Natural Resources Conservation Service

United States Department of Agriculture

Gridded Soil Survey Geographic (gSSURGO) Database

User Guide

Version 1.1
April 2014
National Soil Survey Center
National Geospatial Center of Excellence

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Introduction

Gridded SSURGO (gSSURGO) is similar to the standard product from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database, but is in the Environmental Systems Research Institute, Inc. (ESRI®) file geodatabase format. A file geodatabase has the capacity to store significantly more data and thus greater spatial extents than the traditional SSURGO product. This allows for statewide or even Conterminous United States (CONUS) tiling of data. gSSURGO contains all of the original soil attribute tables in SSURGO. All spatial data are stored within the geodatabase instead of externally as separate shape files. Both SSURGO and gSSURGO are considered products of the National Cooperative Soil Survey (NCSS).

An important addition to the new format is a 10-meter raster (MapunitRaster_10m) of the map unit soil polygons feature class, which provides statewide coverage in a single layer. This new addition provides greater performance and important analysis capabilities to users of soils data. Statewide tiles consist of soil survey areas needed to provide full coverage for a given State. In order to create a true statewide soils layer, some clipping of excess soil survey area gSSURGO data may be required. The new format also includes a national Value Added Look Up (valu) Table database that has several new "ready to map" attributes.

Along with these important advantages, the gSSURGO format has a few disadvantages:

- File geodatabases such as gSSURGO are NOT compatible with the NRCS Soil Data Viewer application.
- The file geodatabase format supports a limited subset of the standard query language (SQL) that the Microsoft® Access® database format or Microsoft® SQL Server® uses.
- Unlike vector layers, the geodatabase is unable to store permanent table relates for raster layers.

Official Release of SSURGO/gSSURGO Data and Update Exceptions

The SSURGO data, available to the public on either the USDA-NRCS Geospatial Data Gateway (GDG) or USDA-NRCS Web Soil Survey (WSS), are updated or refreshed annually. The annual refresh normally occurs around October 1, which is the start of the Federal Government's fiscal year.

There can be exceptions to this once-a-year update when:

- A significant error is found in the data, or
- New data becomes available for an area that has not had coverage in the past.

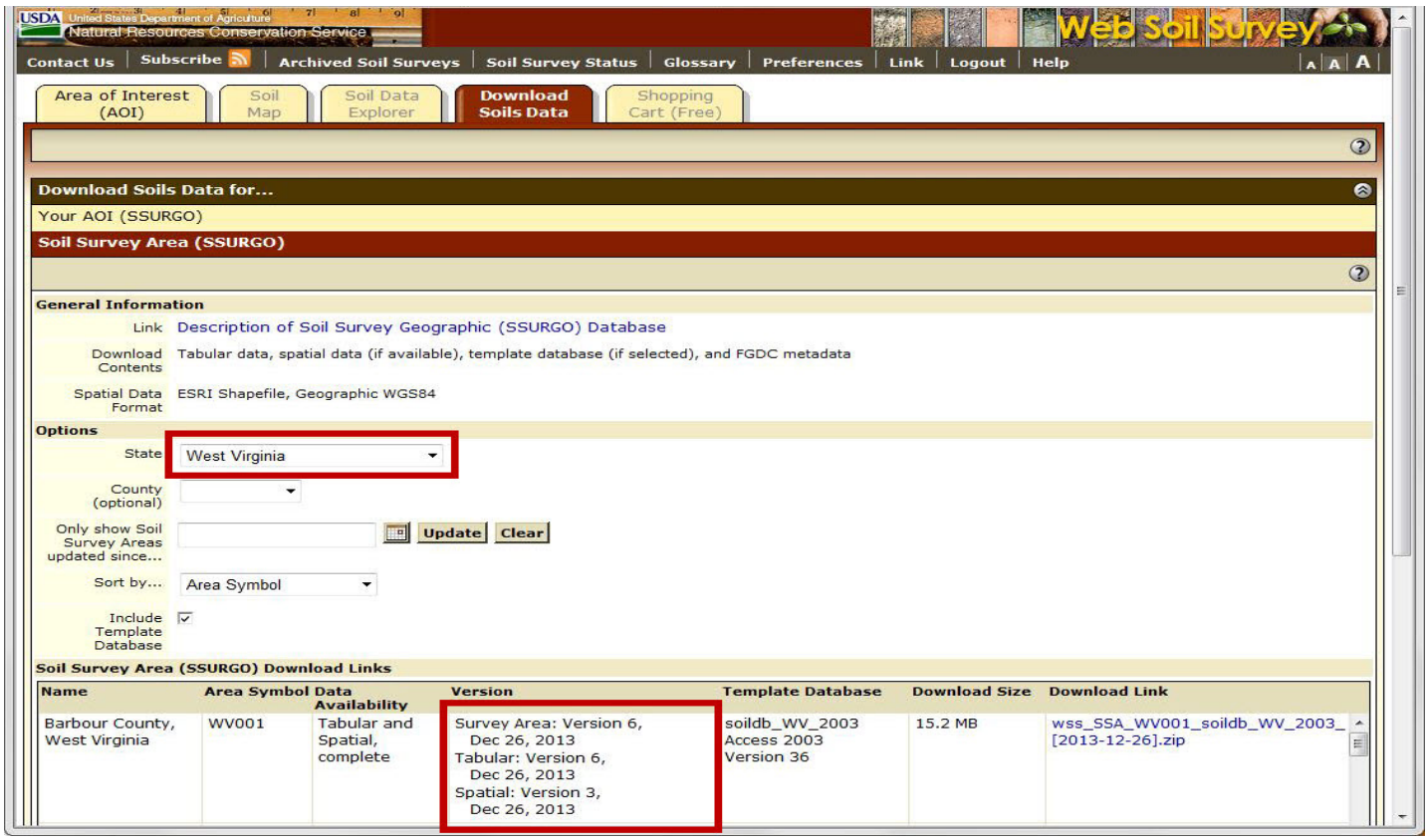
The corrected or new data will be incorporated into the vector SSURGO data available from the Geospatial Data Gateway or Web Soil Survey. However, the gSSURGO data will NOT be updated. gSSURGO, available from the GDG, is created just once each fiscal year based on the October refresh.

How to Verify SSURGO and gSSURGO Data Creation Dates

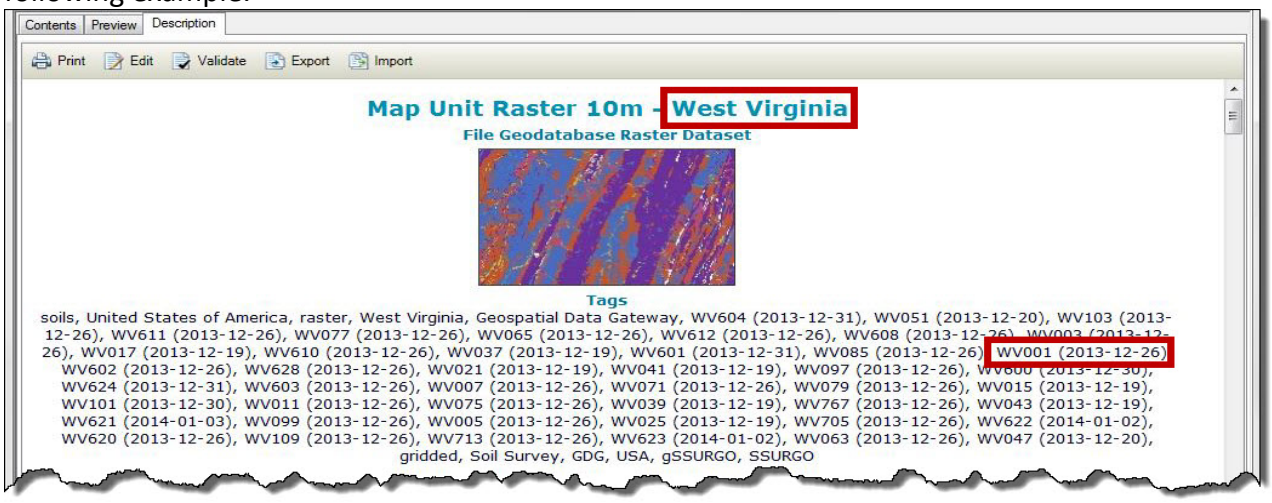
There are several ways to compare the date of the soils data in gSSURGO with the date of the SSURGO vector data:

1. View the Web Soil Survey Download Soils Data page.

   List all the data for a State.



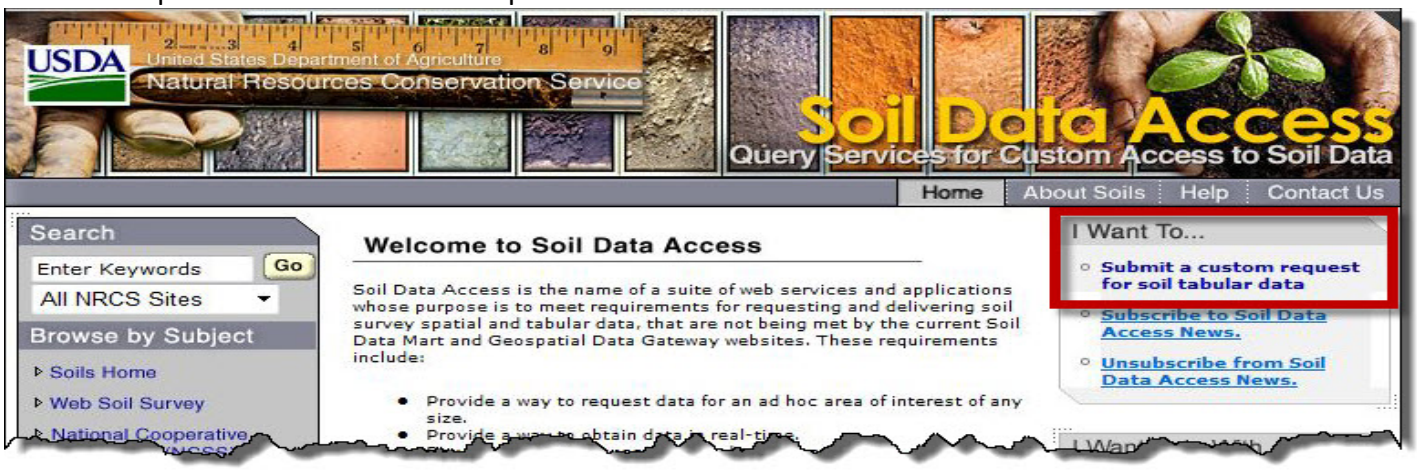
The individual survey dates from Web Soil Survey can be compared with the gSSURGO metadata. See following example.



For this comparison, the date of the WV001 SSURGO data is “Dec 26, 2013” and the date of the WV001 gSSURGO data is “2013-12-26.” The same data exists in both SSURGO and gSSURGO.

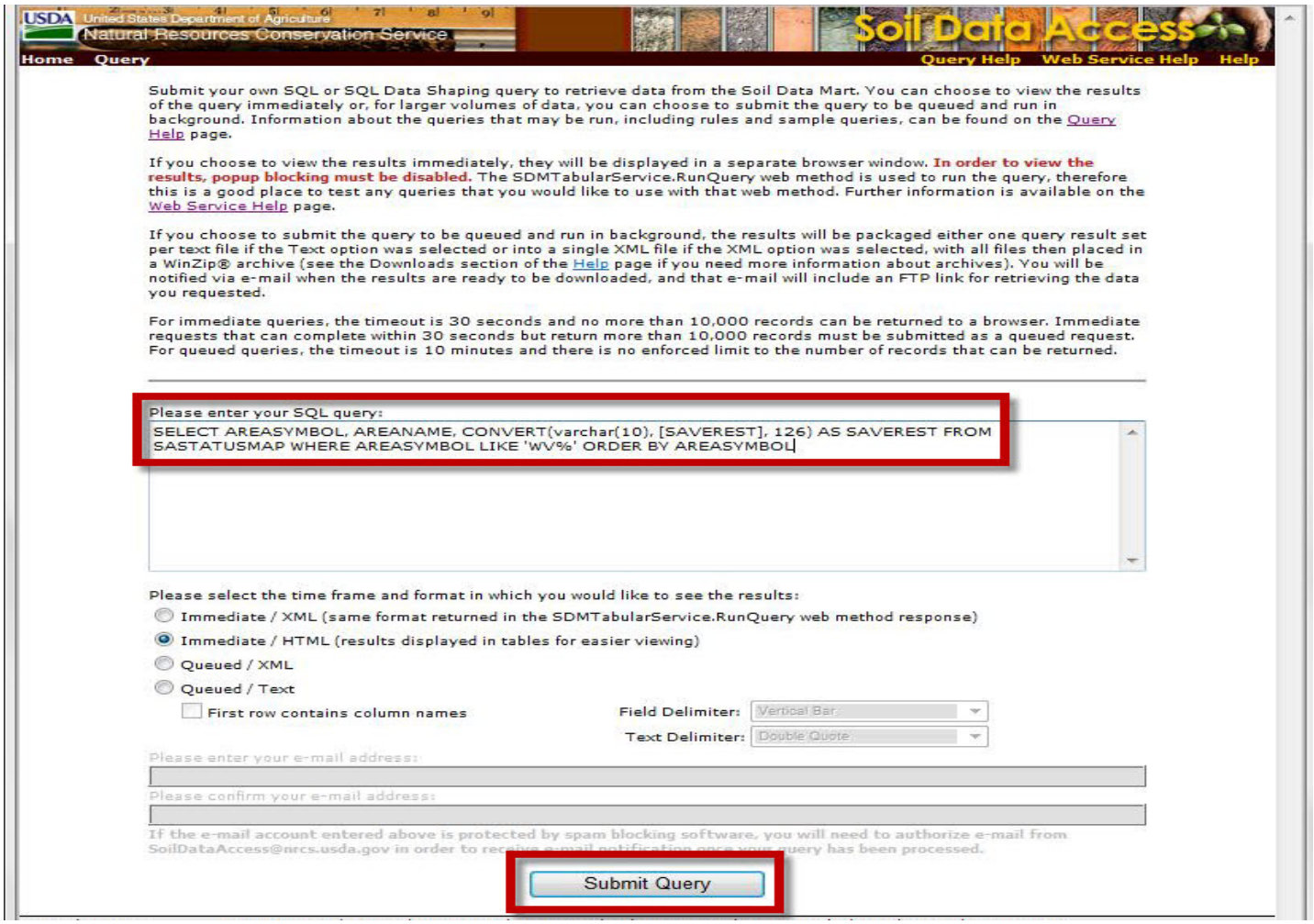
2. Query the Soil Data Access service at http://sdmdataaccess.nrcs.usda.gov/.

Select the option “Submit a custom request for soil tabular data.”

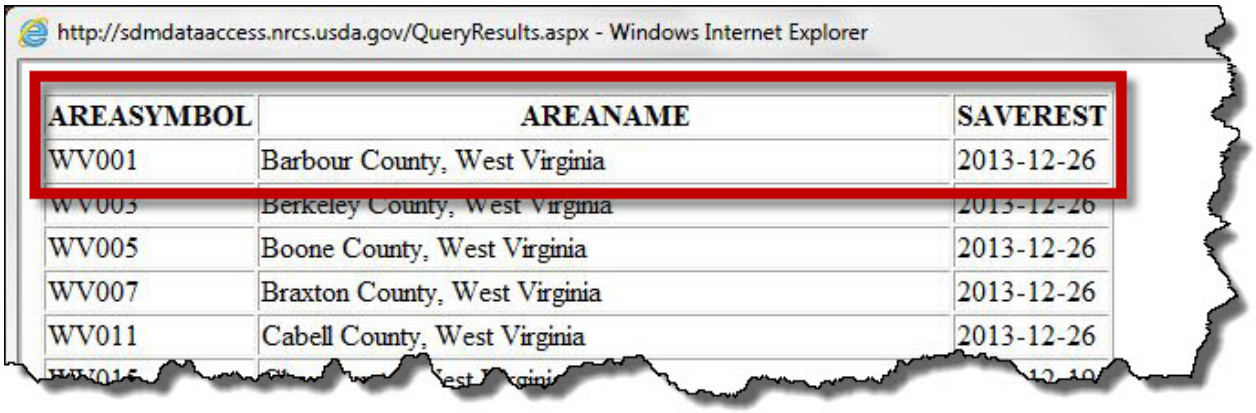


Input the following query and select “Submit Query”:

SELECT AREASYMBOL, AREANAME, CONVERT(varchar(10), [SAVEREST], 126) AS SAVEREST FROM SASTATUSMAP WHERE AREASYMBOL LIKE 'WV%' ORDER BY AREASYMBOL



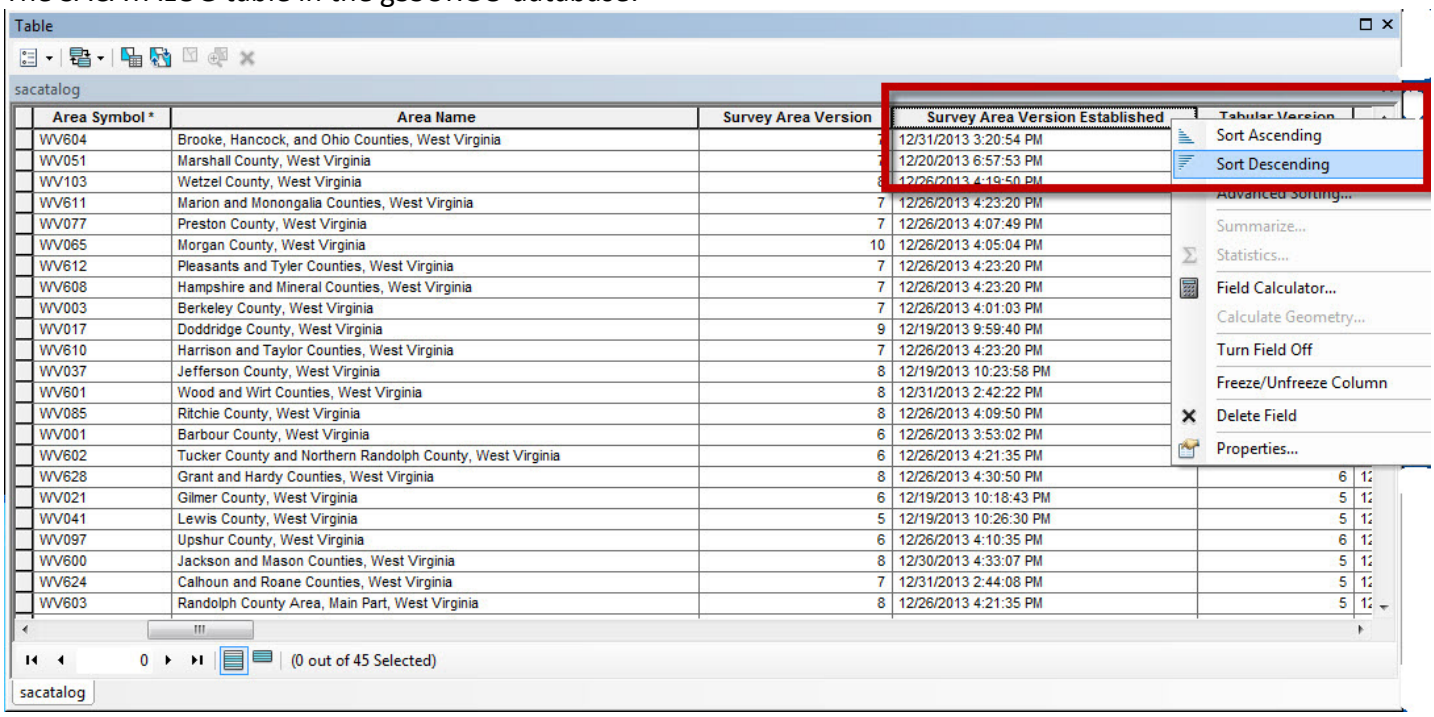
Result:



AREASYMBOL	AREANAME	SAVEREST
WV001	Barbour County, West Virginia	2013-12-26
WV003	Berkeley County, West Virginia	2013-12-26
WV005	Boone County, West Virginia	2013-12-26
WV007	Braxton County, West Virginia	2013-12-26
WV011	Cabell County, West Virginia	2013-12-26

3. Open the SACATALOG table in the gSSURGO database and sort on the SAVEREST (Survey Area Version Established) column in descending order to find the newest data.

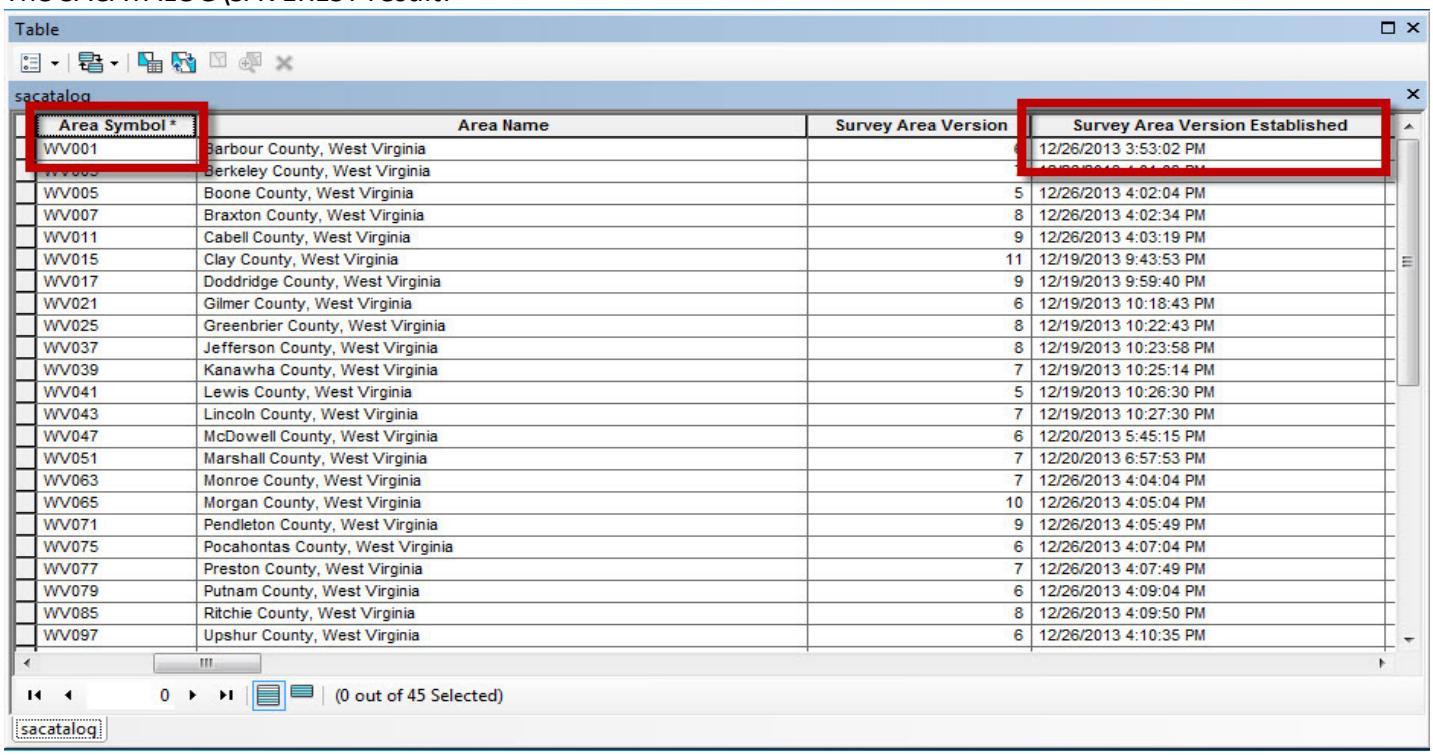
The SACATALOG table in the gSSURGO database:



Area Symbol *	Area Name	Survey Area Version	Survey Area Version Established
WV604	Brooke, Hancock, and Ohio Counties, West Virginia	7	12/31/2013 3:20:54 PM
WV051	Marshall County, West Virginia	7	12/20/2013 6:57:53 PM
WV103	Wetzel County, West Virginia	8	12/26/2013 4:19:50 PM
WV611	Marion and Monongalia Counties, West Virginia	7	12/26/2013 4:23:20 PM
WV077	Preston County, West Virginia	7	12/26/2013 4:07:49 PM
WV065	Morgan County, West Virginia	10	12/26/2013 4:05:04 PM
WV612	Pleasants and Tyler Counties, West Virginia	7	12/26/2013 4:23:20 PM
WV608	Hampshire and Mineral Counties, West Virginia	7	12/26/2013 4:23:20 PM
WV003	Berkeley County, West Virginia	7	12/26/2013 4:01:03 PM
WV017	Doddridge County, West Virginia	9	12/19/2013 9:59:40 PM
WV610	Harrison and Taylor Counties, West Virginia	7	12/26/2013 4:23:20 PM
WV037	Jefferson County, West Virginia	8	12/19/2013 10:23:58 PM
WV601	Wood and Wirt Counties, West Virginia	8	12/31/2013 2:42:22 PM
WV085	Ritchie County, West Virginia	8	12/26/2013 4:09:50 PM
WV001	Barbour County, West Virginia	6	12/26/2013 3:53:02 PM
WV602	Tucker County and Northern Randolph County, West Virginia	6	12/26/2013 4:21:35 PM
WV628	Grant and Hardy Counties, West Virginia	8	12/26/2013 4:30:50 PM
WV021	Gilmer County, West Virginia	6	12/19/2013 10:18:43 PM
WV041	Lewis County, West Virginia	5	12/19/2013 10:26:30 PM
WV097	Upshur County, West Virginia	6	12/26/2013 4:10:35 PM
WV600	Jackson and Mason Counties, West Virginia	8	12/30/2013 4:33:07 PM
WV624	Calhoun and Roane Counties, West Virginia	7	12/31/2013 2:44:08 PM
WV603	Randolph County Area, Main Part, West Virginia	8	12/26/2013 4:21:35 PM

The Survey Area Version dates listed on the Web Soil Survey Download Soils Data page come from the SACATALOG\SAVEREST column.

The SACATALOG\SAVEREST result:



Table

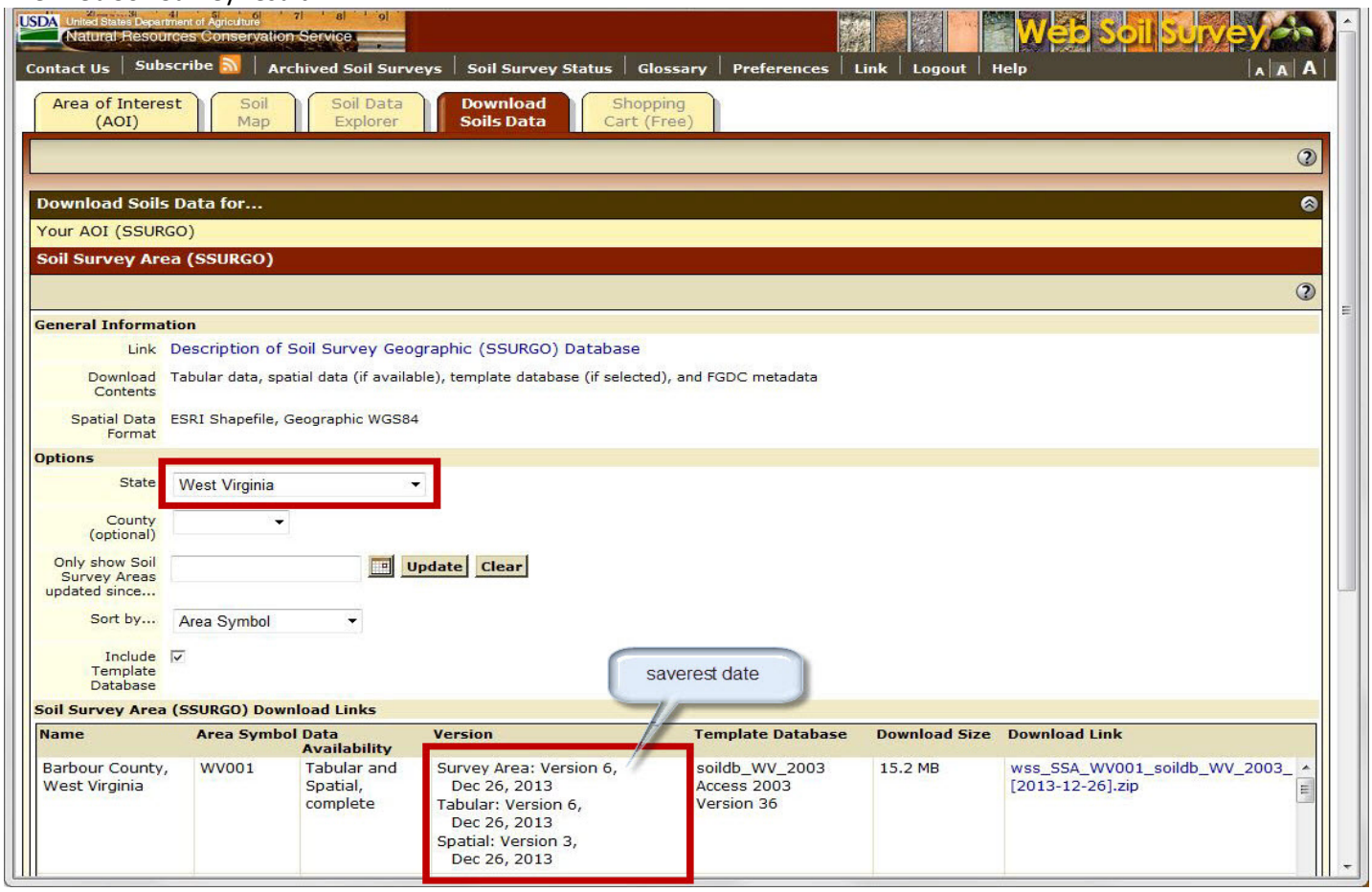
sacatalog

Area Symbol *	Area Name	Survey Area Version	Survey Area Version Established
WV001	Barbour County, West Virginia	6	12/26/2013 3:53:02 PM
[illegible]	Berkeley County, West Virginia	[illegible]	[illegible]
WV005	Boone County, West Virginia	5	12/26/2013 4:02:04 PM
WV007	Braxton County, West Virginia	8	12/26/2013 4:02:34 PM
WV011	Cabell County, West Virginia	9	12/26/2013 4:03:19 PM
WV015	Clay County, West Virginia	11	12/19/2013 9:43:53 PM
WV017	Doddridge County, West Virginia	9	12/19/2013 9:59:40 PM
WV021	Gilmer County, West Virginia	6	12/19/2013 10:18:43 PM
WV025	Greenbrier County, West Virginia	8	12/19/2013 10:22:43 PM
WV037	Jefferson County, West Virginia	8	12/19/2013 10:23:58 PM
WV039	Kanawha County, West Virginia	7	12/19/2013 10:25:14 PM
WV041	Lewis County, West Virginia	5	12/19/2013 10:26:30 PM
WV043	Lincoln County, West Virginia	7	12/19/2013 10:27:30 PM
WV047	McDowell County, West Virginia	6	12/20/2013 5:45:15 PM
WV051	Marshall County, West Virginia	7	12/20/2013 6:57:53 PM
WV063	Monroe County, West Virginia	7	12/26/2013 4:04:04 PM
WV065	Morgan County, West Virginia	10	12/26/2013 4:05:04 PM
WV071	Pendleton County, West Virginia	9	12/26/2013 4:05:49 PM
WV075	Pocahontas County, West Virginia	6	12/26/2013 4:07:04 PM
WV077	Preston County, West Virginia	7	12/26/2013 4:07:49 PM
WV079	Putnam County, West Virginia	6	12/26/2013 4:09:04 PM
WV085	Ritchie County, West Virginia	8	12/26/2013 4:09:50 PM
WV097	Upshur County, West Virginia	6	12/26/2013 4:10:35 PM

0 (0 out of 45 Selected)

sacatalog

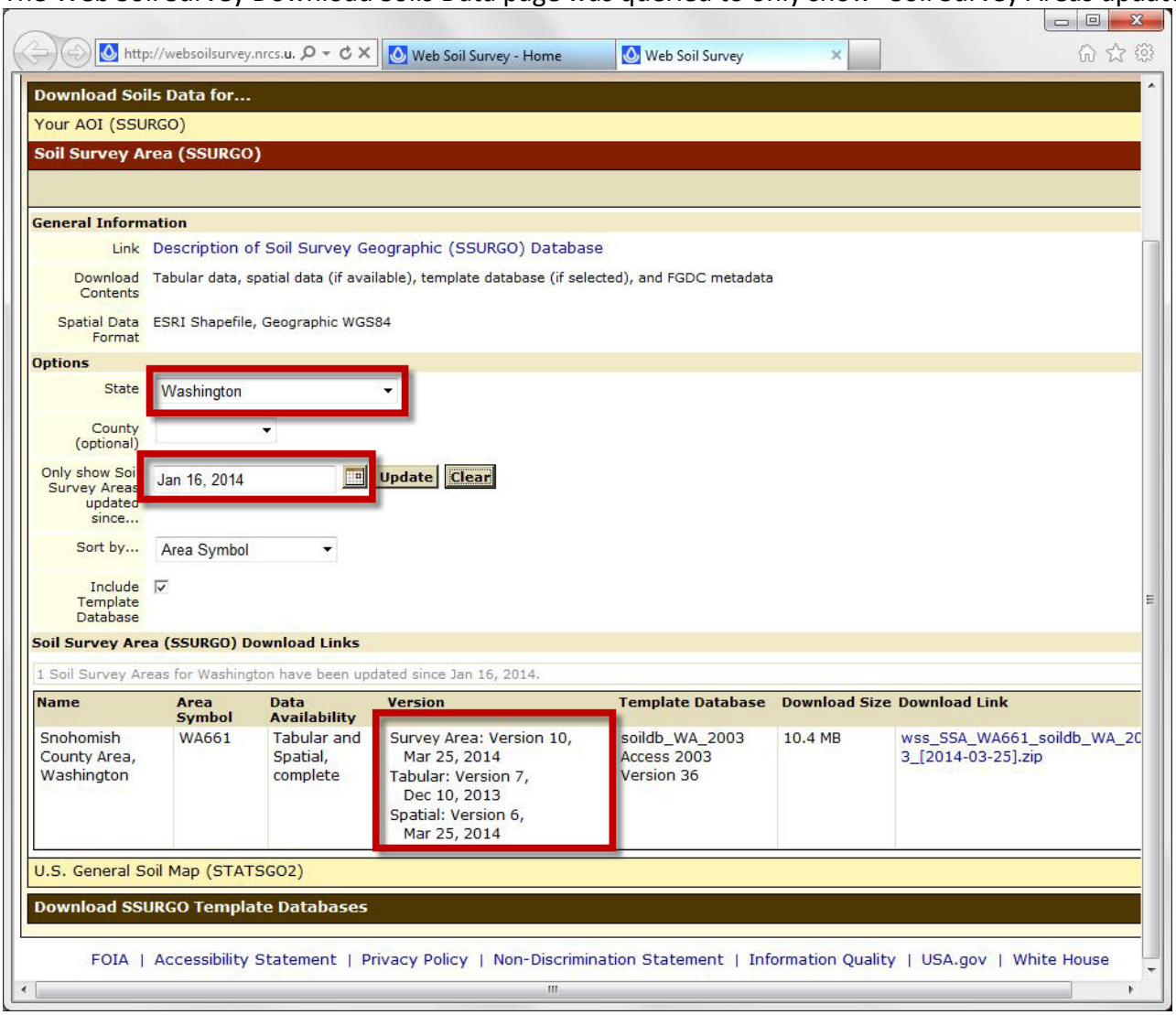
The Web Soil Survey result:



Example of Verifying Dates of SSURGO and gSSURGO Data

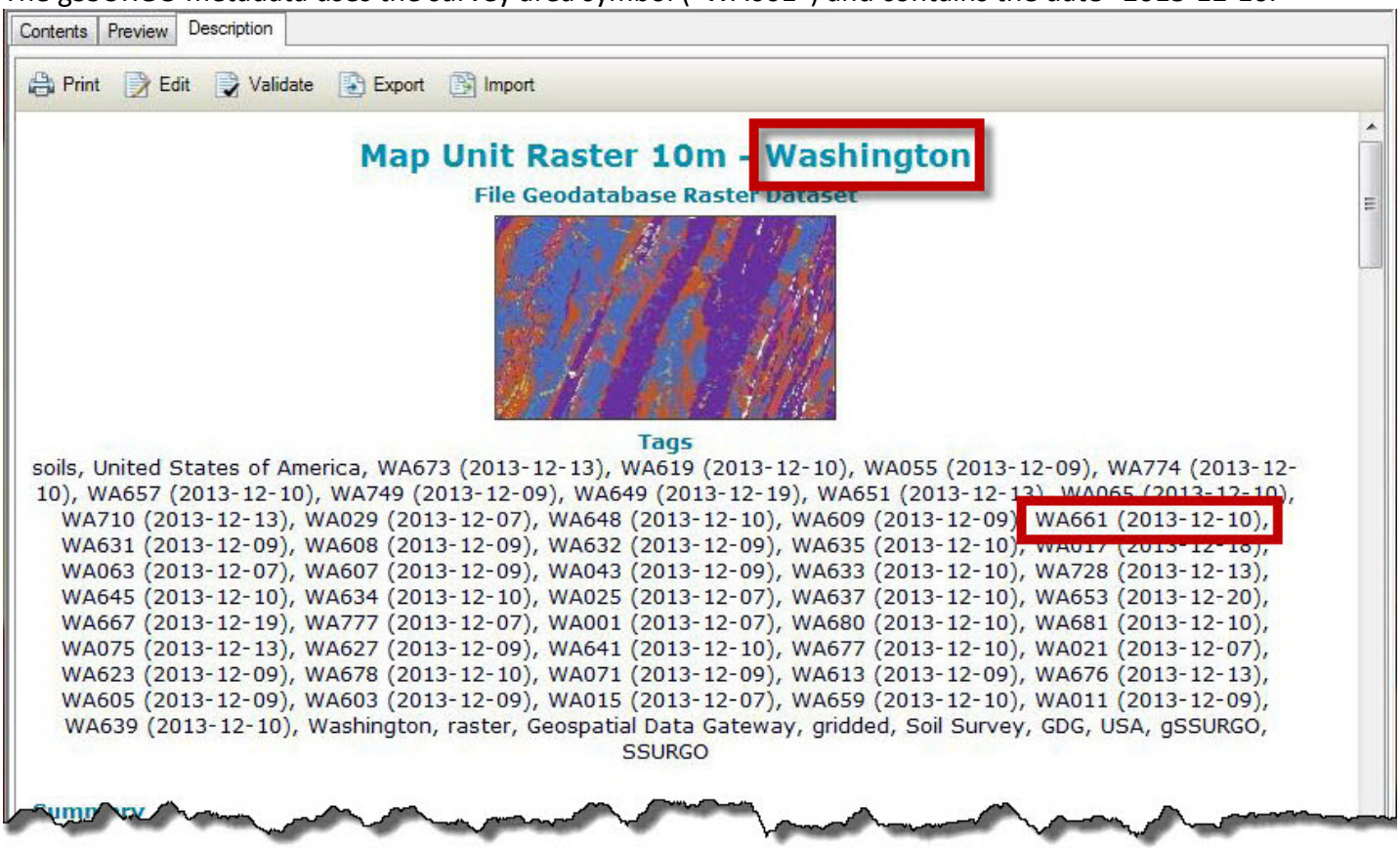
The Washington gSSURGO data were downloaded from the Geospatial Data Gateway. The data were created from the January 15, 2014 refresh of the SSURGO data. Has any of the individual Washington SSURGO data been updated since January 15?

