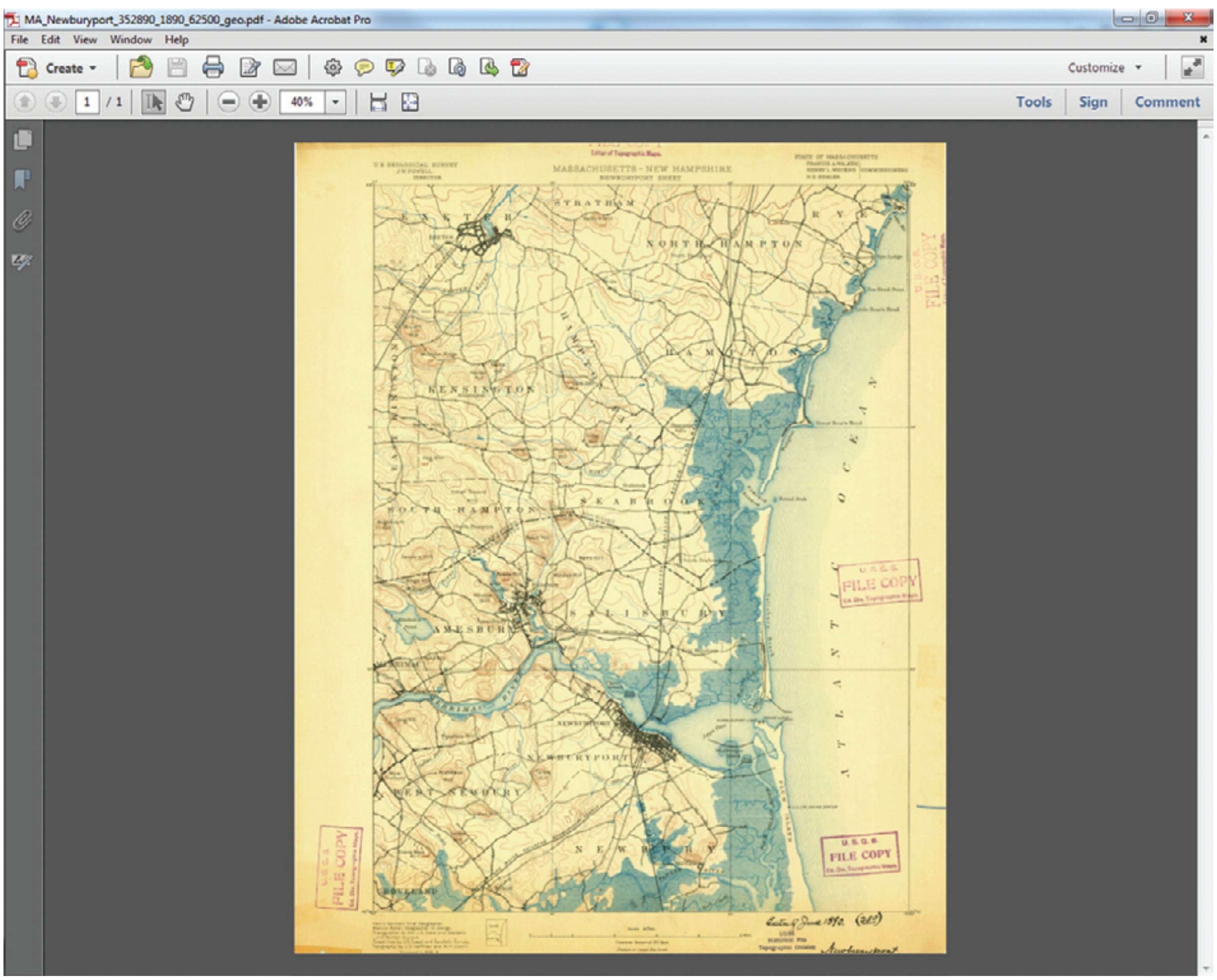


**Figure 1.** A georeferenced portable document format (GeoPDF) map of the historical 1890 Newburyport topographic map.

Although this standard is driven in part by the capabilities of specific commercial software systems, it is notable that Adobe Systems, Inc., released the PDF1.7 specification to be published by the International Organization for Standardization (ISO). The document is now available as ISO 32000-1 (see *http://www.iso.org/iso/pressrelease.htm?refid=Ref1141*) (International Organization for Standardization, 2008). Adobe continues to document extended features that are based upon ISO 32000-1 (PDF1.7), including geospatial encoding, and has submitted these extensions to the ISO for inclusion in future ISO specification revisions (*http://www.adobe.com/devnet/pdf/pdf_reference.html*) (Adobe Systems, Inc., 2009).

