Iowa USNG 1:6,000 Mapbooks

Mapbook Creation Instructions

2016
Created for Iowa Homeland Security & Emergency Management Division Joint Forces Headquarters (HSEMD)
Created by SharedGeo (www.sharedgeo.org)

Table of Contents

- Table of Contents
- Introduction
- Setting up the ArcMap Documents
- Data Resources in Map Documents
  - USNG Grid and Related Data
  - Structures and Basemap/Reference Data
  - Aerial Imagery
  - Iowa USNG 1:6,000 Mapbooks Data Summary
  - Iowa USNG Data Folder Naming Convention
- Overview of ArcMap Documents and Map Layouts
  - Aerial Photography and Street 1K Map Documents
    - Data Frames
    - USNG Grid and Graticule
    - USNG Grid Reference Box, Text and Standard Citation
    - USNG Magnetic Declination Diagram (North Arrow)
    - Scale Element
    - Dynamic Text
  - Cover Map Document
    - Map Layout
  - Map Legend
- Creating Data Driven Dataset for Individual City
- Setting up Data Driven Pages
- Exporting the Maps
  - Pre-Export Checklist
    - Check Coordinate System
    - Check Map Scale
    - Update Declination Arrow URL
  - Exporting the Street and Ortho Map page PDFs
- Checking the Maps
    - Check Grid Lines, Adjacent Map Indicators and Scale Bar
    - Check USNG Grid Reference Box, Text and Standard Citation, Map Name, Locator Maps, Map Date and Declination Arrow
- Create extra files
  - Cover PDF
  - Data Source PDF
  - Additional files
- Compile the Mapbooks
  - Review of Mapbook Components
  - Mapbook script overview

Creating a mapbook map index list
Writing and Running a Mapbook Batch File
Example Mapbook Batch File Content
Adding new Mapbook Boundary to Web Map JSON
Appendix A: USNG Data
A.1 General USNG Data
A.2 Mapbook-specific USNG Data
Appendix B: Structures and Basemap/Reference Data
B.1 City-specific datasets
B.2 Structures
B.3 HSEM Logo
B.4 Basemap/Reference Data Layers (general)
Appendix C: Aerial Imagery
Appendix D: Data Folder Naming Convention
Appendix E: MXD Folder Organization Convention

Introduction

The U.S. National Grid (USNG) is a standardized grid reference system that is seamless across jurisdictional boundaries and allows for pinpointing exact locations. As the simplest of all Common Operating Picture systems, it is particularly helpful in emergency situations. USNG reference maps that cover large or small areas are valuable items to have in hard copy and/or in electronic format, especially when they show the locations of political boundaries, aerial imagery and other important features, such as hospitals. Integration and use of such maps by first responders, emergency personnel and others familiarizes everyone with the USNG system and how to use it before an emergency occurs.

The standards for use and map creation with USNG are detailed in the Federal Geographic Data Committee (FGDC)'s USNG Standard (FGDC-STD-011-2001). That standard should be followed when making USNG maps, and this document does not replace that as a reference. However, it does highlight some ideas, some general guidelines and items to consider in the creation of USNG maps.

The USNG 1:6,000 Iowa mapbooks cover urban areas in Iowa (urban areas were defined by HSEMD). This document describes the components of and how to make the 1,6000 mapbooks.

Setting up the ArcMap Documents

For each mapbook, three ArcMap Documents are needed:

ArcMap Document	**Description**
Aerial photography 1k map	Map Document that includes orthophotography, a few feature datasets such as street labels, lake and river labels. Example: CedarFalls_NG1K-orthos.mxd
Street 1k map	Map Document that includes several feature datasets including structures, parcels, street centerlines, parks, and many other features useful for general reference and situational awareness. Example: CedarFalls_NG1K-street.mxd
Cover page	Map Document that shows the overview of the area in the mapbook. It also includes a legend that includes all the features shown in the aerial and street maps because those individual map pages do not include a legend. Example: CedarFalls-cover.mxd

Each of these ArcMap Documents is described in more detail later, but first an overview of the data in the documents is provided. It is recommended that the Map Documents be stored in their own city folder. See Appendix E: MXD Folder Organization Convention.

Data Resources in Map Documents

Data referenced in the USNG 1:6,000 mapbooks can be grouped into three categories:

1. USNG Grid and Related Data
2. Structures and Basemap/Reference Data
3. Aerial Photography

During the creation of the 1:6,000 mapbooks, no processing was done on the structures, basemap or reference data provided by HSEMD. The reasoning behind this decision was to use the data sources from the authoritative sources of Iowa cities, counties and agencies (such as Iowa DOT) in the form that they are provided. Then, when updated versions of the same data are available, they can be substituted without any processing, assuming the data retains the same schema.

Next, additional information is provided below about each data category:

USNG Grid and Related Data

USNG Data were downloaded from the USNG Center website (www.usngcenter.org) site and/or created for use in this project by SharedGeo. The USNG data 1 K grid square datasets are used to drive the Data Driven Pages functionality in the maps.

Note that since Esri software does not currently support USNG Grids as a Data Frame overlay in grid zone intersection areas, line Feature Classes substitute for the USNG grids in the grid zone intersection maps. It is not an ideal solution because the grid lines are labelled inside the map area, and not around the perimeter of the main map as with the other maps.

A data dictionary of the USNG data used in the Iowa 1:24,000 map series and the 1:6,000 mapbooks can be found in Appendix A: USNG Data.

Structures and Basemap/Reference Data

In an emergency response, premade USNG-based reference maps are valuable in providing a Common Operating Picture. As such, the maps must meet the dual purpose of providing as much information as is needed in an emergency response while simultaneously keeping the map as clear, understandable and usable as possible. To balance the content and clarity, the data layers included should be evaluated.

The SWEAT acronym, attributed to Florida Emergency Management, can be used as a guide as to whether to include datasets on USNG maps, as follows:

Security	Police, Fire, EMS, Hospitals
Water	Water, Sewage
Energy	Electricity, Fuel
Accessibility	Roads, Schools, Local Government Offices
Telecoms	Telephone Systems, Mobile Phone Towers

In evaluating the need for datasets, local needs may indicate additional datasets as useful and appropriate such as Tsunami evacuation assembly areas. The value of the SWEAT minimum layers list is that it can be used as a framework for communication between decision makers and responders and the geospatial community. For the decision makers and responders with little or no experience in the geospatial world, it can serve as the starting point for discussions on how to effectively move institutions and procedures into alignment with the Common Operating Picture approach required by the National Response Framework (NRF) and National Incident Management System (NIMS). For the geospatial community with little or no experience in the emergency response world, it can serve as the starting point for understanding that while all geospatial data is important during disasters, there are ways to tailor the universe of possibilities so that it is relevant to a particular community – in this case, the decision makers. For both, it can serve as the starting point in understanding that each must work with the other to create a relevant, uniform flow of information that allows geospatial technology to deliver situational awareness during disasters.

It is also important to note that USNG maps should contain a point of contact to whom *data* feedback can be provided. The features represented by datasets in maps are constantly changing - for example if a fire station is relocated, then the dataset on the map should be updated. If there are errors in the data, such errors should be given as feedback to the owners of the data who can correct the original dataset. Then, the USNG maps can be created again with the updated data content.

A summary of the Structures and Basemap/Reference Data used in the Iowa 1:6,000 map series can be found in Appendix B: Structures and Basemap/Reference Data. Additionally, data specific to each mapbook is summarized in the Google Doc: Summary of USNG Urban Areas Data. Note that this document can be downloaded and saved locally as an Excel spreadsheet for future editing, if desired.

Aerial Imagery

Aerial imagery is important for situational awareness. USDA provides statewide aerial photography (NAIP) in map services by state and these have been used in these Iowa maps. The most recent Iowa USDA NAIP aerial photography dates from 2015. A summary of the Aerial

Imagery data used in the Iowa 1:24,000 map series and 1:6,000 mapbooks can be found in Appendix C: Aerial Imagery.

Iowa USNG 1:6,000 Mapbooks Data Summary

The four ArcMap Documents (.mxds) contain the same data layers with the exception of a few additional USNG grid zone Feature Classes in the grid zone intersection area maps. The data groups are described in general the table below. More detail is provided in the appendices.

Data Groups	Data Source	Description
USNG Data	USNG Center & SharedGeo	A set of USNG datasets used as reference layers in the map and as the drivers for Data Driven Pages and dynamic map content.. Learn more in Appendix A: USNG Data
Structures	Various via HSEMD	Collection of layers to provide structures important to situational awareness including fire stations, hospitals, law enforcement, nursing homes, public health, schools, college/universities, airports, correctional institutions, government buildings and mile markers. These are layers that could be updated, removed or added to for future maps. Learn more in Appendix B: Structures and Basemap/Reference Data
Reference/Basemap Layers	Various via HSEMD	Collection of layers to create a basemap over aerial photography including cities, river and lake labels, roads, railroads, trails, city and county boundaries, state parks, forests and recreation areas. These are layers that could be updated, removed or added to for future maps. Learn more in Appendix B: Structures and Basemap/Reference Data
Aerial Photography	USDA FSA	2014 or 2015 aerial photography provided via Map Services for Iowa, Missouri, South Dakota, Wisconsin, Illinois, Minnesota and Nebraska. As newer aerial photography becomes available, these layers should be updated. Learn more in Appendix C: Aerial Imagery

Iowa USNG Data Folder Naming Convention

The spatial data provided to SharedGeo by HSEMD for the Iowa 1:24,000 map series and 1:6,000 mapbooks were stored in a simple folder structure. This was created so that it would be easy to overwrite updated datasets provided by agencies, cities or counties. Of course, any data storage structure will work. ArcMap Documents' data sources will need to be remapped however the data are stored. For an overview of how SharedGeo stored data, see: Appendix D: Data Folder Naming Convention.

Overview of ArcMap Documents and Map Layouts

For each mapbook, three ArcMap Documents are needed. Two ArcMap Documents (the aerial photography and street 1K maps) make the map pairs in the mapbook. The Cover ArcMap Document creates the cover for the mapbook. These three Documents are described in more detail, below. It is recommended that each set of city ArcMap Documents is kept in its own folder. See Appendix E: MXD Folder Organization Convention.