The Web Soil Survey Download Soils Data page was queried to only show "Soil Survey Areas updated since…"



The Snohomish County Area, Washington (WA661) survey has been updated from the January 15, 2014 refresh. The survey area version date of March 25, 2014 can be compared to the Washington gSSURGO metadata.

The gSSURGO metadata uses the survey area symbol (“WA661”) and contains the date “2013-12-10.”

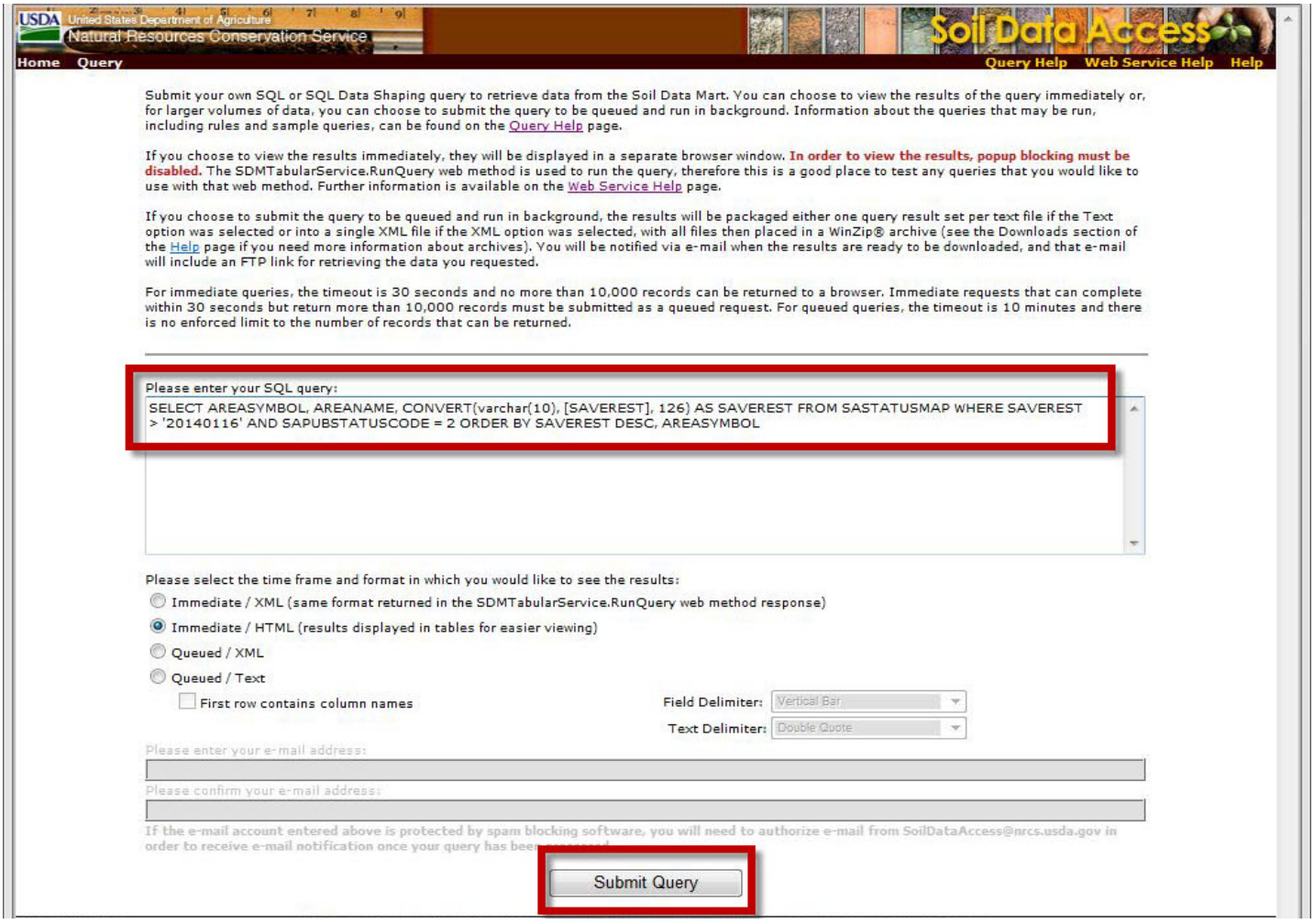


Query the Soil Data Access service at http://sdmdataaccess.nrcs.usda.gov/.

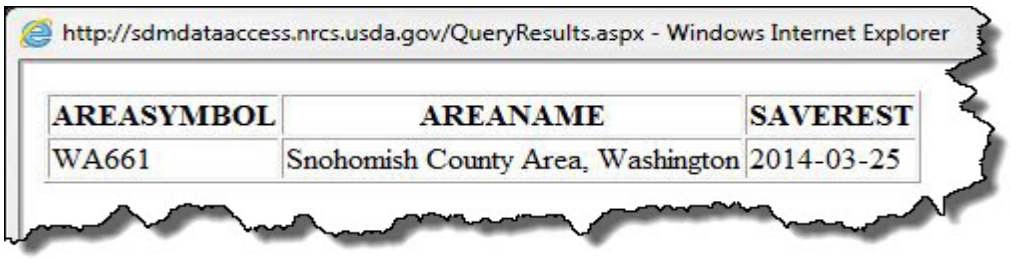
Select “Submit a custom request for soil tabular data.”

Input the following query and select “Submit Query”:

SELECT AREASYMBOL, AREANAME, CONVERT(varchar(10), [SAVEREST], 126) AS SAVEREST FROM SASTATUSMAP WHERE SAVEREST > '20140116' AND SAPUBSTATUSCODE = 2 ORDER BY SAVEREST DESC, AREASYMBOL



Result:



The SSURGO data have been updated. The gSSURGO data still contain the previous, or older, data. The gSSURGO product, available from the NRCS Geospatial Data Gateway will be updated during the annual refresh. A consumer of the SSURGO data can update their copy at any time with a new download.

Obtaining gSSURGO Data

gSSURGO can be obtained as one or more statewide tiles via free download from the USDA-NRCS Geospatial Data Gateway (GDG) website located at http://datagateway.nrcs.usda.gov/. Depending on file size, the data may also be available on CD-ROM or DVD. The cost for a single CD-ROM is $50; the cost for a single DVD is $100.

The conterminous U.S. and/or national collection of gSSURGO data can be obtained by contacting the USDA-NRCS National Geospatial Center of Excellence (NGCE) representative Rosemary Rivera (rosemary.rivera@ftw.usda.gov) or by phoning (817) 509-3371. The cost for this service is $250. The customer provides the external storage device and also pays shipping costs.

NOTE: All gSSURGO User Guide example processes shown in figures and screenshots were prepared using ESRI® ArcGIS™ 10.1 software in a Microsoft® Windows® 7 operating system.

Raster Data Defined

Unlike feature layers which are made up of points, lines, or polygons, raster data is a cell-based matrix organized into rows and columns. Raster data typically possess a uniform cell size along the X and Y axes. Each cell represents a specific value (Figure 1). In the gSSURGO raster, cell values are represented by integer values, which in turn relate to the MUKEY (map unit key) for a soil map unit. Along with the original cell value, the attribute table also contains a MUKEY column.

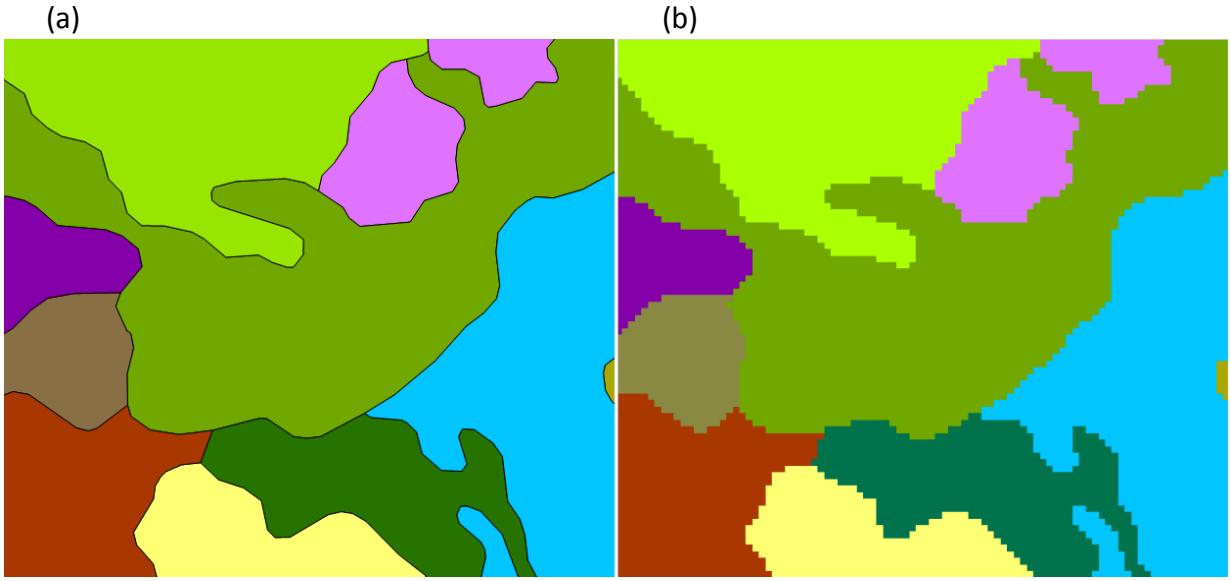


Figure 1.—(a) An example of the traditional vector-based SSURGO map unit polygon format at 1:6,000 map scale; (b) the corresponding new raster-based Gridded SSURGO (gSSURGO) 10-meter map unit format.

Raster Format Advantages

The raster format offers significant advantages over the traditional polygon format when creating maps or performing analyses on a national, statewide, watershed, or regional basis. Map display time and geoprocessing overlay operations are enhanced 15 or 20 times. In addition, many other physical layers used in conjunction with soils data by modelers are commonly in raster format. Examples include land cover, land use, elevation, slope, and climate. Traditionally, raster was not the preferred format due to greater storage requirements. The availability of increased hard drive capacity has minimized this issue.

Raster Specifications

MapunitRaster_10m is the name of the standard file geodatabase raster contained within gSSURGO. It was created by converting the MUPOLYGON feature class to raster format using an Albers Equal Area projection. In order to facilitate analysis based upon areal calculations, a similar Albers Equal Area Conic coordinate system (meters) was selected for each geodatabase. Puerto Rico, the U.S. Virgin Islands, and the lower 48 States share in common the USA Contiguous Albers Equal Area Conic USGS version coordinate system with a horizontal datum of NAD 1983. Alaska, Hawaii, American Samoa, and the Pacific Islands Area each use a different variation of Albers Equal Area Conic coordinate system and a horizontal datum of WGS 1984.

During the conversion process, the output raster cell size is set to 10 meters and snapped to the United States Geological Survey (USGS) National Land Cover Database (NLCD 2006) 30-meter raster. This resolution was chosen to maintain the shape and extent of the original polygons without sacrificing display performance.

This resolution also enhances alignment to other raster layers, including the National Land Cover Database (NLCD) and the USDA National Agricultural Statistical Service (NASS) Cropland Data Layer (CDL). The example in Figure 1(b) exhibits moderate pixilation when compared to the vector in Figure 1(a) because it is being displayed at three times the original digitizing map scale (for illustrative purposes).

Associated Tables in the gSSURGO Database

A complete description of the tables and their relationships is included on the SSURGO webpage. Some of the commonly used tables are described below. Specific information is located in the SSURGO Tables and Columns Report document found on the SSURGO Structural Metadata and Documentation webpage.

- Mapunit – Includes soil map unit name and prime farmland designation. Uses MUKEY as the join field with spatial data.
- Muaggatt – Includes common soil interpretations for map units. Uses MUKEY as the join field with spatial data.
- Component – Includes interpretations and properties for components of map units. Use of this table requires a relate since there are several records in this table for each single MUKEY in the raster data.
- Chorizon – Includes data by horizon for components. Use of this table requires a relate since there are several records in this table for each single MUKEY in the raster data.

National Value Added Look Up (valu) Table Database

The National Value Added Look Up (valu) Table database is designed to facilitate thematic mapping for several important soil properties and interpretations. The valu1 table within this database is a compilation of 57 pre-summarized or "ready to map" attributes derived from the soil survey geographic database, including:

- Soil organic carbon
- Available water storage
- Crop productivity indices
- Crop root zone depths
- Available water storage within crop root zone depths
- Drought-vulnerable soil landscapes
- Potential wetland soil landscapes

Because this table is national in extent, it can be used in conjunction with any gSSURGO product of the same vintage. Related metadata values for themes are included (Figure 2). Table level metadata for specific column definitions are available in the Appendix.

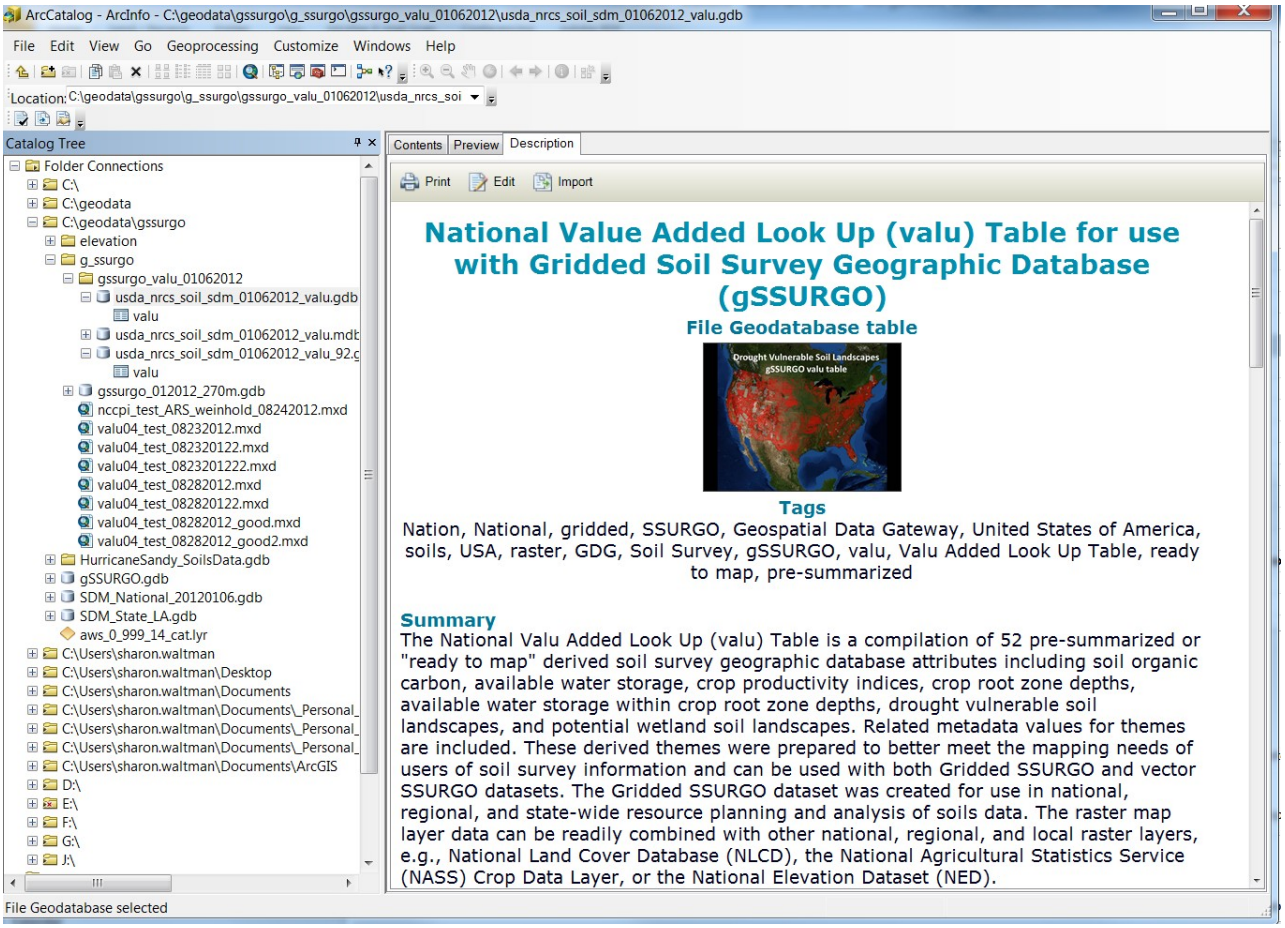


Figure 2.—Screenshot of valu table database metadata shown in ArcCatalog™.

These attribute data are pre-summarized to the map unit level using best practice generalization methods intended to meet the needs of most users. The generalization methods include map unit component weighted averages and percent of the map unit meeting a given criteria. These themes were prepared to better meet the mapping needs of users of soil survey information and can be used with both SSURGO and gSSURGO datasets. The valu1 table contains data for all areas where SSURGO coverage exists.

Please note that some available water storage values in the valu1 table differ from similar calculations viewed in Web Soil Survey. These differences are due to the choice of method used to summarize horizon and component level data. Columns in the valu1 table for available water storage and soil organic carbon were created using strict rules for excluding map unit or component records with missing horizon information or with logical inconsistencies in component percent or horizon depth. Please review the valu table database metadata for greater detail about the valu table summary methods.

Soil Organic Carbon (SOC)

The map unit average soil organic carbon values are given in units of grams carbon per square meter for 11 standard layer or zone depths. Table column names begin with "soc." The average thickness of soil map unit component horizons used in these layer/zone calculations is also included. The standard layers include the following depth ranges:

- 0-5cm
- 5-20cm
- 20-50cm
- 50-100cm
- 100-150cm
- 150-150+cm (maximum reported soil depth)

The standard zones include:

- 0-5cm (also a standard layer)
- 0-20cm
- 0-30cm
- 0-100cm
- 0-150cm
- 0-150+cm (full reported soil depth)

Available Water Storage (AWS)

The map unit average available water storage values are given in units of millimeters for 11 standard layer or zone depths. Table column names begin with "aws." The average thickness of soil map unit component horizons used in these layer/zone calculations is also included. See the information above on soil organic carbon for a list of standard layers and zones.

National Commodity Crop Productivity Index (NCCPI)

The map unit average National Commodity Crop Productivity Index values are provided for major earthy components. (Low index values indicate low productivity, and high index values indicate high productivity.) Table column names begin with "nccpi." NCCPI values are included for corn/soybeans, small grains, and cotton crops. Of these crops, the highest overall NCCPI value is also identified. Earthy components are those soil series or higher level taxa components that can support crop growth. Major components are those soil components for which the MAJCOMPFLAG is "Yes" in the SSURGO component table. A map unit percent composition for earthy major components is provided (Dobos, Sinclair, Jr., and Robotham, 2012).

Crop Root Zone Depths

The map unit average root zone depth values for commodity crops are given in centimeters for major earthy components. Criteria for root-limiting soil depth include the presence of:

- Hard bedrock
- Soft bedrock
- A fragipan
- A duripan
- Sulfuric material
- A dense layer
- A layer having a pH less than 3.5
- A layer having an electrical conductivity greater than 12 decisiemens (dS) per meter within the component soil profile

If no root-restricting zone is identified, a depth of 150 centimeters is used to approximate the root zone depth (Dobos, Sinclair, Jr., and Robotham, 2012).

Available Water Storage within Crop Root Zone Depths

The value for map unit average available water storage within the root zone depth for major earthy components is given in millimeters. Table column is named "rootznaws."

Drought-Vulnerable Soil Landscapes

In the Drought-vulnerable soil landscapes column, map units are identified as either drought vulnerable (1) or not drought vulnerable (0). Drought-vulnerable soil landscape map units have 152 millimeters (6 inches) or less root zone available water storage for major components. Table column is named "droughty."

Potential Wetland Soil Landscapes

The potential wetland soil landscapes (PWSL version 1) information is given as the percentage of the map unit (all components) that meet the criteria for a potential wetland soil landscape. Table column is named "pwsl1pomu." Where water was determined to account for 80 percent or more of a map unit, a value of 999 was used to indicate a water body. This identifies a general water body class for mapping.

The map unit sum of the component percentage representative values is also provided as metadata.

For all columns in the valu1 table, "NULL" is used where data are incomplete or not available.

The valu1 table can be used to map 57 attributes. See examples in the following sections.

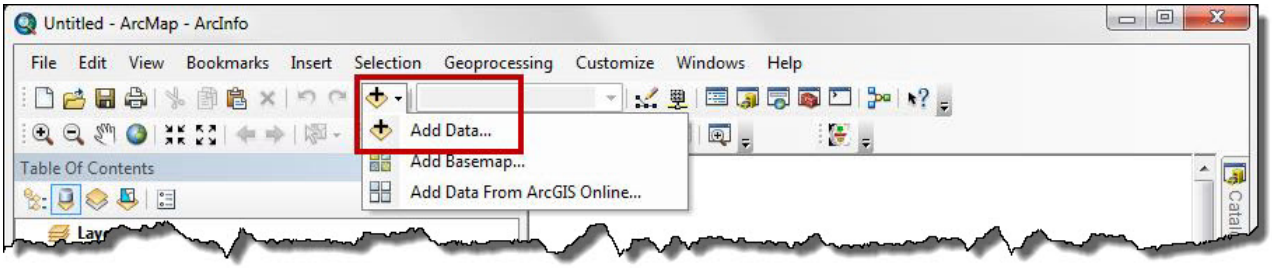
Working with the Raster Soils Layer (MapunitRaster_10m) in ArcMap™

Joining gSSURGO Data with the Muaggatt Table Using the MUKEY Field

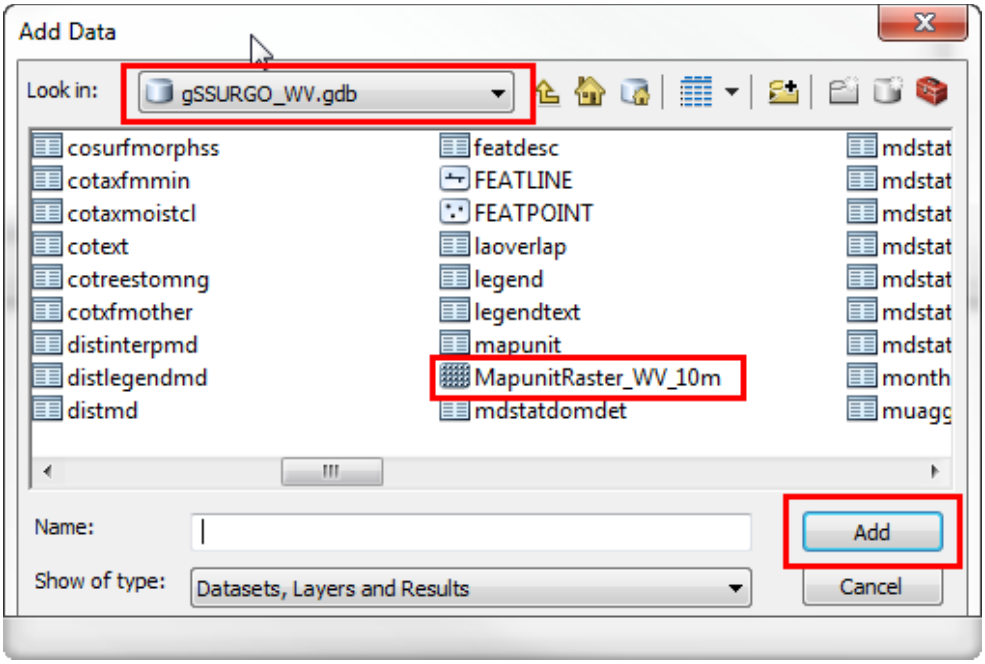
The following example shows how to join the gSSURGO spatial data to the map unit aggregated attribute (muaggatt) table using the MUKEY field.

❑ Start **ArcMap** with a new blank map.

❑ Select **Add Data…** from the drop-down menu.



❑ Choose the appropriate file geodatabase (e.g., **gSSURGO_WV.gdb**), select the raster feature class (e.g., **MapunitRaster_WV_10m**), and click on the **Add** button.



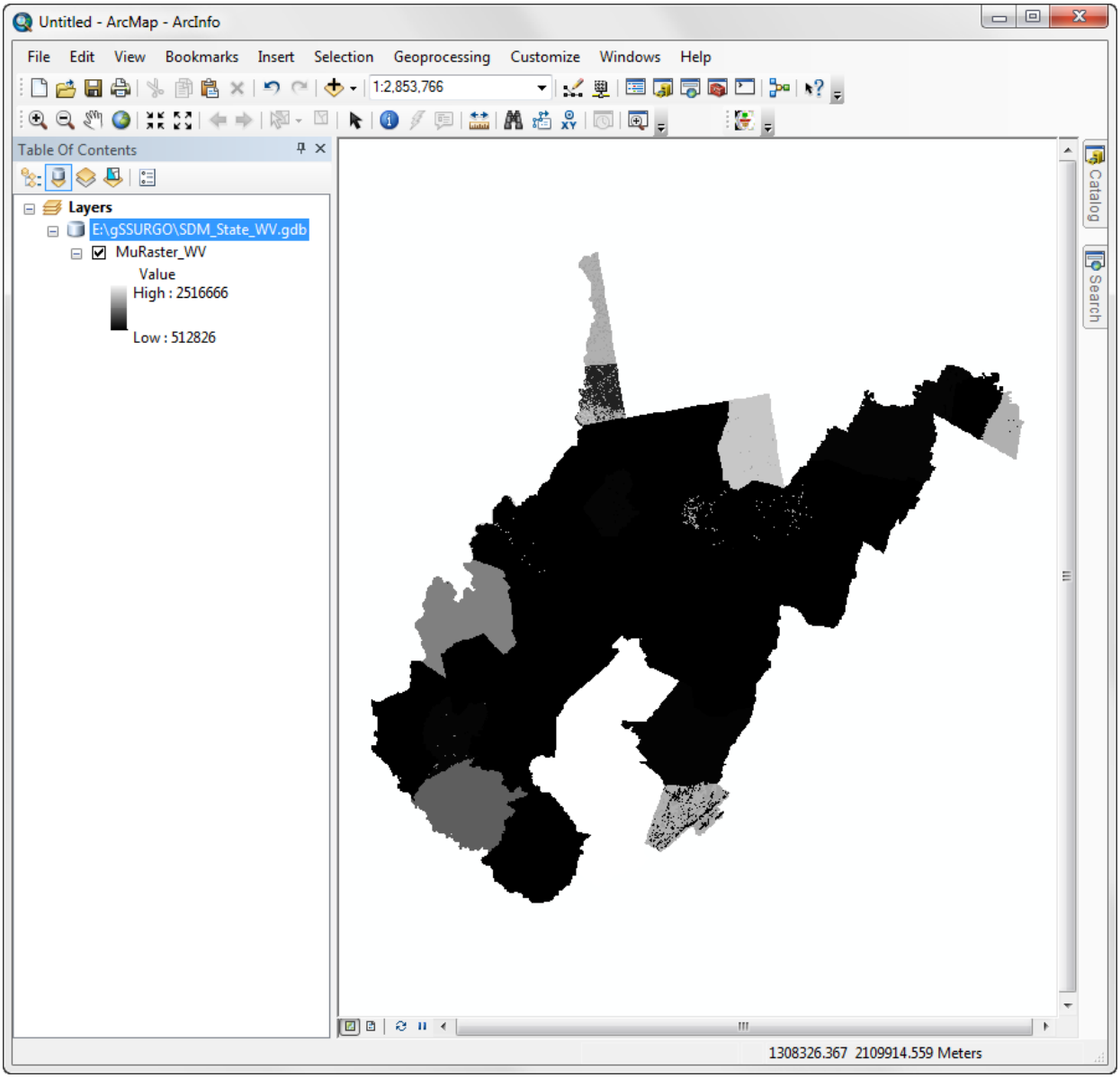
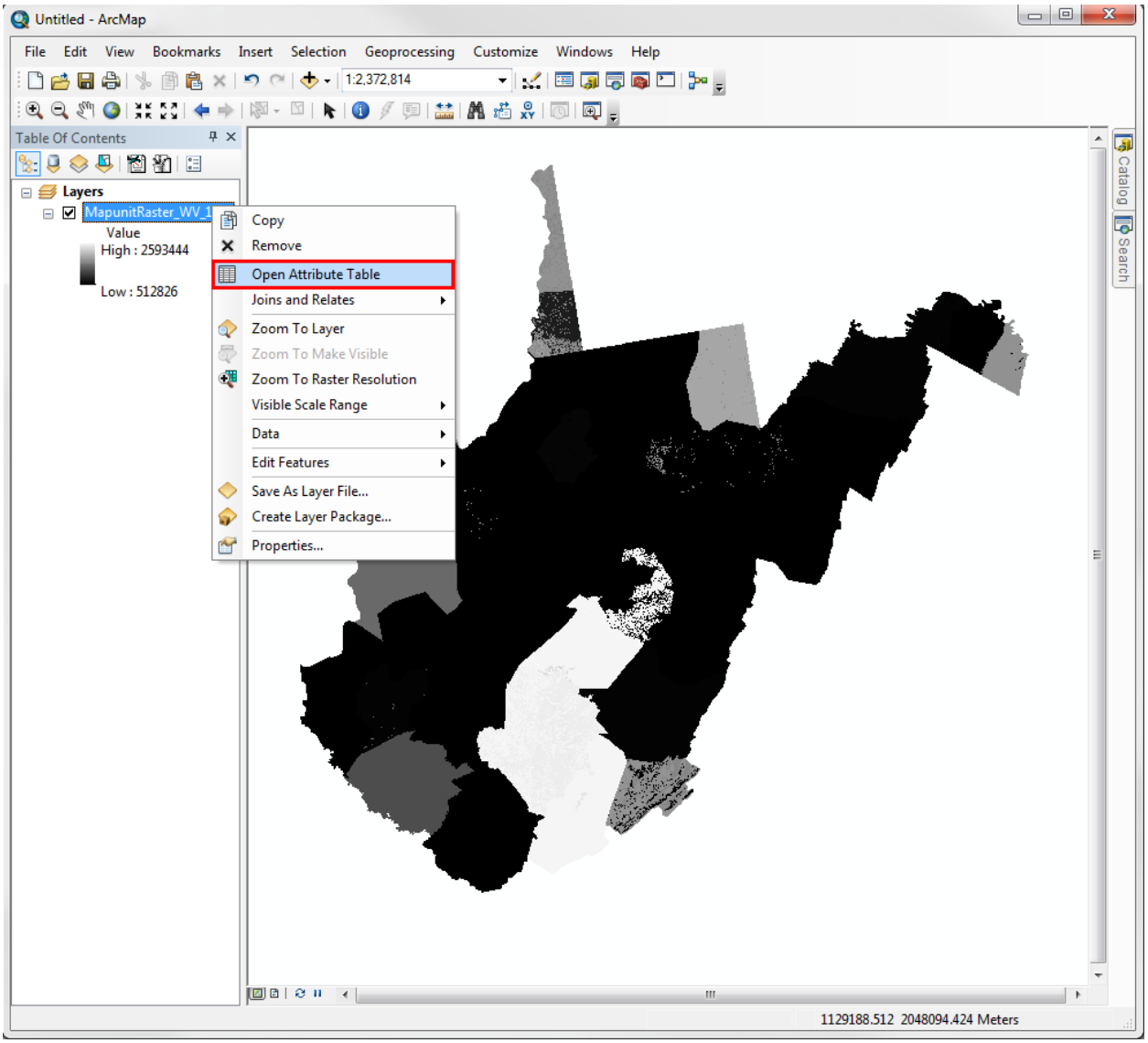


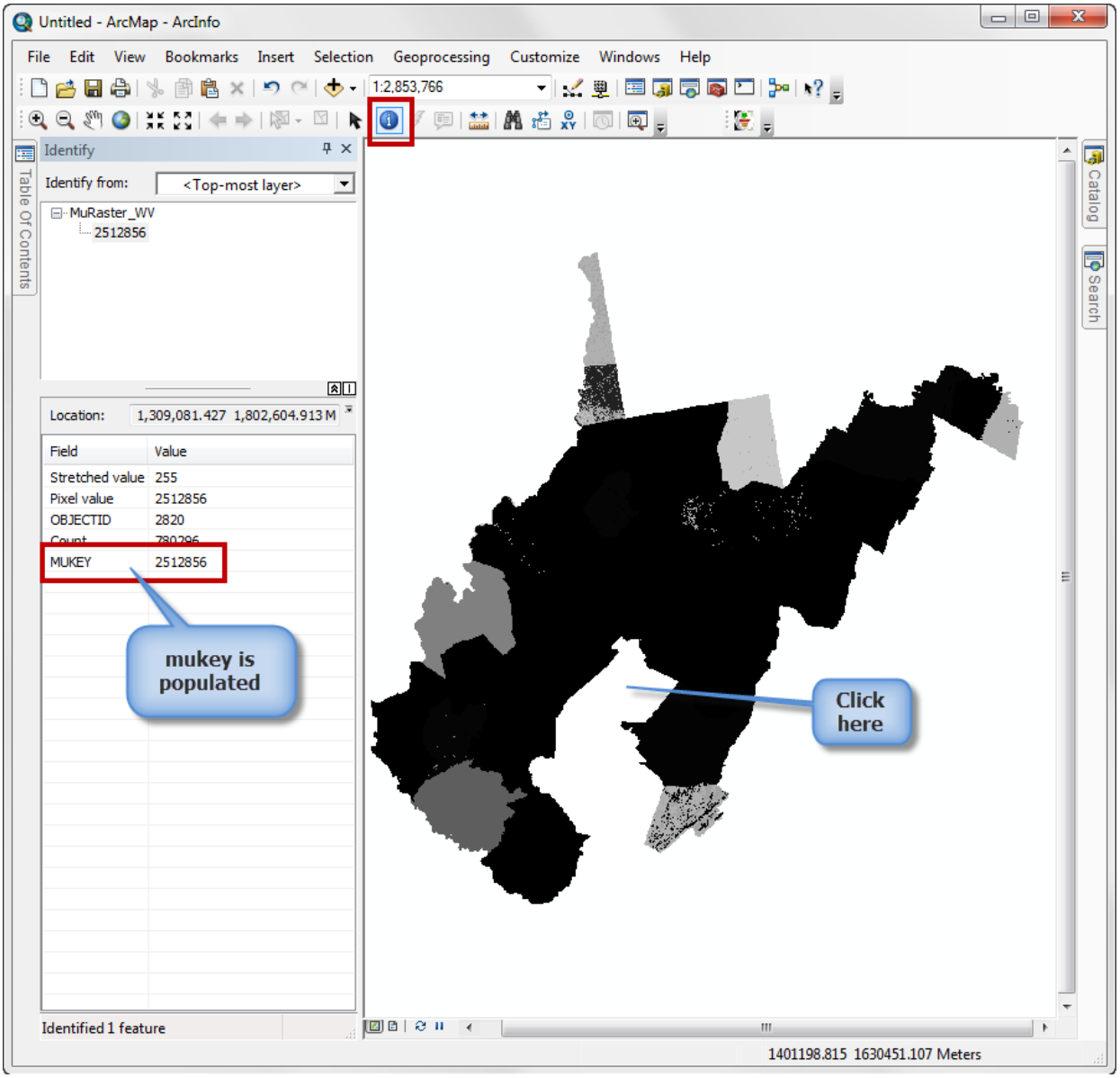
Figure 3.— By default, the raster is symbolized on the Value field using a black to white color ramp.

NOTE: In Figure 3, it may appear that several areas in the south-central part are missing or contain "No Data." This, however, is not the case. Survey areas occasionally appear blank because the stretched renderer displays these areas as white. This is due to the new MUKEY values that have a much lower range than the rest.

❑ Right-click on the raster feature class (e.g., MapunitRaster-WV_10m) and select **Open Attribute Table**.



A quick way to check for missing data is to click in the white area with the **Identify** button.



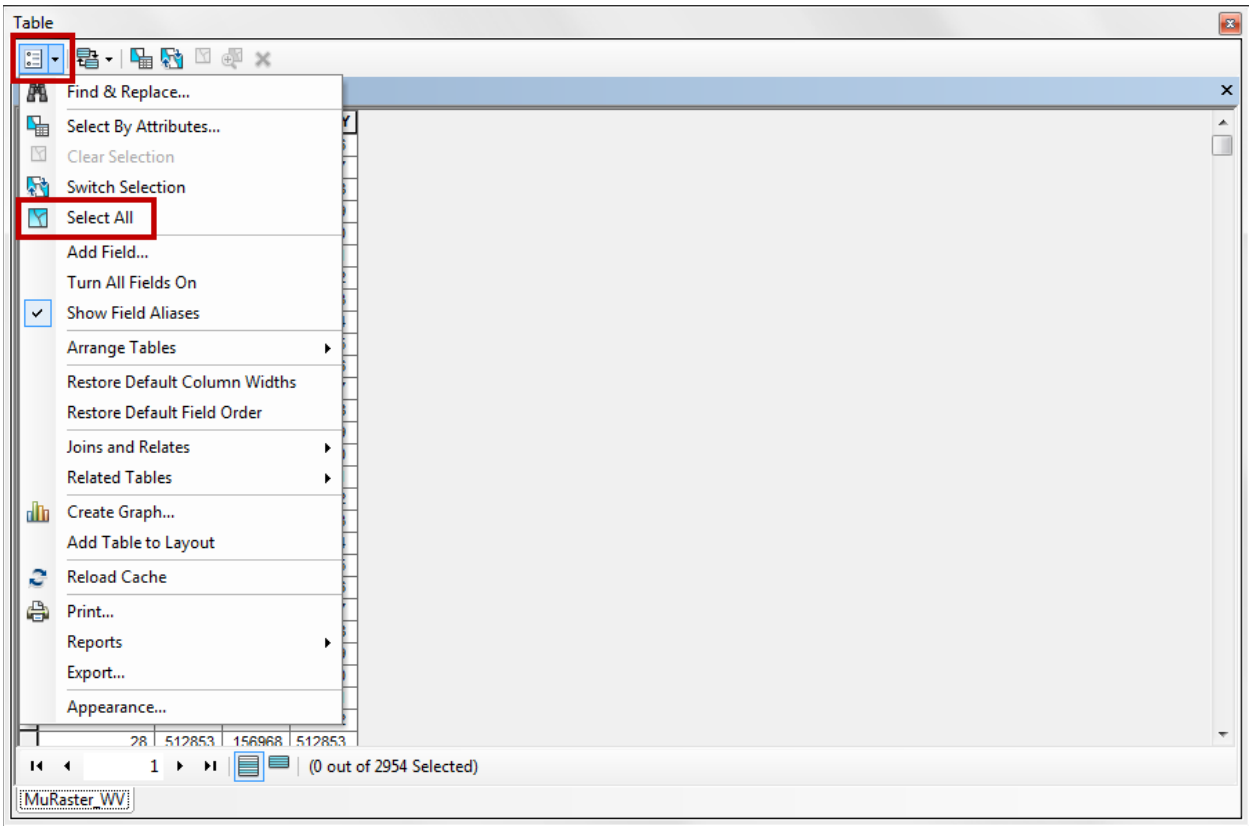
If the MUKEY field contains data, the display renders white. Where the field contains "No Data," spatial data probably does not exist.