TerraGo Technologies, Inc., developed and patented the GeoPDF georegistration technique and holds the implementation rights. This geospatial extension to PDF has been published as an Open Geospatial Consortium (OGC) Best Practices specification, PDF Georegistration Encoding Best Practice Version 2.2, OGC 08-139r3, 2011-1-17. Note that an OGC Best Practice is “a technique or methodology that, through experience and research, has proven to reliably lead to a desired result.” An OGC Best Practice is not a standard but is a means to recognize stable and reliable technological practices (see *http://www.opengeospatial.org/standards/bp*) (Demmy and Reed, 2011).

The GeoPDF lets individuals use georeferenced maps and data, providing spatially correct information. GeoPDF specifically provides a scalable display of the digital map or image with crisp, clear delineation of roads, rivers, contour lines, and other features as the user zooms in for a closer look. PDF maps can be viewed and printed with any conforming PDF viewing or editing software. Adobe Reader versions 9.x, 10.x, and 11.x are known to read and display the functions implemented by USGS datasets correctly, and the software may be downloaded for free at *http://get.adobe.com/reader/*. Adobe Acrobat software may be used in lieu of Adobe Reader, if available. The TerraGo Toolbar is a plug-in that enhances the capabilities of Adobe Reader and Acrobat by taking advantage of the PDF geospatial extensions to allow (for example) reading ground coordinates and measuring ground distances. This plug-in also is available for free and may be downloaded from *http://pages.terragotech.com/terragotechcom-ajfsd/pages/4856c484b07ae211b733d4bed9fa1e9d.html* (TerraGo Technologies, Inc., 2014). At this time (2014), the TerraGo Toolbar is only available for Microsoft Windows operating system versions of Reader and Acrobat. HTMC maps can be displayed and printed with any PDF viewing software that conforms to ISO 32000-1; the TerraGo Toolbar or other specialized software is only needed to take advantage of the geospatial extensions (see fig. 2).

The USGS reserves the right to distribute historical topographic maps in other file formats. Future updates to the standard may include such definitions.

An XML metadata file conforming to the FGDC’s CSDGM (FGDC, 1998) is attached to the GeoPDF map (see fig. 3).

The metadata file contains information found on the map collar, as well as additional information as required by the FGDC CSDGM. A list of the fields and corresponding definitions that are captured from the map collar and how they are captured in the FGDC XML metadata file are included in the HTMC specification (see Allord and others, unpub. data, 2014, appendix C).

## Data Sources

All editions of all USGS standard topographic maps at all published scales and series are included in the scanning project. Every printing (that is, every restock and [or] update) of each historical map is scanned. Each map is scanned “as is”; no enhancements or restorations are made.

The information in the map collar varies depending on the original product but may include USGS and U.S. Department of Interior logos, map title, map date, source notes, projection, horizontal and vertical datum, coordinate system information, quadrangle location and adjoining quadrangle diagrams, scale bars and map scale, accuracy statements, north arrow, and magnetic declination diagram. Much of this information is captured as metadata for cataloguing purposes. The USGS initially captures this data and stores it in a database, a subset of which is used to populate the XML FGDC compliant metadata file that accompanies the GeoPDF map. A link to the complete metadata database is provided at *http://nationalmap.gov/historical/*. A user may view data from the database in hypertext markup language (HTML) and (or) export data from the database into a comma-separated variable (CSV) formatted file readable in many database or spreadsheet software packages (see Shafranovich, 2005, for CSV specification and *World Wide Web Consortium* [W3C], 1999, for HTML specification).

## Resolution, Bit Depth, File Size, and Compression

Scanner optical resolution refers to the number of pixels per inch that the scanner actually samples. The minimum requirement for scanning resolution is 400 PPI. However, 600 PPI results in higher image quality generally without resulting in an unmanageable file size. Thus, the majority of the maps are scanned at 600 PPI. This resolution maintains the visual integrity of the maps as printed and supports a high level of accuracy when the scanned maps are georeferenced.

Bit depth represents the precision with which colors are specified in an image. For example, an 8-bit image (alternatively called a 24-bit image) stores 8 bits per pixel for each of the three primary color channels (red, green, and blue [RGB]), or 256 intensity values for each primary color. Higher bit depth results in a larger file size. An 8-bit image is a true-color image appropriate for high-quality printing and thus is required for the Historical Topographic Map Collection.