Aerial Photography and Street 1K Map Documents

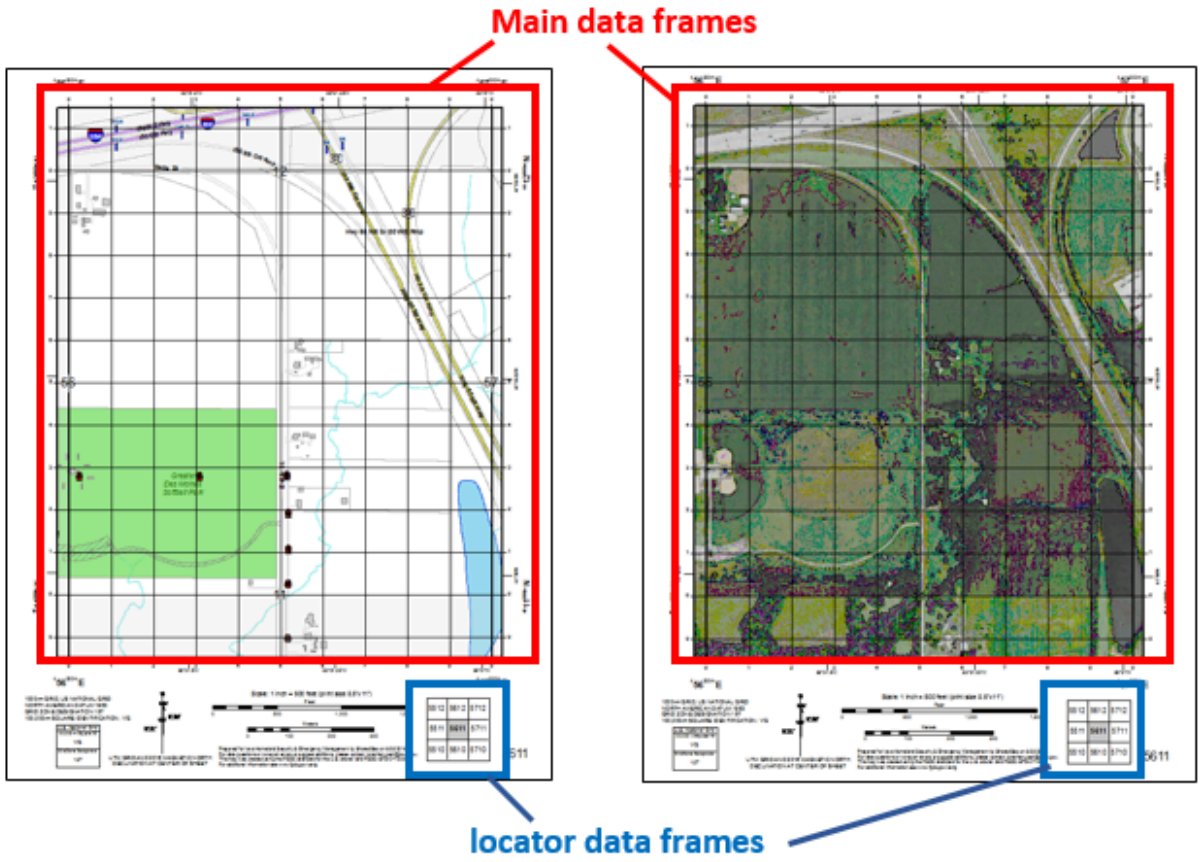
Each mapbook will contain pairs of maps of the same 1k area. Those map pairs are created with two mapbooks:

- Aerial photography 1k map - This map document includes orthophotography, a few feature datasets such as street labels, lake and river labels. Example: CedarFalls_NG1K-orthos.mxd
- Street 1k map - This map document includes several feature datasets including structures, parcels, street centerlines, parks, and many other features useful for general reference and situational awareness. Example: CedarFalls_NG1K-street.mxd

Apart from the data content of Data Frame, these two map document contain the same peripheral map elements on the paired Map Layouts.

Data Frames

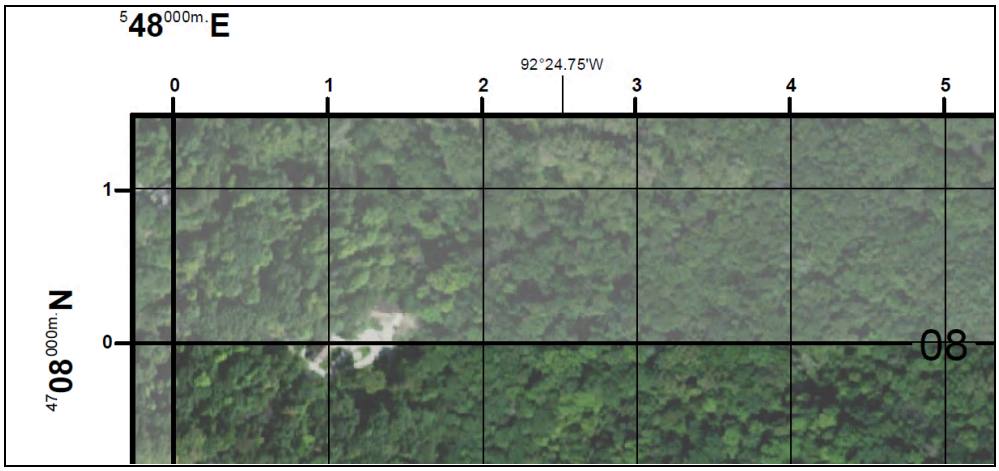
There are two Data Frames in the maps. The main Data Frame and the locator map. The locator map contains the 1K map areas to show the neighboring mapbook pages.



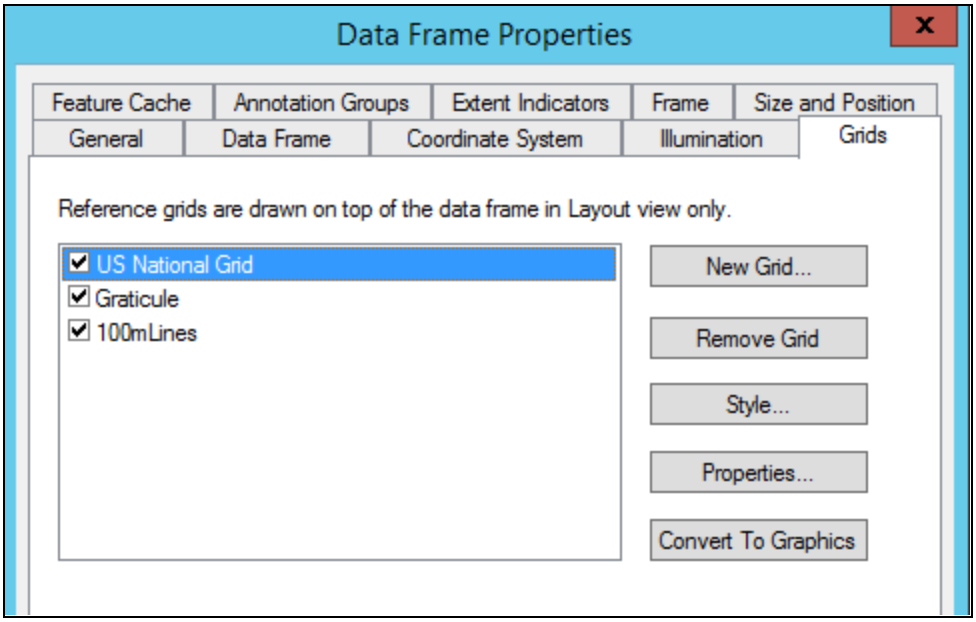
USNG Grid and Graticule

According to the FGDC USNG standard, the 10,000-meter and 1,000-meter digits are known as the *principal digits* and identify USNG grid lines in the main map layout. Preceding and following UTM digits are shown with superscript font. Alternatively, only the principal digits for grid lines need be shown, but a sample full UTM value for both the Easting and Northing axis must be depicted at least once on the map, usually near the southeast corner.

In the Iowa ArcMap Documents, the ArcMap USNG Grid is used. Additionally, a Lat./Long. Graticule is also shown. The graphic below shows a detail of the Grid and Graticule.

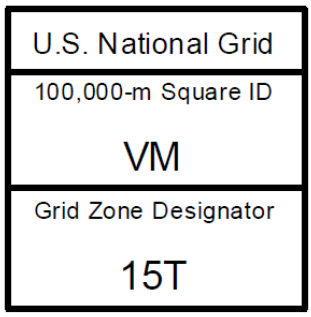


To review and/or edit the USNG grid or Lat./Long. graticule in the ArcMap Document, open the Data Frame Properties and select the Grid tab. Here you will be able to set the Grid properties.



USNG Grid Reference Box, Text and Standard Citation

The Iowa 1:6,000 USNG maps contain the required a USNG grid reference box. The box is comprised of three sections - the top section names the box as U. S. National Grid, the middle section names and shows the identification value for the 100,000-meter square and the third section names and shows the value for the grid zone designator. Learn more from the FGDC USNG Standard (FGDC-STD-011-2001).



In addition to the USNG grid reference box, the USNG map, according to the FGDC standard, include the following information regarding the grid:

- Size of grid squares and identification grid as US National Grid
- Datum to which grid is referenced
- Grid Zone Designation data
- 100,000-meter Square Identification data

An example of this text is provided below:

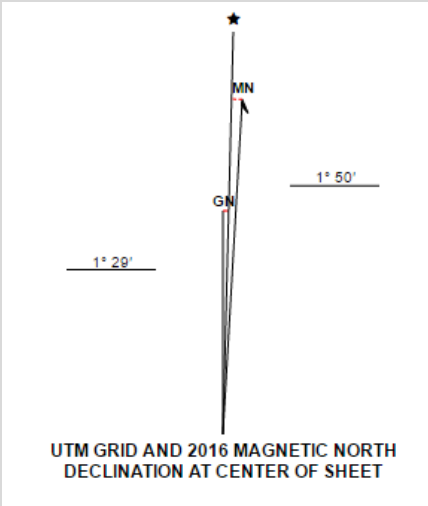
1000-m GRID, US NATIONAL GRID
NORTH AMERICAN DATUM 1983
GRID ZONE DESIGNATION: 15T
100,000-m SQUARE IDENTIFICATION: VM

It is also recommended to include the FGDC USNG standard as a reference on the map. An example is provided below. This is included on the 1:6,000 maps in the text box under the scale bar.