The raster attribute table contains three default fields: OBJECTID, Value, and Count.

- **OBJECTID** uniquely identifies each row in the table.
- **Value** uniquely lists each cell value contained in the raster.
- **Count** lists the number of cells that contain the cell value.

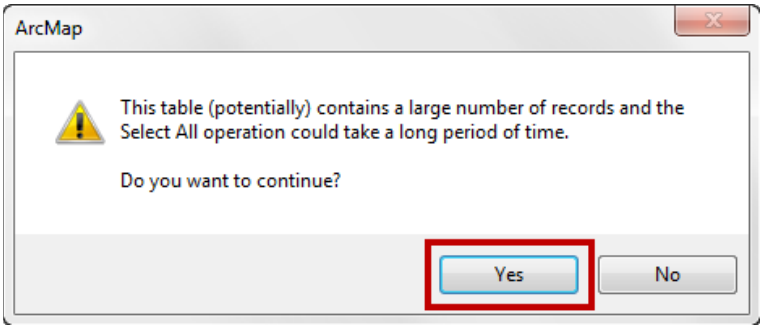
The MUKEY field (a new addition) will be used to join with other soil attribute tables containing the MUKEY column.

❑ Select the **Table Options** drop-down arrow and click on **Select All**.

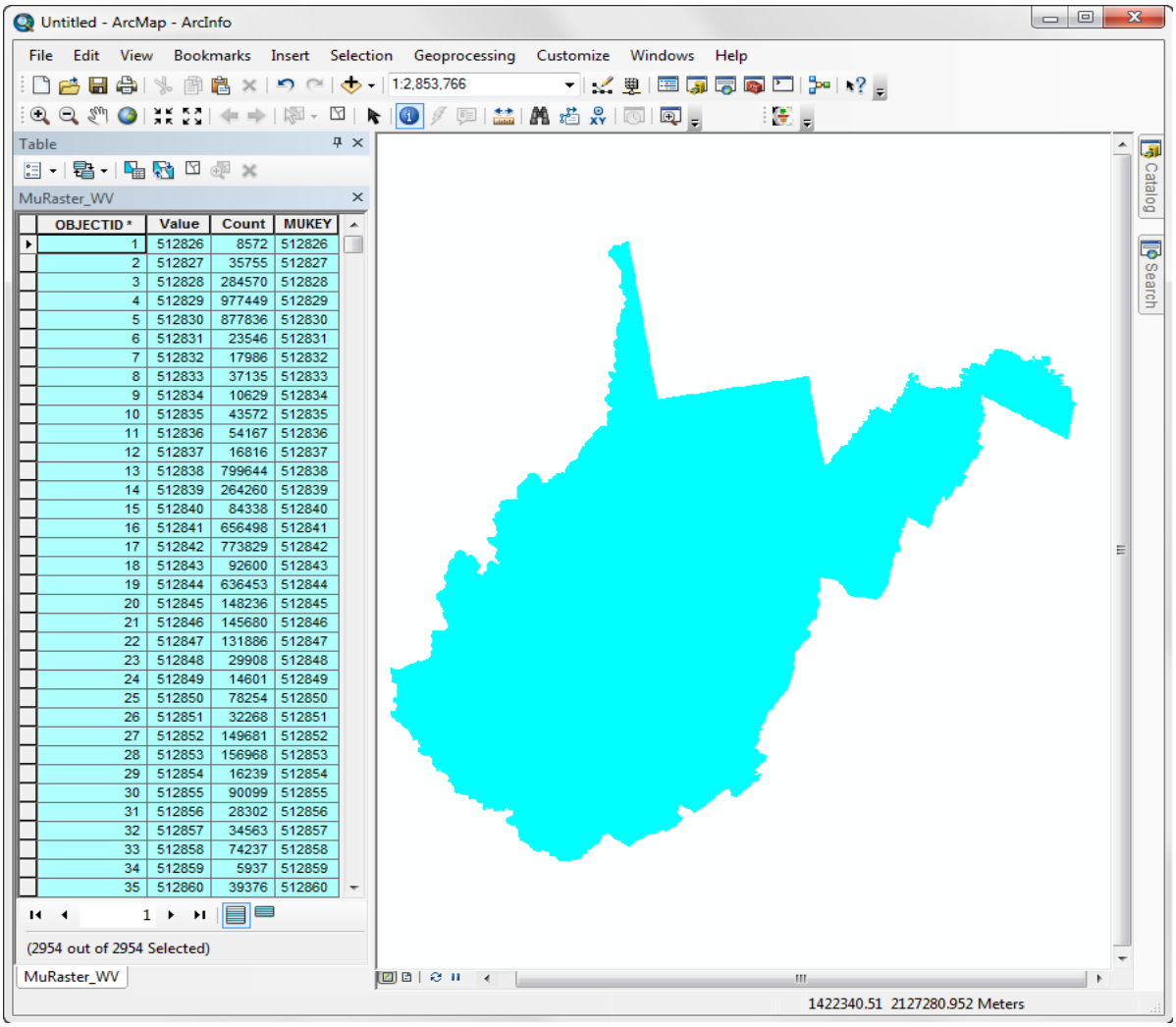


A warning may pop up indicating that the table may contain a large number of records and that the select operation may take significant time.

❑ Click **Yes** to continue.

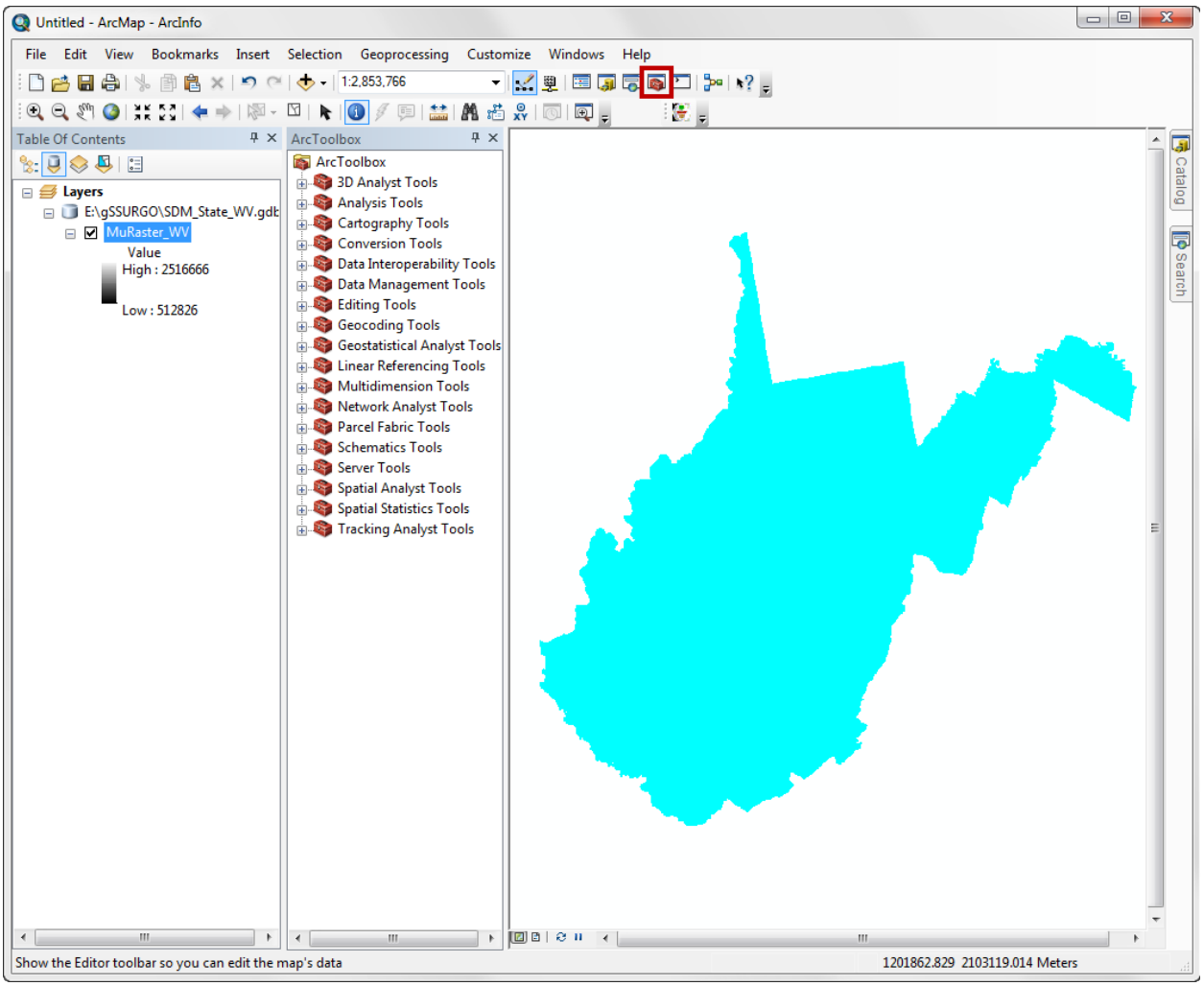


Both the ArcMap display and attribute table windows now show all records selected.

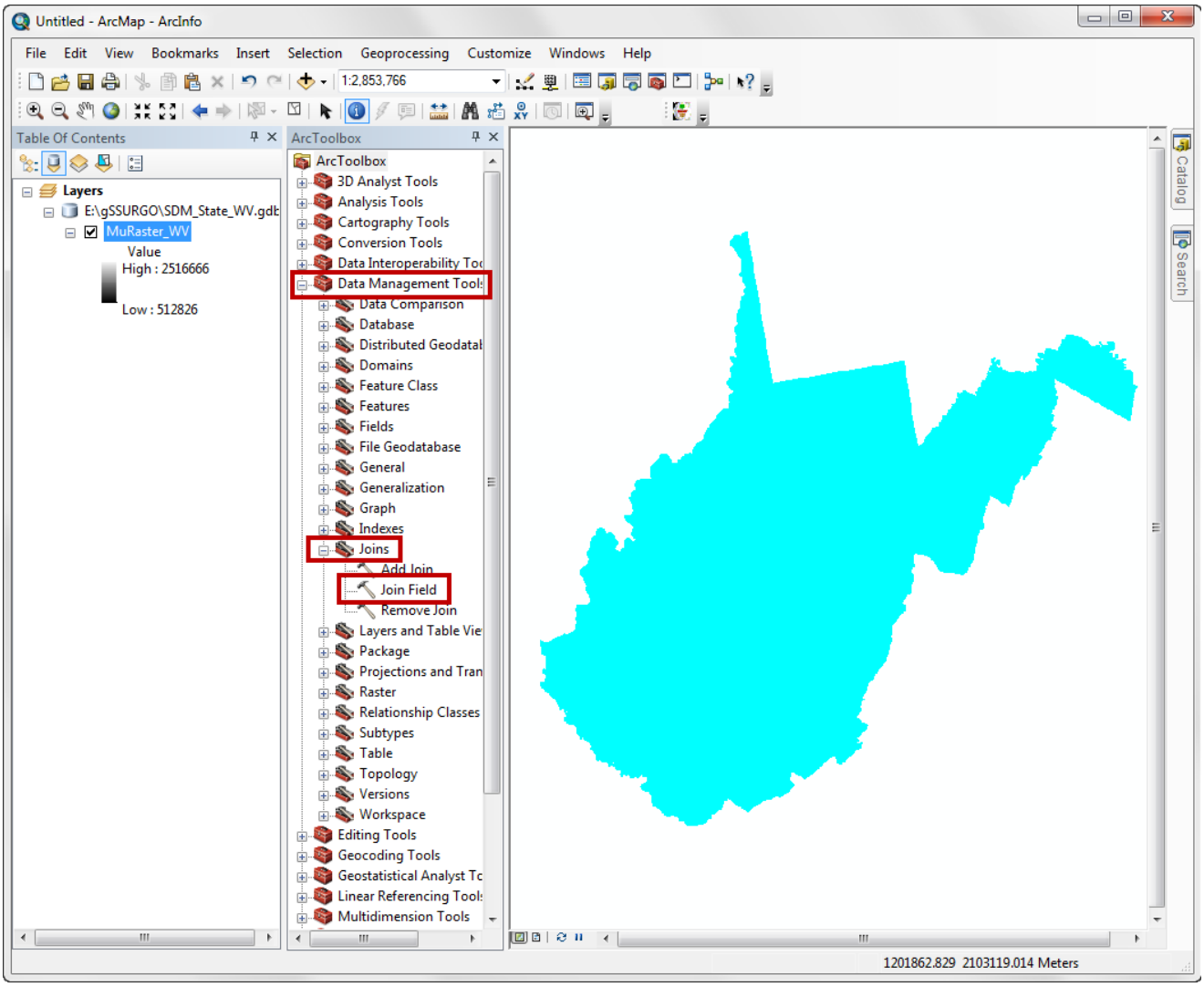


A join is typically established using the **Add Join** tool. This will temporarily append the fields of one table to another with a common attribute, e.g., MUKEY. In ArcGIS™ 10.0, however, temporary joins do not allow symbolization of the data using a classified renderer. It is best to use the **Join Field** tool to permanently add the fields to the table for symbolization purposes. The fields can be dropped later, if necessary. In ArcGIS™ 10.1, the longer column names are truncated using a temporary join.

❑ Click on the red toolbox icon to open **ArcToolbox**.

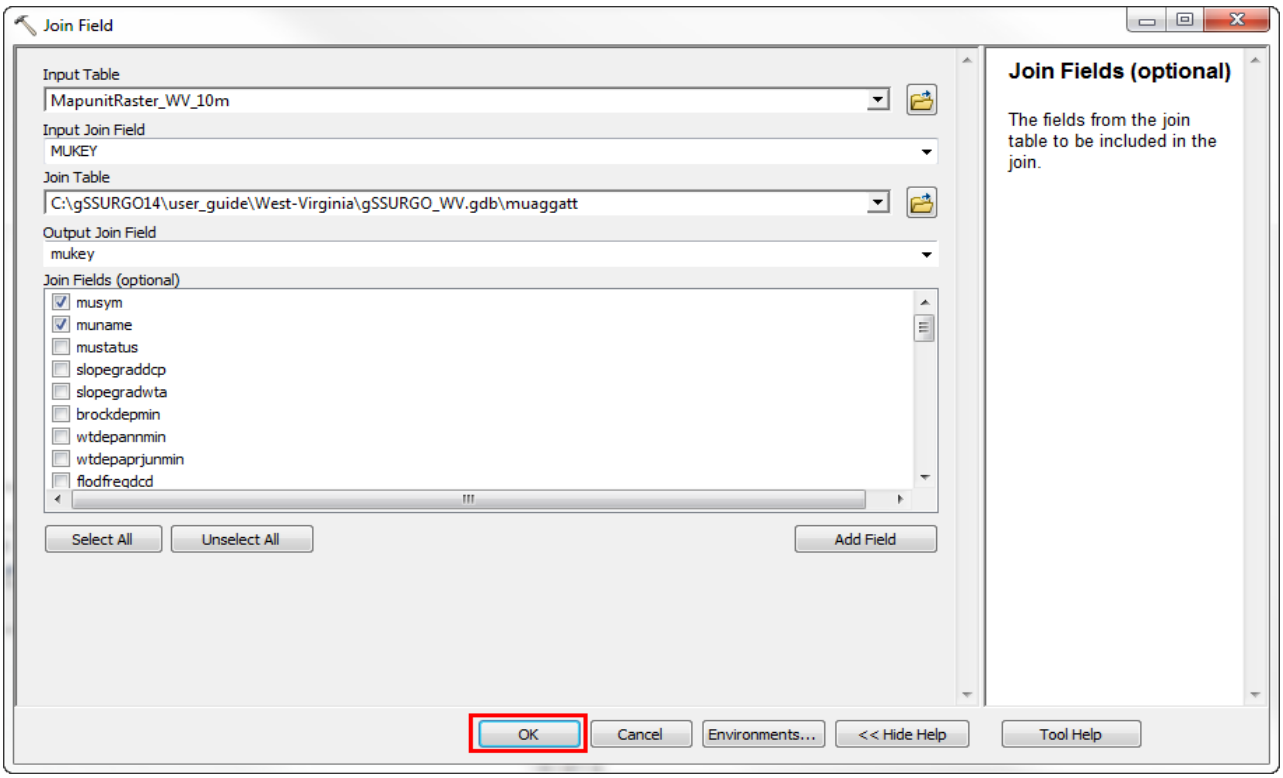


❑ Expand **Data Management Tools**, expand the **Joins** tools, and double-click on the **Join Field** tool to open a dialog box.

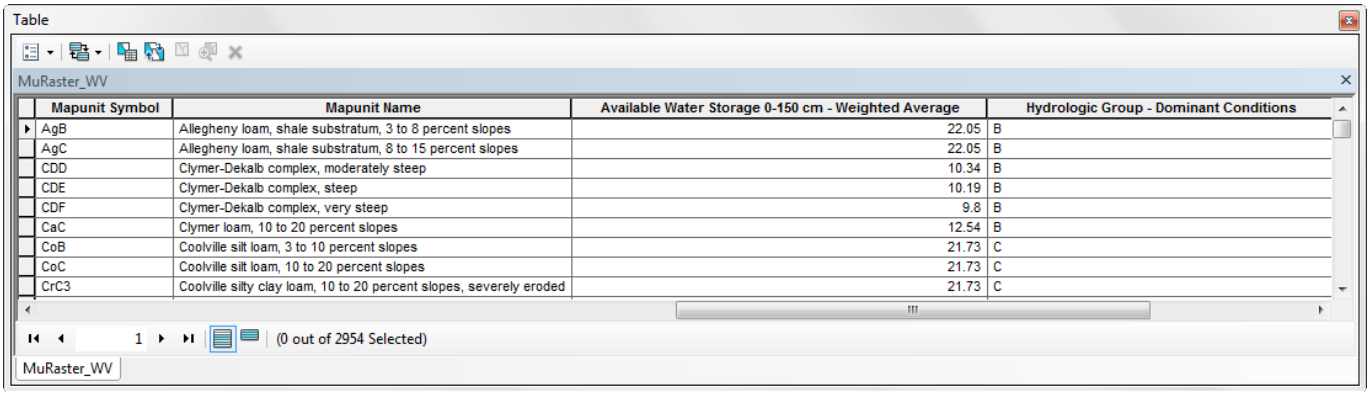


❑ Complete the **Join Field** dialog box:

- For the Input Table, select **MapunitRaster_WV_10m.**
- For the Input Join Field, select **MUKEY.**
- For the Join Table, browse to **muaggatt.**
- For the Output Join Field, select **mukey.**
- For the Join Fields (optional), check **musym**, **muname**, **aws0150wta**, and **hydgrpdcd.**
- Click **OK.**



The attribute table will now contain the additional fields: Mapunit Symbol (musym), Mapunit Name (muname), Available Water Storage 0-150 cm – Weighted Average (aws0150wta), and Hydrologic Group – Dominant Conditions (hydgrpdcd).

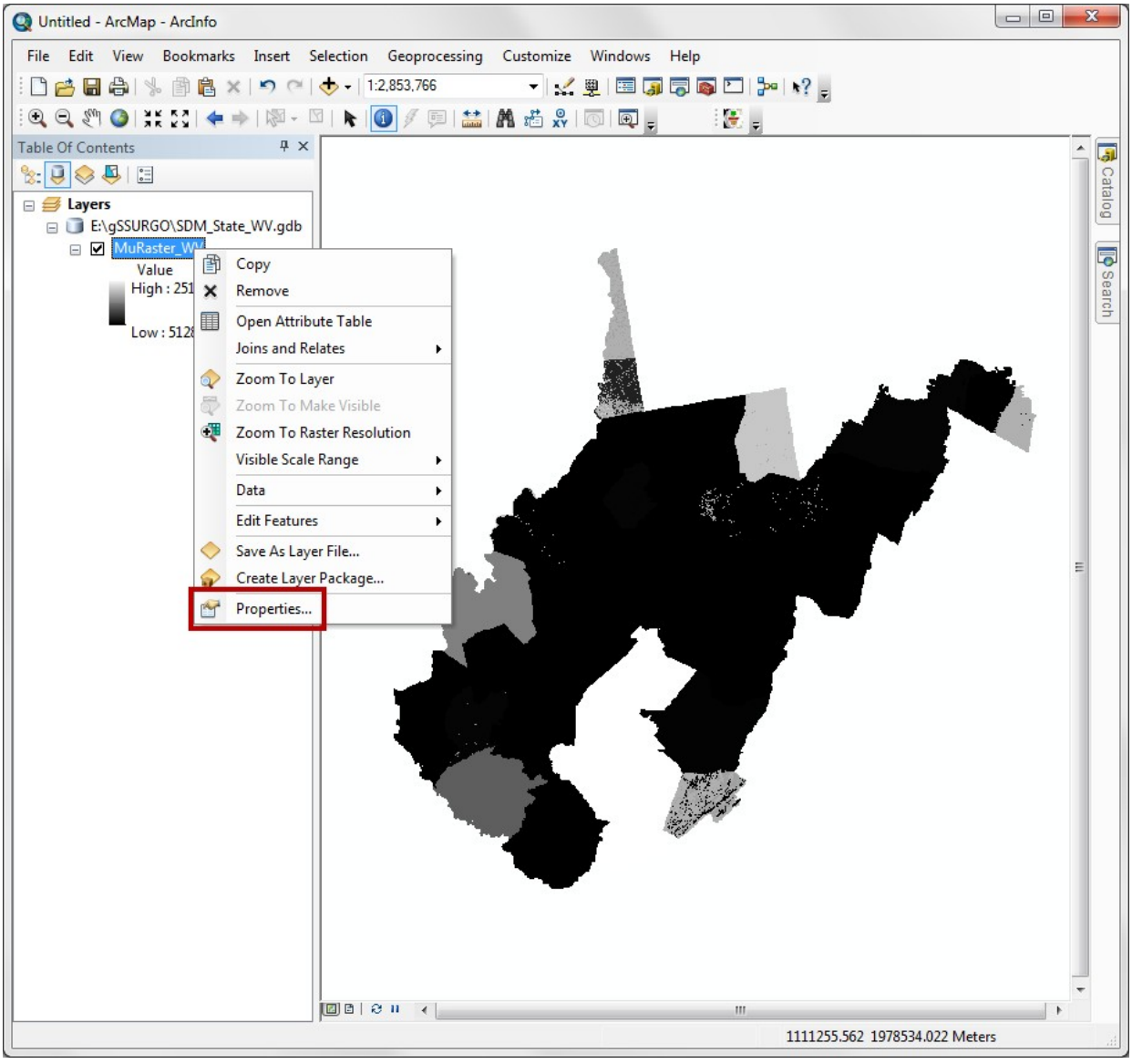


Mapunit Symbol	Mapunit Name	Available Water Storage 0-150 cm - Weighted Average	Hydrologic Group - Dominant Conditions
AgB	Allegheny loam, shale substratum, 3 to 8 percent slopes	22.05	B
AgC	Allegheny loam, shale substratum, 8 to 15 percent slopes	22.05	B
CDD	Clymer-Dekalb complex, moderately steep	10.34	B
CDE	Clymer-Dekalb complex, steep	10.19	B
CDF	Clymer-Dekalb complex, very steep	9.8	B
CaC	Clymer loam, 10 to 20 percent slopes	12.54	B
CoB	Coolville silt loam, 3 to 10 percent slopes	21.73	C
CoC	Coolville silt loam, 10 to 20 percent slopes	21.73	C
CrC3	Coolville silty clay loam, 10 to 20 percent slopes, severely eroded	21.73	C

TIP: If the attribute table does not display the additional columns after processing is complete, exit and restart ArcMap™. Add the raster and open the attribute table. The additional columns will appear.

Symbolize the data based on the entries for Hydrologic Group – Dominant Conditions.

❑ Right-click on the raster layer and select **Properties…**



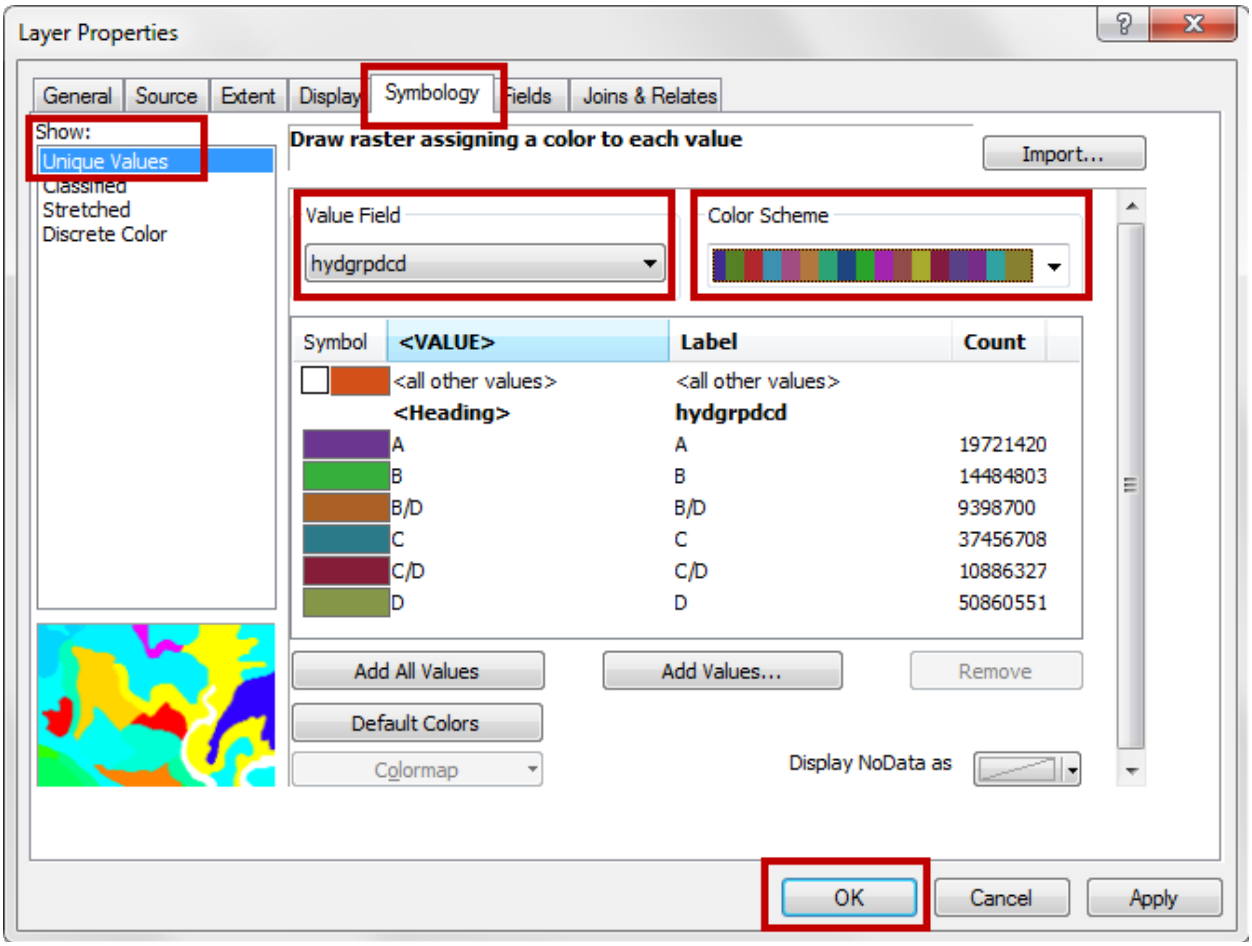
❑ Select the **Symbology** tab in the **Layer Properties** dialog box.

❑ In the Show group, select **Unique Values**.

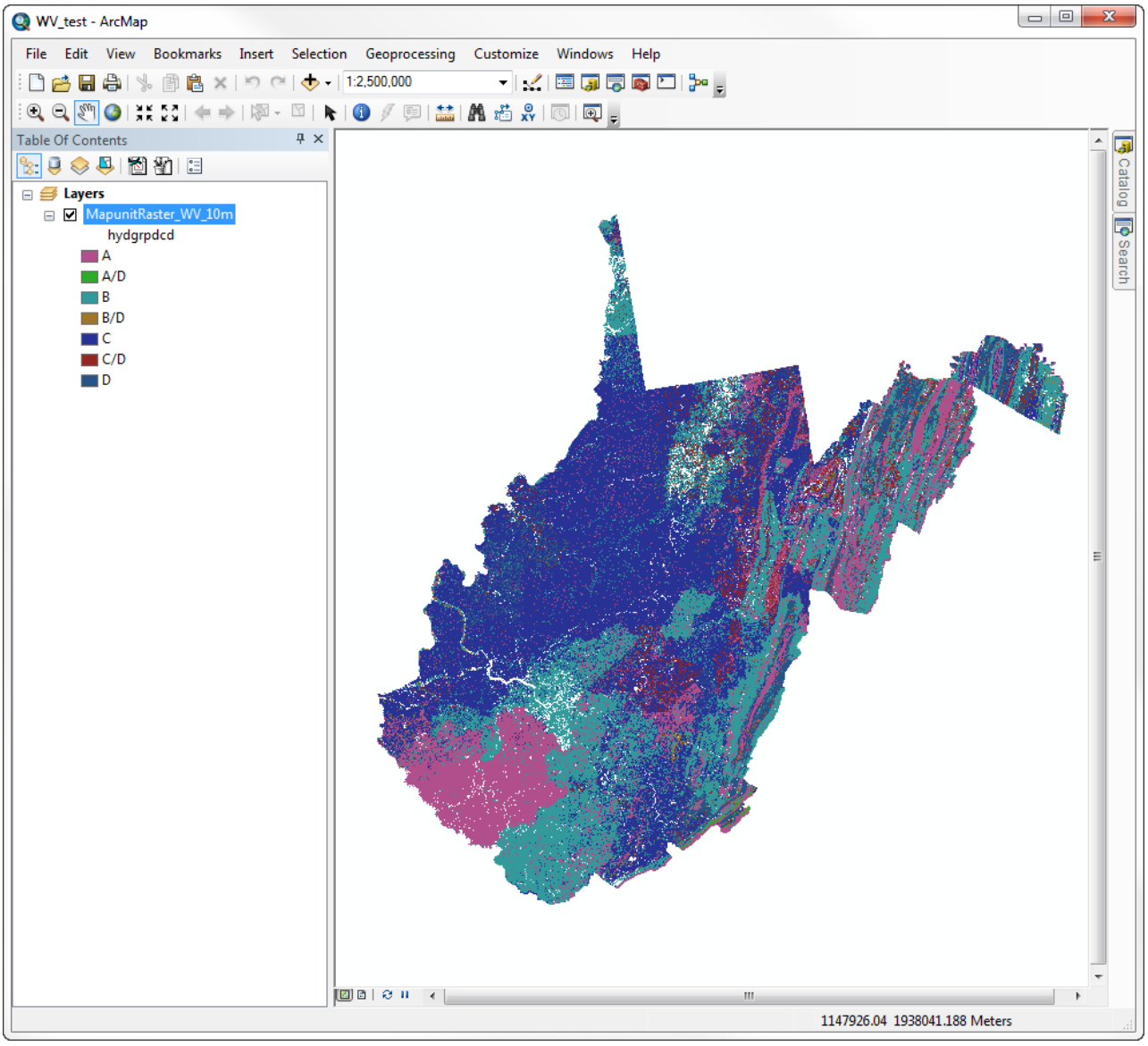
❑ From the Value Field drop-down menu, select **hydgrpdcd**.

❑ Choose a color palette from the **Color Scheme**.

❑ Click **OK**.

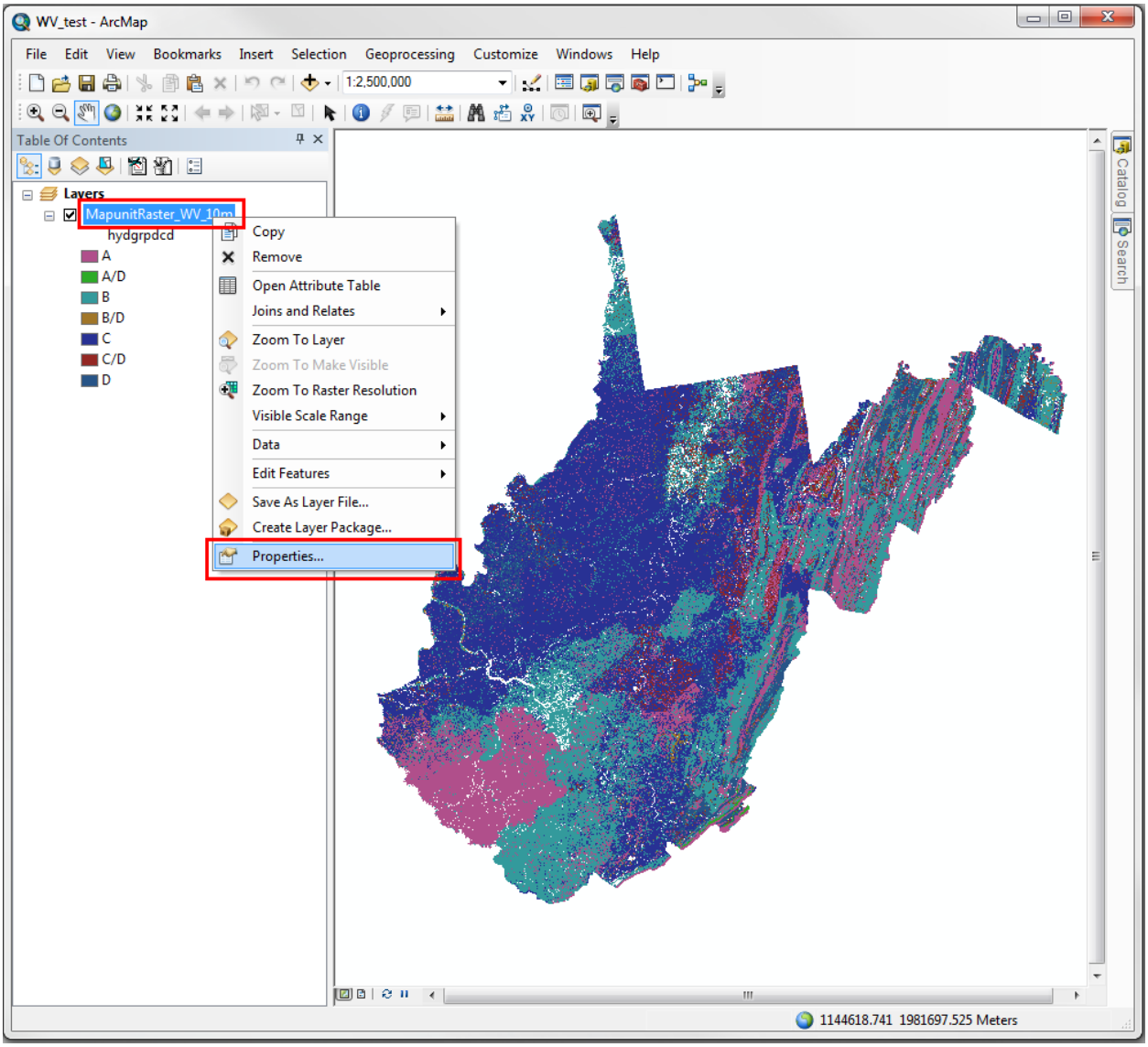


The dominant condition for the map unit is rendered for Hydrologic Group.



Available water storage is best symbolized using the classified renderer.

❑ Right-click on the raster layer and select **Properties…**



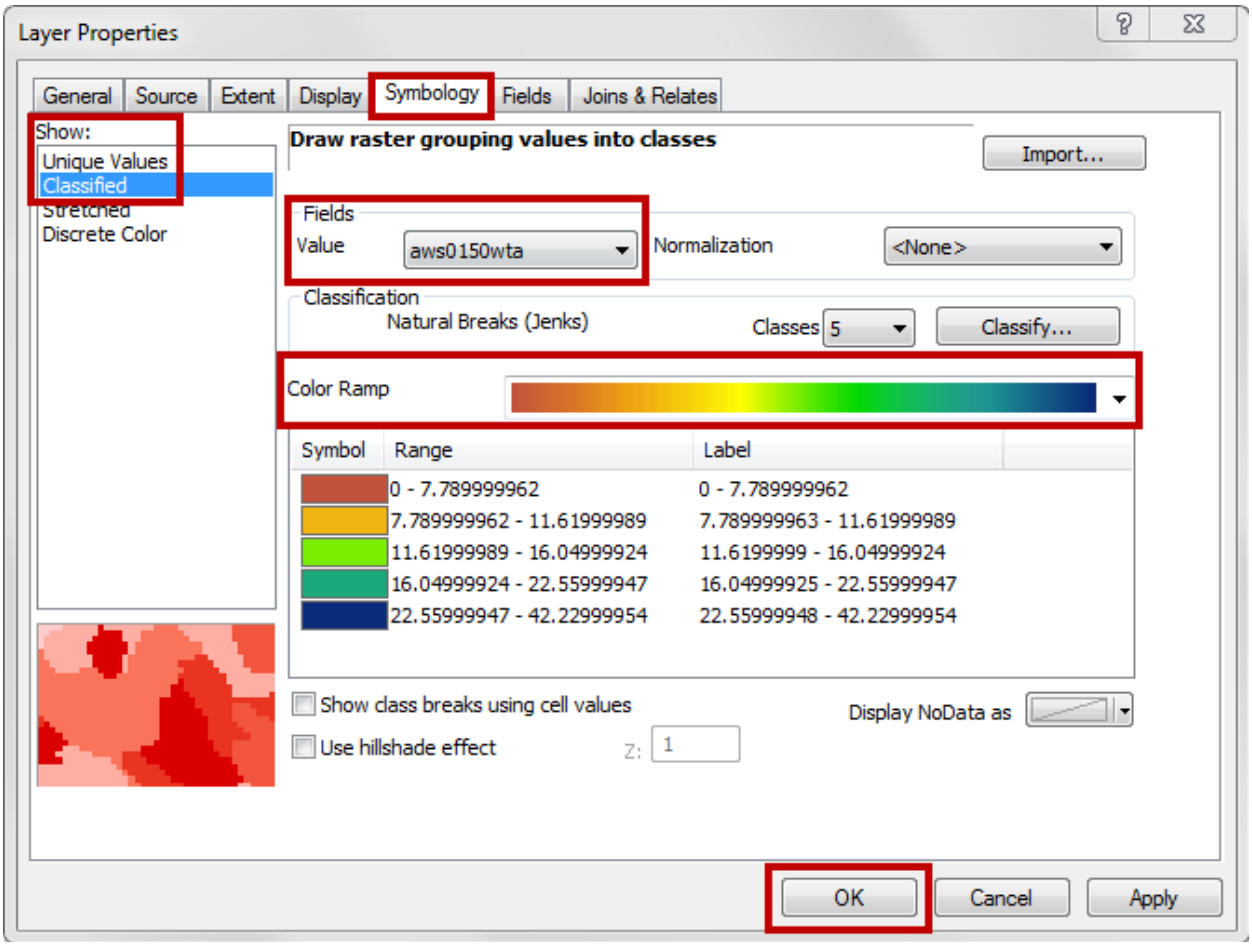
❑ Select the **Symbology** tab in the **Layer Properties** dialog box.