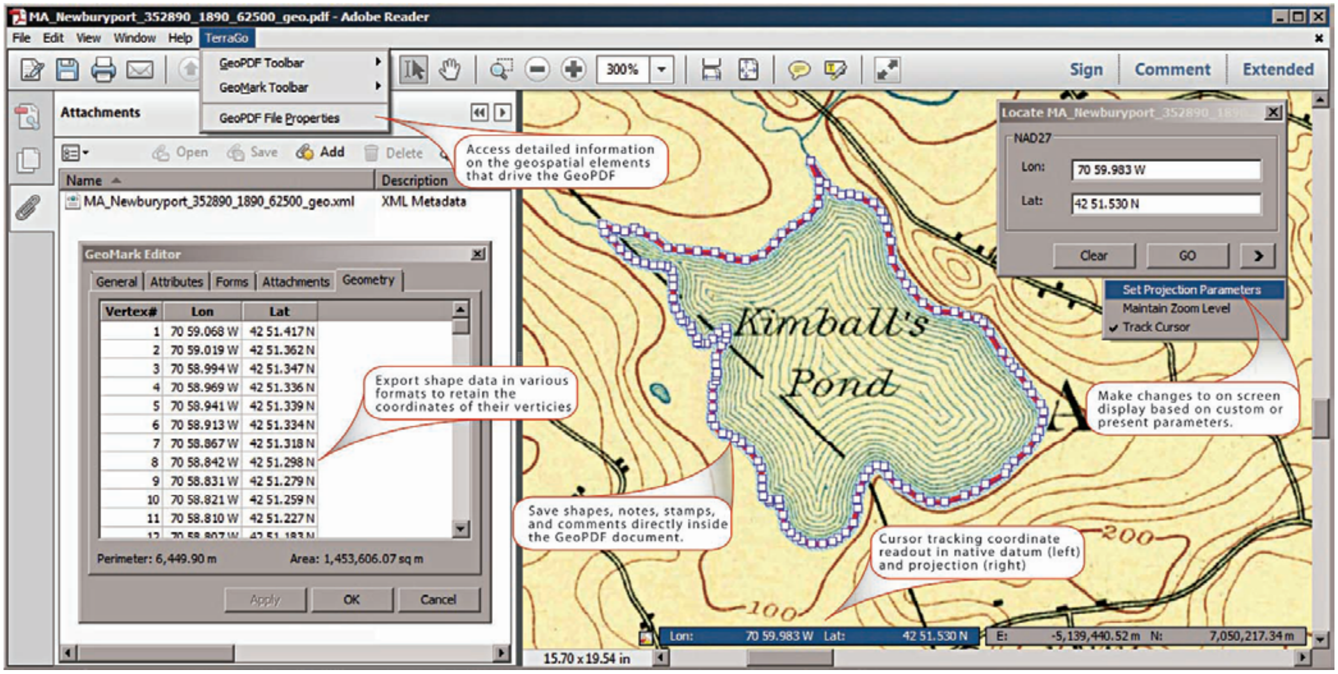


**Figure 2.** Example TerraGo Toolbar functions of a georeferenced portable document format (GeoPDF) map.

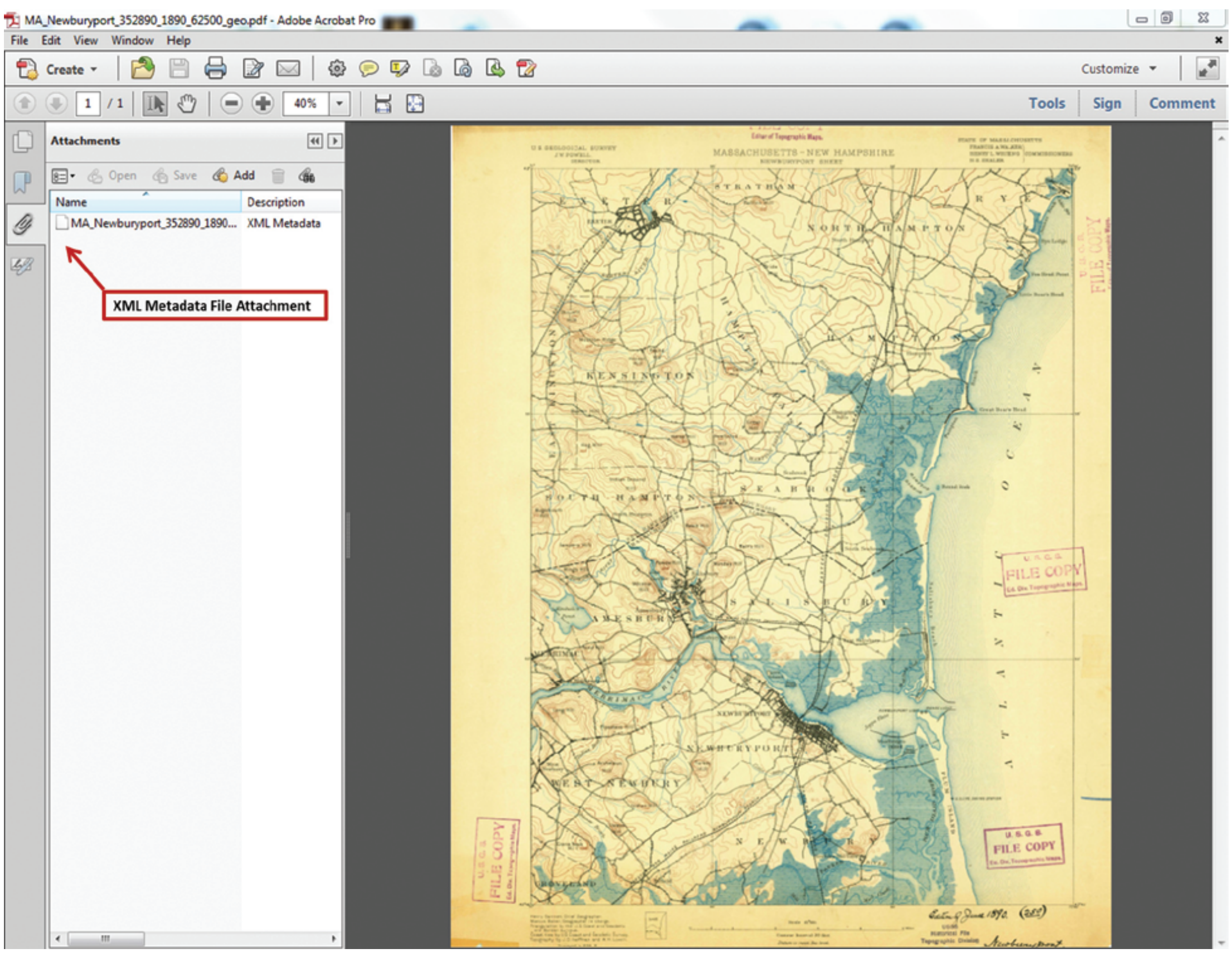


**Figure 3.** Extensible markup language (XML) metadata file attachment to the georeferenced portable document format (GeoPDF) map.

The objective of the GeoPDF map is to produce a digital map that supports high-quality printing and yet is a manageable file size for storage, viewing, and manipulation in its native digital format. The goal is to produce a GeoPDF map with a file size less than 20 MB. This is a goal, not a hard requirement, because the source-map sheet size varies. This file size is small enough for optimal performance and large enough to maintain high quality for printing. The GeoPDF map is produced by first georeferencing the scanned map. JPEG compression then is used when the GeoPDF map is produced, which provides smaller file sizes and maintains the image quality. Note that compression is achieved with built-in features of commercial software for which the precise algorithms are proprietary. Displaying and printing requires decompressing the data, which is done automatically by Adobe Reader software.

## Datums, Projections, and Coordinate Systems

The georeferencing process requires that the original datum of the paper map be used. This information normally is found in the map collar, although with some of the older maps, the map datum is not stated or only the ellipsoid (typically Clarke 1866) is included. In those cases, the North American Datum of 1927 (NAD 27) is used. See appendix A for further discussion about the history of datums used by the USGS.

The GeoPDF maps are georeferenced to the original datum and are also re-projected to the original map projection of the paper map. The intent is to provide the user with a map that may be printed in its original form.

Note that the TerraGo Toolbar used with the GeoPDF map provides a coordinate readout capability and also allows the user to change the datum and projection, as required (see fig. 2).

## Georeferencing

The georeferencing tool used by the USGS for the Historical Topographic Map Collection was developed by the University of Wisconsin-Madison. The software is called QUAD-G (Burt and others, 2012). A user guide for the process and software used to georeference the scanned tagged image file format (TIFF) images may be found at *http://www.geography.wisc.edu/research/projects/QUAD-G/* (Burt and others, 2014).