This map was created using the FGDC
Standard for the U.S. National Grid
FGDC-STD-011-2001
For additional information
see http://www.fgdc.gov/usng

All of these map layout elements are included in the Iowa 1:6,000 USNG maps and the text elements that need to change are set up as Data Driven Pages content that are described in the section below.

USNG Magnetic Declination Diagram (North Arrow)



USNG maps should include a magnetic declination arrow. This is a group of three arrows: one showing True North (with the star), one showing Grid North (GN) and one showing the Magnetic Declination or North (MN). On traditional USGS Topo series maps, the map is aligned with the principal arrow (with the star) whereas on a USNG map, the map is aligned with grid north. The adjacent diagram shows this USNG usage of a magnetic declination diagram and the associated text indicating the year the diagram was created.

The 1:6,000 Iowa USNG maps contain a Magnetic Declination Diagram that is created for each map dynamically. The declination arrow is based on the center of the USNG 1K grid area. Each map will have a unique declination diagram that is generated using a web-based service that returns a graphic that is shown in the layout. The URL for this service is stored in the Data Driven Pages Feature Class in a field named "ArrowURL". This URL must be updated before creating any map from the ArcMap Document because the declination diagram changes based on the date. If the "ArrowURL" field doesn't exist, simply add a text field with the name "ArrowURL" and give it 100 text character length. Follow the instructions below to fill the ArrowURL field.

Example URL:
https://usngapp.org/mdd-gen?date=2016.64&lat=40.3246&lon=-91.4109&zone=15

The URL is comprised of several parts: the URL to the service (https://usngapp.org/mdd-gen?) followed by 4 parameter and value pairs (separated by '&'). Note that the parameters and values must include '=' between the pairs.

Parameter	Example Value	Description
date	2016.64	Decimal Year (learn more about decimal dates here: https://en.wikipedia.org/wiki/Decimal_time)
lat	40.3246	Latitude value in decimal degrees, with 4 decimals
lon	-91.4109	Longitude value (note negative) in decimal degrees, with 4 decimals
zone	15	UTM Zone (number only)

To update the URL in the table, use the Field Calculator. Two field calculator options are shown. The first is a more complicated calculation that can be cut and paste as it is, and the second is a simpler calculation, but that requires some updating. Note that both these calculations require the following Fields to be included in the table:

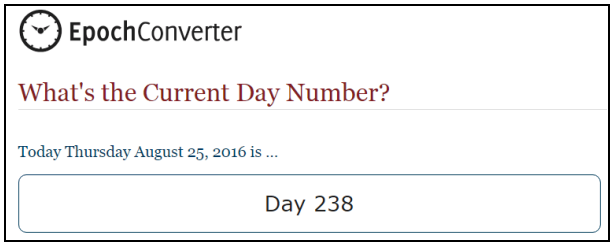
Field	Example value	description
x	-91.410941	X coordinate of center point of USNG area. Note that the calculation will truncate the longitude to 4 decimal places in the URL string.
y	40.324629	Y coordinate of center point of USNG area. Note that the calculation will truncate the latitude coordinate to 4 decimal places in the URL string.
NGGZD	15T	Grid Zone. Note that the calculation just takes the first 2 characters (15) and adds them to the URL string.

Process 1 - More complicated calculation, but no updating needed:

'https://usngapp.org/mdd-gen?date=' + str(datetime.datetime.now( ).year + math.ceil((datetime.datetime.today().timetuple().tm_yday) /365.0 * 10.0) / 10.0) + '&lat=' + str(round(!y! ,4)) + '&lon=' + str(round(!x! ,4)) + "&zone=" + !NGGZD![:2]

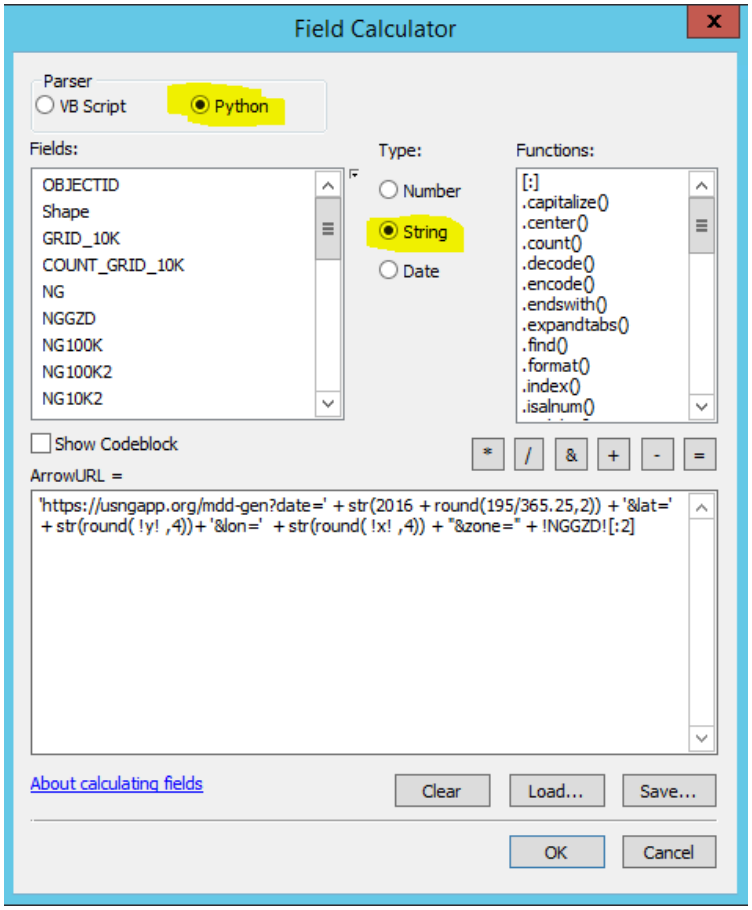
Process 2 - Less complicated, but requires updating:
First go to http://www.epochconverter.com/daynumbers and find out what the current day is for the day you will create the maps. For example, August 25 would be 238.

Next, use the following expression in the Field Calculator and substitute the items in red with the appropriate values. In this expression 2016 should be the current year and 195 should be the current day number, so I would need to substitute 195 with 238.



'https://usngapp.org/mdd-gen?date=' + str(**2016** + round(**195**/365.25,2)) + '&lat=' + str(round(!y! ,4))+ '&lon=' + str(round(!x! ,4)) + "&zone=" + !NGGZD![:2]

Note that when using the Field Calculator for either expression, use the Python Parser and Type: String (see highlighted areas in graphic below), otherwise Field Calculator error may occur.

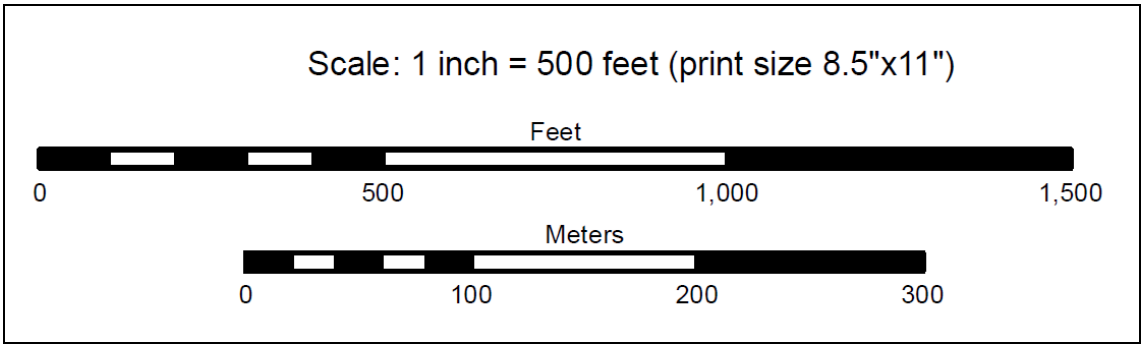


The calculation will populate the ArrowURL field and the value that should change is the decimal date (highlighted below in yellow), according to the day on which the map layout series are created.

ArrowURL
https://usngapp.org/mdd-gen?date=2016.64&lat=41.4626&lon=-96.0033&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.4692&lon=-96.0661&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.5431&lon=-96.0014&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.5592&lon=-96.062&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.5622&lon=-96.1818&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.6031&lon=-96.0&zone=14
https://usngapp.org/mdd-gen?date=2016.64&lat=41.6489&lon=-96.059&zone=14

Scale Element

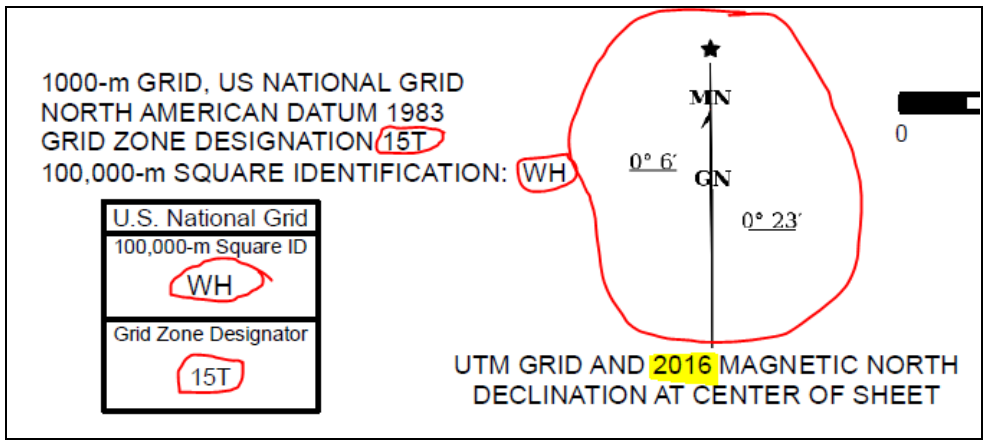
The scale map element is centered under the map content and includes scale bars showing feet and meters. A representative fraction is also included on the map (1:6,000) as well as a verbal scale (such as 1 inch = 500 feet). **A specified print size is also included in case the map is reduced or enlarged in hard copy format.** The graphic below shows the scale element on the Iowa mapbook pages.