❑ In the Show group select **Classified**.

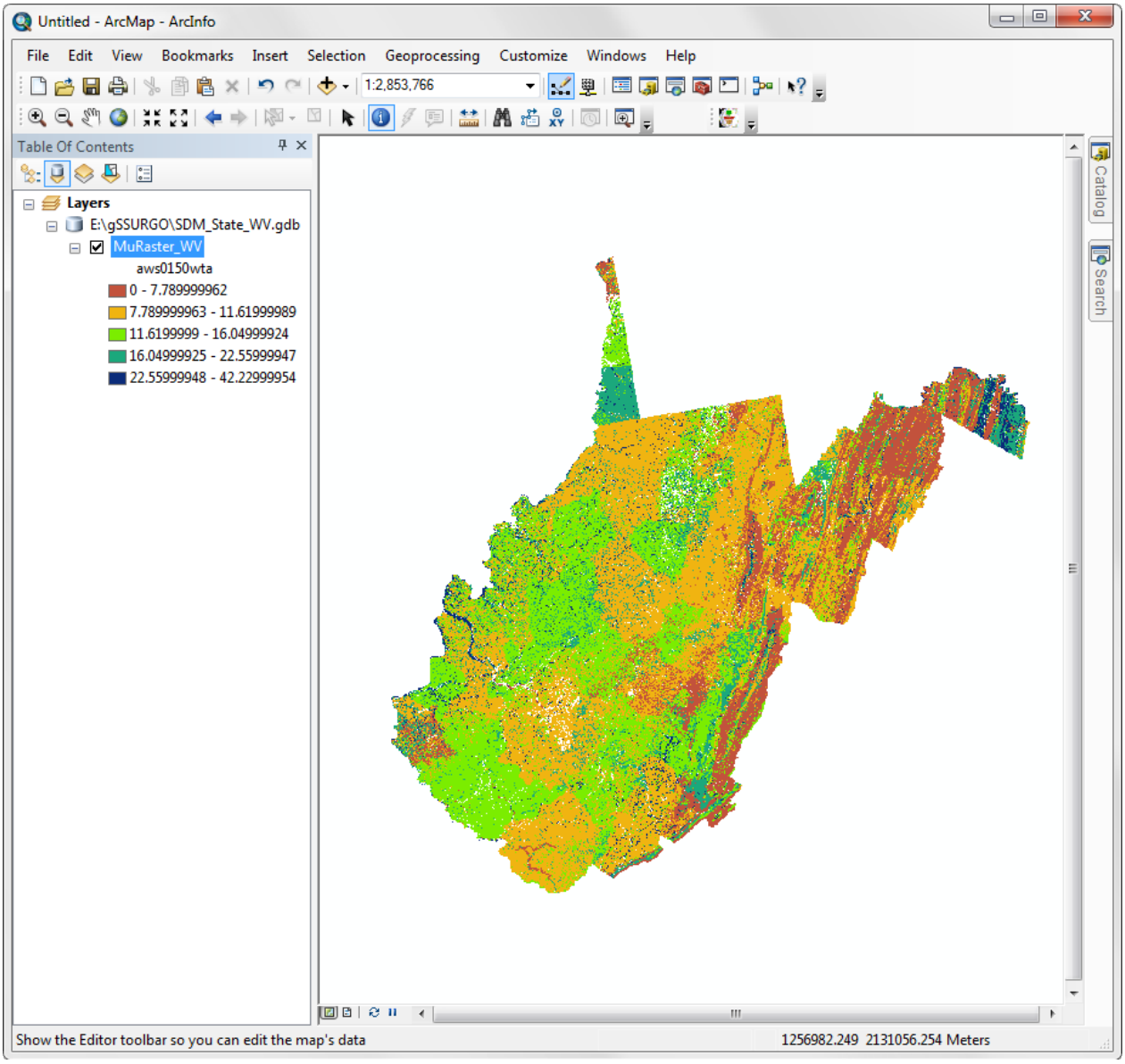
❑ From the **Fields** drop-down menu, select **aws0150wta**.

❑ Choose a color palette from the **Color Ramp**.

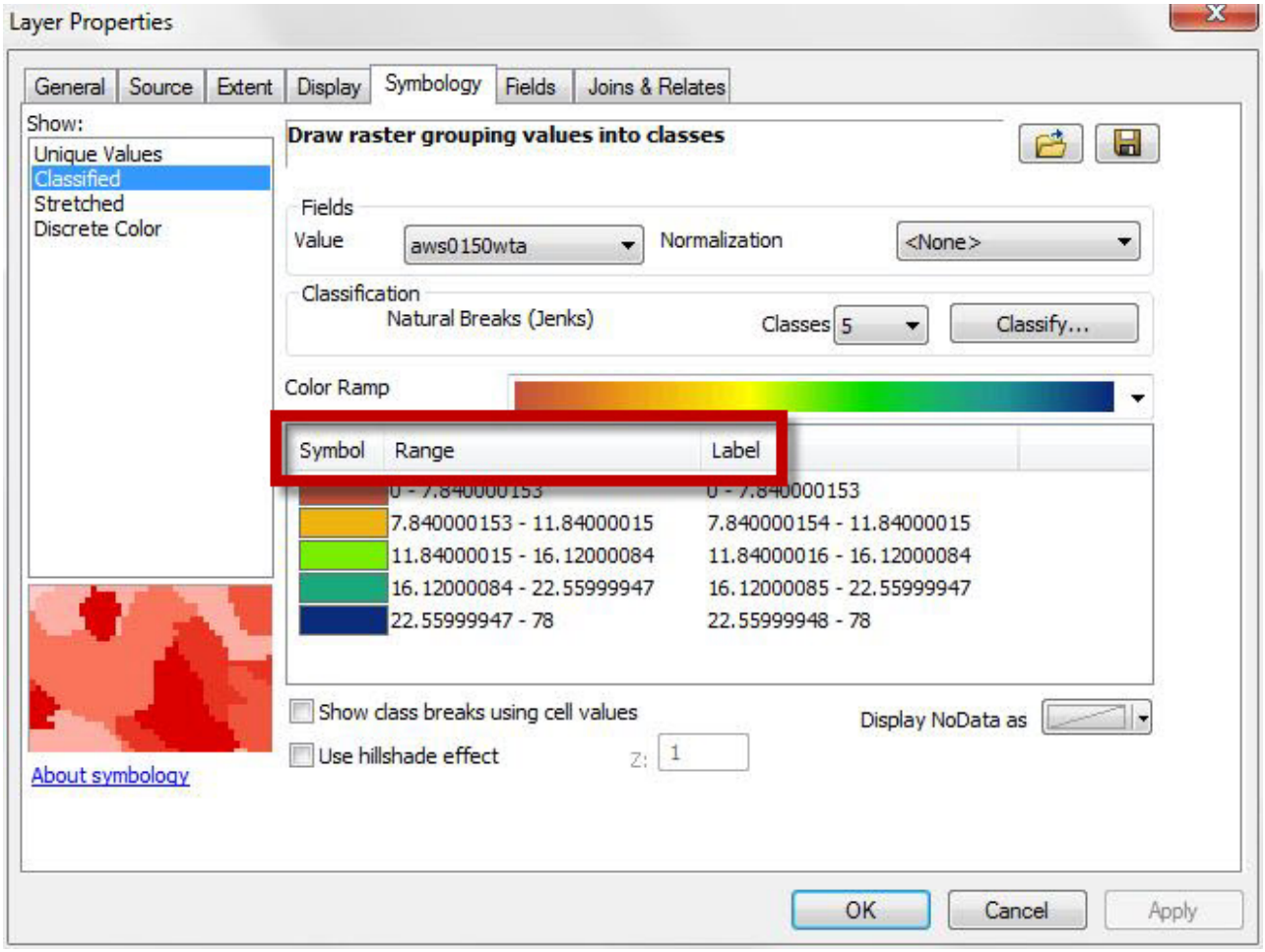
❑ Click **OK**.



The weighted average for the map unit is rendered for Available Water Storage 0-150 cm.



Clicking on the Symbol, Range, or Label column heading in the Layer Properties dialog box allows the user to alter settings, such as the number of decimal places. Changing these settings will also change the layer's legend in the Table of Contents and make it easier to read.



Other Classification Methods

The previous screenshot used the ArcGIS® default Natural Breaks (Jenks) classification method. Other classification options can be applied. It is important to consult a subject matter expert to ensure that appropriate and meaningful breaks are applied to the data.

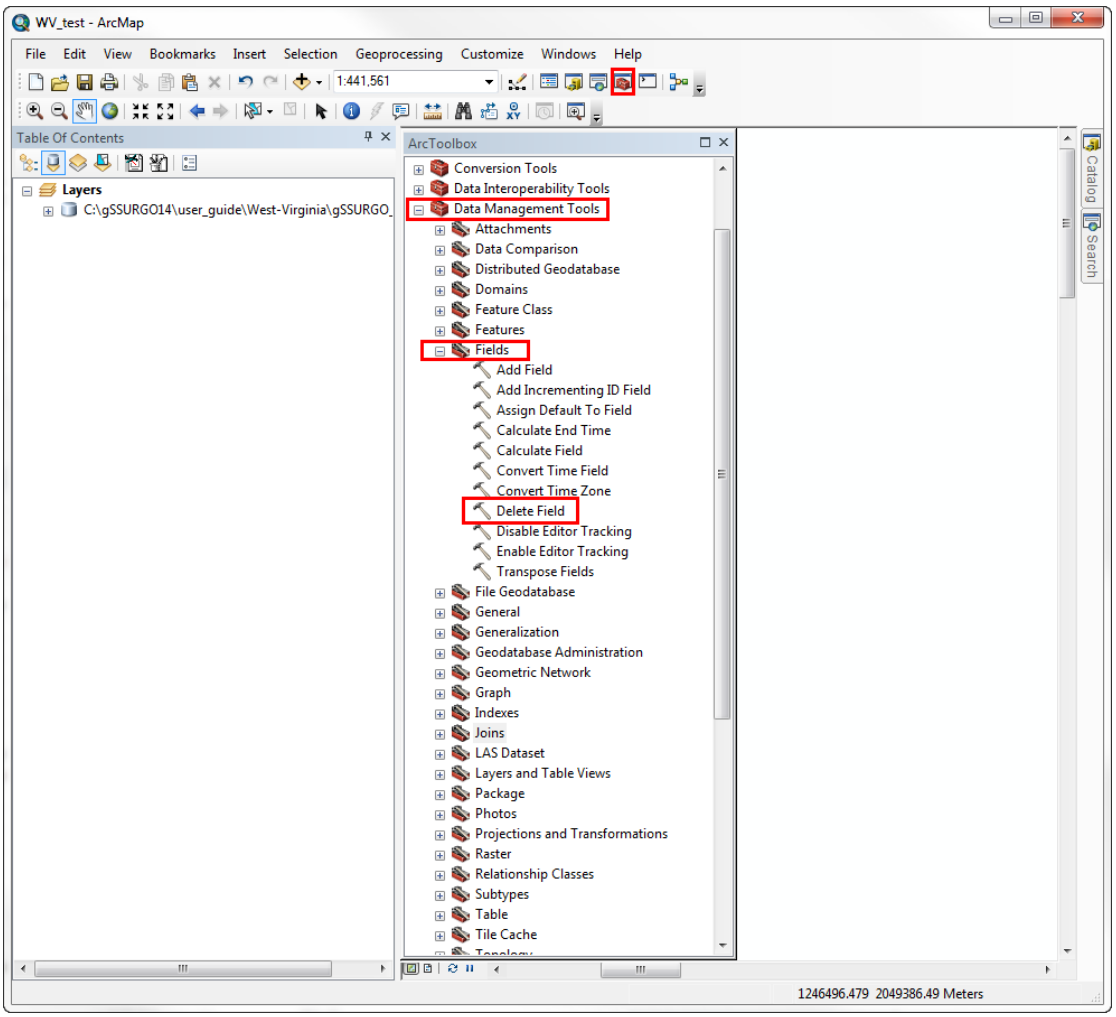
Removing Join Columns from the Attribute Table

As mentioned earlier in this section, using **Add Join** in ArcGIS™ 10.0 does not allow symbolization of the data using the classified methods. It is best to use the **Join Field** tool to permanently add the fields to the table for symbolization purposes. The following example demonstrates how to drop columns in the attribute table.

Choose the ArcToolbox tool **Delete Field** to delete multiple fields quickly.

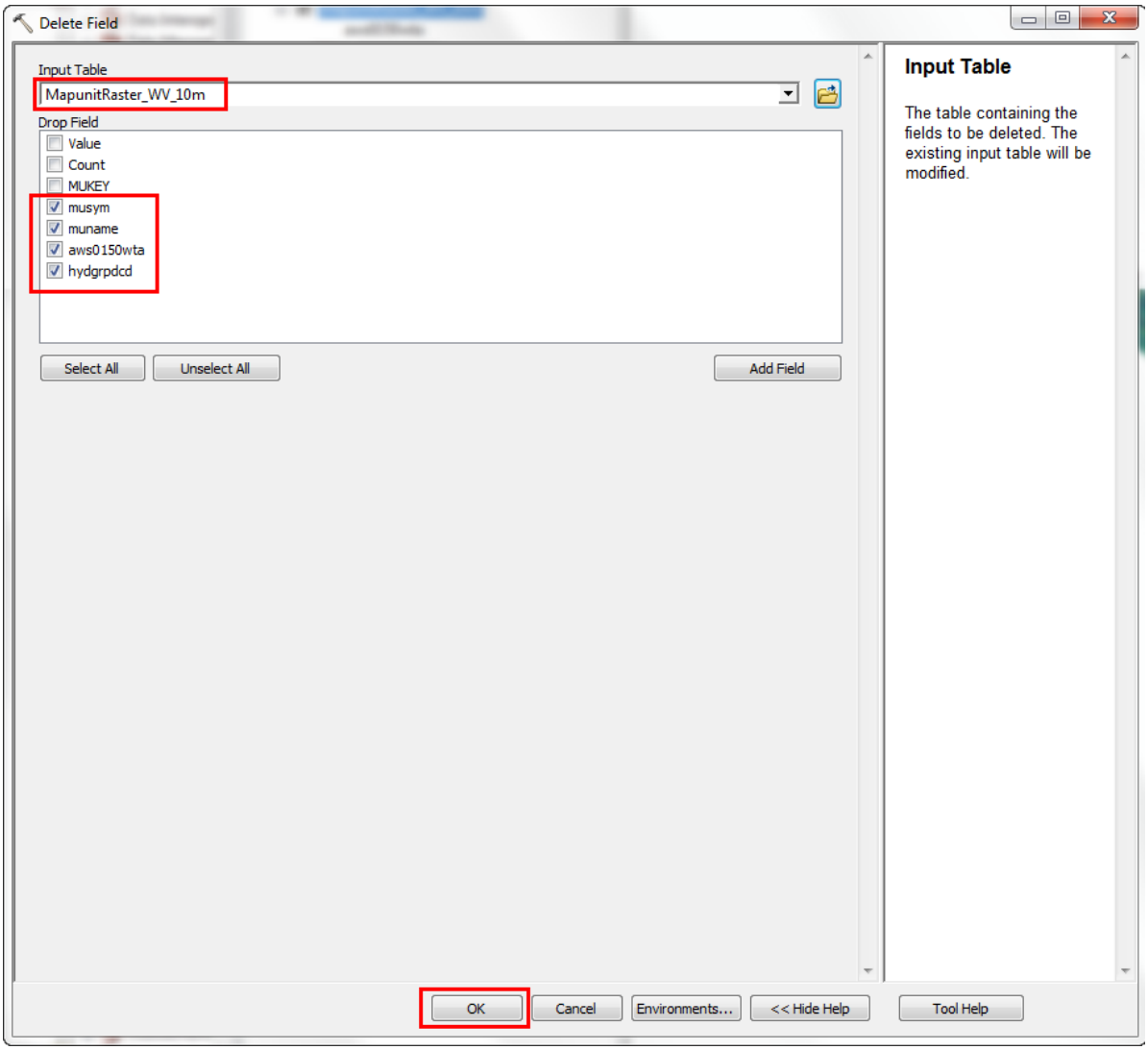
❑ Click on the red toolbox icon to open **ArcToolbox**.

❑ Expand **Data Management Tools**, expand **Fields**, and double-click on the **Delete Field** tool to open a dialog box.



❑ Complete the **Delete Field** dialog box:

- For the Input Table, select **MapunitRaster_WV_10m.**
- Place a check in the box beside the name of the field(s) that you want to delete.
- Click **OK.**



WARNING: Do NOT try to delete the Value, Count, or MUKEY columns. The Value and Count columns are managed by the geodatabase and cannot be deleted or calculated. See the section "Restoring MUKEY Values in Raster Layers" in the event that the MUKEY column or data is lost.

TIP: If, after processing is complete, the attribute table does not display with the additional fields removed, exit and restart ArcMap™. Add the raster and open the attribute table. The additional columns should be gone.

Using Relationship Classes in a Geodatabase

A relationship class stores information about table relates in a geodatabase. These classes are similar to relationships in a Microsoft® Access® database but are more limited in functionality.

Relationship classes can be used to:

- Navigate through related tables using the Identify button
- Select related records in related tables

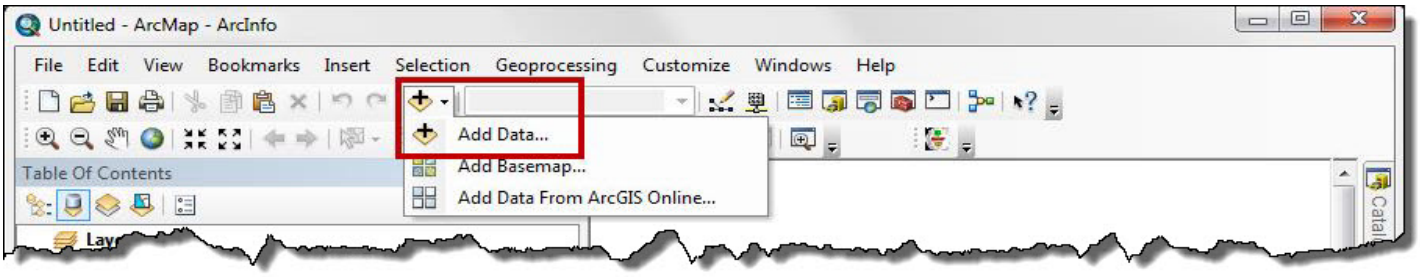
In the following example, the relationship is traced between the Mapunit Polygon attribute table and the Component Geomorphic Description (cogeomordesc) Table. This is a "top down" approach. It can be useful to "drill down" through the component and horizon tables to investigate differences in interpretation values between adjacent surveys.

The selection sequence is: MUPOLYGON feature class, mapunit, component, cogeomordesc.

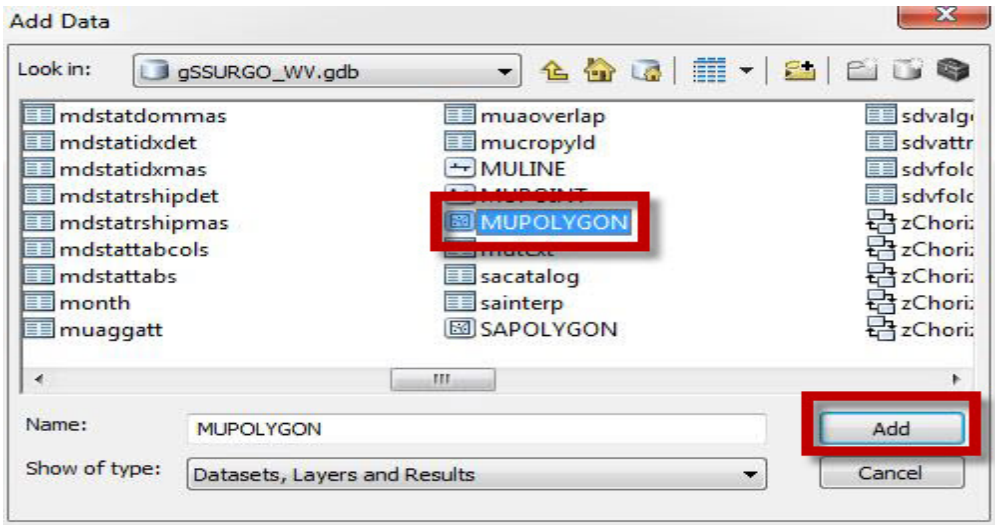
There must be relationship classes in the geodatabase for this to succeed.

❑ Start **ArcMap** with a new blank map.

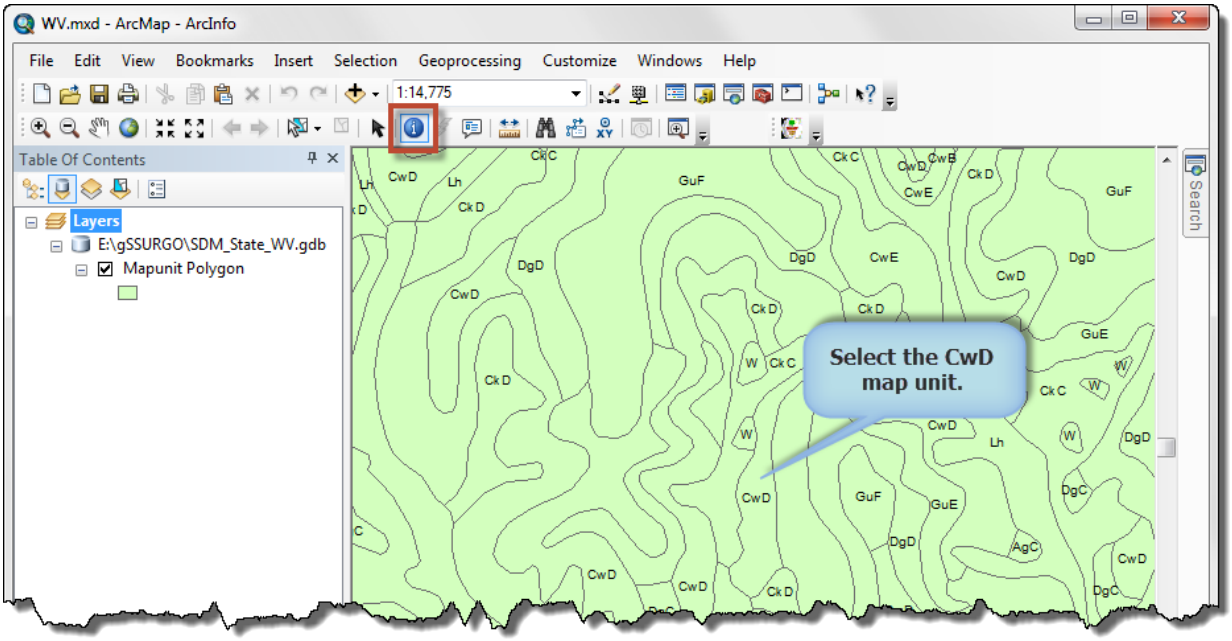
❑ Select **Add Data…** from the drop-down menu.



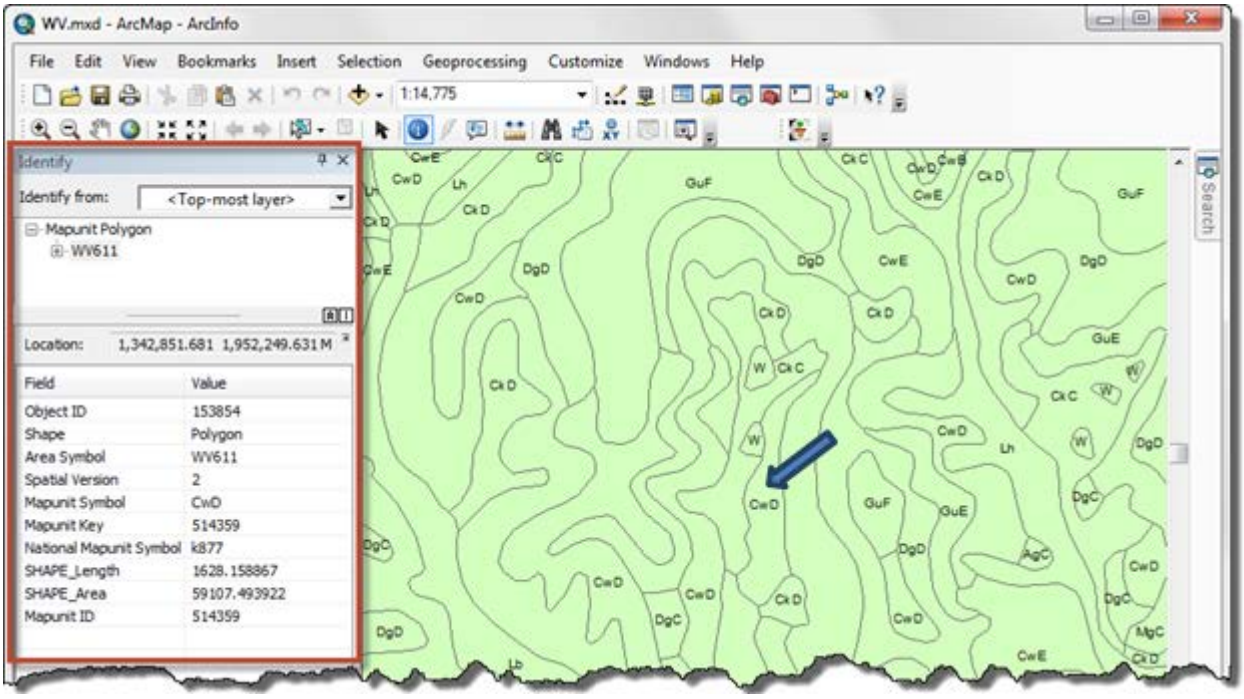
❑ Choose the appropriate file geodatabase (e.g., **MapunitRaster_WV_10m**), select the vector feature class (e.g., **MUPOLYGON**), and click on the **Add** button.



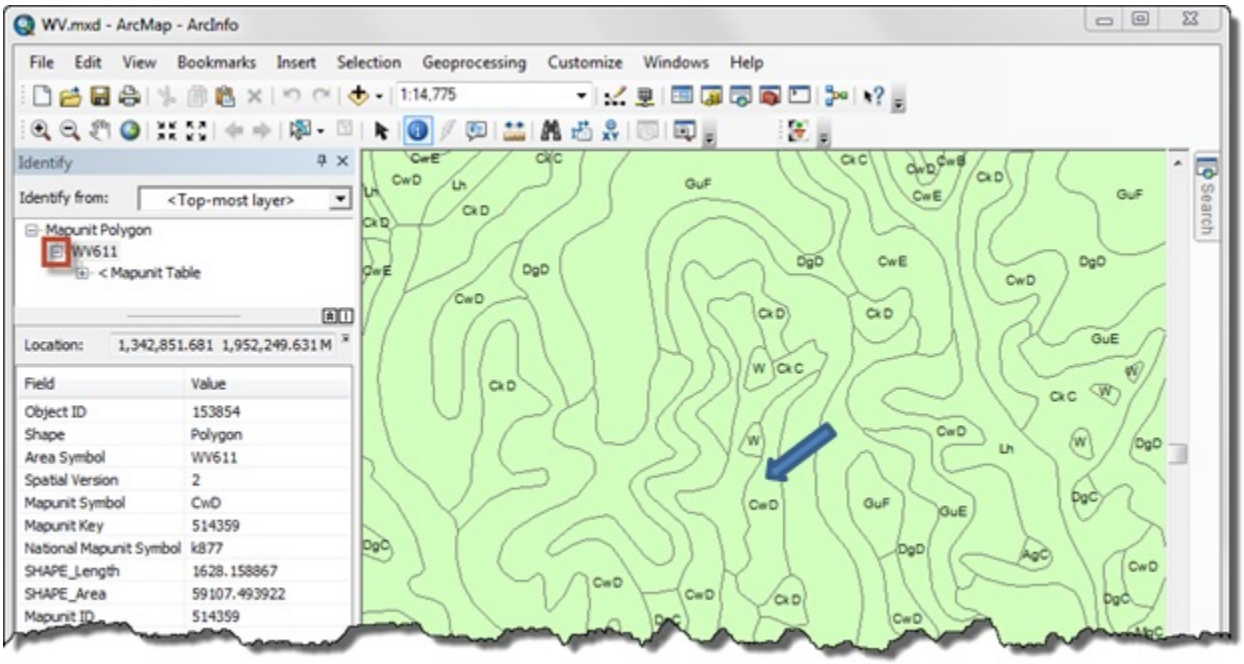
❑ Use the **Identify** button to click on a single polygon.



The Identify results window can be docked in the ArcMap window.

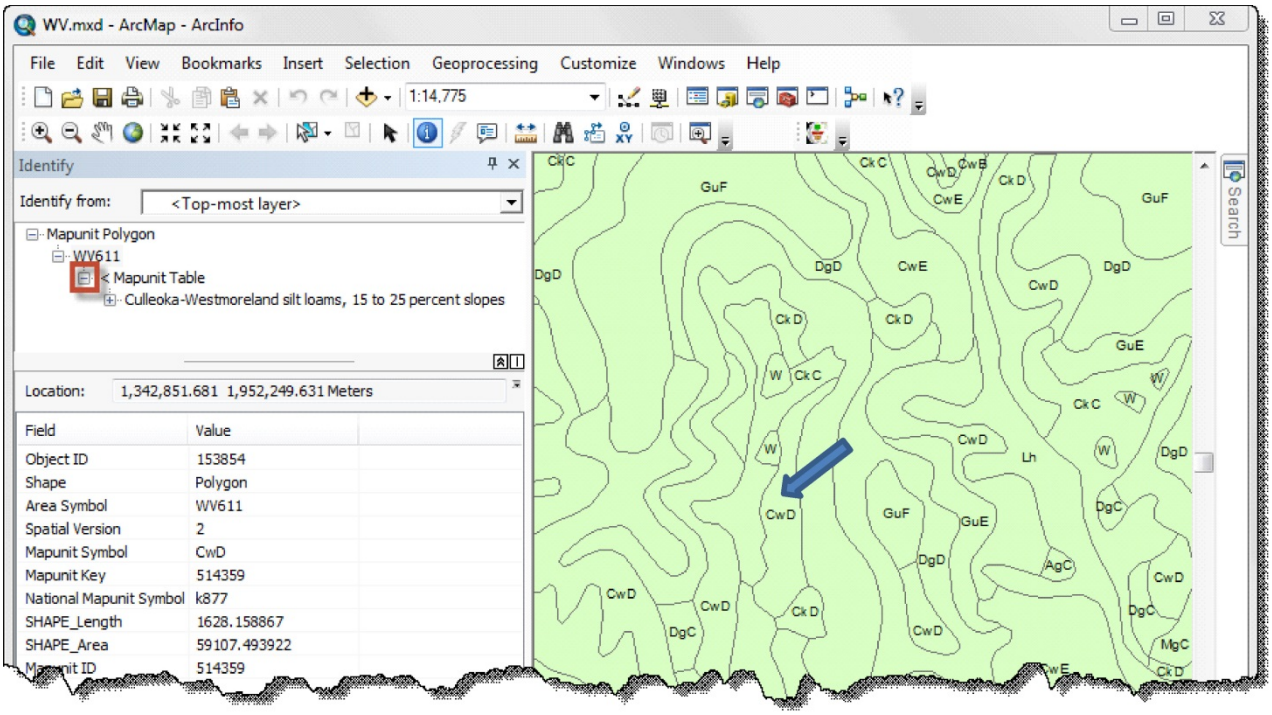


❑ Click on the **plus sign (+)** under the Mapunit Polygon and beside the area symbol (e.g., WV611) in the Identify results window.



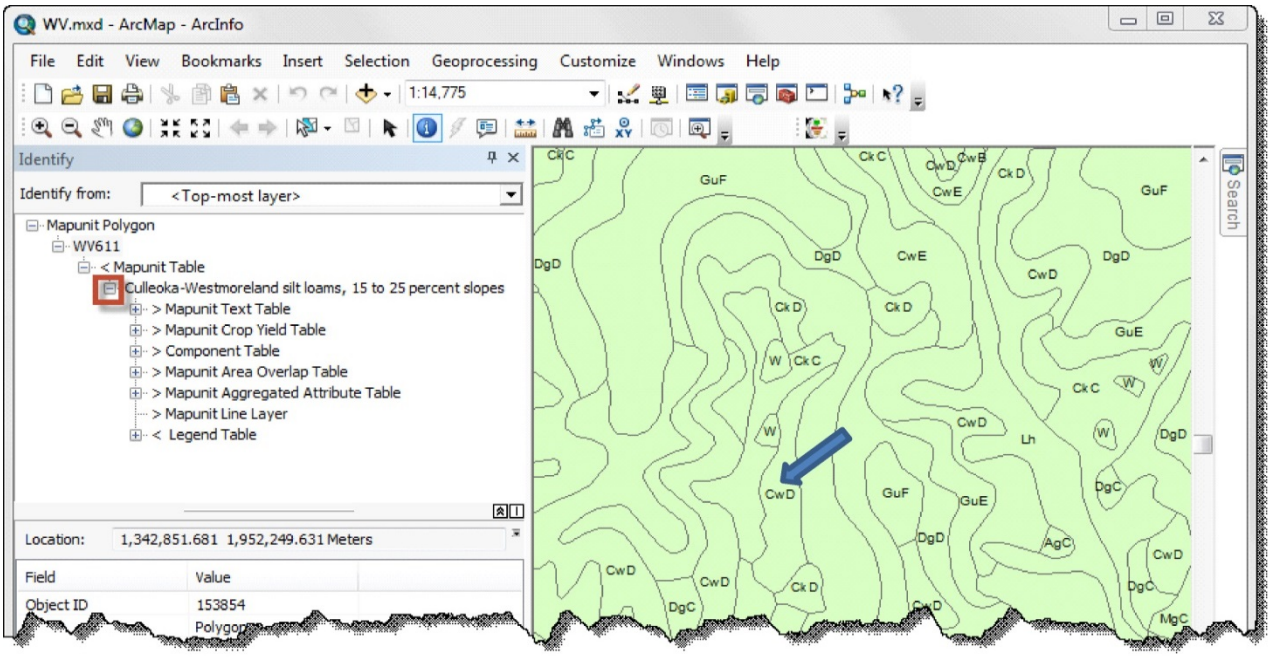
The Mapunit Table is shown.

❑ Click on the **plus sign (+)** beside the Mapunit Table in the Identify results window to expand.



The result displays the map unit for the selected polygon “Culleoka-Westmoreland silt loams, 15 to 25 percent slopes.”

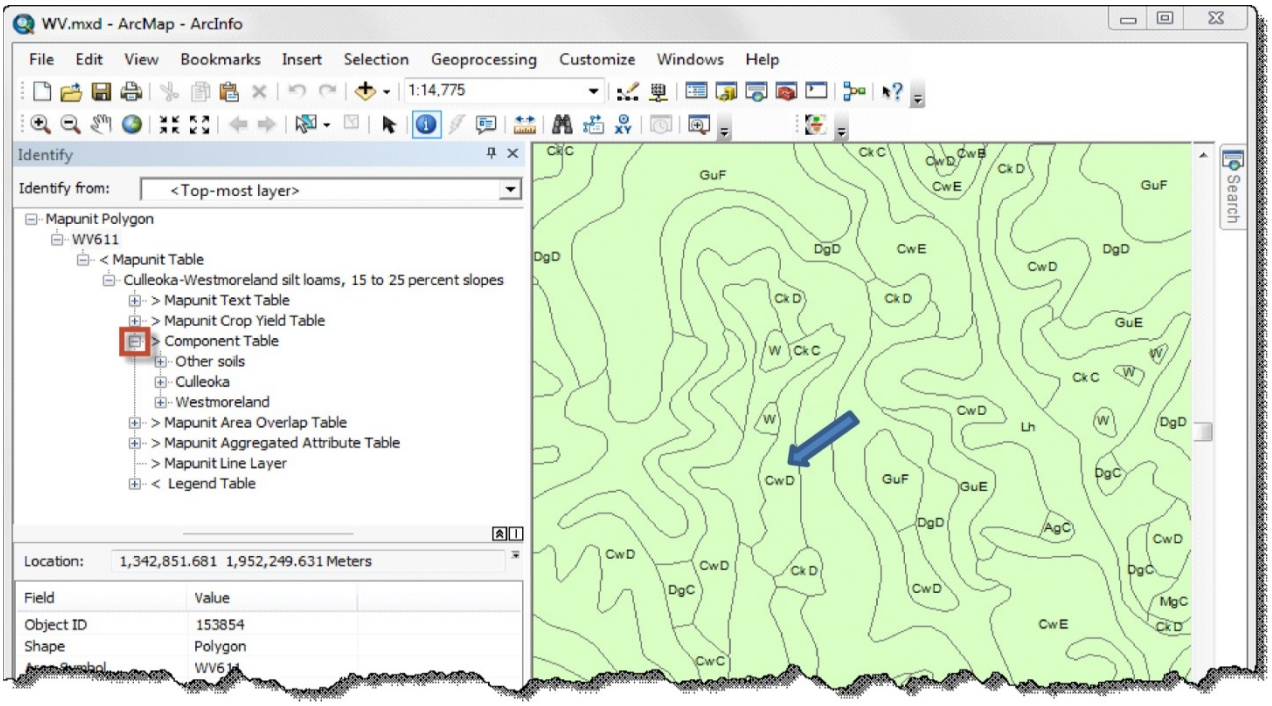
❑ Select the **plus sign (+)** beside the map unit name in the Identify results window to expand the selected map unit.



The display shows the relationship classes created from the Mapunit Table and its child tables.