The USGS integrated the georeferencing tool into the production process to create a fully georeferenced file. The number of control marks used in georeferencing depends on the source map and whether or not the source map is on a standard grid. For maps on a standard grid, the process uses all corner and graticule tick coordinates available in the map to maintain the accuracy of the original map. Table 1 lists the number of graticule ticks and corners used in the georeferencing process for each of the historical map scales and series on a standard grid. In some cases, the actual corner graticules cannot be used in georeferencing, and the number of graticule ticks used in georeferencing may be less than what is shown in table 1.

**Table 1.** Number of graticule ticks by U.S. Geological Survey topographic map scale and series.

| Map scale (series) | Number of graticule ticks used for georeferencing |
|---|---|
| 1:24,000 (7.5 × 7.5 minutes) | 16 |
| 1:25,000 (7.5 × 7.5 minutes) | 16 |
| 1:24,000 (7.5 × 15 minutes) | 28 |
| 1:31,680 (7.5 × 7.5 minutes) | 16 |
| 1:48,000 (15 × 15 minutes) | 16 |
| 1:62,500 (15 × 15 minutes) | 16 |
| 1:63,360 (15 × 15 minutes) | 16 |
| 1:63,360 (Alaska) | Varies |
| 1:100,000 (30 × 60 minutes) | 45 |
| 1:125,000 (30 × 30 minutes) | 16 |
| 1:250,000 (1 × 2 degrees) | 45 |

## Data Quality

Components of data quality typically include currency, consistency, completeness, and accuracy. Since the objective of this project is to create a digital archive and dissemination capability for historical maps, the standards for currency, consistency, and completeness vary according to the standards that were used to produce the original map. Scanning does not affect these characteristics of data quality.

Regarding positional accuracy, however, the historical map product was compiled to meet National Map Accuracy Standards (NMAS) of the era when the map was originally published. The high-scanning resolution ensures the TIFF image is an excellent facsimile of the paper map. Even the thinnest of lines are several pixels wide in the image. The georeferencing procedure requires that transformed image control marks be within the lineweight of the graticule tick as shown on the original map (typically 4 pixels). If stretching or other physical degradation of the paper map made this impossible, the image was not included in the archive, or it was rescanned to obtain acceptable results.

## Digital File Organization

The GeoPDF file can be produced as a single layer or a multiple layer format and can include file attachments. Requirements associated with this digital file format for the HTMC GeoPDF map product are presented in the following subsections.

## Layers

The HTMC GeoPDF map is a single layer composed of a scanned image of the original printed topographic map.

## Startup Conditions

Specifying software behavior is unusual for a USGS product standard but is used in this case because of the tight coupling between GeoPDF, the commercial software tools that can read a GeoPDF, and this product standard. The following startup behaviors depend on the Adobe Reader or Acrobat software and the TerraGo Toolbar extension, which is controlled by TerraGo Technologies, Inc. Therefore, these requirements are considered provisional.

When the GeoPDF map file opens in a current version of Adobe Reader or Acrobat that has the TerraGo Toolbar installed, the following actions are displayed:

- The map width is fit to the view page.
- The folder structure is hidden, meaning the map layer and file attachments are not visible in the sidebar.

## Metadata Files

An FGDC-compliant metadata file in XML format is attached to each HTMC GeoPDF map. The metadata file contains the same information as the map collar as well as additional information as required by the FGDC metadata content standard (FGDC, 1998). The benefit of duplicating collar information is that the XML file can be parsed by software.

## File Names

The HTMC file naming convention contains five key identification elements associated with each topographic map, including State, map name, scan identification, year, and scale. Files are named using the following convention:

***state_ mapname_scanID_year_scale_*****geo.*****yyy***

(For example: *MA_Newburyport_352890_1890_62500_geo.pdf*)

where,

- ***state*** is the 2-letter capitalized postal abbreviation of the U.S. State whose printed name is listed first in the map collar.
- ***mapname*** is the printed name on the specific HTMC map. The first letter in each word of the map name is capitalized.
- ***scanID*** is a unique 6- or 7-digit integer assigned to the scanned map.
- ***year*** is the four-digit date in the lower portion of the map collar that is the year the map was created.
- ***scale*** is the denominator of the ratio of paper map units to ground units.
- **geo** is a string literal that indicates the file is georeferenced.
- ***yyy*** is the filename extension associated with the file type:
  - ***pdf*** indicates Adobe portable document format (PDF).
  - ***xml*** indicates an extensible markup language (XML) file.