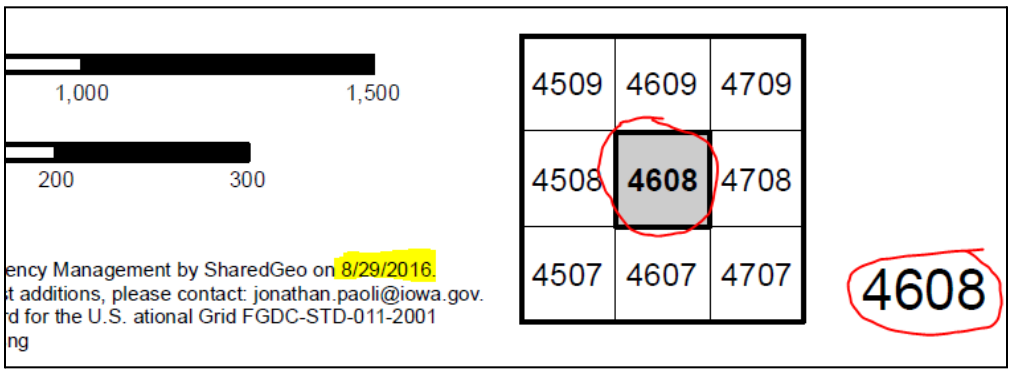


Dynamic Text

There are many text elements on the map layouts that include dynamic text. The dynamic text is either modified by Data Driven Page elements (which change for each created map sheet) or dynamic text that is the same for all maps (such as a Map date). Sample graphics below feature:

- red-circled dynamic Data Driven Page text and elements that change on each map sheet, and
- yellow-highlighted dynamic text that is the same on all map sheets.





Cover Map Document

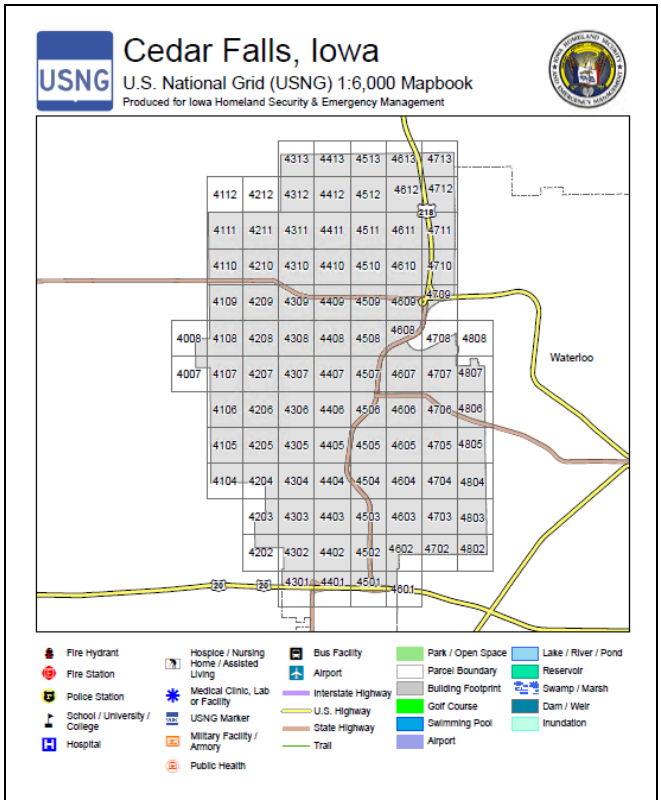
This Map Document that shows the overview of the area covered in the mapbook. It provides two key items:

- Mapbook extents included in the mapbook (labelled by the map book identifier which is the last 4 digits of the USNG coordinate)
- Legend that shows the symbology for all the layers included on the subsequent individual mapbook pages. This legend includes all the features shown in the aerial and street maps because those individual map pages do not include a legend.

An example cover map document would be named: CedarFalls-cover.mxd.

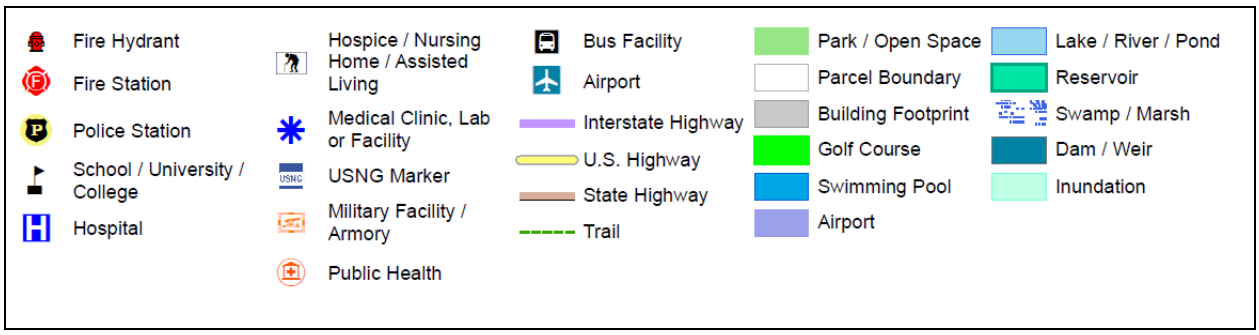
Map Layout

The Cover Map Document has one Data Frame that shows labeled map book 1K areas with a few key reference layers such as major roads and adjacent city boundaries. The map also includes some static texts applicable to all maps.



Map Legend

As with all maps, inclusion of a legend on a USNG maps is necessary. For the mapbooks, the legend is included in the cover page.

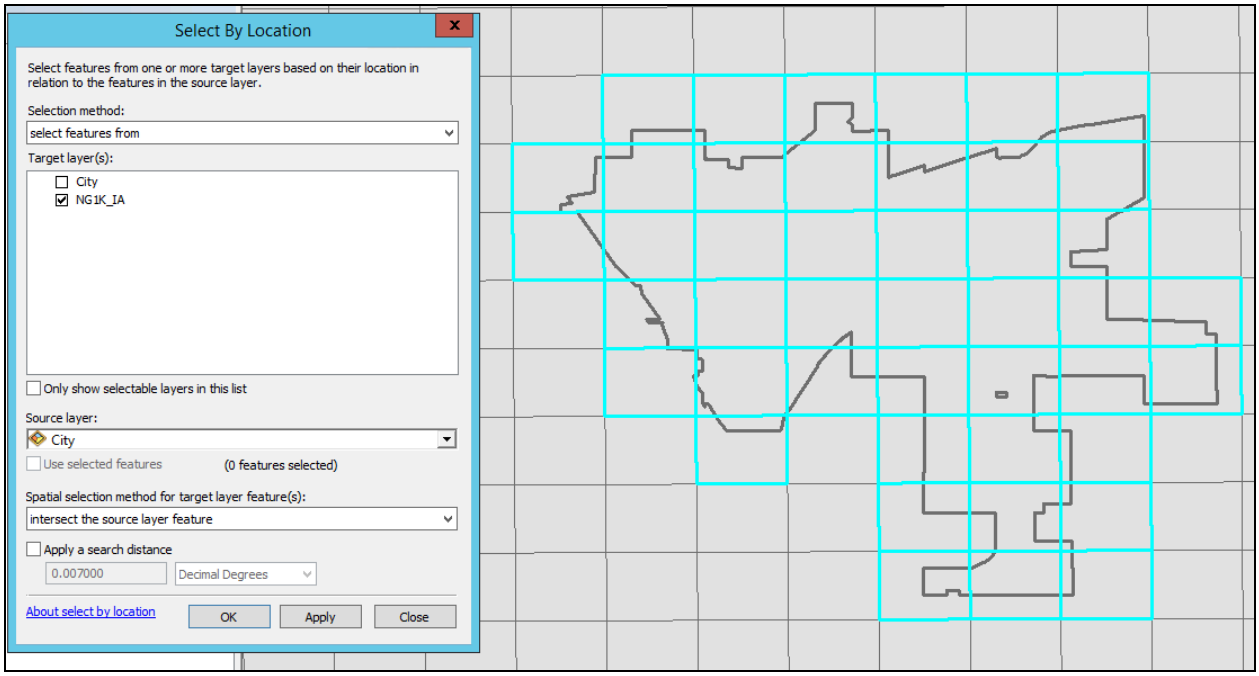


Creating Data Driven Dataset for Individual City

Each map book requires a USNG 1K Feature Class that is used to define the extent of the city for which the mapbook is being made. This is an important Feature Class because it is used to drive the mapbook data driven page functionality. The Feature Class Attribute Table contains many fields that are used to fill dynamic text in the map layout.

To create this Feature Class, take the following steps.

1. In ArcMap, add the NG1K_IA Feature Class (from the **Iowa_USNG_Data.gdb**),
2. Add the City boundary Feature Class,
3. Use a Select by Location query to select the polygon Features from the NG1K_IA Feature Class that Intersect the City boundary,
4. Export the selected Features and save them to the Iowa USNG Mapbook Data File Geodatabase (**Iowa_USNG_Mapbook_Data.gdb**). Name the Feature Class in the following way: [City_Name]_NG1K_DDPsetup (example: Altoona_NG1K_DDPsetup).