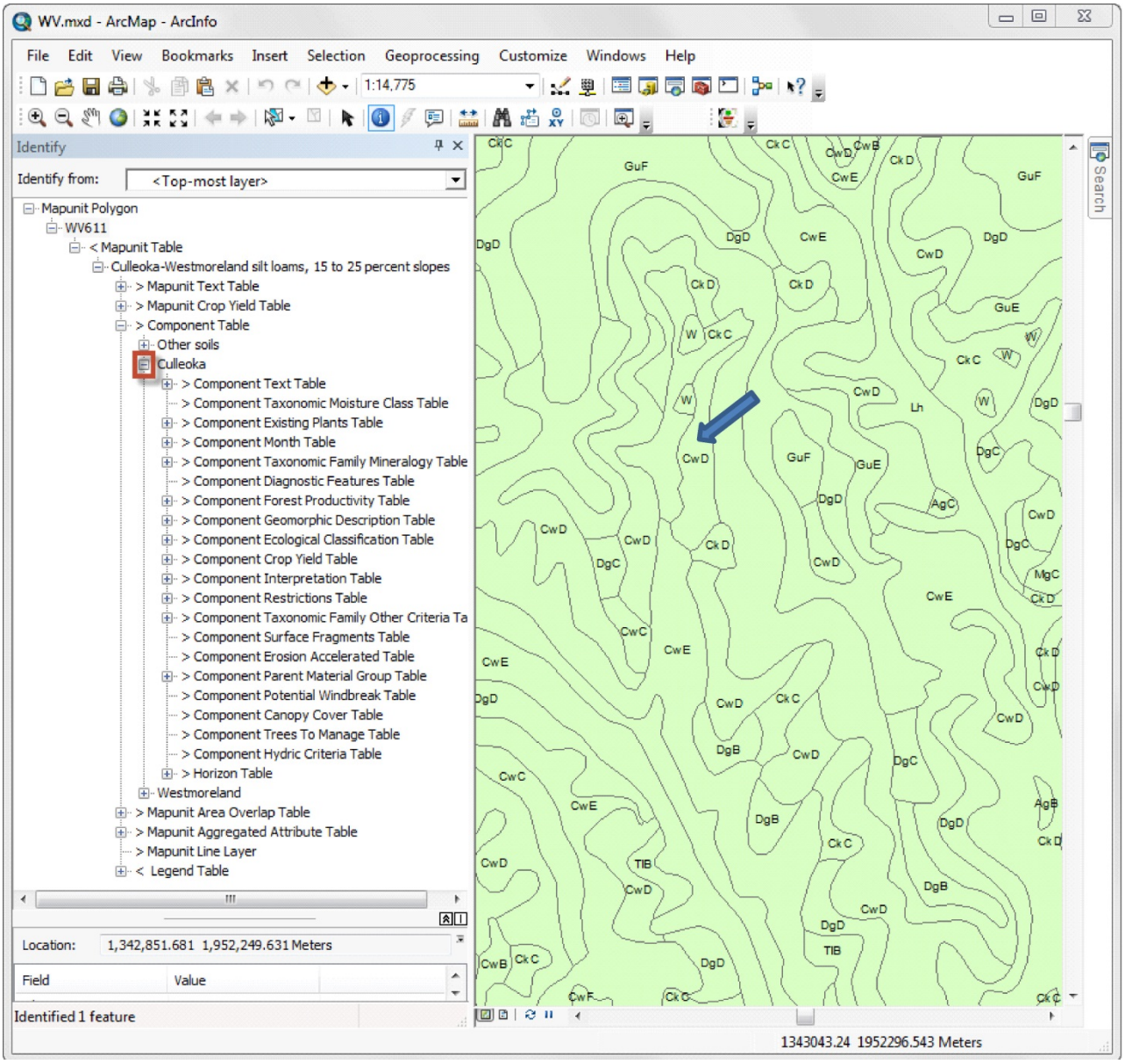
If the table does not contain records, there will not be a corresponding plus sign beside the table.

❑ Select the **plus sign (+)** beside the Component Table in the Identify results window to expand.



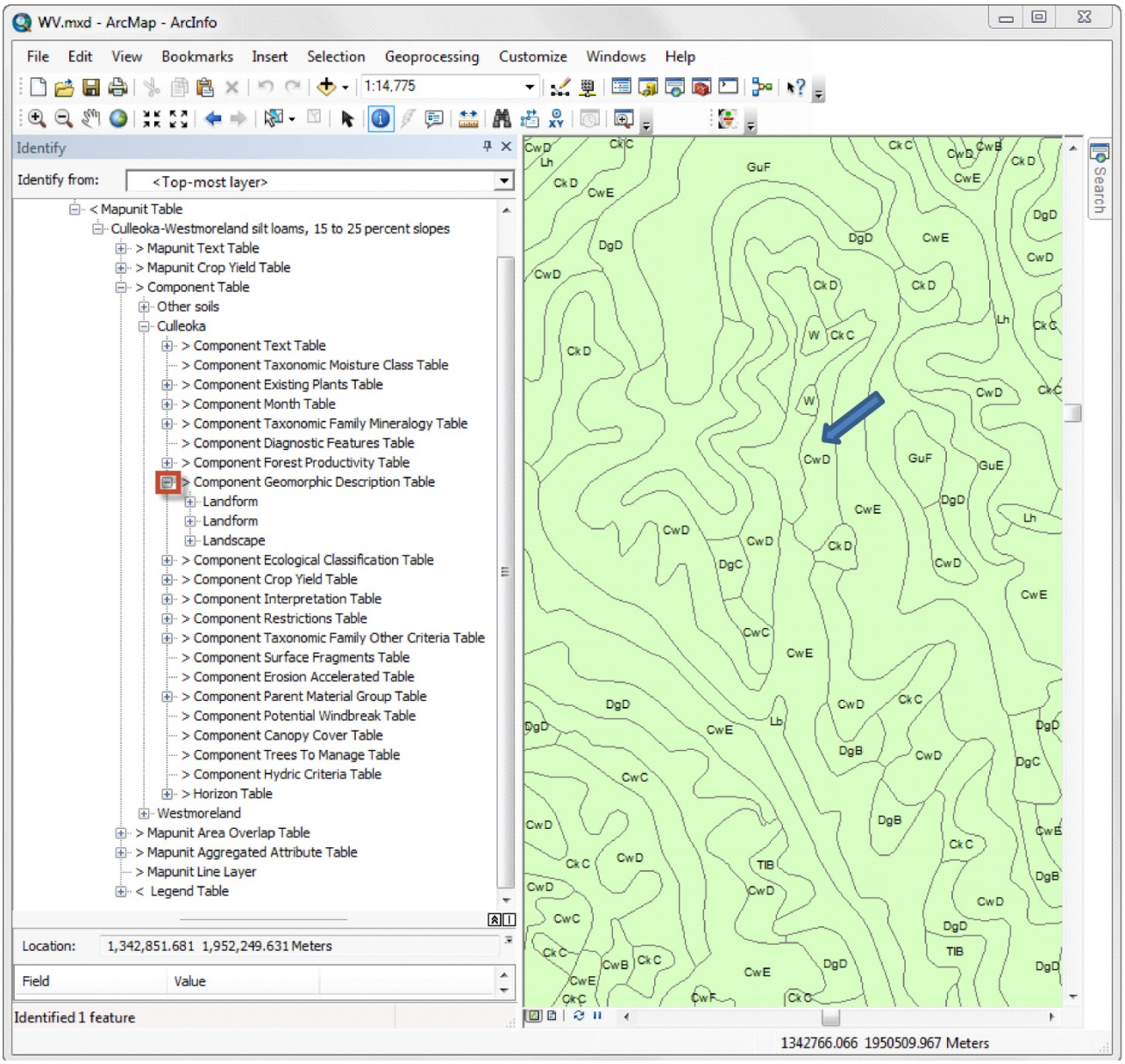
The map unit components—Other soils, Culleoka, and Westmoreland—are displayed.

❑ Expand the **plus sign (+)** beside Culleoka in the Identify results window for this example.



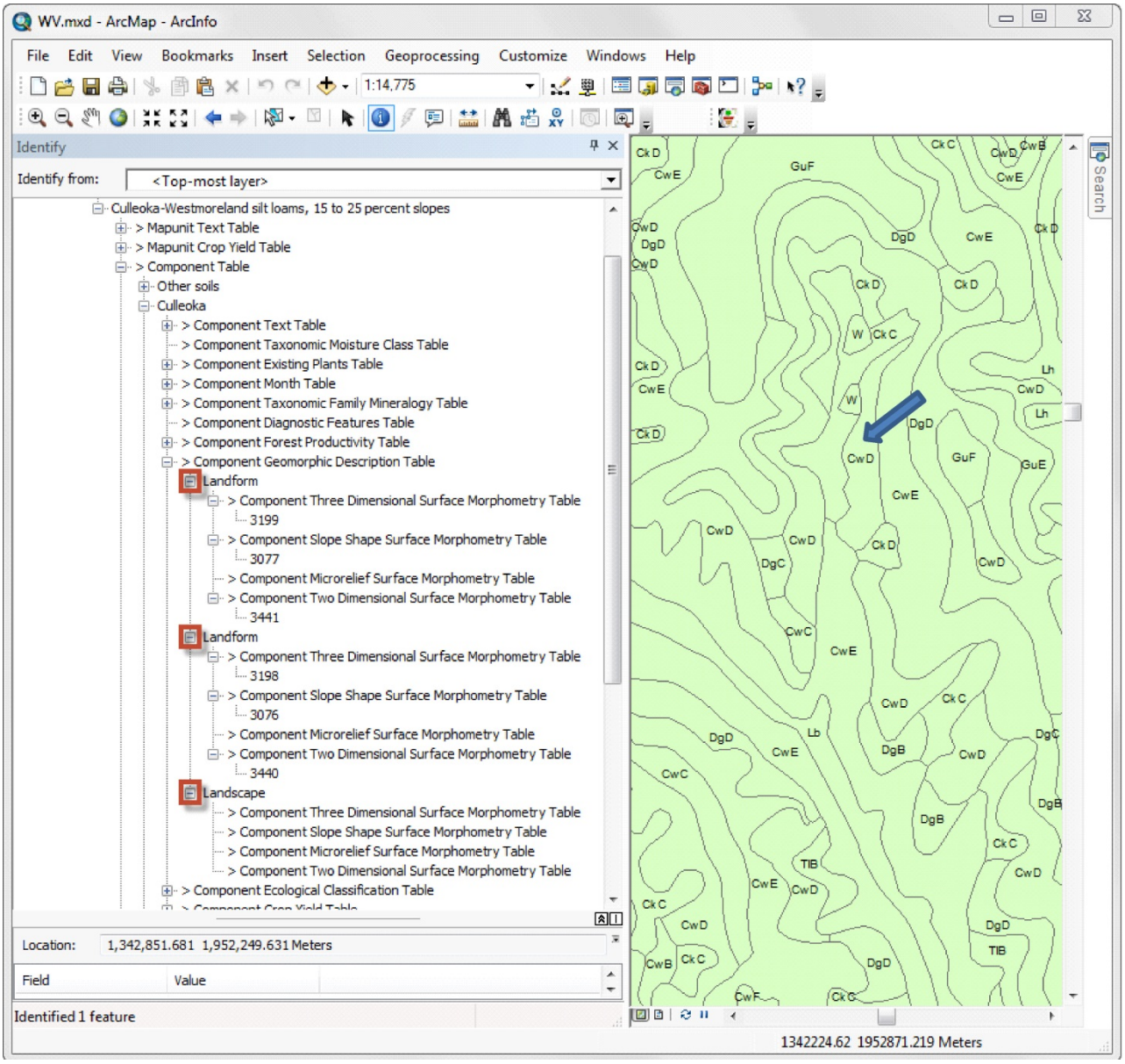
The display shows the relationship classes for the child tables of the Culleoka component.

❑ Expand the **plus sign (+)** beside the Component Geomorphic Description Table in the Identify results window.

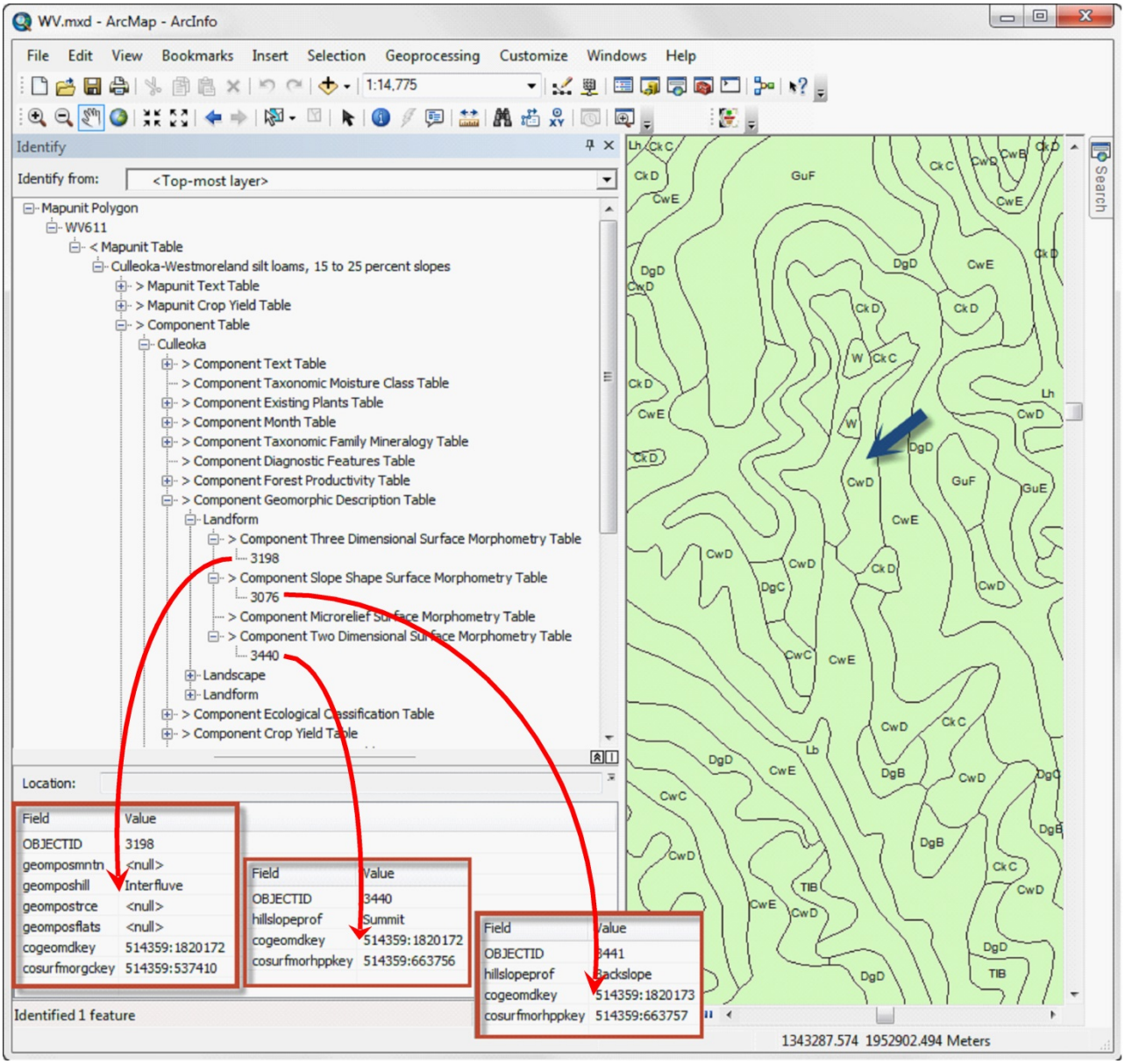


The landform and landscape positions of the Culleoka component are displayed.

❑ Expand the **plus sign (+)** beside each Landform and Landscape choice in the Identify results window.



In order for the values to make sense, click on the individual numeric values to decode.



The table aliases are displayed in the Identify results tree. A table alias is one of the properties that was set when the relationship classes were created.

The Landform record can also be expanded to display information contained in four child tables of the Component Geomorphic Description Table. In this example, no related information exists in the Component Microrelief Surface Morphometry Table.

Using Relationship Classes to Find Related Records in Related Tables

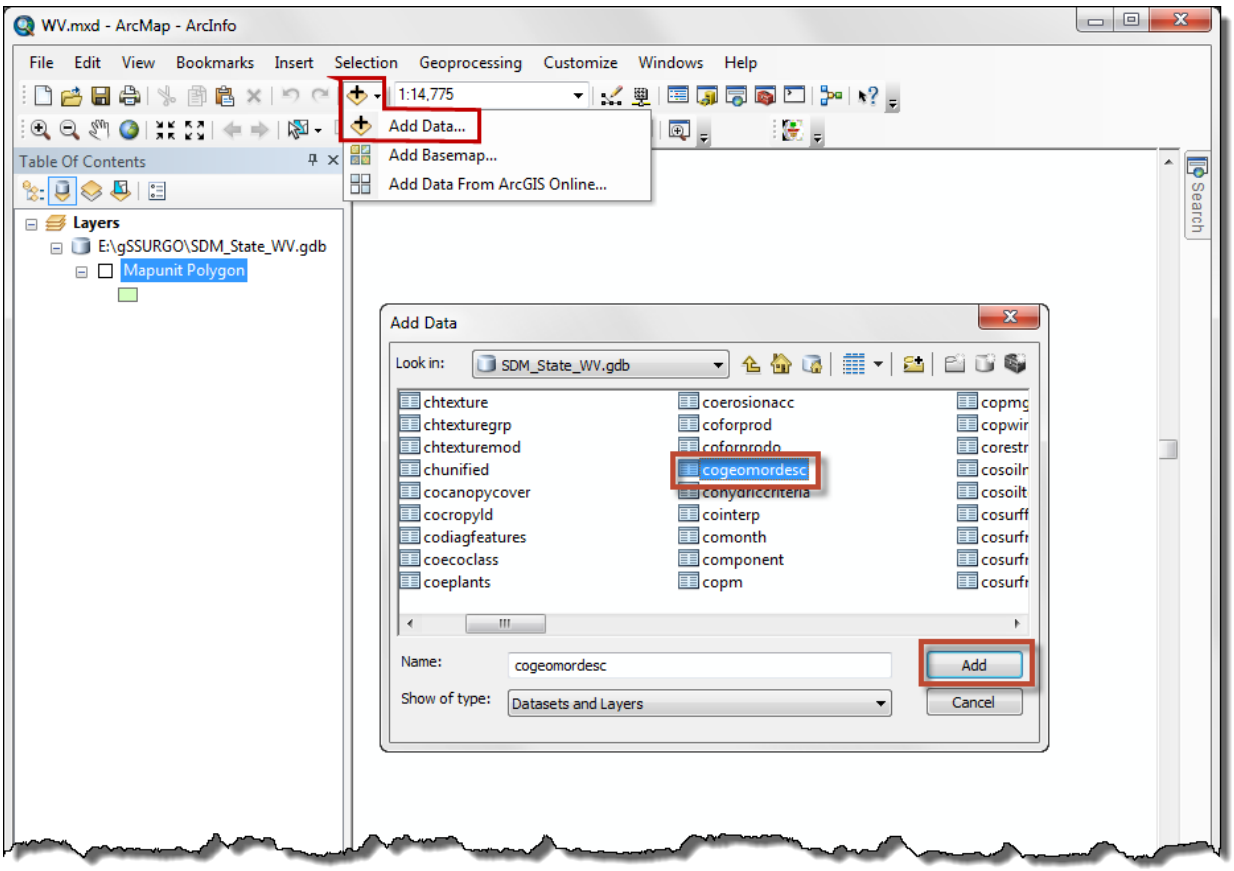
In the following example, the relationship is traced between the Component Geomorphic Description (cogeomordesc) Table and the Map Unit Polygon attribute table. This is the "bottom up" approach.

The selection sequence is: cogeomordesc, component, mapunit, MUPOLYGON feature class.

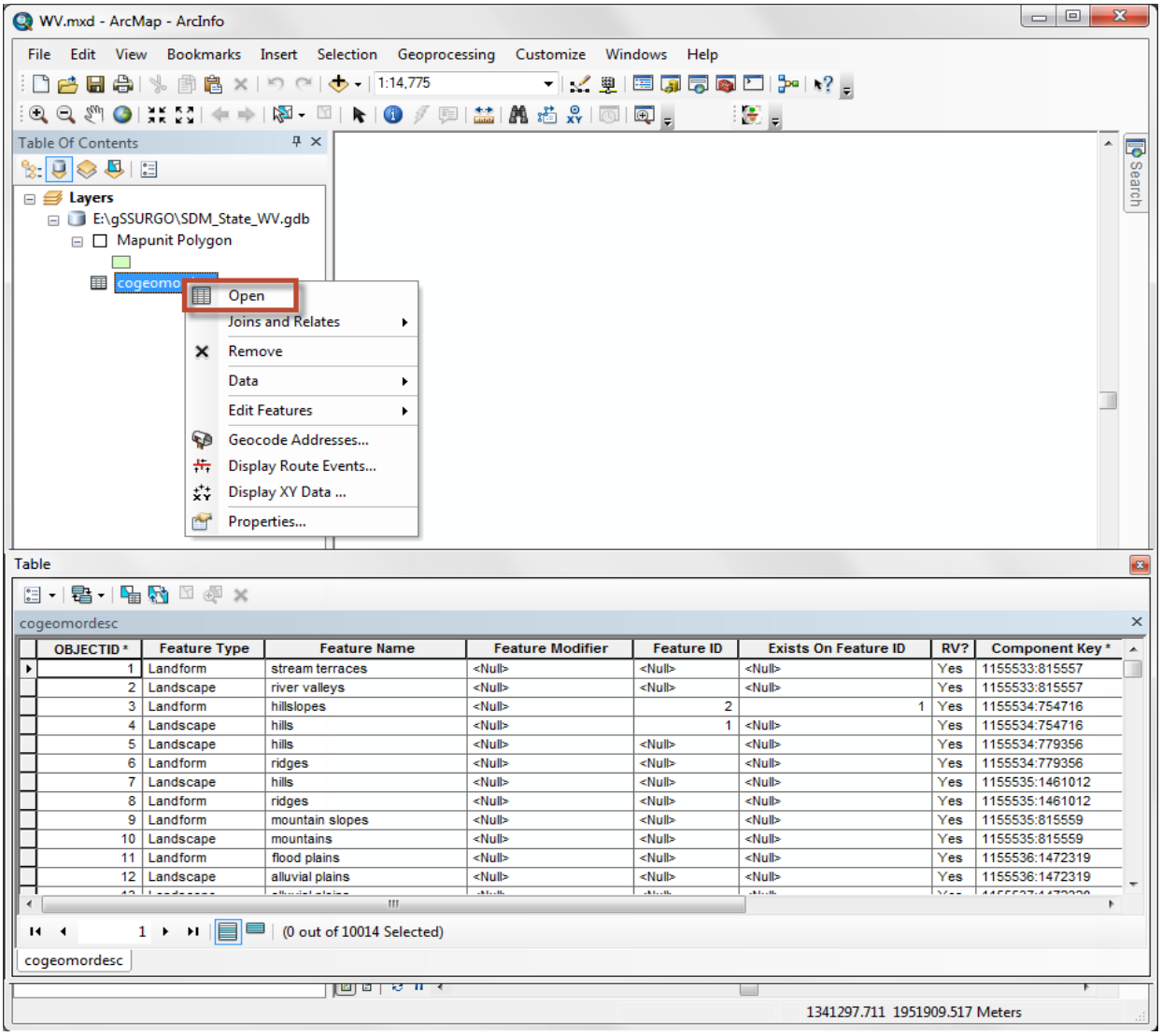
Begin with the cogeomordesc table and find map units containing "flood plains."

❑ Select **Add Data…**from the drop-down menu.

❑ Choose the appropriate file geodatabase (e.g., **gSSURGO_WV.gdb**) , select the table (e.g., **cogeomordesc**), and click on the **Add** button.

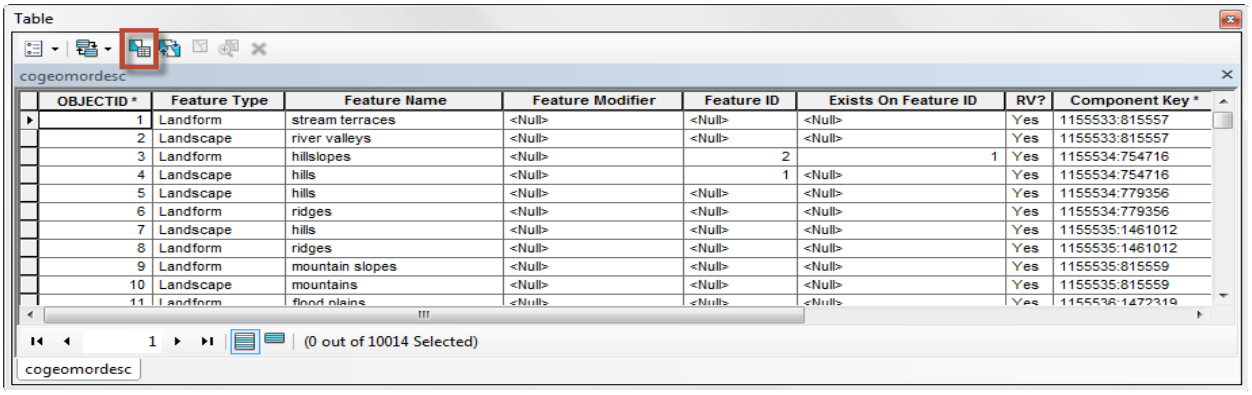


❑ Right-click on the table name and choose **Open**.



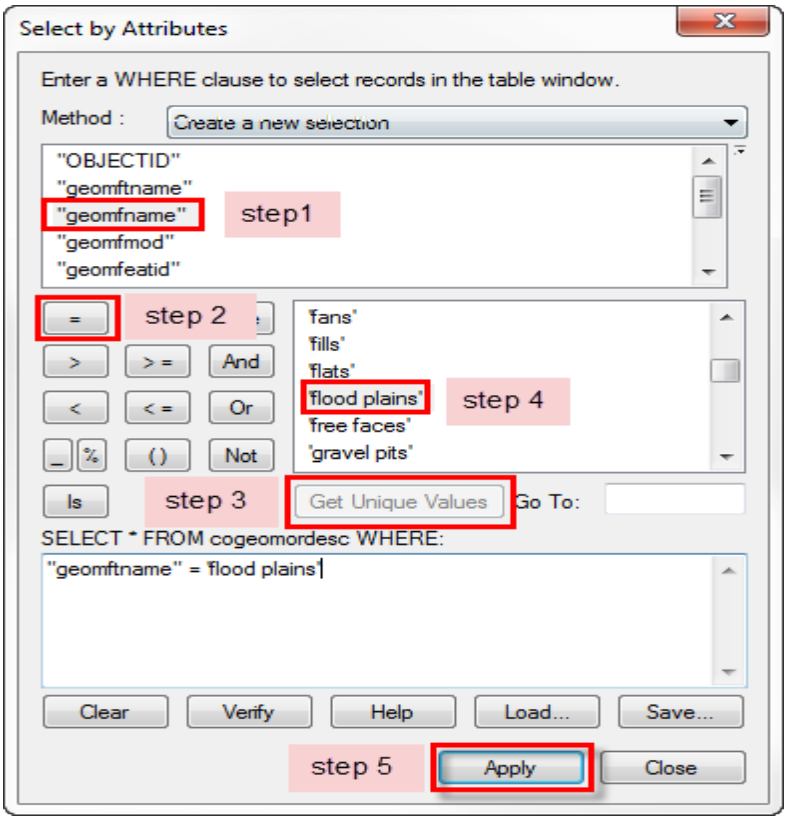
Narrow the number of records to work with.

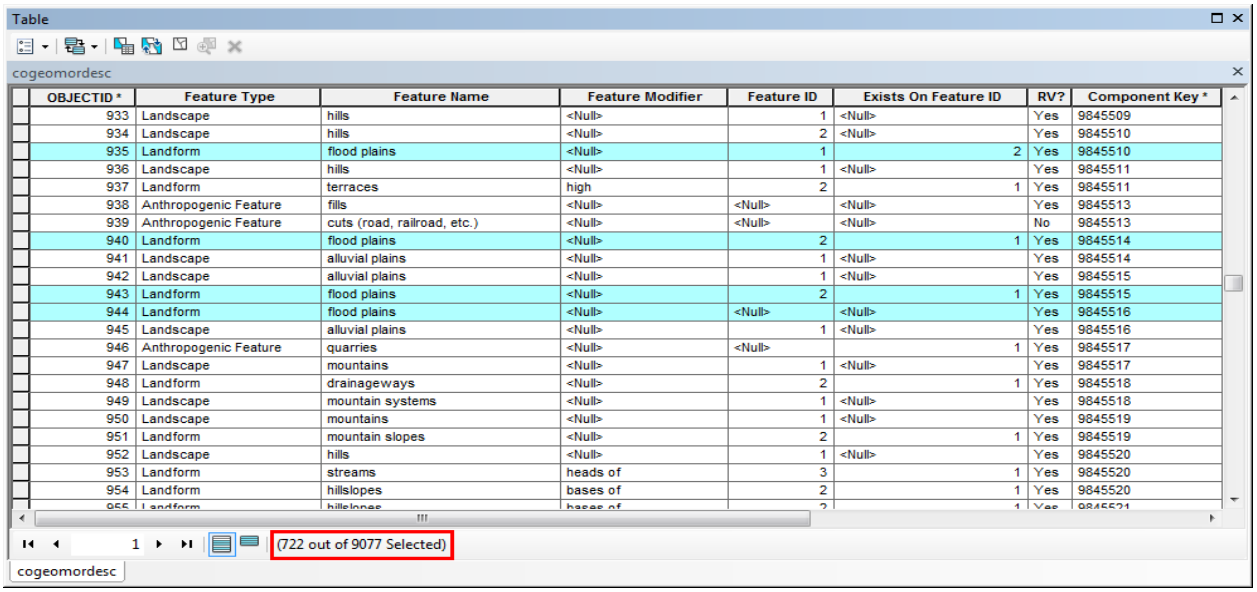
❑ Click on the **Select by Attributes** button in the Table dialog box.



❑ Complete the **Select by Attributes** dialog box:

- Double-click on **geomfname** (Feature Name).
- Single-click on **equals sign (=)**.
- Click on the **Get Unique Values** button for a list of values for the feature name field.
- Double-click on **flood plains** to complete the selection.
- Select **Apply.**



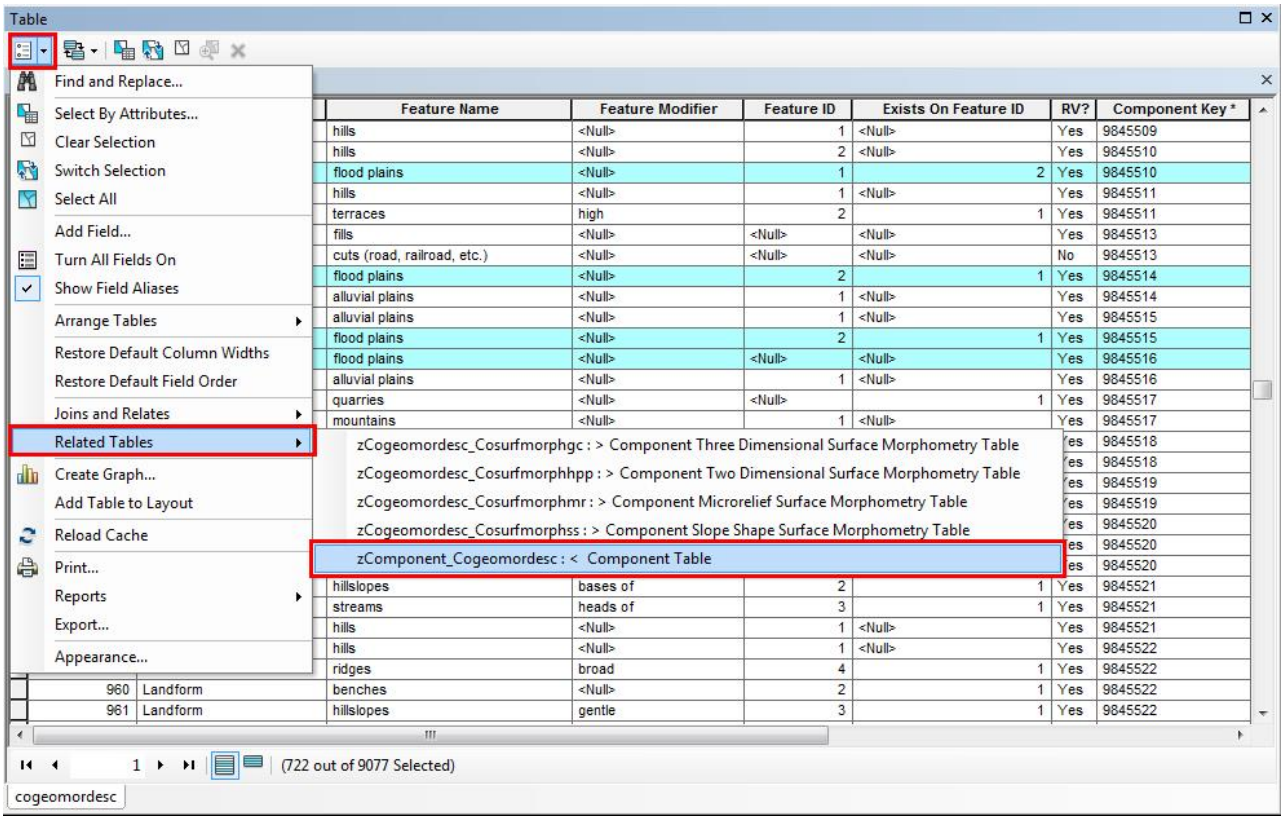


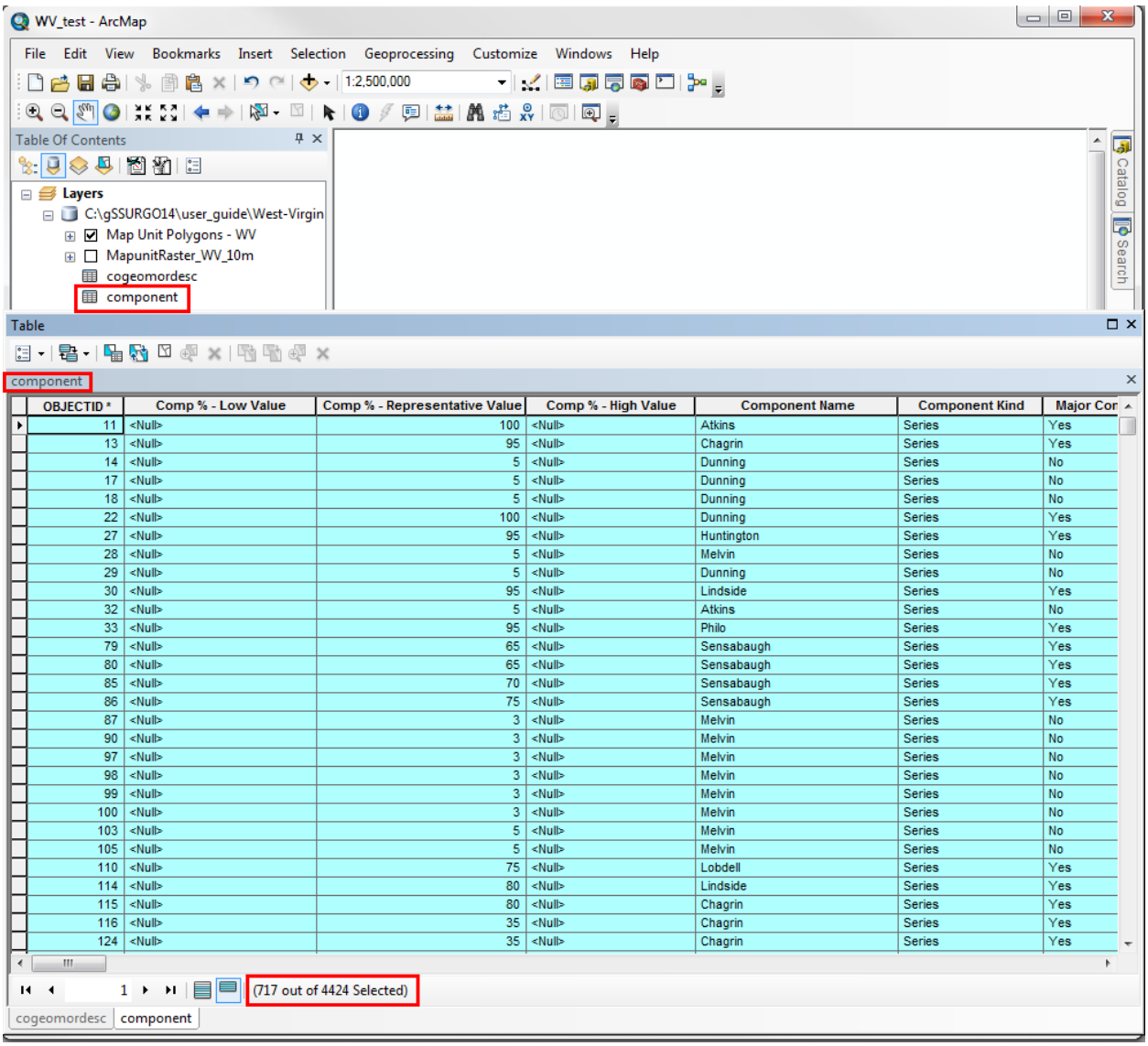
OBJECTID *	Feature Type	Feature Name	Feature Modifier	Feature ID	Exists On Feature ID	RV?	Component Key *
933	Landscape	hills	<Null>	1	<Null>	Yes	9845509
934	Landscape	hills	<Null>	2	<Null>	Yes	9845510
935	Landform	flood plains	<Null>	1	2	Yes	9845510
936	Landscape	hills	<Null>	1	<Null>	Yes	9845511
937	Landform	terraces	high	2	1	Yes	9845511
938	Anthropogenic Feature	fills	<Null>	<Null>	<Null>	Yes	9845513
939	Anthropogenic Feature	cuts (road, railroad, etc.)	<Null>	<Null>	<Null>	No	9845513
940	Landform	flood plains	<Null>	2	1	Yes	9845514
941	Landscape	alluvial plains	<Null>	1	<Null>	Yes	9845514
942	Landscape	alluvial plains	<Null>	1	<Null>	Yes	9845515
943	Landform	flood plains	<Null>	2	1	Yes	9845515
944	Landform	flood plains	<Null>	<Null>	<Null>	Yes	9845516
945	Landscape	alluvial plains	<Null>	1	<Null>	Yes	9845516
946	Anthropogenic Feature	quarries	<Null>	<Null>	1	Yes	9845517
947	Landscape	mountains	<Null>	1	<Null>	Yes	9845517
948	Landform	drainageways	<Null>	2	1	Yes	9845518
949	Landscape	mountain systems	<Null>	1	<Null>	Yes	9845518
950	Landscape	mountains	<Null>	1	<Null>	Yes	9845519
951	Landform	mountain slopes	<Null>	2	1	Yes	9845519
952	Landscape	hills	<Null>	1	<Null>	Yes	9845520
953	Landform	streams	heads of	3	1	Yes	9845520
954	Landform	hillslopes	bases of	2	1	Yes	9845520

In this example, the query selected 722 records from the 9077 contained in the table.

Add the Component Table to the Table of Contents:

- ❑ Click the down arrow next to **Table Options** in the cogeomordesc table dialog box.
- ❑ Click on the arrow next to **Related Tables**.
- ❑ Select **Component Table**.