A naming convention is not dictated for transfer or distribution files. For example, a zip file containing the GeoPDF map and an XML metadata file need not conform to any particular naming convention.

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# Glossary

**GeoPDF** A georeferenced (tied to a known earth coordinate system) portable document format (PDF).

**National Geospatial Program (NGP)** An administrative unit of the U.S. Geological Survey responsible for mapping and geographic information system (GIS) activities. The NGP is under the USGS Core Science Systems. Information about the NGP is available at *http://nationalmap.gov/historical/*.

**Metadata information** Information about a map or other geospatial product that describes how the product was made, the sources of data, and other relevant information (see *http://geology.usgs.gov/tools/metadata/*). The Federal Geographic Data Committee's (FGDC's) Content Standard for Digital Geospatial Metadata (version 2.0), FGDC-STD-001-1998, defines content and organization of metadata files.

**Standard cell** Geographic quadrangle that aligns with appropriate increments of latitude and longitude (see table 1). These cells, their official names, and other attributes are stored in the Geographic Cell Names Database (GCNDB), which is a part of the Geographic Names Information System (GNIS).

**USGS Mapping Program** An umbrella term that encompasses most of the activities of the NGP, including all aspects of *The National Map*.

## Useful Web Sites

*http://geology.usgs.gov/tools/metadata/*

This site provides useful information about how to implement the FGDC metadata standard.

*http://geonames.usgs.gov/*

This is the USGS home page for the U.S. Board on Geographic Names.

*http://get.adobe.com/reader/*

The free Adobe Reader software may be downloaded from this site.

*http://nationalmap.gov/*

This is the USGS home page for *The National Map*.

*http://nationalmap.gov/historical/*

This is the USGS home page for the Historical Topographic Map Collection.

*http://nationalmap.gov/standards/*

Feedback on the standards for the USGS Historical Topographic Map Collection can be submitted via this site.

*http://nationalmap.gov/ustopo/*

This is the USGS home page for topographic quadrangle maps of the United States.

*http://store.usgs.gov/*

USGS maps may be downloaded from this site.

*http://www.terragotech.com/home/*

The free TerraGo Toolbar extension may be downloaded from this site.

*http://www.fgdc.gov/*

This is the home page for the Federal Geographic Data Committee (FGDC).

*http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/*

The FGDC Content Standard for Digital Geospatial Metadata may be downloaded from this site.

*http://www.gdal.org/*

This is the home page for the Geospatial Data Abstraction Library (GDAL).

*http://www.geography.wisc.edu/research/projects/QUAD-G/*

This site provides a user guide for the georeferencing tool used by the USGS for the Historical Topographic Map Collection developed by the University of Wisconsin-Madison.

*http://www.iso.org/*

This is the home page for the International Organization for Standardization (ISO).

*http://www.opengeospatial.org/*

This is the home page for the Open Geospatial Consortium (OGC).

*http://www.osgeo.org/*

This is the home page for the Open Source Geospatial Foundation (OSGeo).

*http://www.usgs.gov/ngpo/*

This is the home page for the USGS National Geospatial Program.

# Appendix A. Historical Datum Notes and Discussion

The following excerpt was taken from Snyder (1987, p. 13) and was originally quoted from a National Academy of Sciences (1971, p. 7) report titled "North American Datum."

> "The first official geodetic datum in the United States was the New England Datum, adopted in 1879. It was based on surveys in the eastern and northeastern states and referenced to the Clarke Spheroid of 1866, with triangulation station Principio, in Maryland, as the origin. The first transcontinental arc of triangulation was completed in 1899, connecting independent surveys along the Pacific Coast. In the intervening years, other surveys were extended to the Gulf of Mexico. The New England Datum was thus extended to the south and west without major readjustment of the surveys in the east. In 1901, this expanded network was officially designated the United States Standard Datum, and triangulation station Meades Ranch, in Kansas, was the origin. In 1913, after the geodetic organizations of Canada and Mexico formally agreed to base their triangulation networks on the United States network, the datum was renamed the North American Datum. By the mid-1920's, the problems of adjusting new surveys to fit into the existing network were acute. Therefore, during the 5-year period 1927−1932 all available primary data were adjusted into a system now known as the North American 1927 Datum. The coordinates of station Meades Ranch were not changed but the revised coordinates of the network comprised the North American 1927 Datum."

NAD27 is used in the scanned historical topographic quadrangle collection because the difference between NAD27 and the older datums is negligible as compared to error inherent in the older maps.

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*http://ngtoc.usgs.gov/*

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