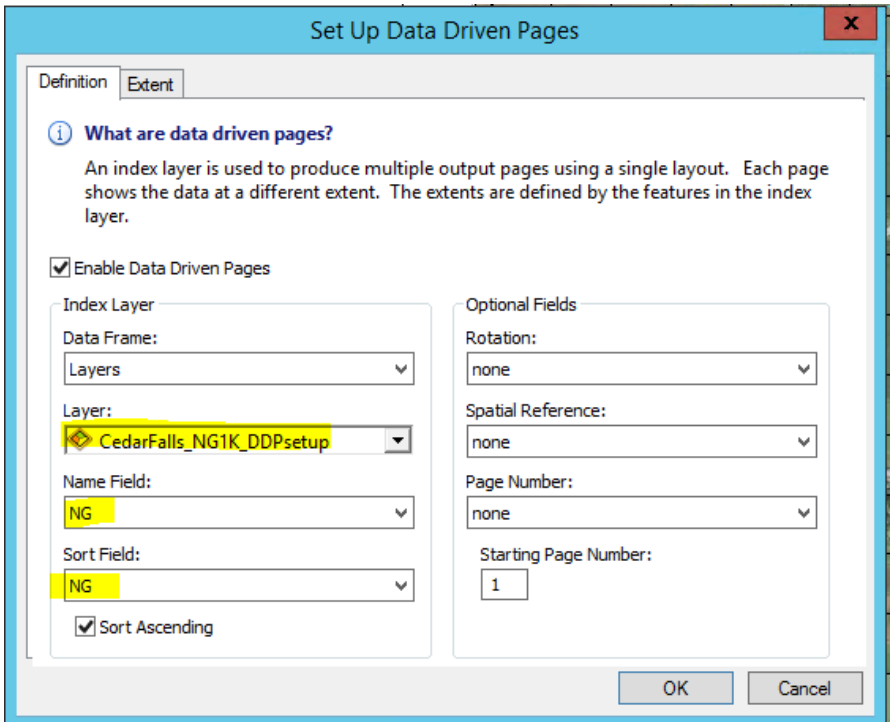


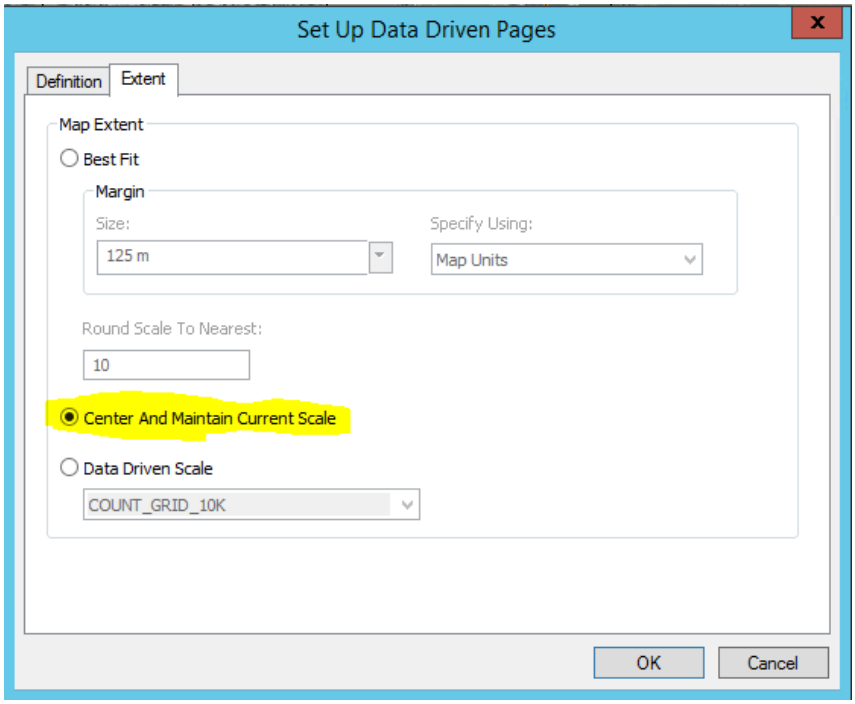
Setting up Data Driven Pages

The Iowa USNG 1:6,000 mapbooks are setup to use a subset of the USNG 1K polygon dataset (NG10K_IA) that was created specifically for the mapbook area. See the previous section for how to create a subset and save it in the Iowa USNG Mapbook Data File Geodatabase (**Iowa_USNG_Mapbook_Data.gdb**).

This dataset contains all the fields necessary to drive the creation of the maps and add many dynamic element to the map page.

Set up Data Driven Pages as shown in the properties below (where the city-specific Data Driven Pages Feature Class is selected as the Layer:)





Exporting the Maps

Pre-Export Checklist

Check Coordinate System

Does the Data Frame have the correct Coordinate System selected (e.g., for producing maps in the UTM Zone 15N NAD83 area, that must be the Coordinate System selected for the main map Data Frame)

Check Map Scale

The main map Data Frame scale set must be set to 1:6,000.

Update Declination Arrow URL

Use the instructions provided in the declination diagram section above to update the "ArrowURL" field to ensure that declination diagrams will be correct.

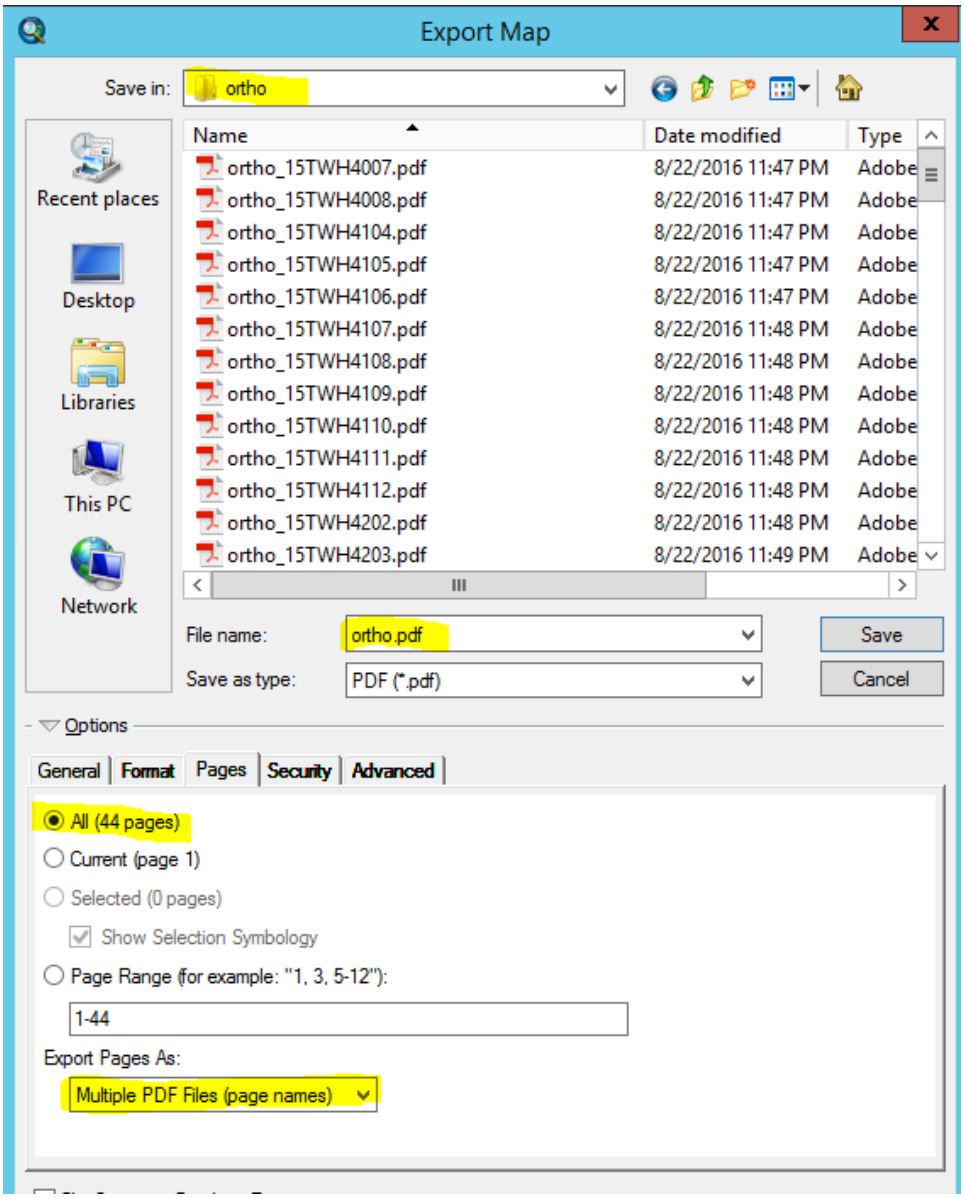
Exporting the Street and Ortho Map page PDFs

When the maps are ready for export to PDFs, take the following steps:

1. In ArcMap, from the File menu, select Export,
2. In Export Map dialog:
    a. Select the folder where you'd like the maps to be stored in the "Save in:" box,
    b. In the "File name:" box, type the name and select the folder. File name recommendations for these are below:

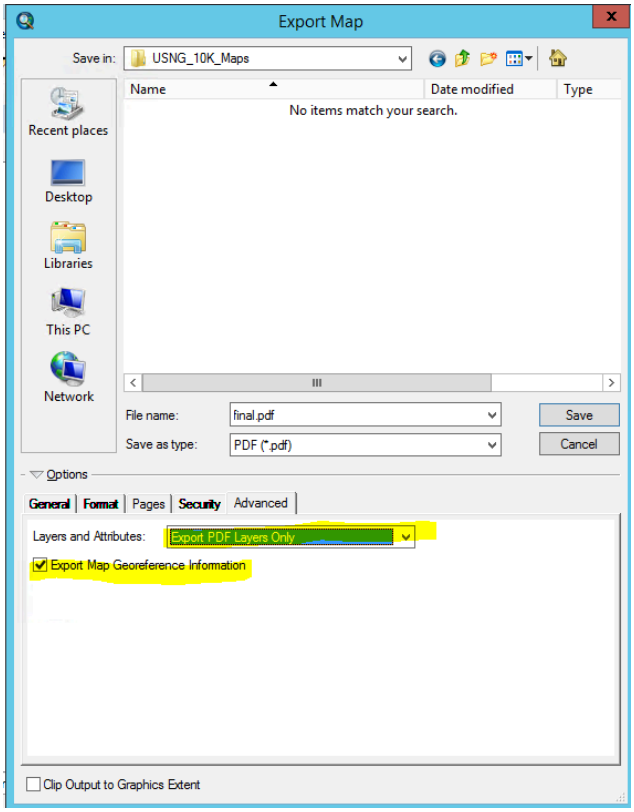
Mapbook Page Type	**Recommended File Name**	**Folder Location**
Orthophotography	ortho	...\mapbooks_parts\ortho
Street map	street	...\mapbooks_parts\street

    c. In the "Save as type:" box, ensure PDF (*.pdf) is selected,
    d. Expand the Options section, select the "Pages" tab
        i. Select the appropriate set of pages to create. Hint: it is recommended to select a limited Page Range and print a few of maps to check on output before printing several hundred.
        ii. Under "Export Pages As:", select "Multiple PDF Files (page names)". This will name each PDF file with the USNG coordinate number set up in Data Driven Pages.



e. Under the Option section, select the “Advanced” tab
    i. Check the “Export Map Georeference Information” checkbox. This ensures that the output PDF files are geospatially referenced.
    ii. Under “Layers and Attributes:”, check the desired selection for inclusion of layers. The initial Iowa maps were made with “Export PDF Layers Only”. This allows PDF files to have layers shown or hidden in Acrobat software. By selecting none, this will not be possible, but the file size will be smaller. By selecting “Export PDF Layers and Feature Attributes”, PDF users will be able to click and get attribute information about all features in the map. The map layers have not been optimized for this option (appropriate field names set etc.), so this is not recommended. If you

choose this option, review the field aliases and hide fields that would not be useful for PDF users. Additionally, the map file size will be much larger.



f. When all the options have been set, click the “Save” button.