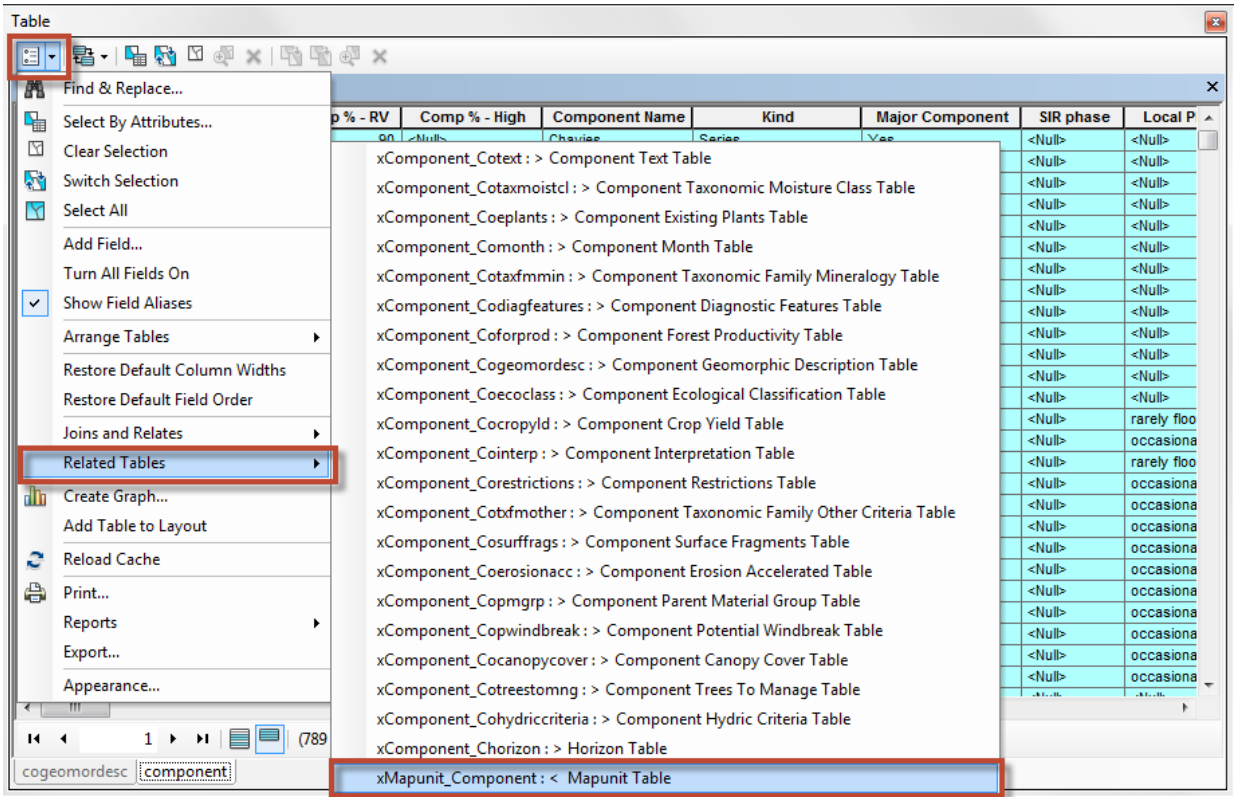


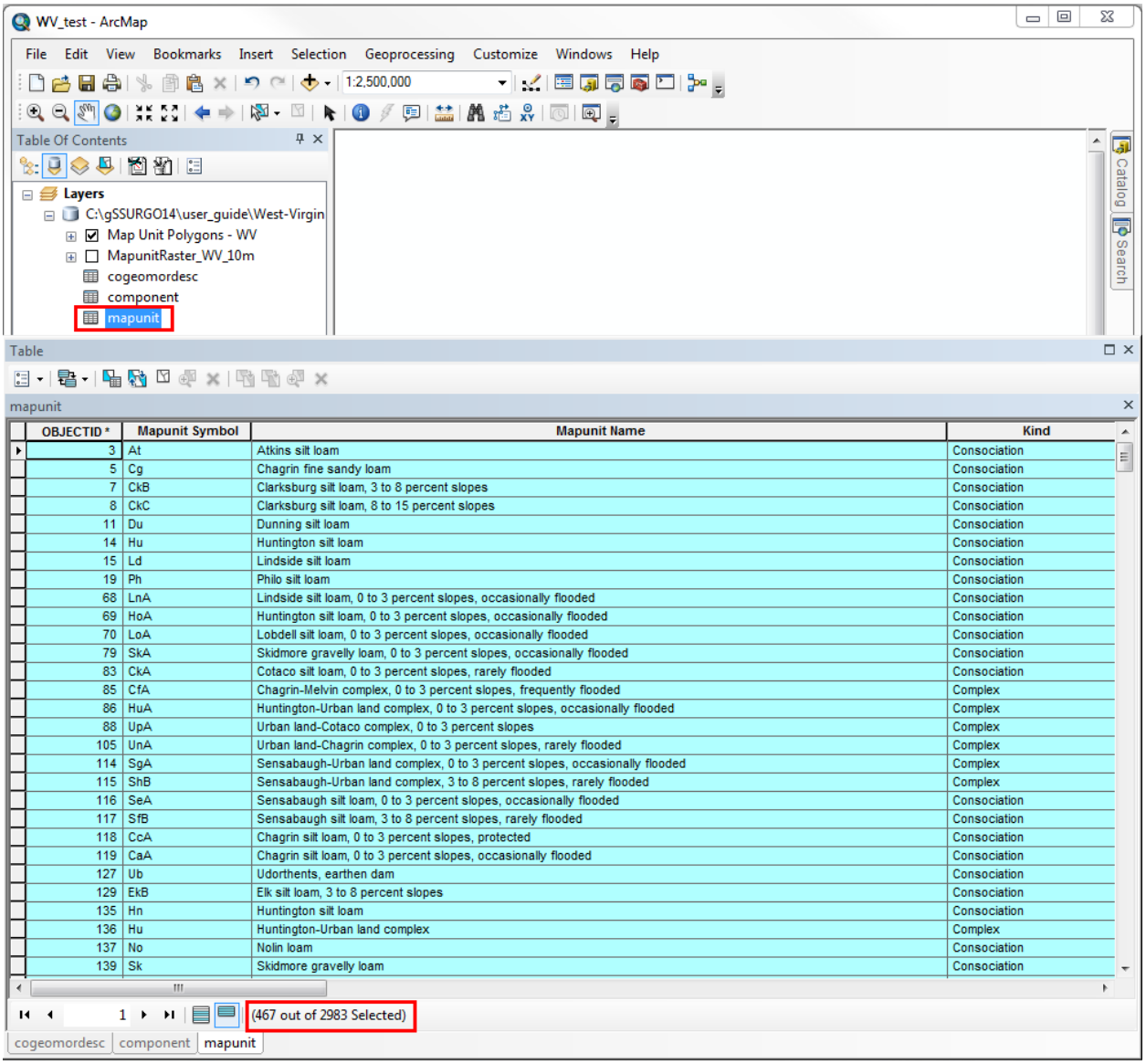


The component table is added to the Table of Contents and will open with all related records selected. In this example, 717 records out of 4424 were selected.

Add the Mapunit Table to the Table of Contents:

- ❑ Click the down arrow next to **Table Options** in the component table dialog box.
- ❑ Click on the arrow next to **Related Tables**.
- ❑ Select **Mapunit Table**.





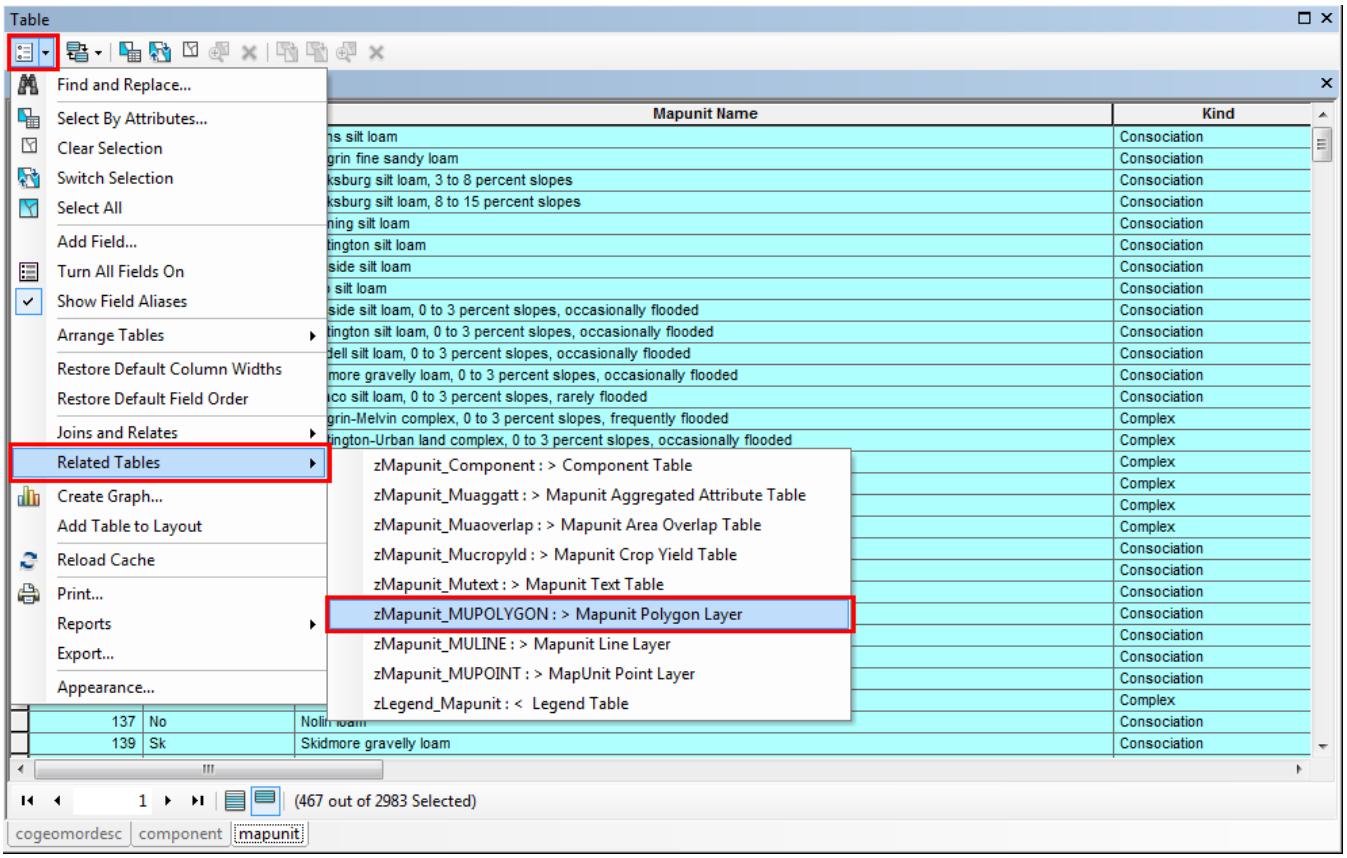
OBJECTID *	Mapunit Symbol	Mapunit Name	Kind
3	At	Atkins silt loam	Consociation
5	Cg	Chagrin fine sandy loam	Consociation
7	CkB	Clarksburg silt loam, 3 to 8 percent slopes	Consociation
8	CkC	Clarksburg silt loam, 8 to 15 percent slopes	Consociation
11	Du	Dunning silt loam	Consociation
14	Hu	Huntington silt loam	Consociation
15	Ld	Lindside silt loam	Consociation
19	Ph	Philo silt loam	Consociation
68	LnA	Lindside silt loam, 0 to 3 percent slopes, occasionally flooded	Consociation
69	HoA	Huntington silt loam, 0 to 3 percent slopes, occasionally flooded	Consociation
70	LoA	Lobdell silt loam, 0 to 3 percent slopes, occasionally flooded	Consociation
79	SkA	Skidmore gravelly loam, 0 to 3 percent slopes, occasionally flooded	Consociation
83	CkA	Cotaco silt loam, 0 to 3 percent slopes, rarely flooded	Consociation
85	CfA	Chagrin-Melvin complex, 0 to 3 percent slopes, frequently flooded	Complex
86	HuA	Huntington-Urban land complex, 0 to 3 percent slopes, occasionally flooded	Complex
88	UpA	Urban land-Cotaco complex, 0 to 3 percent slopes	Complex
105	UnA	Urban land-Chagrin complex, 0 to 3 percent slopes, rarely flooded	Complex
114	SgA	Sensabaugh-Urban land complex, 0 to 3 percent slopes, occasionally flooded	Complex
115	ShB	Sensabaugh-Urban land complex, 3 to 8 percent slopes, rarely flooded	Complex
116	SeA	Sensabaugh silt loam, 0 to 3 percent slopes, occasionally flooded	Consociation
117	SfB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	Consociation
118	CcA	Chagrin silt loam, 0 to 3 percent slopes, protected	Consociation
119	CaA	Chagrin silt loam, 0 to 3 percent slopes, occasionally flooded	Consociation
127	Ub	Udorthents, earthen dam	Consociation
129	EkB	Elk silt loam, 3 to 8 percent slopes	Consociation
135	Hn	Huntington silt loam	Consociation
136	Hu	Huntington-Urban land complex	Complex
137	No	Nolin loam	Consociation
139	Sk	Skidmore gravelly loam	Consociation

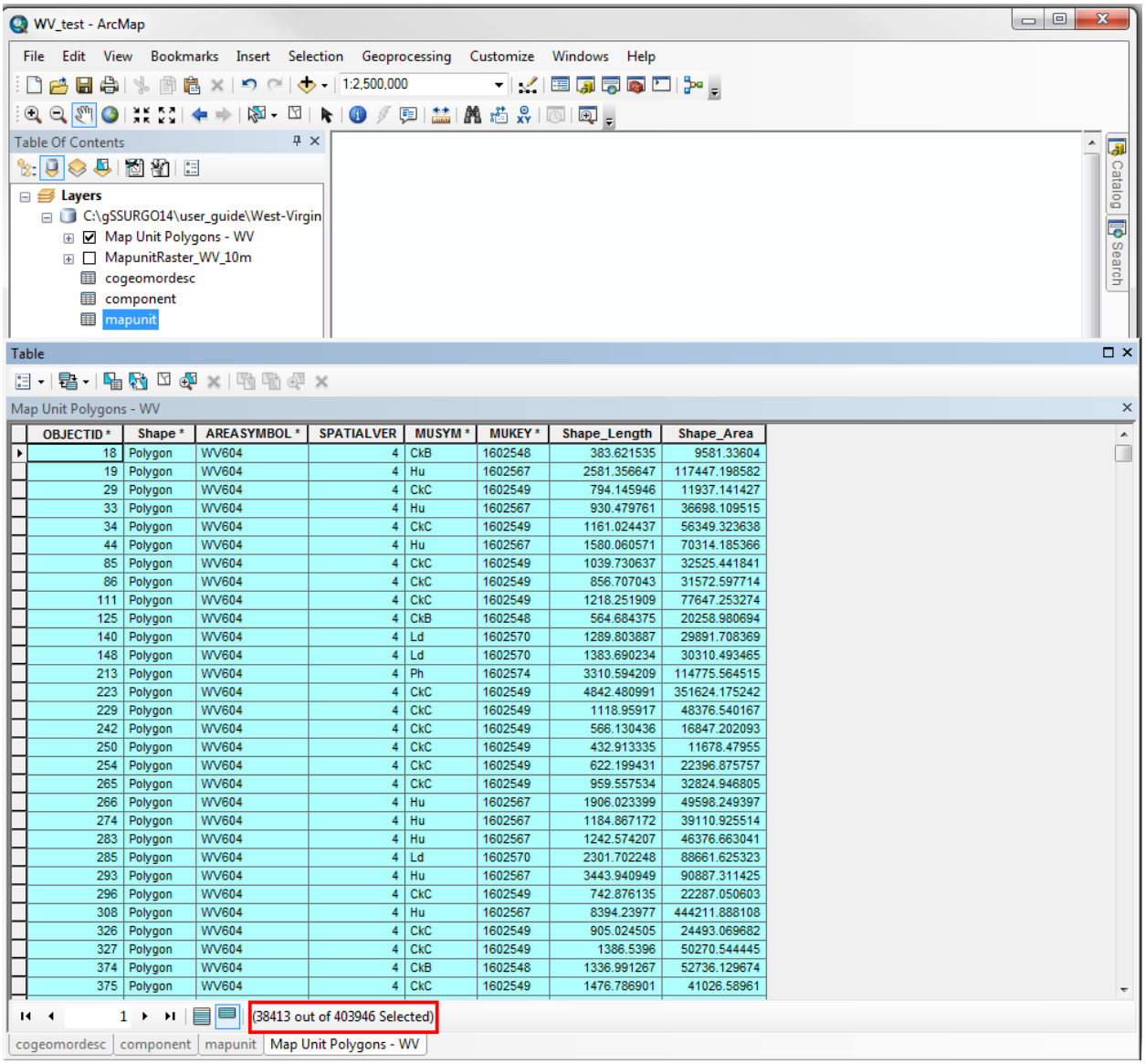
The Mapunit Table is added to the Table of Contents and will open with all related records selected. In this example, 467 of 2983 records were selected.

View the selected flood-plain feature in the map unit polygon layer:

- ❑ Click the down arrow next to the **Table Options** button in the Mapunit Table dialog box.
- ❑ Click on the arrow next to **Related Tables**.
- ❑ Select **MapUnit Polygon Layer**.

This may take some time to process, depending on how many records are selected.



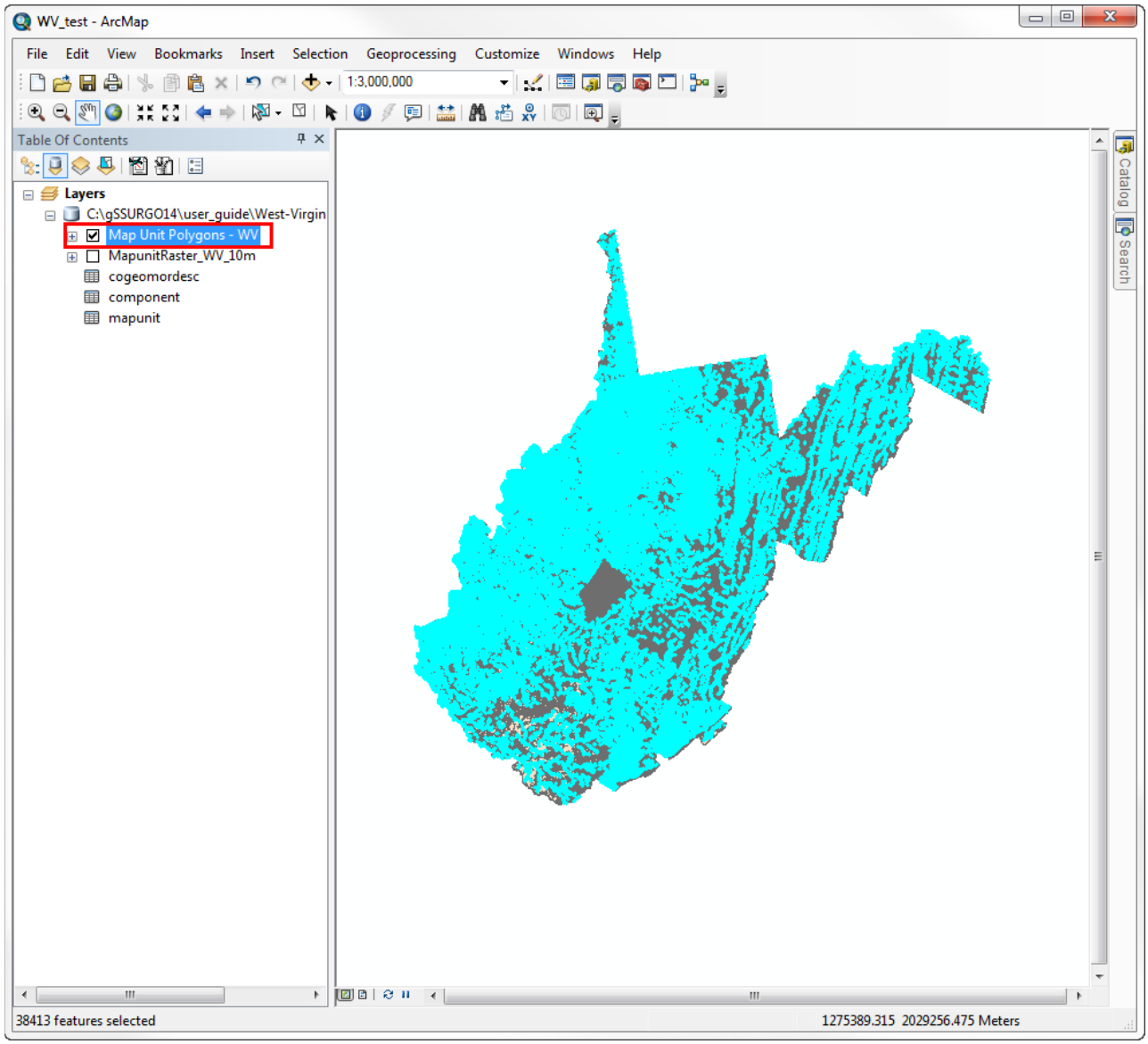


OBJECTID *	Shape *	AREASYMBOL *	SPATIALVER	MUSYM *	MUKEY *	Shape_Length	Shape_Area
18	Polygon	WV604	4	CkB	1602548	383.621535	9581.33604
19	Polygon	WV604	4	Hu	1602567	2581.356647	117447.198582
29	Polygon	WV604	4	CkC	1602549	794.145946	11937.141427
33	Polygon	WV604	4	Hu	1602567	930.479761	36698.109515
34	Polygon	WV604	4	CkC	1602549	1161.024437	56349.323638
44	Polygon	WV604	4	Hu	1602567	1580.060571	70314.185366
85	Polygon	WV604	4	CkC	1602549	1039.730637	32525.441841
86	Polygon	WV604	4	CkC	1602549	856.707043	31572.597714
111	Polygon	WV604	4	CkC	1602549	1218.251909	77647.253274
125	Polygon	WV604	4	CkB	1602548	564.684375	20258.980694
140	Polygon	WV604	4	Ld	1602570	1289.803887	29891.708369
148	Polygon	WV604	4	Ld	1602570	1383.690234	30310.493465
213	Polygon	WV604	4	Ph	1602574	3310.594209	114775.564515
223	Polygon	WV604	4	CkC	1602549	4842.480991	351624.175242
229	Polygon	WV604	4	CkC	1602549	1118.95917	48376.540167
242	Polygon	WV604	4	CkC	1602549	566.130436	16847.202093
250	Polygon	WV604	4	CkC	1602549	432.913335	11678.47955
254	Polygon	WV604	4	CkC	1602549	622.199431	22396.875757
265	Polygon	WV604	4	CkC	1602549	959.557534	32824.946805
266	Polygon	WV604	4	Hu	1602567	1906.023399	49598.249397
274	Polygon	WV604	4	Hu	1602567	1184.867172	39110.925514
283	Polygon	WV604	4	Hu	1602567	1242.574207	46376.663041
285	Polygon	WV604	4	Ld	1602570	2301.702248	88661.625323
293	Polygon	WV604	4	Hu	1602567	3443.940949	90887.311425
296	Polygon	WV604	4	CkC	1602549	742.876135	22287.050603
308	Polygon	WV604	4	Hu	1602567	8394.23977	444211.888108
326	Polygon	WV604	4	CkC	1602549	905.024505	24493.069682
327	Polygon	WV604	4	CkC	1602549	1386.5396	50270.544445
374	Polygon	WV604	4	CkB	1602548	1336.991267	52736.129674
375	Polygon	WV604	4	CkC	1602549	1476.786901	41026.58961

In this example, 38413 map unit polygons have a component with the landform “flood plain.”

The Map Unit Polygons feature class is already in the Table of Contents.

❑ Check the box next to the MapUnit Polygons feature class in the Table of Contents to display the data.



At the end of this "bottom up" approach to relationship classes is a display of flood-plain map units.

NOTE: In this example, the percentages of the components were not taken into consideration, only the presence or absence of flood plains.

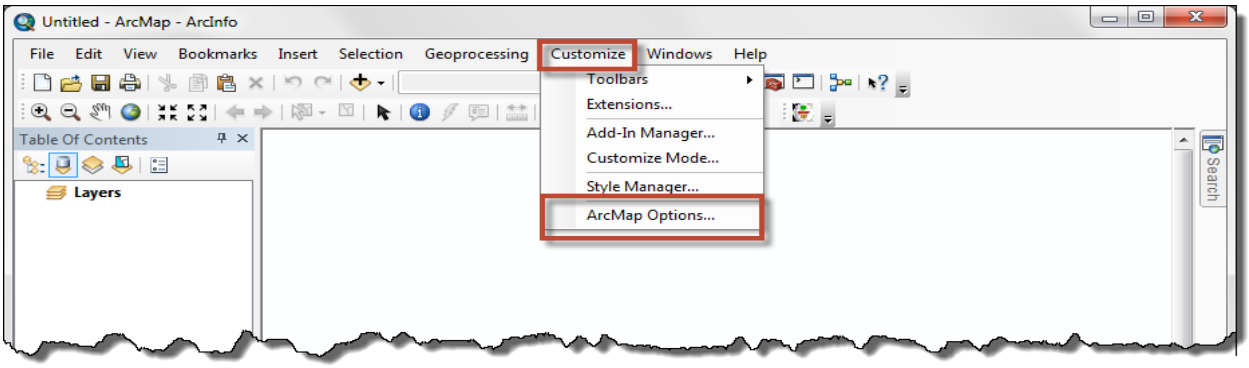
Performance Tips

Displaying Layers in the ArcMap™ Table of Contents

Making Newly Added Layers Visible by Default

Normally ArcMap™ automatically begins to display a map layer as soon as the user adds it to the Table of Contents. When working with very large feature classes that have thousands, if not millions, of records, turning off the default draw can greatly speed up the process. This gives the user an opportunity to first modify the layer symbology or to zoom to a new location. This default setting can easily be changed by the user and need only be changed once.

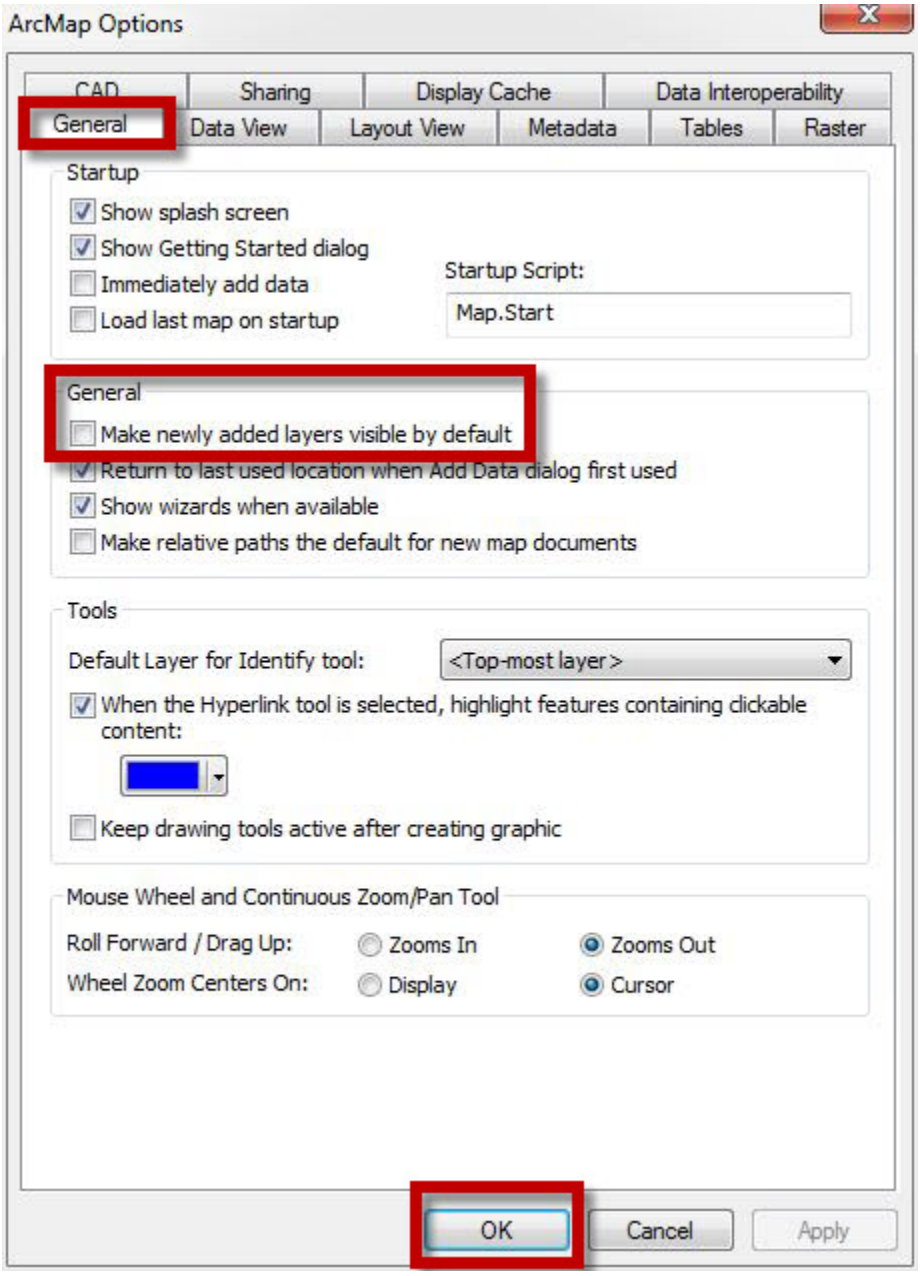
❑ Select **Customize**, then **ArcMap Options…**



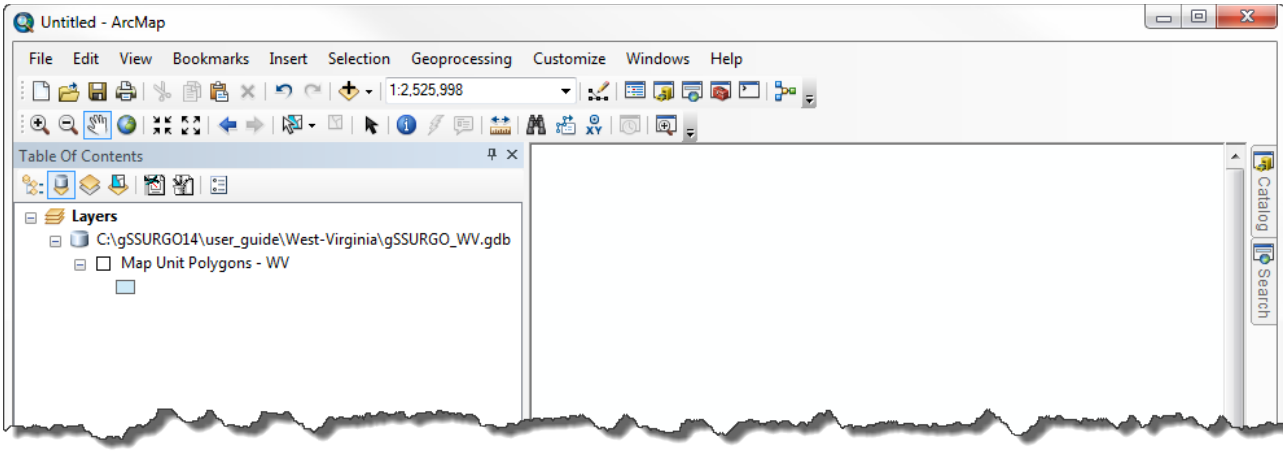
❑ Select the **General** tab from the ArcMap Options dialog box.

❑ In the General section, uncheck the box next to **Make newly added layers visible by default**.

❑ Select **OK**.



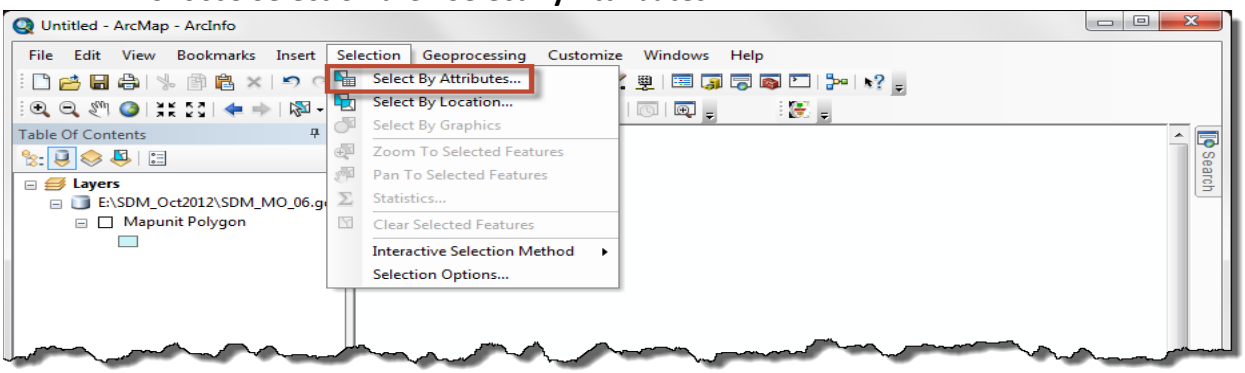
The West Virginia file geodatabase has been added. There are more than 400,000 records in the geodatabase. The layer did not automatically draw after adding to the Table of Contents. Selecting a smaller area of interest before proceeding will help speed up the process.



Selecting an Area of Interest to Reduce the Number of Records

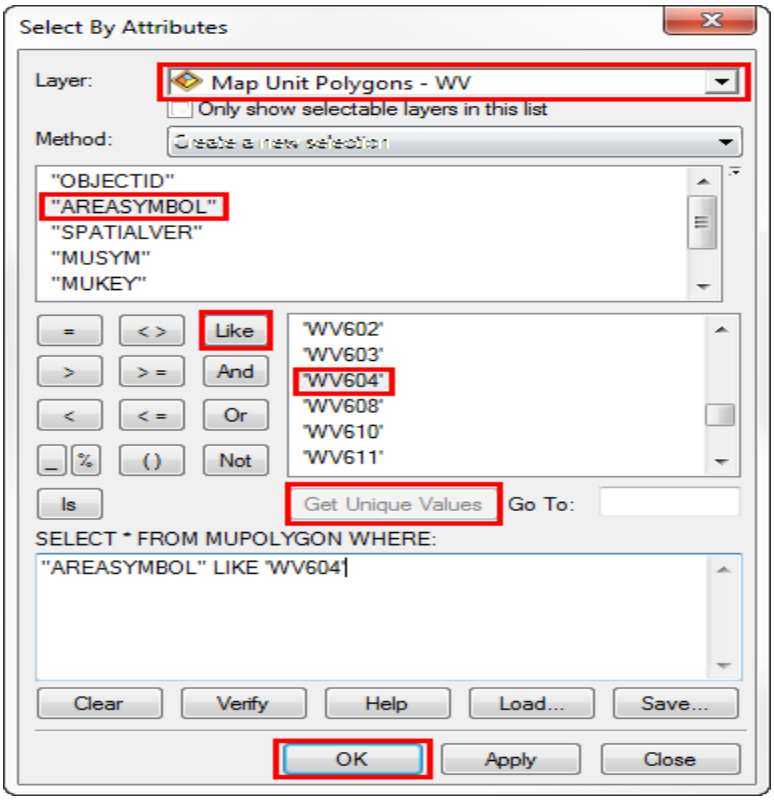
If a specific area is needed, a selection to reduce the number of records to draw in the display area is useful.

❑ Choose **Selection** then **Select By Attributes…**



❑ Complete the **Select by Attributes** dialog box:

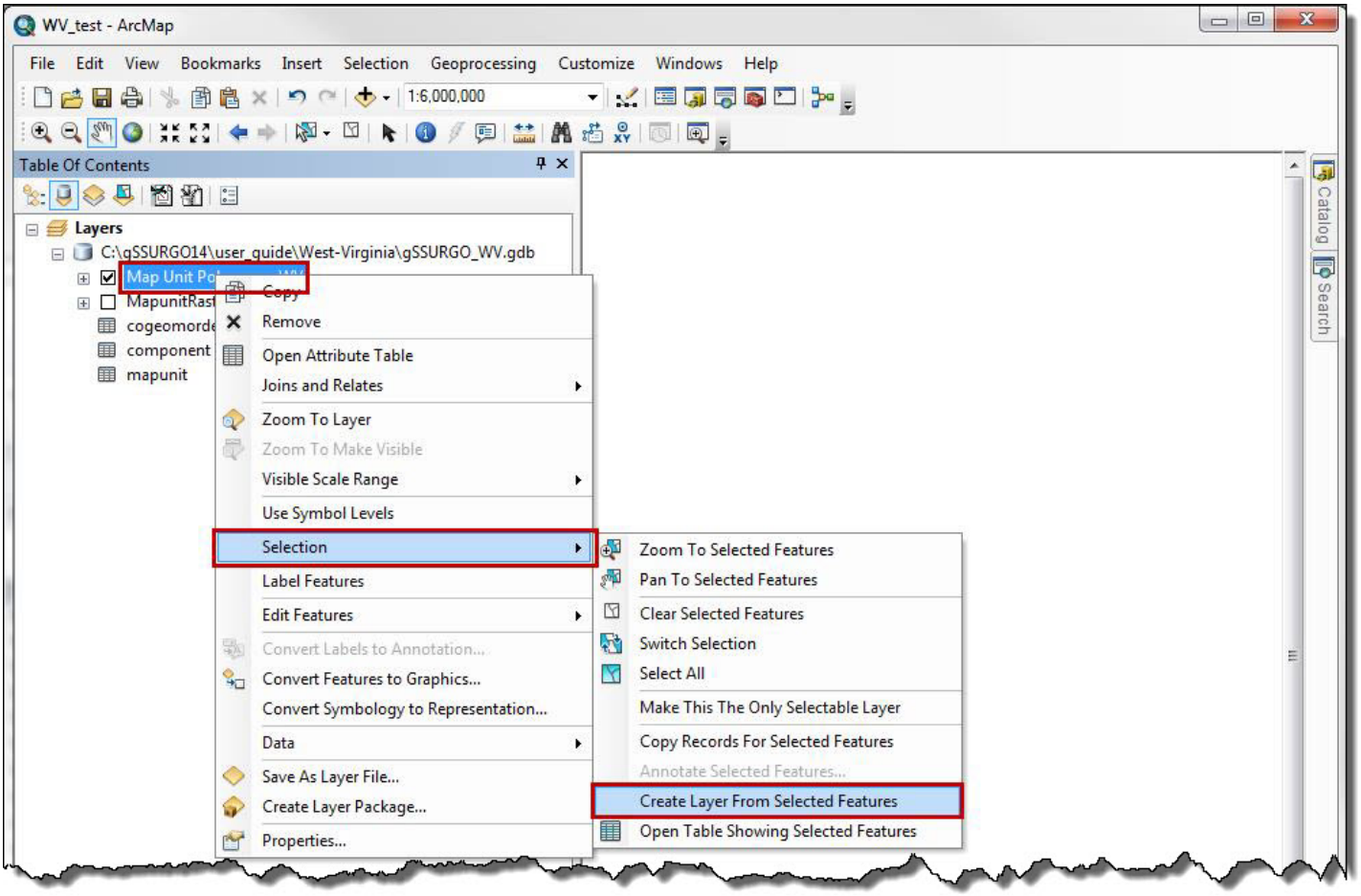
- Select **Map Unit Polygons** for Layer.
- Double-click on **"AREASYMBOL".**
- Single-click on **Like.**
- Click on the **Get Unique Values** button.
- Double-click on **'WV604'.**
- Click **OK.**

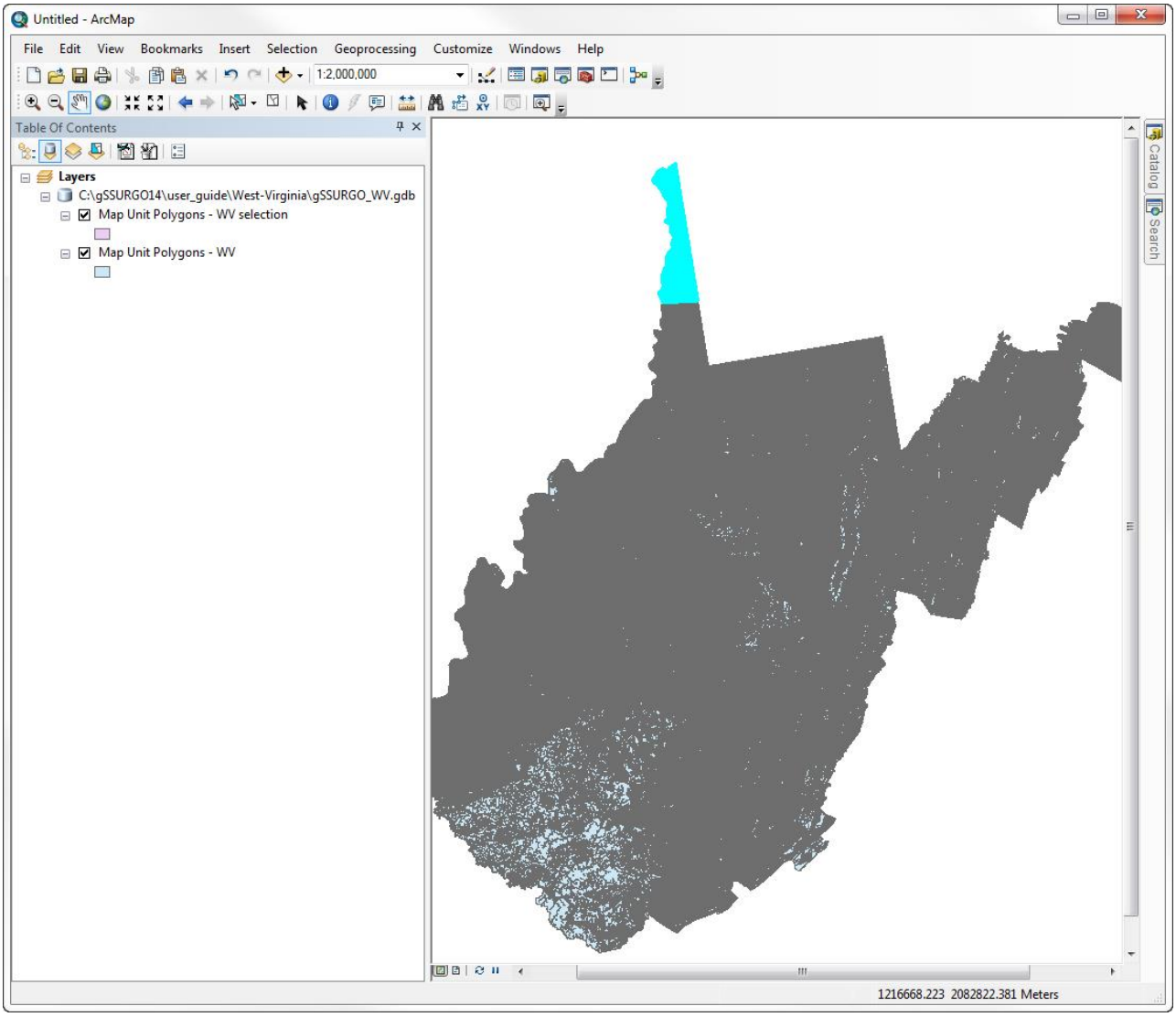


Creating a layer file to be used over and over again for analysis will eliminate the need to create a selected set each time specific data are needed.

Creating a Layer File from Selected Features

❑ Right-click on the feature class (e.g., **MapUnit Polygons-WV**), click on arrow next to **Selection**, and select **Create Layer From Selected Features**.



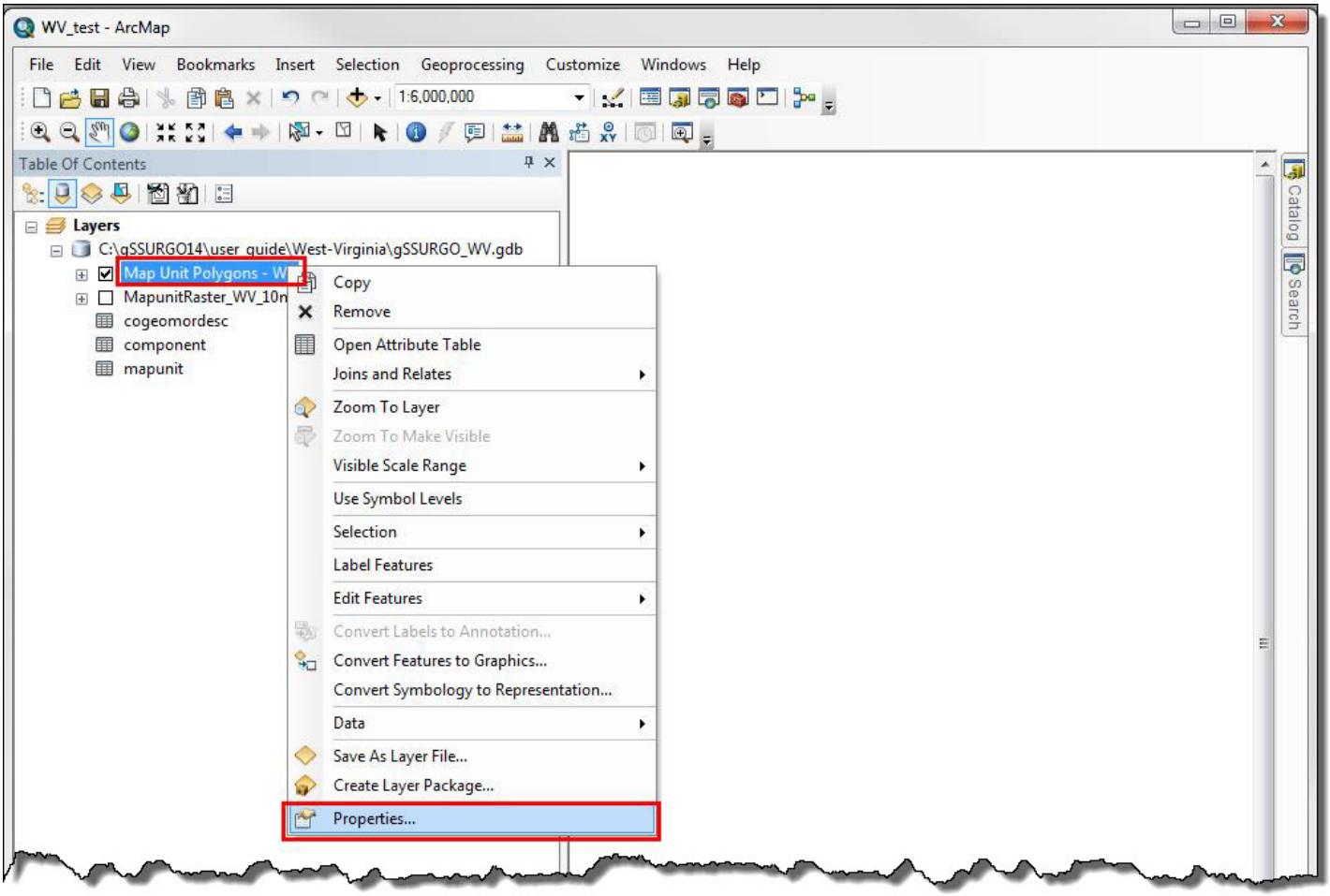


The new layer is automatically added to the Table of Contents. Adjust the symbology, if desired.

Using a Layer Definition Query to Reduce the Number of Selected Records

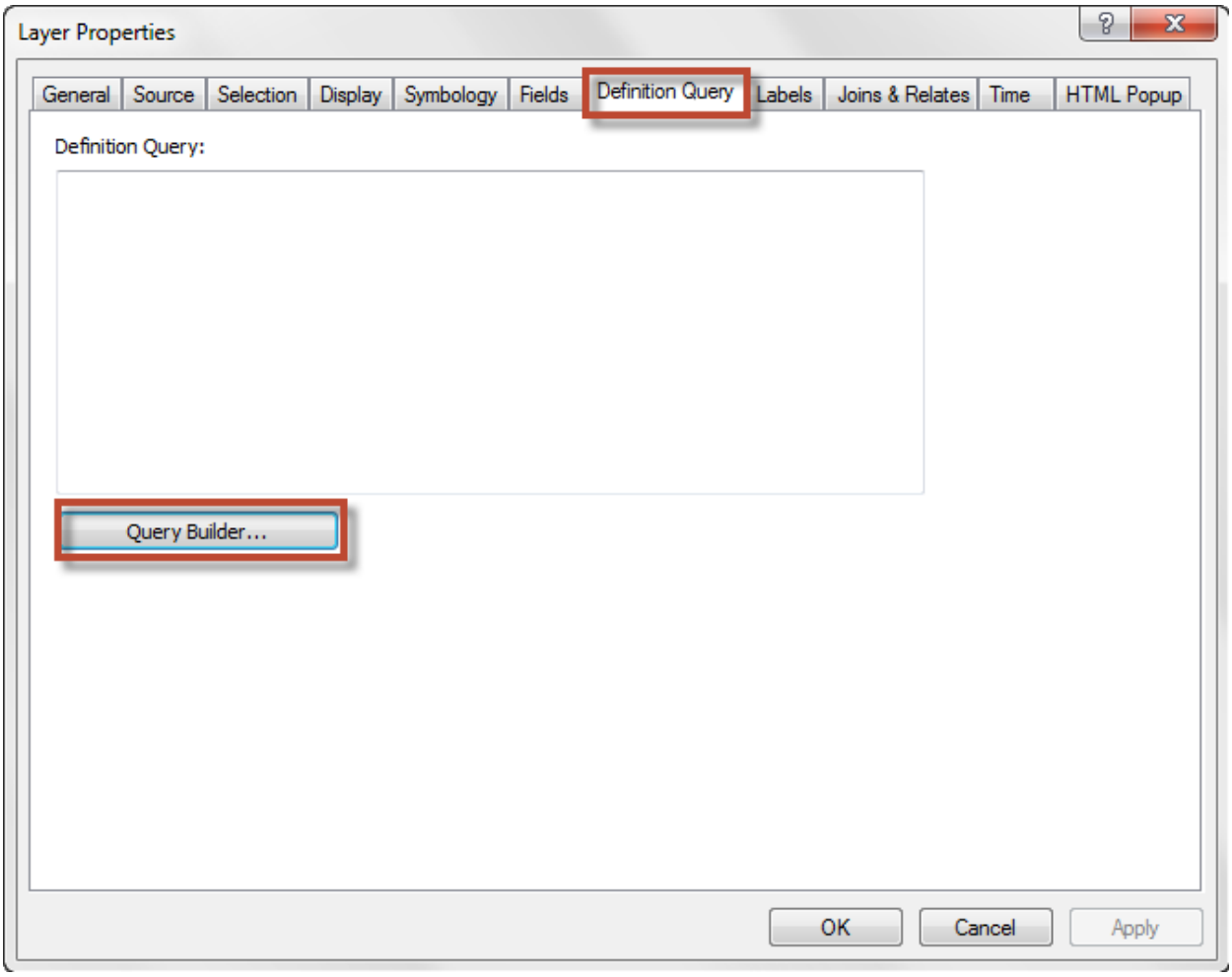
A definition query can be used to reduce the number of records before displaying in ArcMap™.

❑ Right-click on the feature class (e.g., **Map Unit Polygons - WV**) and select **Properties…**



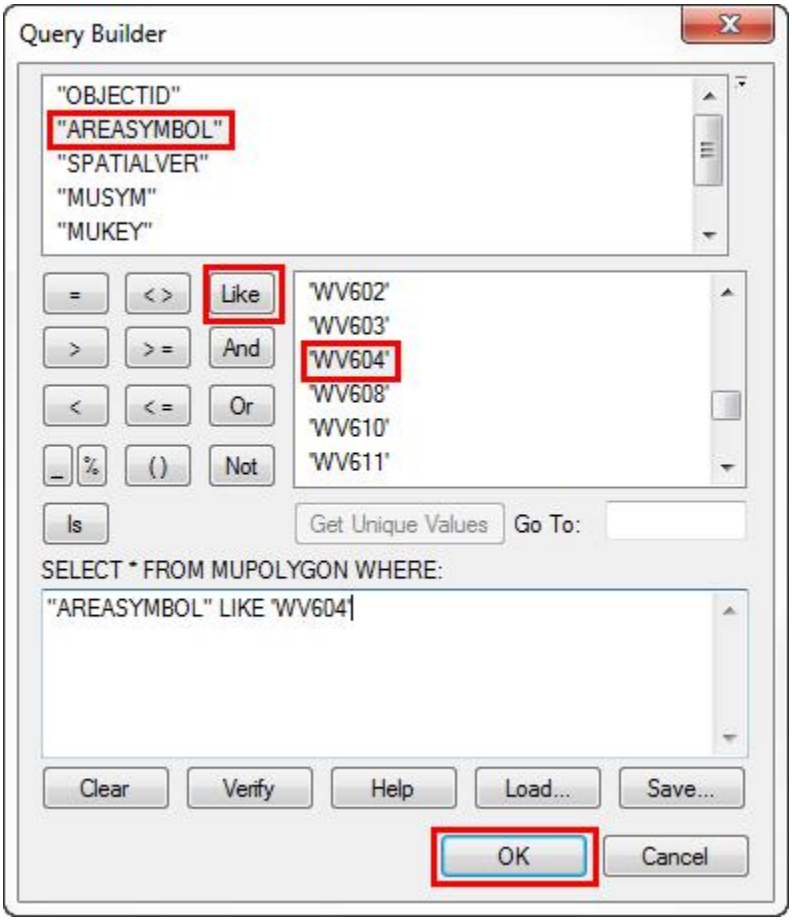
❑ Select the **Definition Query** tab in the Layer Properties dialog box.

❑ Select **Query Builder…**



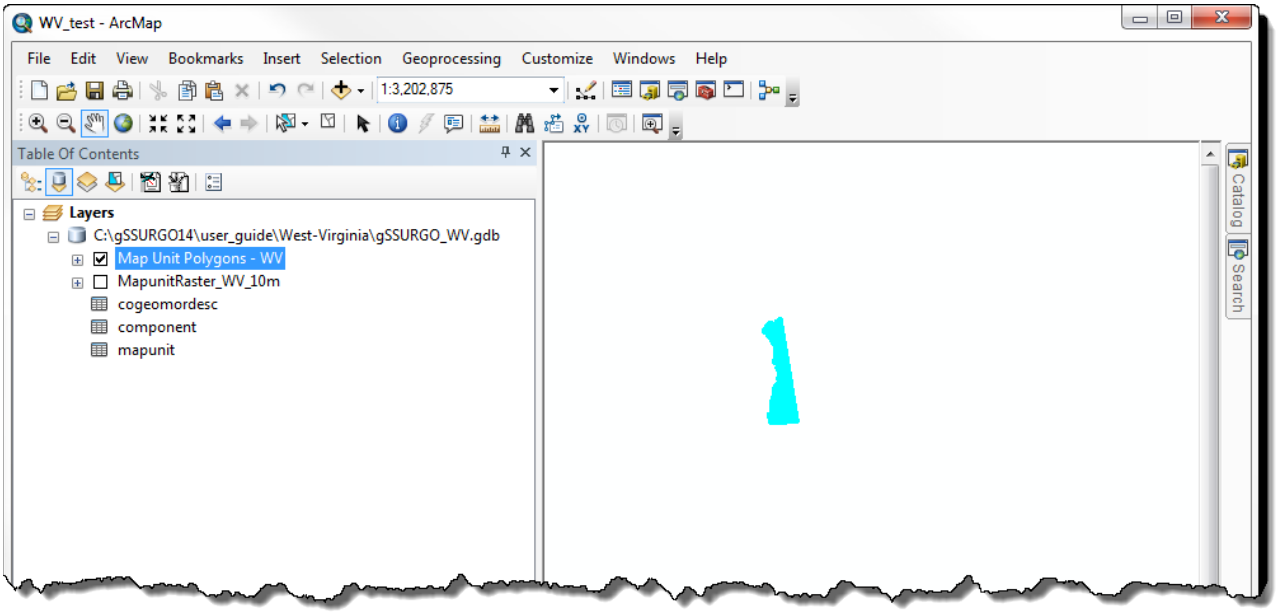
❑ Complete the **Query Builder** dialog box:

- Double-click on **“AREASYMBOL”.**
- Single-click on **Like.**
- Click on the **Get Unique Values** button.
- Double-click on **‘WV604’.**



❑ Click **OK**.

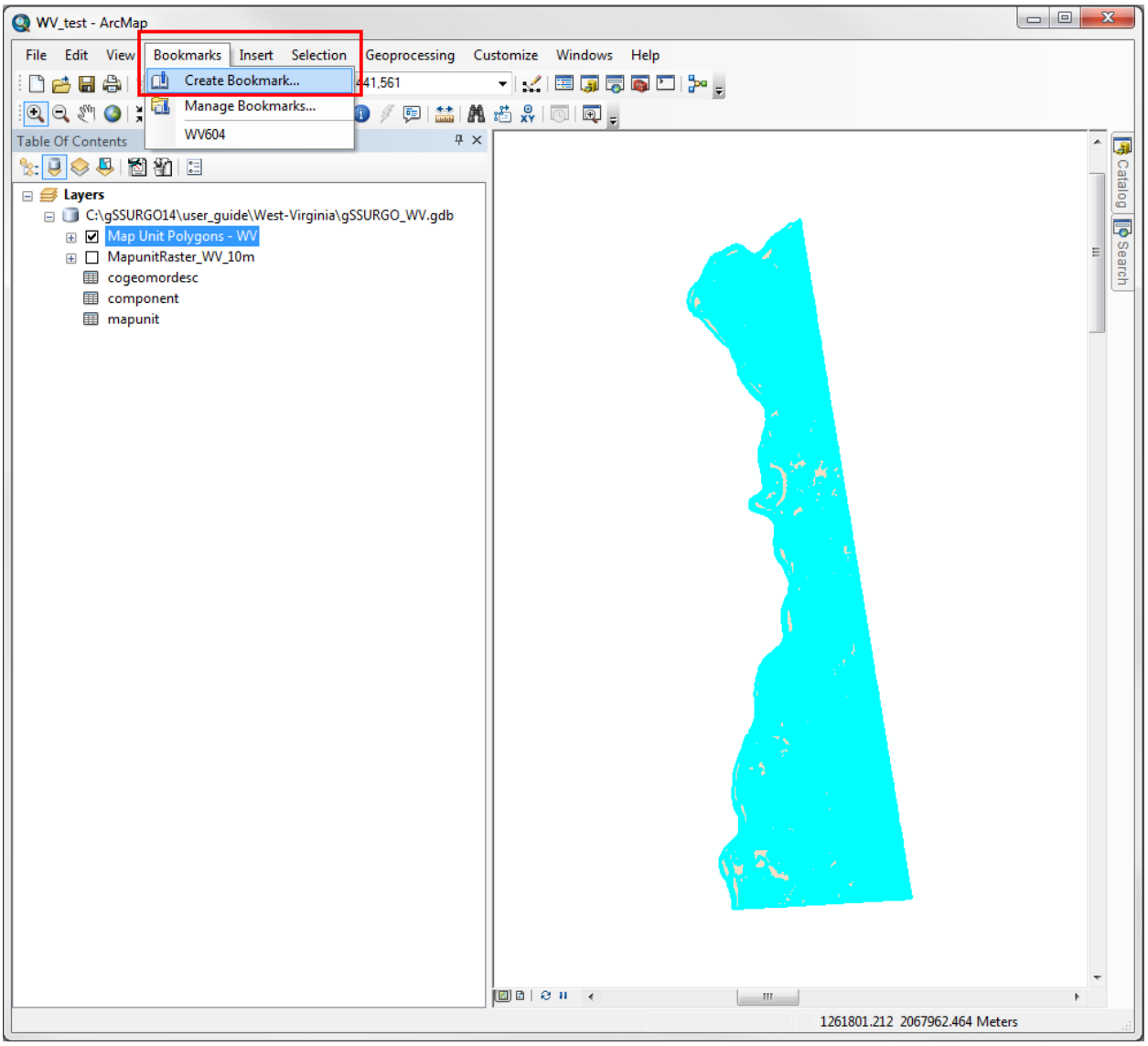
❑ Check the box next to the feature class in the Table of Contents to display the selected records.



Bookmarks

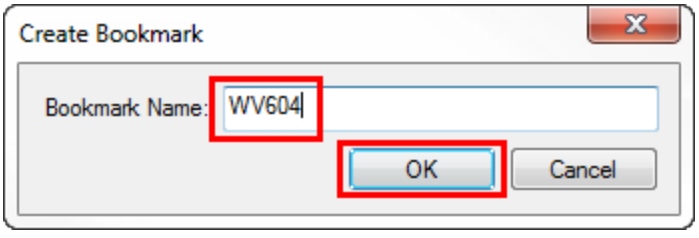
A bookmark can be created to reduce the time it takes to navigate to an area of interest.

❑ Select **Bookmarks**, then **Create Bookmark...**.



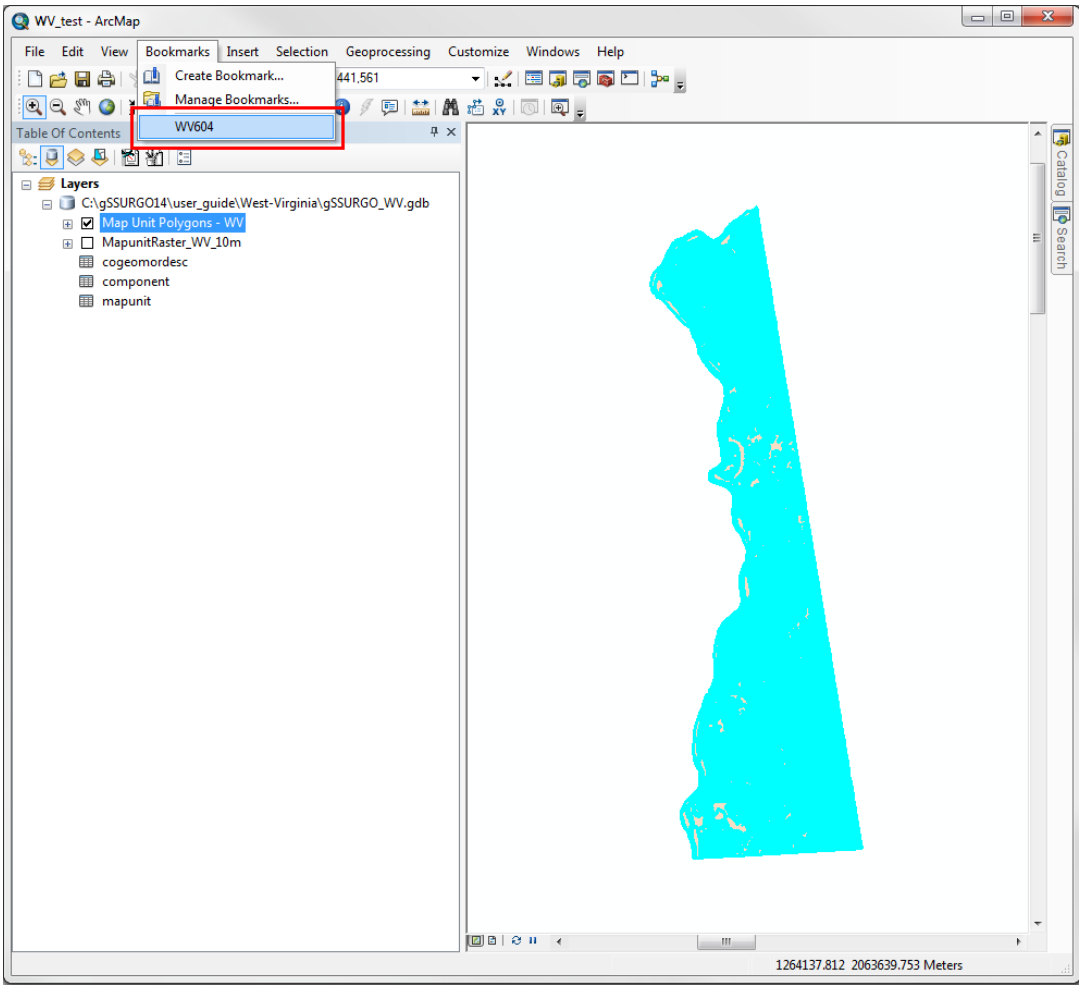
❑ Enter a bookmark name that can be used to navigate to a particular area, (e.g., **WV604**).

❑ Click **OK**.



To navigate to the area:

- ❑ Click on **Bookmarks** and the bookmark name.



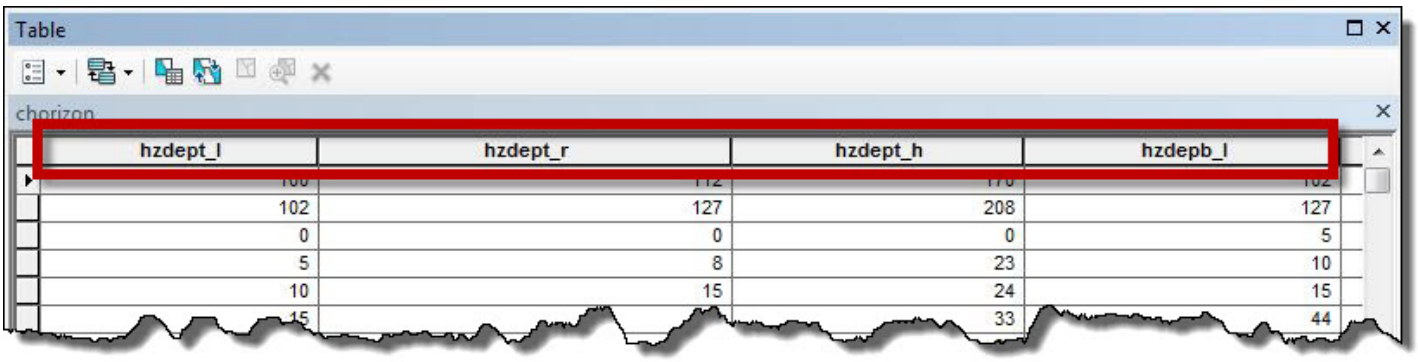
ArcMap™ will go directly to the area of interest.

The **Manage Bookmarks…** option in the **Bookmarks** menu can be used to delete bookmarks that are no longer needed. It can also be used to arrange the order of the bookmarks that appear in the drop-down box.

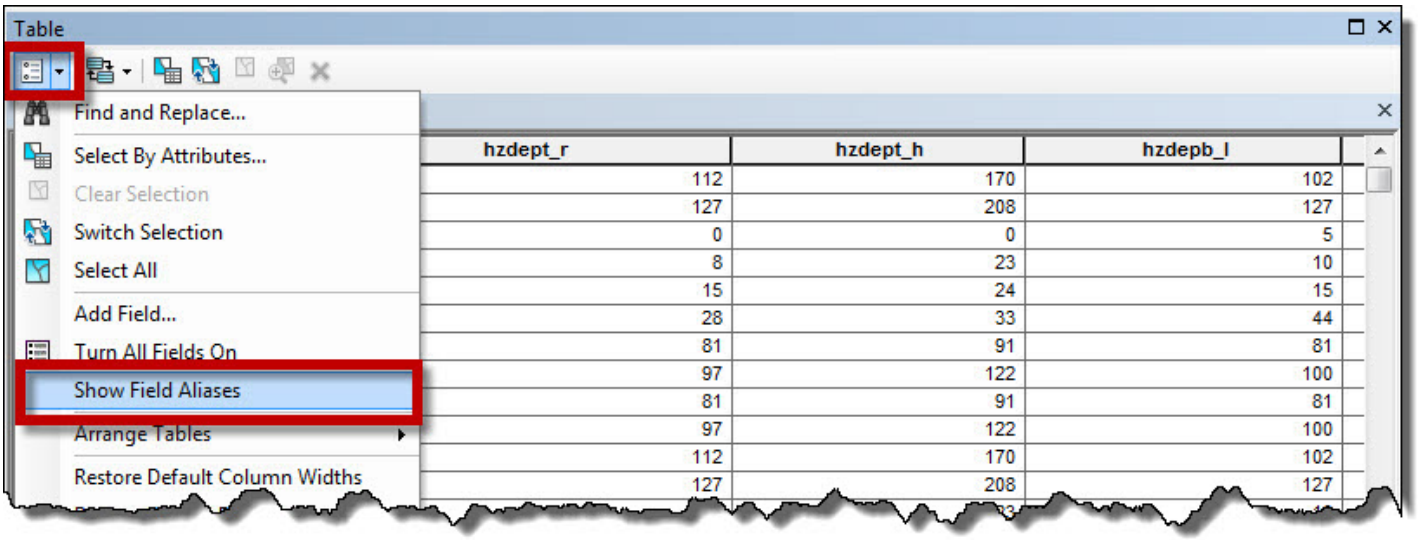
Turning Off Field Aliases in Attribute Tables

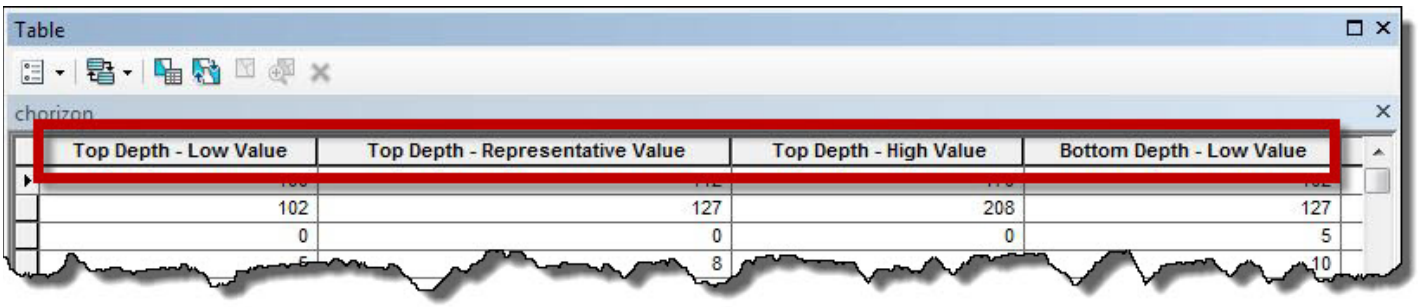
A geodatabase can store aliases for column or field names. This makes it easier to view a table. The longer names, however, can result in a very wide table. The field aliases can easily be turned off using the **Options** button at the bottom.

The field aliases are “off”.



❑ Click on the down arrow next to the **Table Options** button in the dialog box and select **Show Field Aliases**.

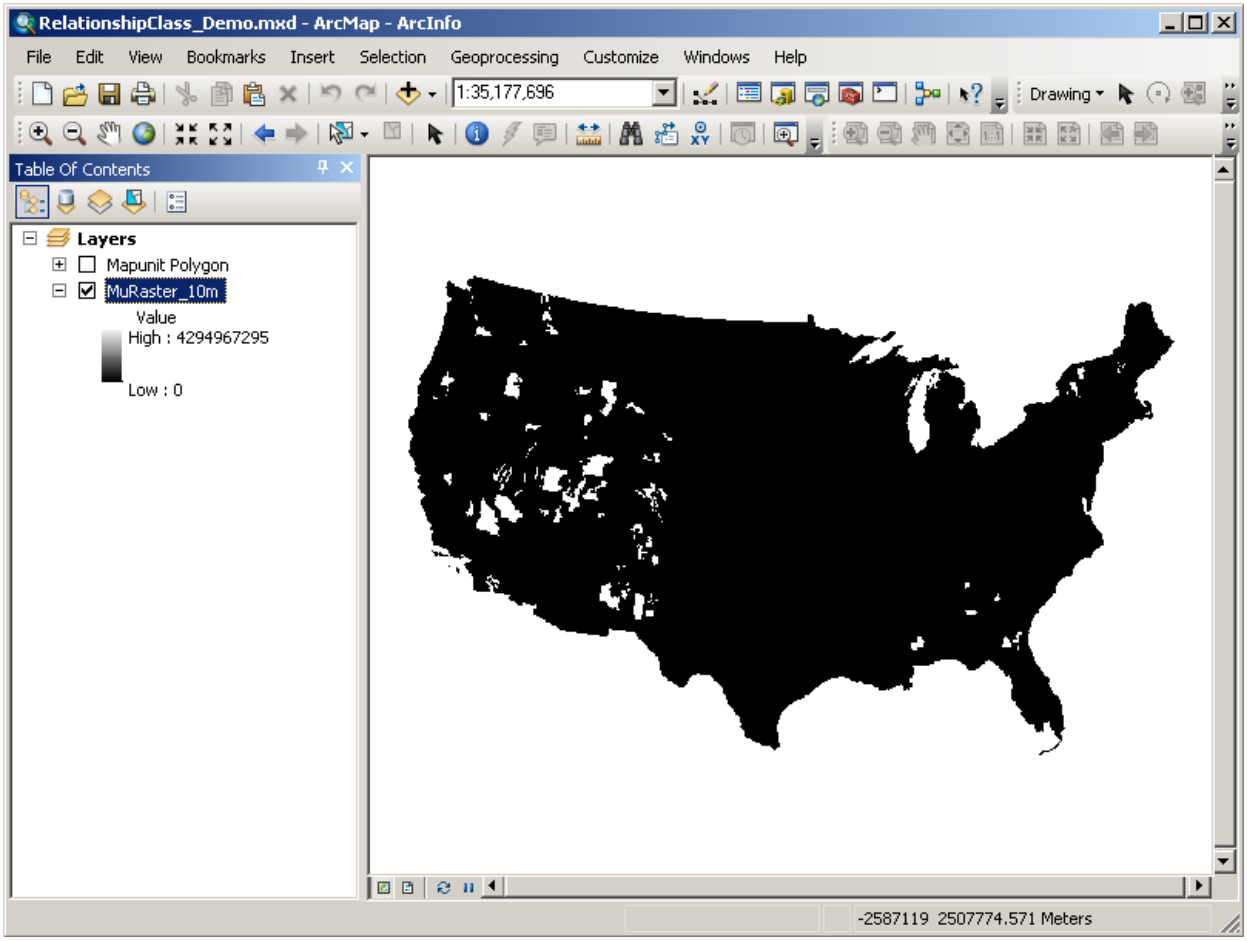




The field aliases are “on”.

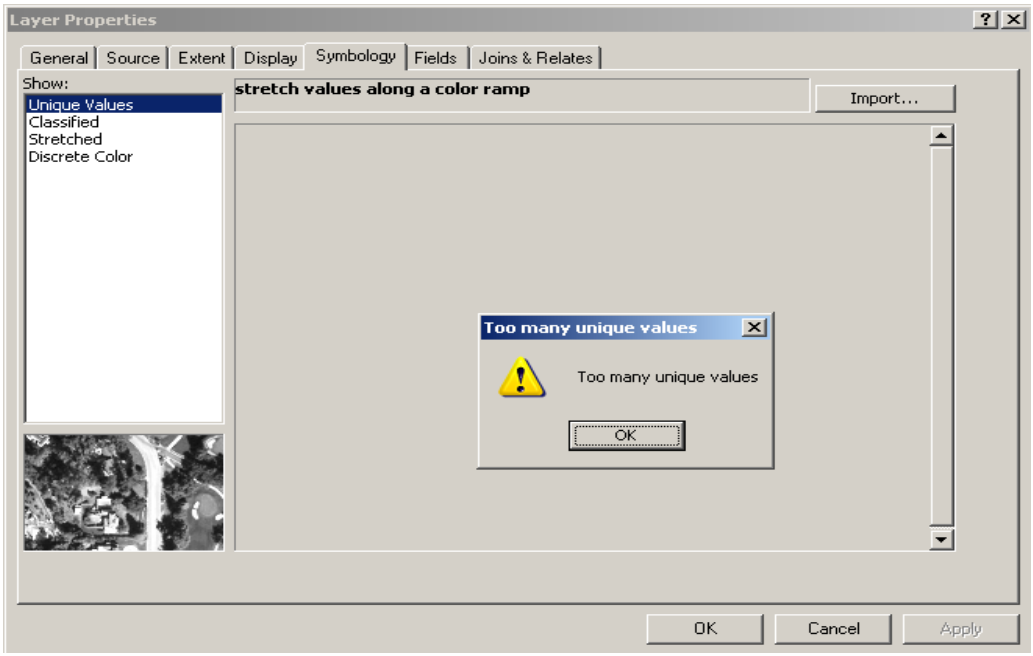
Displaying Very Large Rasters

There are settings or options in ArcMap™ that can affect the way raster layers are displayed. In this example, the raster layer (October 2012 CONUS gSSURGO geodatabase) contains 290,786 unique MUKEY values.



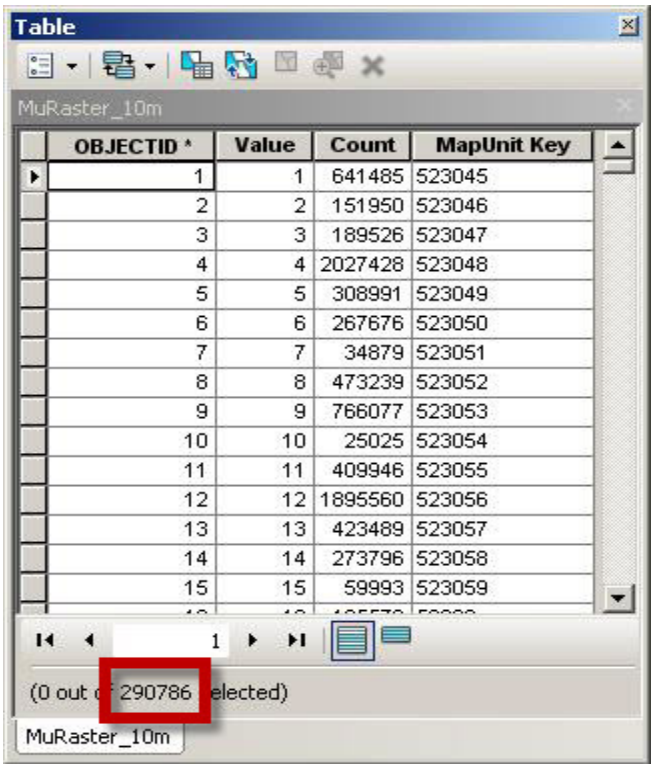
ArcMap™ normally defaults to the “stretched value” renderer for raster layers.

Attempting to alter symbology for an existing raster layer may not be possible for the **Unique Values** option.



If not possible, a warning message is displayed.