Checking the Maps

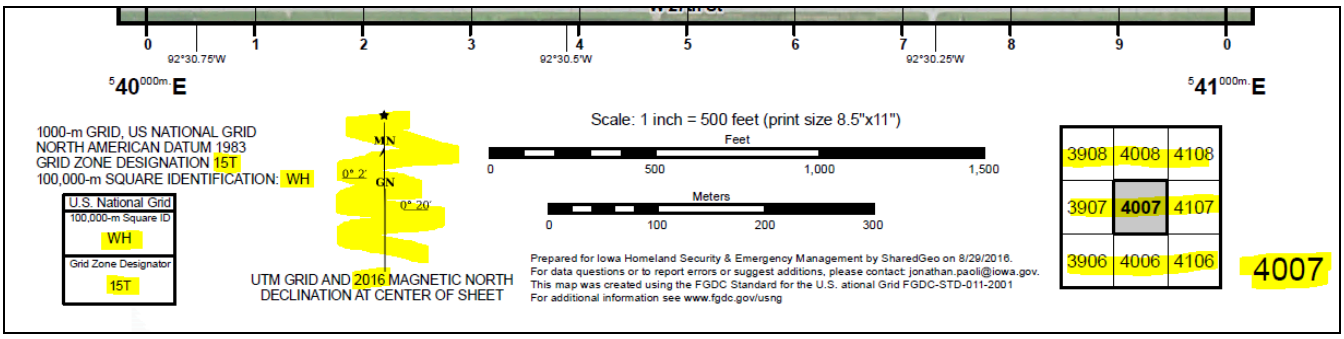
When all the PDF files have been exported from ArcMap, check them to make sure they are being produced properly by the Data Driven Page functions. Here are things to look for:

Check Grid Lines, Adjacent Map Indicators and Scale Bar

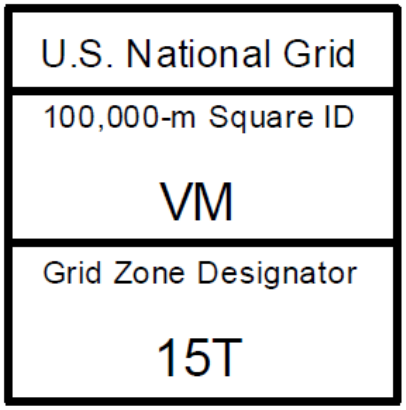
Open the PDF map and make sure the USNG Grid lines and graticule indicators are shown. Make sure the adjacent map indicators are filled in with the appropriate adjacent USNG grid references. Make sure the scale bars appear as they should and the representative fraction scale is shown as 1:6,000.

Check USNG Grid Reference Box, Text and Standard Citation, Map Name, Locator Maps, Map Date and Declination Arrow

The graphic below shows highlighted areas of dynamic content in the map surround that can be checked.



Make sure the USNG grid reference box contains the correct grid reference. The box is comprised of three sections - the top section names the box as U. S. National Grid, the middle section names and shows the identification value for the 100,000-meter square and the third section names and shows the value for the grid zone designator.



In addition, check that the USNG grid reference box text is correct. The USNG map, according to the FGDC standard, include the following information regarding the grid:

- Size of grid squares and identify grid as US National Grid
- Datum to which grid is referenced
- Grid Zone Designation data
- 100,000-meter Square Identification data

1000-m GRID, US NATIONAL GRID
NORTH AMERICAN DATUM 1983
GRID ZONE DESIGNATION: 15T
100,000-m SQUARE IDENTIFICATION: VM

Create extra files

Cover PDF

Export the cover from the ArcMap Document.

Name	Folder location
[cityname]-cover.pdf (example: Altoona-cover.pdf)	...\mapbooks_parts\extras

Data Source PDF

Export the data sources list from the data dictionary or other document. The initial data source pages created by SharedGeo were exported from the specific City tab on the Google Spreadsheet Doc: Summary of USNG Urban Areas Data.

Name	Folder location
[cityname]-datasources.pdf (example: Altoona-datasources.pdf)	...\mapbooks_parts\extras

Additional files

Two additional PDF files are required: Blank.pdf and USNG.pdf. These files are already made and included in the "...\mapbooks_parts\extras" folder.

Compile the Mapbooks

Review of Mapbook Components

To create a mapbook PDF, several parts are needed:

1. Mapbook cover PDF file
2. Street map book PDF files
3. Orthophotography map book PDF files
4. Data sources PDF file
5. Blank page PDF file

Note: None of the PDF file names can include spaces. These files can be stored in different folder locations, but this is a suggested folder organization structure:

Folder location	**PDF Files to Store**
\mapbook_parts\extras	Mapbook covers, Data sources, and Blank page PDF files
\mapbook_parts\street	Street map book PDF files
\mapbook_parts\ortho	Orthophotography map book PDF files

Mapbook script overview

The python script, make1kmapbook.py, can be found in the “Processing_Iowa_Mapbook” folder. This script compiles the individual PDF files and creates a single large mapbook PDF document. The script uses a python library called pyPdf. This libraray is already in the folder, but it can also be downloaded from http://pybrary.net/pyPdf/.

The script can be run from the Python command line by using the python script name and the following parameters.

Parameter	**Example**	**Description**
Mapbook name (required)	DesMoines-East	Name of mapbook *AND* mapbook list input
Orthophoto map locations (required)	d:\mapbooks_parts\orthos	Folder location of the orthophoto mapbook pages (Note: no spaces in path)
Prefix for orthophoto	ortho_	Prefix for ortho mapbook pages. For

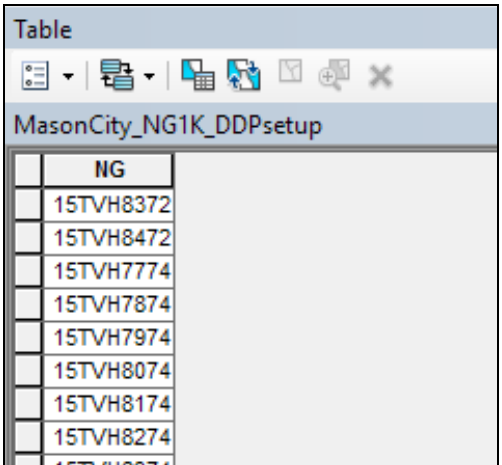
mapbook pages (optional)		example, a PDF file name would become: ortho_15TVF4195.pdf
Street map locations (required)	d:\mapbooks_parts\street	Folder location of the street mapbook pages (Note: no spaces in path)
Prefix for street mapbook pages (optional)	street_	Prefix for street mapbook pages. For example, a PDF file name would become: street_15TVF4195.pdf
Output directory (optional)	d:\temp	Folder location to which output mapbook file is written. If not included, mapbook is written to directory of python script. (Note: no spaces in path)
Extras directory (optional)	d:\mapbooks_parts\extras\	Folder location where other PDF files, such as cover, sources and blank pages are stored. If not included, these files should be in directory of python script. (Note: no spaces in path)

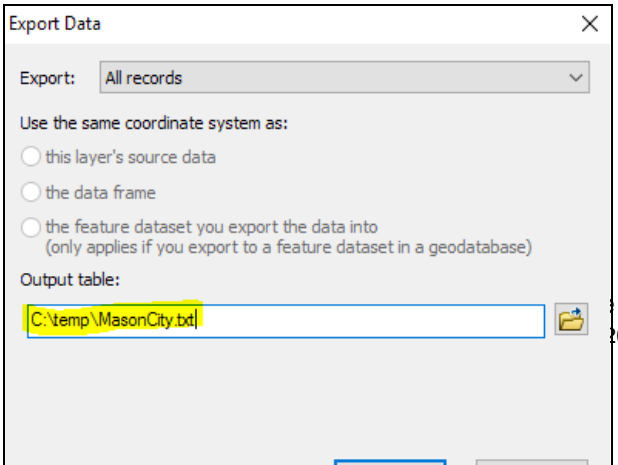
Creating a mapbook map index list

The python script compiles individual map pages and creates a mapbook using a list of USNG coordinates. The list must be in a text file format and include all the USNG coordinates for the mapbook, each on a new line. The mapbook index must be a text file that contains a list USNG Coordinates.

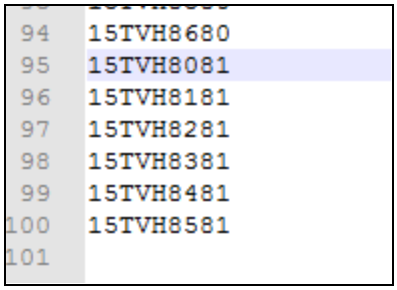
To create a list file of map pages in ArcMap, follow these instructions:

1. Load a data driven page Feature Class into ArcMap (for example MasonCity_NG1K_DDPsetup),
2. In the Layer Properties, under the Fields tab, hide all the fields except “NG”
3. From the Table of Contents, open the Feature Class Attribute Table,
4. Sort the Table in ascending order (this will order the map in the mapbook),
5. Under the Table context menu, select Export Data,
6. In the Export Data dialog, select the file selector and choose Text file format,
7. Navigate to appropriate folder to save the file,



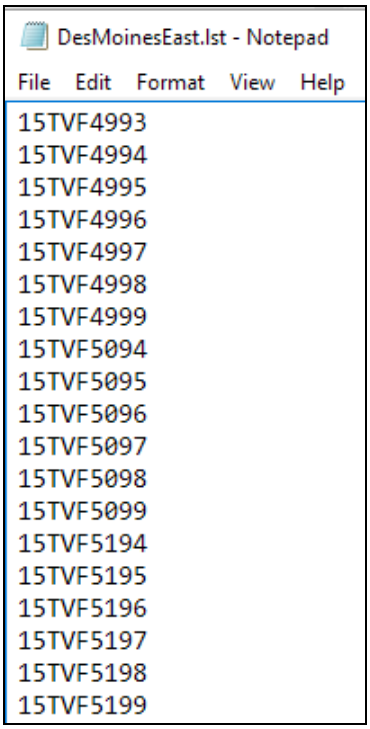


8. Then, navigate to the folder where the .txt file was save, and use the Rename function to change the file extension from ".txt" to ".lst"
9. Open the file in a text editor and delete the first line (which will be the field heading NG)
10. Go to the end of the file and add one extra hard return, so the file looks like this at the bottom:



10. Save the .lst file and store the file in the "Processing_Iowa_Mapbook" folder.

Hint: The file must be named [cityname].lst, where [cityname] is the actual name of the mapbook city or area. For example, this graphic shows a part of the list file for the Des Moines East mapbook. It is named "DesMoinesEast.lst".



Note - the advantage of using lists to compile mapbooks is that list of different areas can be created, such as fire districts, police areas, or areas for special events. Also note that the python script and library cannot process a high number of PDF file pages to compile, resulting in a failure. In Iowa, large cities where many map book pages are needed to cover the urban area, they can be split into sections to make smaller map books. For example Dubuque and Des Moines are split into separate mapbook output files.

Writing and Running a Mapbook Batch File

While the python script can be run at the Python command line, it is easier to create a batch file that can be saved and rerun as needed. The batch file simply calls the python script and parameters and can be run from the Windows command line.

Example Mapbook Batch File Content

make1kmapbook.py CedarFalls d:\iowaproject\outputs\mapbooks_parts\ortho ortho_ d:\iowaproject\outputs\mapbooks_parts\street street_ d:\temp d:\iowaproject\outputs\mapbooks_parts\extras\

Save the batch file with the file extension “.bat” (for example “cedarfalls.bat”). Batch files can contain lines for several mapbooks.

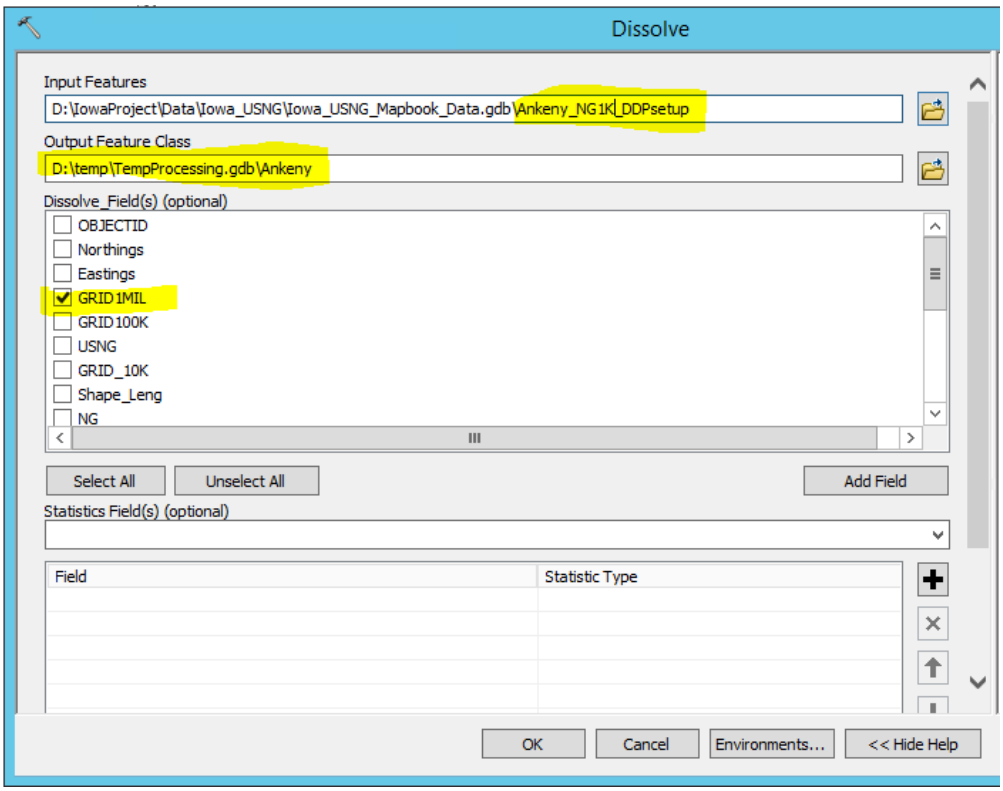
Adding new Mapbook Boundary to Web Map JSON

The web map interface, which can be used to find mapbooks, uses a JSON file to show the map book outlines on a basemap and also provides a link to the map's PDF file.

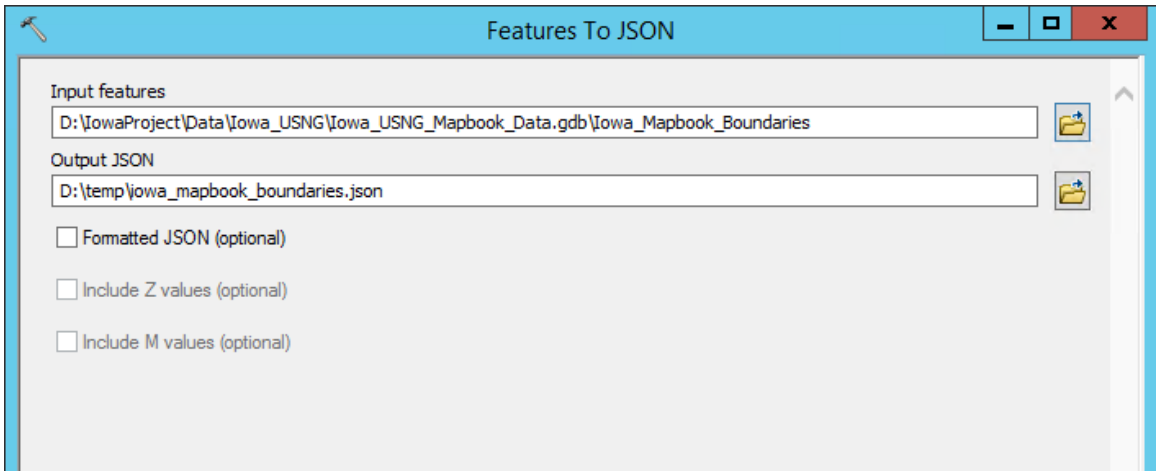
The JSON file has one record for each mapbook that so that the web map can show the boundary of the mapbook file. The JSON file is created from a Feature Class ("Iowa_Mapbook_Boundaries") that includes one polygon for each mapbook boundary. Each record has a value in the "Name" field that provides both the label name on the web map and the PDF file name (with the .pdf file extension). The Iowa_Mapbook_Boundaries Feature Class is stored in the WGS84 coordinate system because this is required for the JSON file.

To add a new mapbook to the JSON file for the web map take the following steps:

1. Using ArcToolbox, dissolve the Data Driven pages 1 km Feature Class into a single polygon. Use a temporary Geodatabase to hold the results. As the Dissolve Field, choose a field that already has the same value for all the records, or first create a field and fill it with same value.



2. Take the resulting dissolved Feature Class and merge this one feature into the mapbooks dataset called: “Iowa_Mapbook_Boundaries”. This can be done interactively in ArcMap or by using the “Append” tool in ArcToolbox.
3. In ArcMap, edit the new feature, so the Name field in the “Iowa_Mapbook_Boundaries” Feature Class is the name of the mapbook and area. For example, “Ankeny”. Note that the PDF mapbook output must match this name exactly with the file extension “.pdf”. For example, “Ankeny.pdf”.
4. To convert the “Iowa_Mapbook_Boundaries” Feature Class to a JSON file, in ArcToolbox, open the “Features to JSON” tool under Data Conversions and JSON. For Input features, point to the “Iowa_Mapbook_Boundaries” Feature Class and for Output JSON, point to a temporary location.



5. Overwrite the existing JSON mapbook boundary file on the website with the new JSON file. Note that the filenames must match exactly. If a new file name is used, then the json.config file must be updated on the website. The JSON coordinates must be in lat/long and this will happen automatically when the JSON is exported because the Iowa_Mapbook_Boundaries Feature Class is stored in the WGS84 Geographic Coordinate System.

Appendix A: USNG Data

The Iowa USNG Data File Geodatabase (**Iowa_USNG_Data.gdb**) contains many USNG Feature Classes that are required for the Iowa USNG 1:24,0000 map series and 1:6,000 mapbooks. The Data Dictionary below describes each Feature Class used.

A.1 General USNG Data

Feature Class	**Description**
MGRS_GRID	Polygon Feature Class of 6 USNG zones covering Iowa. This is used in the locator maps of the USNG 1:24,0000 maps.
MGRS_GRID_Lines	Line Feature Class of 6 USNG zones covering Iowa.
NG100K	Line Feature Class of 100K USNG zones for the entire US. This is used in 1:24,000 Grid Zone intersection maps to show the USNG Grid.
NG10K_IA	Polygon Feature Class of all 10K areas covering Iowa. This important Feature Class is used to drive the Data Driven Pages in the 1:24,000 (10K) maps. It contains many fields that are used to fill dynamic text in the map layout.
NG10K_IA_Mask_State_Edge	Polygon Feature Class of merged 10K areas surrounding Iowa and used in USNG 1:24,0000 maps at the edge of the state.
NG1K_US_lines	Line Feature Class of all 1K USNG lines in US. This is used in 1:24,000 (10K) Grid Zone intersection maps to act as the USNG Grid. This Feature Class is labelled in the grid intersection maps inside the Data Frame in the same manner that the USNG grid is labelled outside the map in the “regular” 1:24,000 (10K) maps.
NG1K_IA	Polygon Feature Class of all 1K areas covering Iowa. This important Feature Class is used to drive the Data Driven Pages in the 1:6,000 (1K) mapbooks. It contains many fields that are used to fill dynamic text in the map layout.
USNG_**UTM14**_GZINT_Pseudo_Polys USNG_**UTM15**_GZINT_Pseudo_Polys	These polygon Feature Classes for 10K areas covering the UTM Zone **14** and UTM Zone **15 grid zone intersection** areas in Iowa. These polygons are “pseudo” polygons because the true shape of the polygon is not a square, but rather an incomplete square on the edge of a UTM Zone. This Feature Class is used to drive the Data Driven Pages in the 1:24,000 (10K) maps in the ArcMap Documents: IA_10_km_UTM14_GZINT_vt_MapMaker.mxd and IA_10_km_UTM15_GZINT_vt_MapMaker.mxd.

A.2 Mapbook-specific USNG Data

The Iowa USNG Mapbook Data File Geodatabase (**Iowa_USNG_Mapbook_Data.gdb**) contains many USNG Feature Classes specific to the creation of 1:6,000 mapbooks. The Data Dictionary below describes the Feature Class naming format and some of the Feature Classes in the Geodatabase.

Feature Class	**Description**
[City_Name]_NG1K_DDPsetup	Example Feature Class: Altoona_NG1K_DDPsetup There will be many of these Feature Classes, each created by selecting and saving as a subset of the NG1K_IA in the Iowa_USNG_Data.gdb described above. More information about how to subset the data is provided earlier in this document. The file is named with the city name, then “NG1K_IA” to know where it originated, followed by “DDPsetup” to indicate that it is used to set up a **D**ata **D**riven **P**age Document. These are important Feature Classes because they are used to drive the mapbook Data Driven Page functionality. The Feature Classes contains many fields that are used to fill dynamic text in the map layout.
Iowa_Mapbook_Boundaries	Feature Class that contains one polygon of the boundary of the city mapbook area. This polygon is created by merging (dissolving) features for each city mapbook’s 1k Feature Class. The Iowa_Mapbook_Boundaries Feature Class has one “Name” field that includes the name of the city. This should match the mapbook name. The Iowa_Mapbook_Boundaries Feature Class is used to create the JSON file that is used in the website.

Appendix B: Structures and Basemap/Reference Data

The tables below describes the structures and basemap/reference data used in the Iowa USNG 1:6,0000 map series. The folder structure is intended to be simple and scalable, but if data are stored in other locations, data layers in ArcMap Documents can be repointed to those sources.

Additionally, data specific to each mapbook is summarized in the Google Doc: Summary of USNG Urban Areas Data. Note that this document can be downloaded and saved locally as an Excel spreadsheet for future editing, if desired.

B.1 City-specific datasets

Data specific to each individual mapbook is summarized in the Google Doc: Summary of USNG Urban Areas Data. Note that this document can be downloaded and saved locally as an Excel spreadsheet for future editing, if desired.

During the creation of the 1:6,000 mapbooks, no processing was done on the directory structures, basemap or reference data provided by HSEMD. The reasoning behind this decision was to use the data sources from the authoritative sources of Iowa cities and counties in the form that they are provided. Then, when updated versions of the same data become available, they can be substituted without any processing, assuming the data retains the same schema.

Additionally, to facilitate the easy swap out of updated data, the folder locations for local data was kept intentionally simple and scalable. See Appendix D: Data Folder Naming Convention.

The following list of data layers was used as the goal for data collection from cities.

Street Centerlines	Red Cross	Trail
City Boundary	Zoo	Park / Open Space
Fire Hydrant	School / University / College	Parcel Boundary
Fire Station	Bus Facility	Building Footprint
Police Station	USNG Marker	Parking
Emergency Management Center	Mile Marker	Road Edge / Bridge / Driveway
Hospice / Nursing Home / Assisted Living	Correctional Institution	Golf Course
	Military Facility / Armory	Recreation Area
Hospital	Public Health	Swimming Pool
Medical Clinic, Lab or Facility	Airport	Skywalk / Skyway
Cemetery	Interstate Highway	Lake / River / Pond
Government Building	U.S. Highway	Reservoir
Community Center	Stream	Swamp / Marsh / Dam / Weir
Library	Bike Facility	Inundation Area

B.2 Structures

Not all of these layers were used in all mapbooks, but this list provides information about Statewide and/or other datasets that may have been included, especially if local data are not available.

Layer Name	Data Source	File Location
Fire Station	Iowa HSEMD	Iowa_HSEM\FireStations.shp
Hospital	Iowa HSEMD	Iowa_HSEM\Hospitals.shp
Law Enforcement	Iowa HSEMD	Iowa_HSEM\Police_LawEnforcement.shp
Nursing Home	Iowa HSEMD	Iowa_HSEM\NursingHomes.shp
Public Health	Iowa HSEMD	Iowa_HSEM\PublicHealthDepts.shp
Schools	Iowa HSEMD	Iowa_HSEM\PublicSchools.shp
Private Schools	Iowa HSEMD	Iowa_HSEM\PrivateSchools.shp
College/University	Iowa HSEMD	Iowa_HSEM\CollegesandUniversities.shp
Armory	Iowa HSEMD	Iowa_HSEM\ARNG_Sites.shp
Airport	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Airports
State Capitol Complex	Iowa HSEMD	Iowa_HSEM\MajorStateGovtBldgs.shp
Mile Markers	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Reference_Posts
Correctional Institutions	Iowa HSEMD	Iowa_HSEM\StateCorrectionalInstitution.shp

B.3 HSEM Logo

Layer Name	Data Source	File Location
HSEM Logo	Iowa HSEMD	Iowa_HSEM\FierceLogo_lg.jpg Note that the logo is positioned on the map layout as a separate Data Frame so it scales well on map

B.4 Basemap/Reference Data Layers (general)

Not all of these layers were used in all mapbooks, but this list provides information about Statewide and/or other datasets that may have been included, especially if local data are not available.

Layer Name	Data Source	File Location
Rivers	Iowa HSEMD	Iowa_HSEM\major_rivers.shp
Interstate Highway	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Interstates
U.S. Highway	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\US_Highways
State Highway	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Iowa_Highways
County Road	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Signed_County_Road
Interchange	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Interchanges
Railroad	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\RailLines
State Trail	Iowa HSEMD	Iowa_HSEM\StateTrails.shp
Unincorporated City	Iowa DOT	Iowa_DOT\Iowa_DOT.gdb\Unincorporated_Cities
City Boundary	Iowa HSEMD	Iowa_HSEM\Incorporated_Cities.shp
County Boundary	Iowa HSEMD	Iowa_HSEM\County.shp
State Park	Iowa HSEMD	Iowa_HSEM\StateParks.shp
State Forest	Iowa HSEMD	Iowa_HSEM\StateForest.shp
State Recreation Area	Iowa HSEMD	Iowa_HSEM\StateRecreationArea.shp
Lakes	Iowa HSEMD	Iowa_HSEM\major_lakes.shp
US States	Esri*	US_Esri\dtl_cnty.gdb* (detailed county boundaries)
Iowa Counties	Iowa HSEMD	Iowa_HSEM\County.shp
NHD Hydrography	USGS*	USGS_NHD\NHD_H_19_GDB.gdb\Hydrography \NHDWaterbody and NHDAreas**

*Esri detailed county data can be substituted with other county boundary data, or downloaded from Esri Maps and Data.

**USGS NHD Hydrography can be downloaded from http://nhd.usgs.gov/data.html

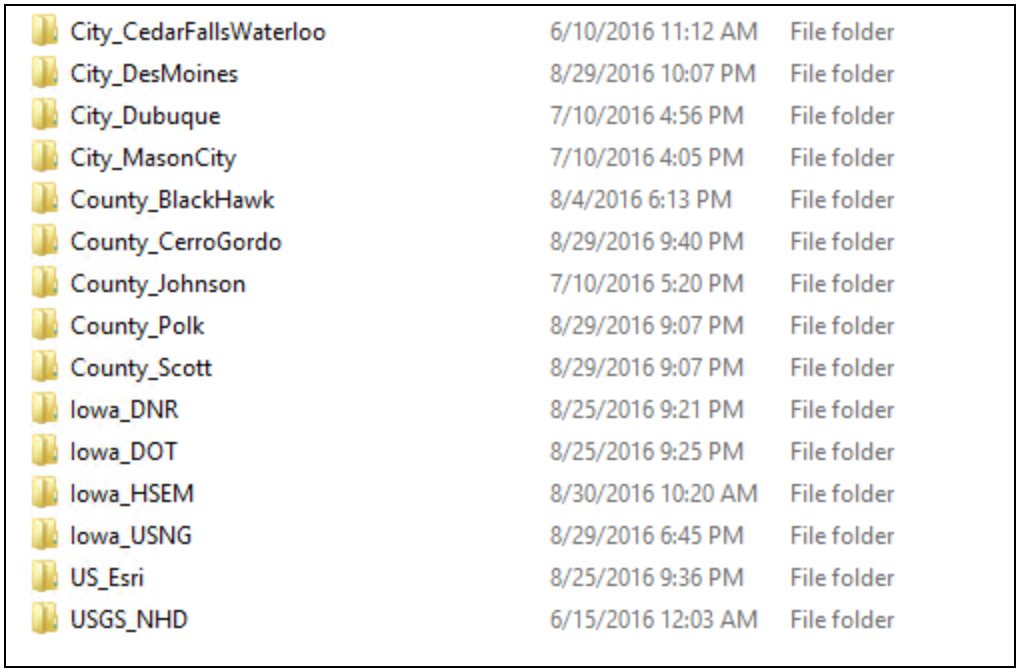
Appendix C: Aerial Imagery

The NAIP aerial imagery used in the Iowa USNG 1:24,0000 map series is accessed from USDA directly from USDA map services. The details of these services are provided in the table below. More general information about USDA NAIP aerial imagery and services can be found here: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/

State	Year	Service URL
Iowa	2015	http://gis.apfo.usda.gov/arcgis/services/NAIP/Iowa_2015_1m/ImageServer
Illinois	2015	http://gis.apfo.usda.gov/arcgis/services/NAIP/Illinois_2015_1m/ImageServer
Minnesota	2015	http://gis.apfo.usda.gov/arcgis/services/NAIP/Minnesota_2015_1m/ImageServer
Missouri	2014	http://gis.apfo.usda.gov/arcgis/services/NAIP/Missouri_2014_1m/ImageServer
Nebraska	2014	http://gis.apfo.usda.gov/arcgis/services/NAIP/Nebraska_2014_1m/ImageServer
South Dakota	2014	http://gis.apfo.usda.gov/arcgis/services/NAIP/South_Dakota_2014_1m/ImageServer
Wisconsin	2015	http://gis.apfo.usda.gov/arcgis/services/NAIP/Wisconsin_2015_1m/ImageServer

Appendix D: Data Folder Naming Convention

The data folders used for the Iowa 1:24,000 map series and 1:6,000 mapbooks use the geography of the data as part of the naming convention. For example, city, county and Iowa are used in the folder name, where Iowa indicates a statewide data layer. National datasets are indicated with the “US_” prefix or agency prefix (such as “USGS_”).



Appendix E: MXD Folder Organization Convention