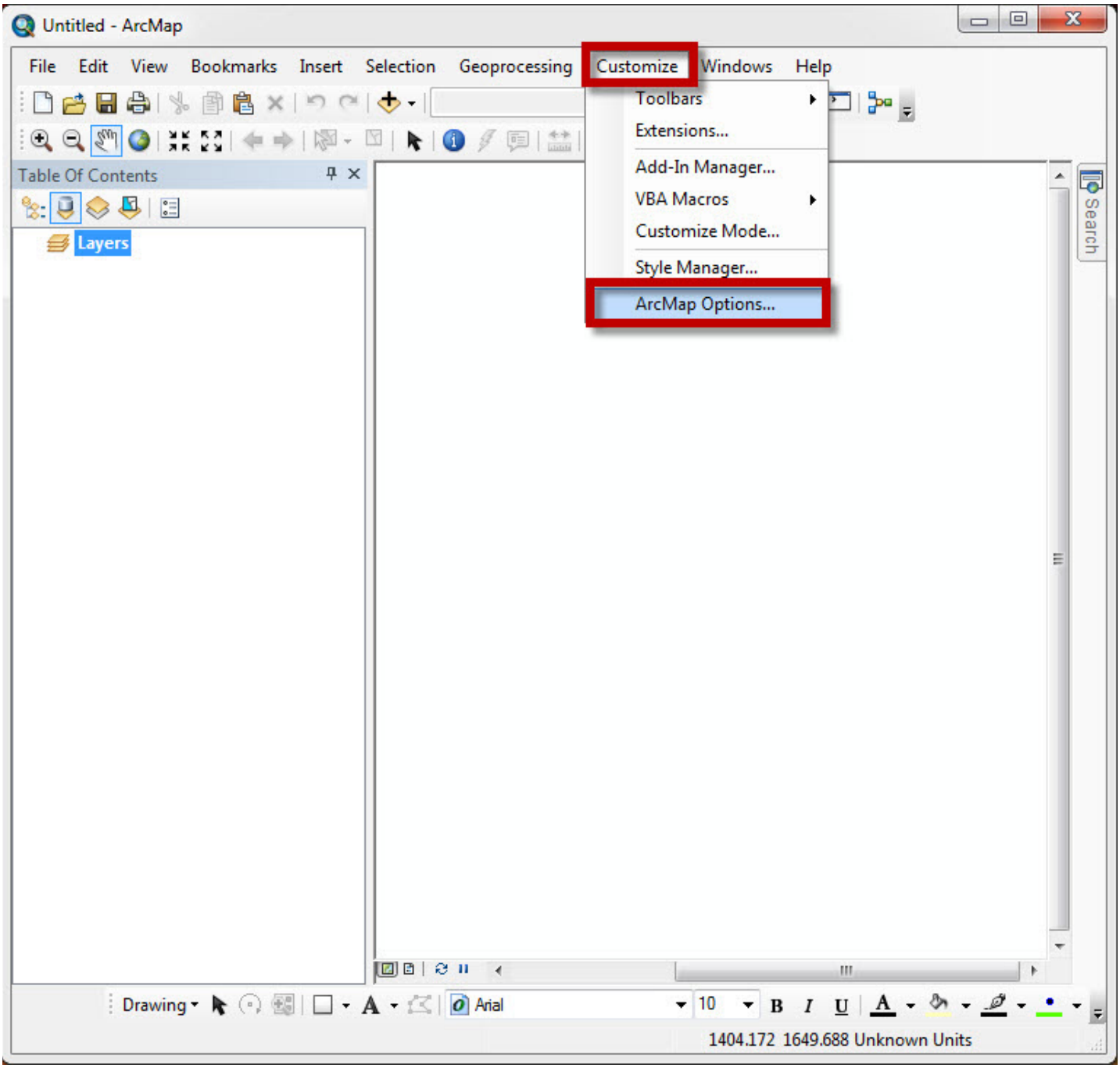
Open the attribute table for the offending raster.



The number of unique values is listed at the bottom left corner.

To alter the values to display a large raster, from the ArcMap™ menu:

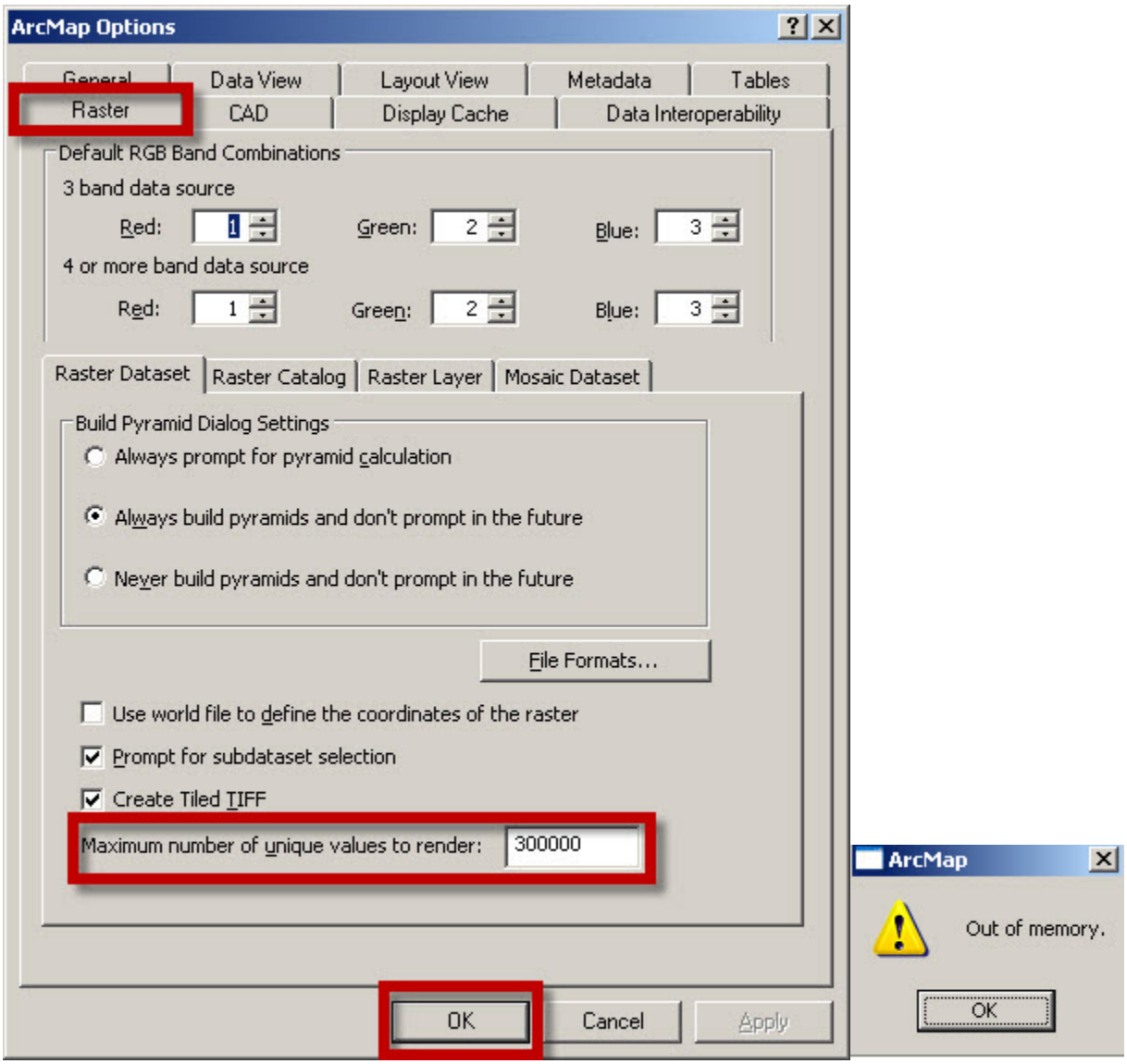
- ❑ Select **Customize.**
- ❑ Select **ArcMap Options...**



❑Select the **Raster** tab.

❑Change the maximum number of unique values to render to a number greater than would normally be in the data.

❑Select **OK**.



WARNING: Setting this value too high, especially on a Windows XP computer, can cause ArcMap™ to use up all of the available RAM and crash the application.

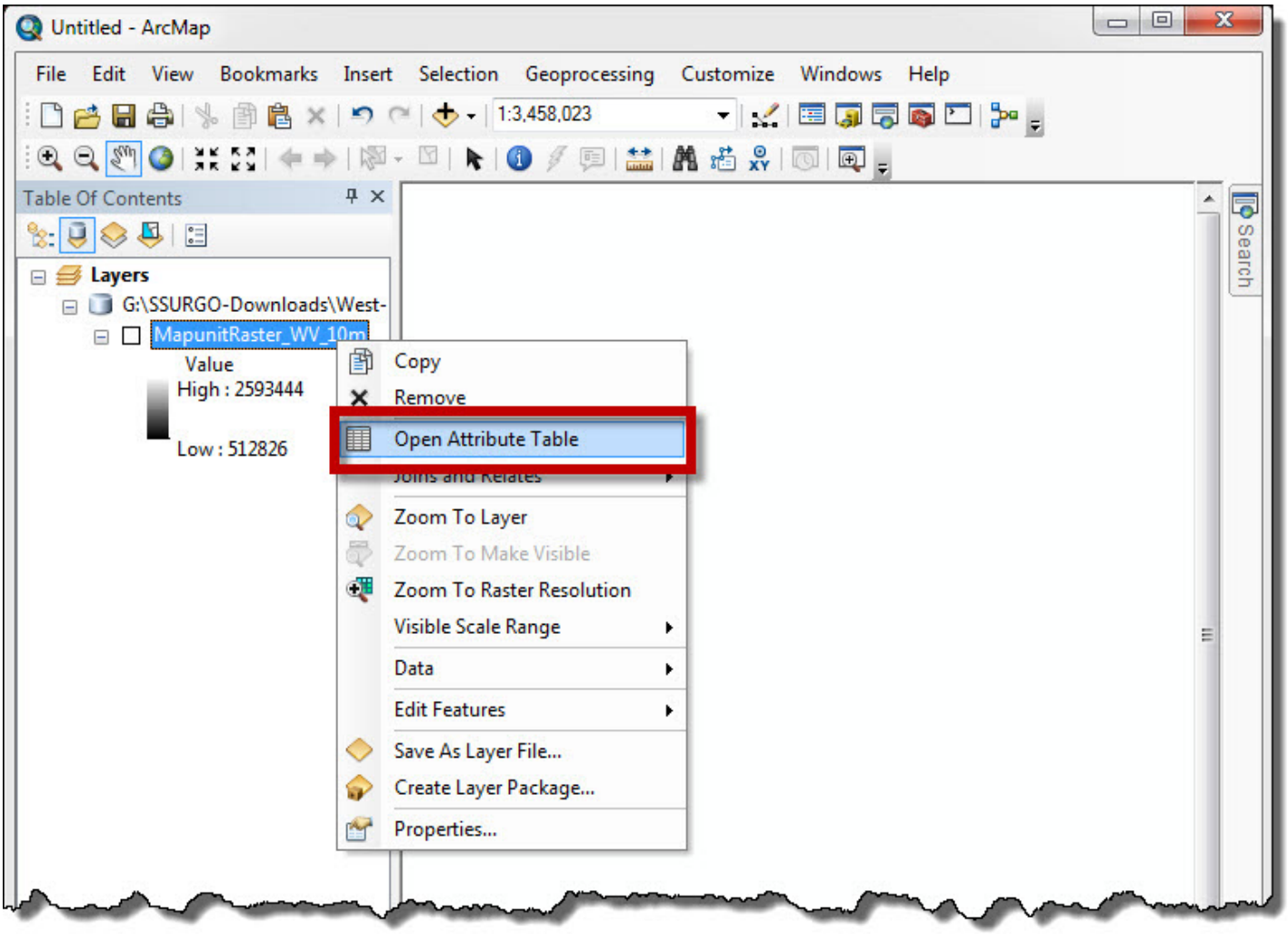
Computers running Windows® 7 with 8 gigabytes or more of RAM may allow this value to be set to 300,000 or greater.

Restoring MUKEY Values in Raster Layers

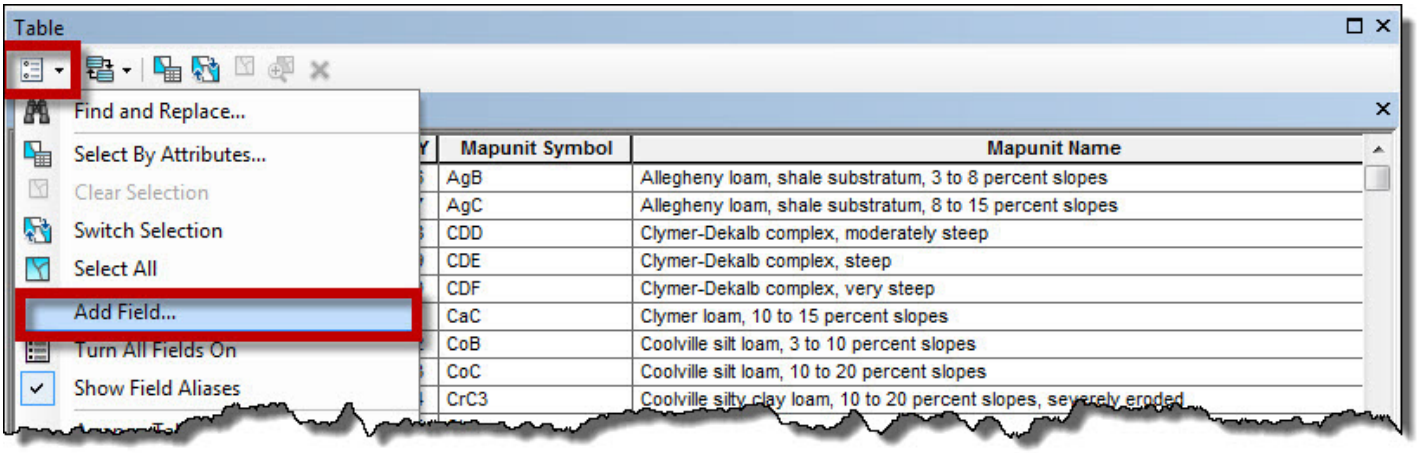
Depending upon the version of ArcGIS being used, some geoprocessing procedures can cause the MUKEY column to be lost from the attribute table of output raster layers. The MUKEY column can be manually added to the raster.

Open the attribute table of the raster (e.g., MapunitRaster_WV_10m) to add the field and calculate the value.

❑Right-click on the raster feature class (e.g., **MapunitRaster_WV_10m**) and select **Open Attribute Table**.



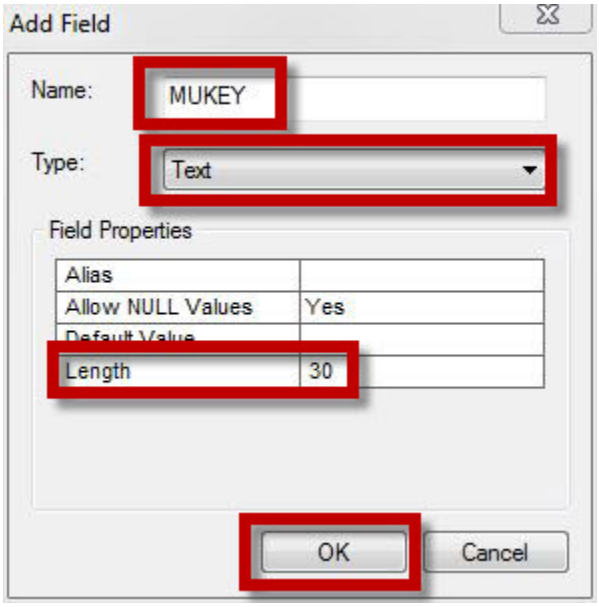
❑Click on the down arrow next to the **Table Options** button in the dialog box and select **Add Field…**



❑Use the following parameters to complete the **Add Field** dialog box:

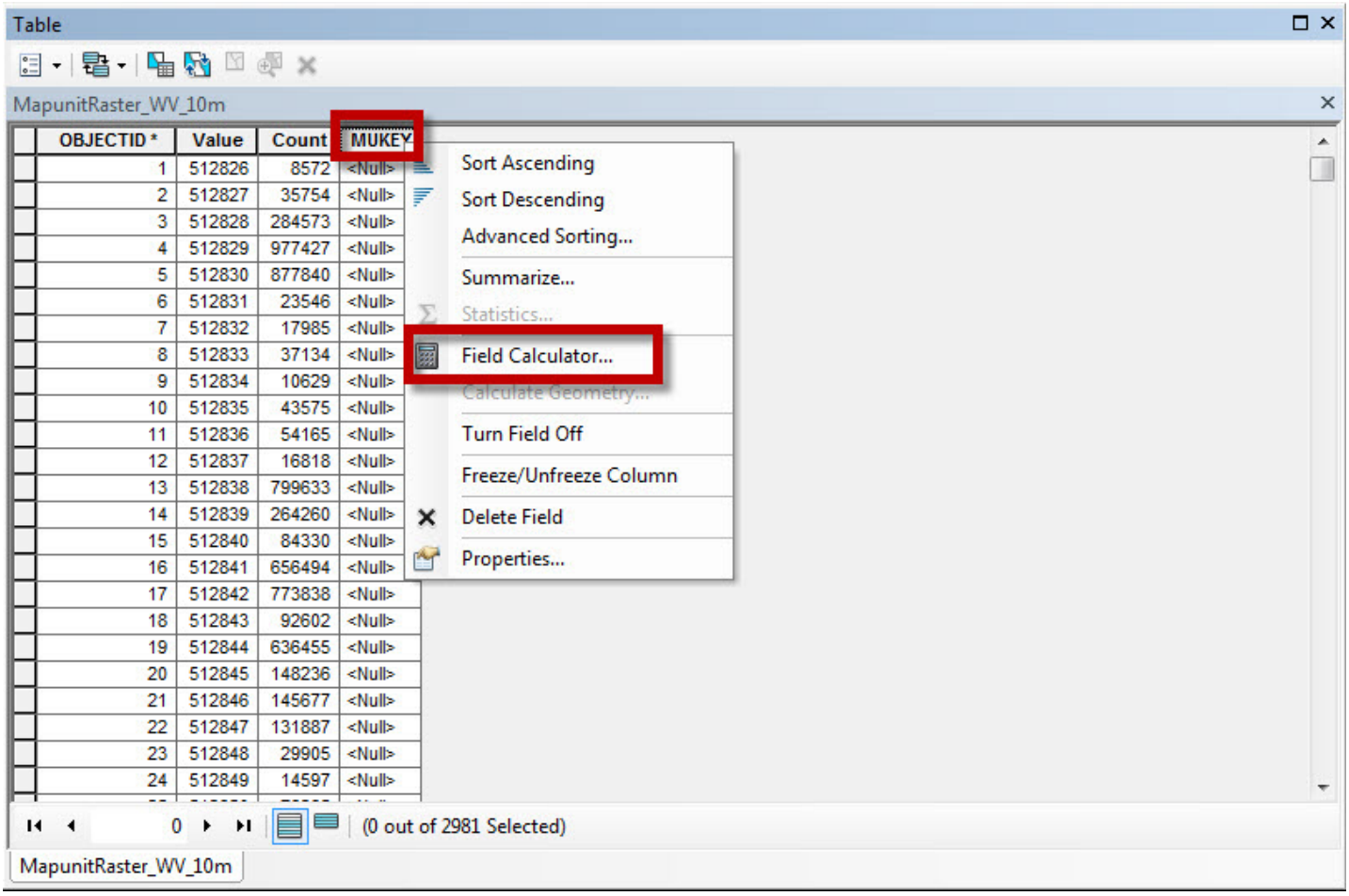
- Name: **MUKEY**
- Type: **Text**
- Length: **30**

❑ Click **OK.**



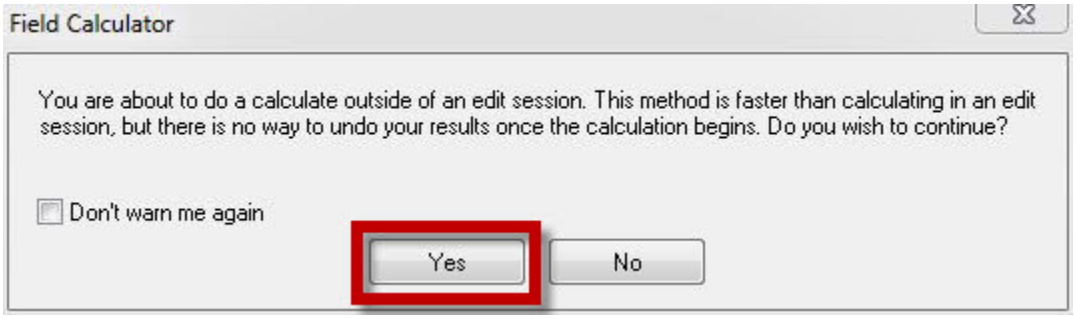
The column will not have data. Add the MUKEY values by calculating the Value field to **MUKEY** with the **Field Calculator**.

❑ Right-click on the MUKEY column header and select **Field Calculator…**



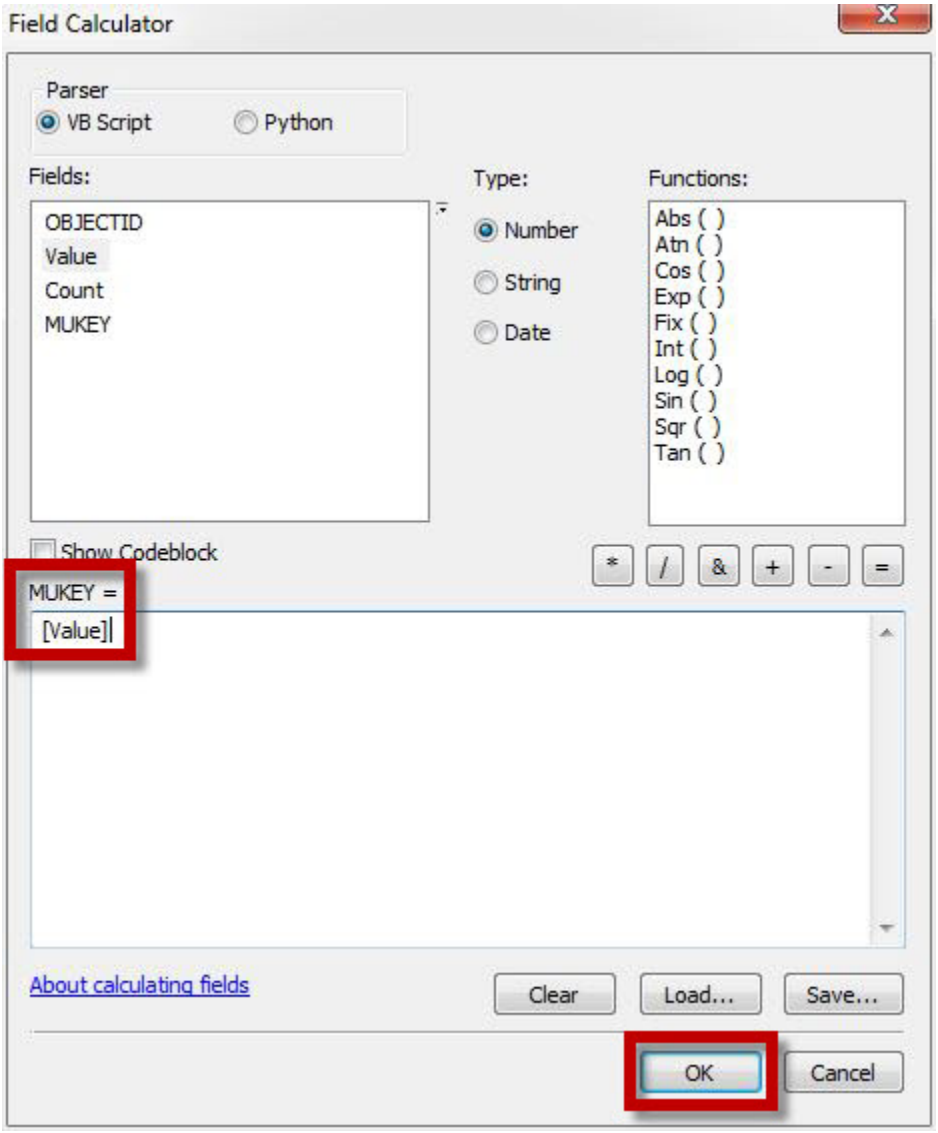
A message will pop up warning that a calculation will be performed outside an edit session.

❑ Click **Yes**.

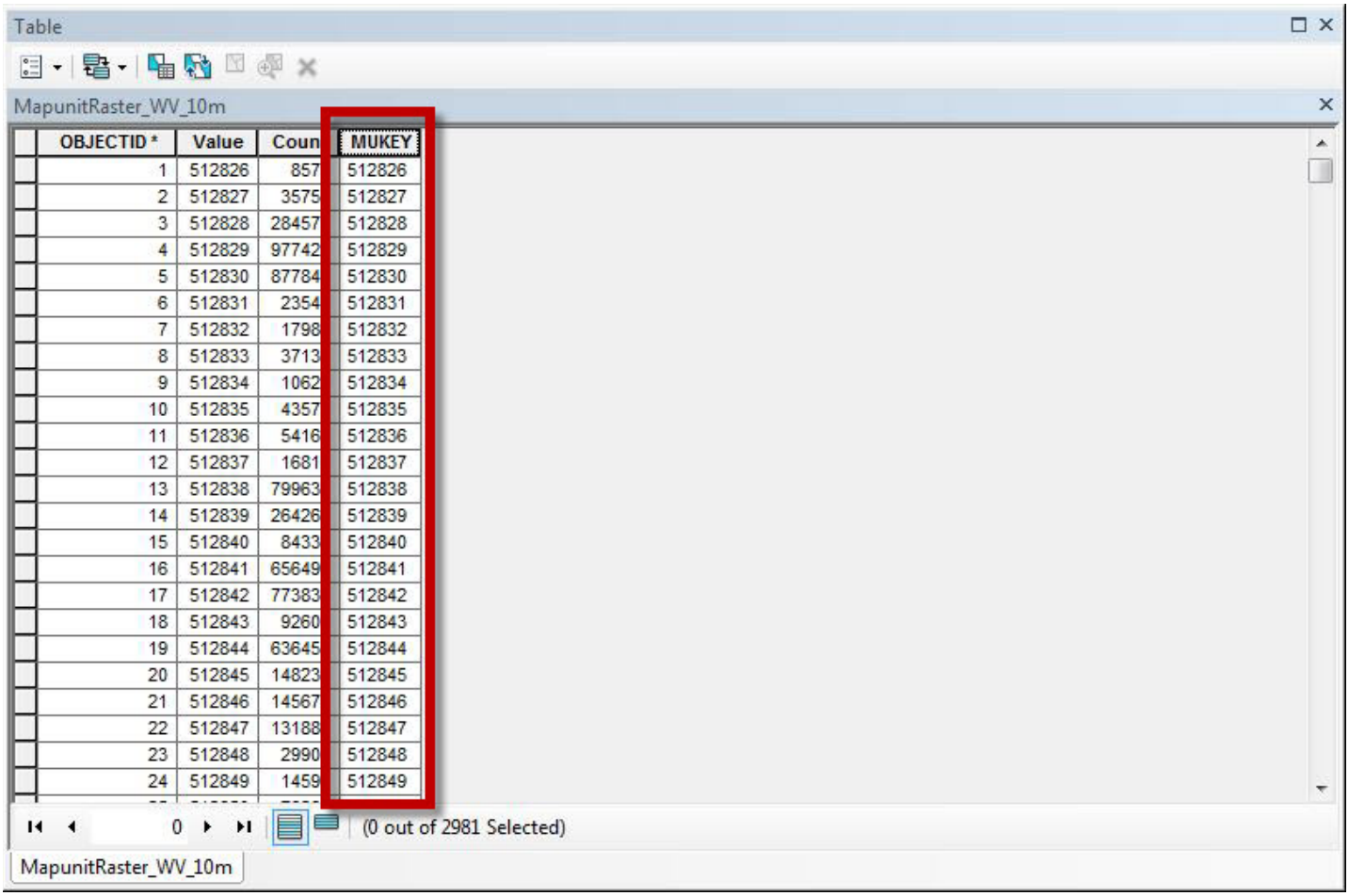


Complete the **Field Calculator** dialog box.

- ❑ In the **Field Calculator** dialog box, double-click on **Value** to complete the statement.
- ❑ Click **OK.**



The MUKEY column is populated.



Citing gSSURGO Data

It is a good scientific practice to cite all the data sources and methods used to conduct the assessment or research study. A section on methods and materials commonly cites other literature sources, which are listed in a reference section.

These gSSURGO and National Value Added Look Up (valu) Table data are anticipated to be released on an annual basis using a Soil Data Mart database snapshot source taken in October (the start of the Federal fiscal year). The metadata (Description tab in ArcCatalog®) provides information about the source date for the gSSURGO product.

The USDA Natural Resources Conservation Service recommends the following citations be used in internal and published documents that describe assessments and studies which used the Gridded SSURGO (gSSURGO) data product and the National Value Added Look Up (valu) Table Database.

The Citation for gSSURGO

State Tile

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for *State name*. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. *month, day, year* (FY*year* official release).

Conterminous US Tile

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the Conterminous United States. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. *month, day, year* (FY*year* official release).

National Collection of Tiles

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. *month, day, year* (FY*year* official release).

The Citation for the National Value Added Look Up (valu) Table Database

Soil Survey Staff. National Value Added Look Up (valu) Table Databasefor the Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. *month, day, year* (FY*year* official release).

Citation Examples

The following examples are for the FY2014 gSSURGO dataset for the State of West Virginia. Such citations should appear in the reference section of your document.

State Tile

Soil Survey Staff. The Gridded Soil Survey Geographic (SSURGO) Database for West Virginia. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. January 15, 2014 (FY2014 official release).

Conterminous US Tile

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the Conterminous United States. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. January 15, 2014 (FY2014 official release).

National Collection of Tiles

Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. January 15, 2014 (FY2014 official release).

The following example is for the National Value Added Look Up (valu) Table Database. Such citations should appear in the reference section of your document.

National Value Added Look Up (valu) Table Database

Soil Survey Staff. National Value Added Look Up (valu) Table Database for the Gridded Soil Survey Geographic (gSSURGO) Database for the United States of America and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. United States Department of Agriculture, Natural Resources Conservation Service. Available online at http://datagateway.nrcs.usda.gov/. January 15, 2014 (FY2014 official release).

See http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053368 for recommended citations for other data provided by the USDA Natural Resources Conservation Service and the National Cooperative Soil Survey.

Acronyms

AWS	Available Water Storage
aws0150wta	Available Water Storage 0 to 150cm - Weighted Average
CDL	Cropland Data Layer
cm	centimeter
cogeomordesc	Component Geomorphic Description Table
CONUS	Conterminous United States
dS	decisiemens
ESRI®	Environmental Systems Research Institute, Inc.
FY	Fiscal Year (Federal fiscal year begins October 1 of each year)
GDG	Geospatial Data Gateway
gSSURGO	Gridded Soil Survey Geographic Database
hydgrpdcd	Hydrologic Group - Dominant Conditions
m	meter
MAJCOMPFLAG	Major Component Flag
muaggatt	Map Unit Aggregate Attribute Table
MUKEY	Map Unit Key
muname	Map Unit Name
MUPOLYGON	Map Unit Polygon
musym	Map Unit Symbol
NAD	North American Datum
NASS	National Agricultural Statistical Service
NCCPI	National Commodity Crop Productivity Index
NCSS	National Cooperative Soil Survey
NGCE	National Geospatial Center of Excellence
NLCD	National Land Cover Database
NRCS	Natural Resources Conservation Service
PWSL	Potential Wetland Soil Landscapes
RAM	Random Access Memory
SACATALOG	Survey Area Catalog
SAVEREST	Survey Area Version Established
SOC	Soil Organic Carbon
SQL	Standard Query Language
SSURGO	Soil Survey Geographic Database
US	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey
Valu	Value Added Look Up Table
WGS	World Geodetic System
WSS	Web Soil Survey

References

Note: Data were created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit http://www.esri.com/.

Dobos, Robert R., H. Raymond Sinclair, Jr., and Michael P. Robotham. 2012. National commodity crop productivity index (NCCPI) user guide, Version 2. United States Department of Agriculture, Natural Resources Conservation Service, Lincoln, Nebraska.

Homer, C., and others. 2007. Completion of the 2001 National Land Cover Database for the Conterminous United States. Photographic Engineering and Remote Sensing 73:337–341. Data are available online at http://www.mrlc.gov/nlcd2001.php.

United States Department of Agriculture, National Agricultural Statistics Service. 2012. News release: NASS releases new geospatial data in CropScape (Crop Data Layer [CDL]). Available online at http://www.nass.usda.gov/Newsroom/2012/02_03_2012.asp.

United States Department of Agriculture, Natural Resources Conservation Service. 2013a. Description of Gridded Soil Survey Geographic (gSSURGO) Database. Available online at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053627.

United States Department of Agriculture, Natural Resources Conservation Service. 2013b. General Manual Title 430, Part 402—Soil Survey, Subpart A. Available online at NRCS eDirectives - Subpart A - Introduction.

Appendix: National Value Added Look Up (valu) Table Database

	A	B	C	D
1	**VALU Table Theme**	**VALU Table Column Name _ short**	**VALU Table Column Name _ long**	**VALU Table Column Name Short Description**
2	Map unit identifier	mukey	mukey	Map unit key is the unique identifier of a record in the Mapunit table. Use this column to join the Component table to the Mapunit table.
3	Available Water Storage (mm)	aws0_5	aws_0_5	Available water storage estimate (AWS) in standard layer 1 or standard zone 1 (0-5 cm depth), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
4	Available Water Storage (mm)	aws5_20	aws_5_20	Available water storage estimate (AWS) in standard layer 2 (5-20 cm depth), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
5	Available Water Storage (mm)	aws20_50	aws_20_50	Available water storage estimate (AWS) in standard layer 3 (20-50 cm depth), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
6	Available Water Storage (mm)	aws50_100	aws_50_100	Available water storage estimate (AWS) in standard layer 4 (50-100 cm depth), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
7	Available Water Storage (mm)	aws100_150	aws_100_150	Available water storage estimate (AWS) in standard layer 5 (100-150 cm depth), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
8	Available Water Storage (mm)	aws150_999	aws_150_999	Available water storage estimate (AWS) in standard layer 6 (150 cm to the reported depth of the soil profile), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
9	Available Water Storage (mm)	aws0_20	aws_0_20	Available water storage estimate (AWS) in standard zone 2 (0-20 cm depth), expressed in mm. The volume of plant available water that the soil can store in this zone based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
10	Available Water Storage (mm)	aws0_30	aws_0_30	Available water storage estimate (AWS) in standard zone 3 (0-30 cm depth), expressed in mm. The volume of plant available water that the soil can store in this zone based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
11	Available Water Storage (mm)	aws0_100	aws_0_100	Available water storage estimate (AWS) in standard zone 4 (0-100 cm depth), expressed in mm. The volume of plant available water that the soil can store in this zone based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
12	Available Water Storage (mm)	aws0_150	aws_0_150	Available water storage estimate (AWS) in standard zone 5 (0-150 cm depth), expressed in mm. The volume of plant available water that the soil can store in this zone based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
13	Available Water Storage (mm)	aws0_999	aws_0_999	Available water storage estimate (AWS) in total soil profile (0 cm to the reported depth of the soil profile), expressed in mm. The volume of plant available water that the soil can store in this layer based on all map unit components (weighted average). NULL values are presented where data are incomplete or not available.
14	Thickness (cm) used in the Available Water Storage calculation	tk0_5a	thick_0_5_aws	Thickness of soil components used in standard layer 1 or standard zone 1 (0-5 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
15	Thickness (cm) used in the Available Water Storage calculation	tk5_20a	thick_5_20_aws	Thickness of soil components used in standard layer 2 (5-20 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.

	A	B	C	D
16	Thickness (cm) used in the Available Water Storage calculation	tk20_50a	thick_20_50_aws	Thickness of soil components used in standard layer 3 (20-50 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
17	Thickness (cm) used in the Available Water Storage calculation	tk50_100a	thick_50_100_aws	Thickness of soil components used in standard layer 4 (50-100 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
18	Thickness (cm) used in the Available Water Storage calculation	tk100_150a	thick_100_150_aws	Thickness of soil components used in standard layer 5 (100-150 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
19	Thickness (cm) used in the Available Water Storage calculation	tk150_999a	thick_150_999_aws	Thickness of soil components used in standard layer 6 (150 cm to the reported depth of the soil profile) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
20	Thickness (cm) used in the Available Water Storage calculation	tk0_20a	thick_0_20_aws	Thickness of soil components used in standard zone 2 (0-20 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
21	Thickness (cm) used in the Available Water Storage calculation	tk0_30a	thick_0_30_aws	Thickness of soil components used in standard zone 3 (0-30 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
22	Thickness (cm) used in the Available Water Storage calculation	tk0_100a	thick_0_100_aws	Thickness of soil components used in standard zone 4 (0-100 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
23	Thickness (cm) used in the Available Water Storage calculation	tk0_150a	thick_0_150_aws	Thickness of soil components used in standard zone 5 (0-150 cm) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
24	Thickness (cm) used in the Available Water Storage calculation	tk0_999a	thick_0_999_aws	Thickness of soil components used in total soil profile (0 cm to the reported depth of the soil profile) expressed in cm (weighted average) for the available water storage calculation. NULL values are presented where data are incomplete or not available.
25	Map Unit summed component percentage (representative value) for Available Water Storage calculations (metadata)	musumcpcta	mu_sum_comppct_r_aws	The sum of the comppct_r (SSURGO component table) values used in the available water storage calculation for the map unit. Useful metadata information. NULL values are presented where data are incomplete or not available.
26	Soil Organic Carbon (g C per square meter)	soc0_5	soc_0_5	Soil organic carbon stock estimate (SOC) in standard layer 1 or standard zone 1 (0-5 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter to a depth of 5 cm. NULL values are presented where data are incomplete or not available.
27	Soil Organic Carbon (g C per square meter)	soc5_20	soc_5_20	Soil organic carbon stock estimate (SOC) in standard layer 2 (5-20 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter for the 5-20 cm layer. NULL values are presented where data are incomplete or not available.
28	Soil Organic Carbon (g C per square meter)	soc20_50	soc_20_50	Soil organic carbon stock estimate (SOC) in standard layer 3 (20-50 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter for the 20-50 cm layer. NULL values are presented where data are incomplete or not available.
29	Soil Organic Carbon (g C per square meter)	soc50_100	soc_50_100	Soil organic carbon stock estimate (SOC) in standard layer 4 (50-100 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter for the 50-100 cm layer. NULL values are presented where data are incomplete or not available.
30	Soil Organic Carbon (g C per square meter)	soc100_150	soc_100_150	Soil organic carbon stock estimate (SOC) in standard layer 5 (100-150 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter for the 100-150 cm layer. NULL values are presented where data are incomplete or not available.

	A	B	C	D
31	Soil Organic Carbon (g C per square meter)	soc150_999	soc_150_999	Soil organic carbon stock estimate (SOC) in standard layer 6 (150 cm to the reported depth of the soil profile). The concentration of organic carbon present in the soil expressed in grams C per square meter for the 150 cm and greater depth layer. NULL values are presented where data are incomplete or not available.
32	Soil Organic Carbon (g C per square meter)	soc0_20	soc_0_20	Soil organic carbon stock estimate (SOC) in standard zone 2 (0-20 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter to a depth of 20 cm. NULL values are presented where data are incomplete or not available.
33	Soil Organic Carbon (g C per square meter)	soc0_30	soc_0_30	Soil organic carbon stock estimate (SOC) in standard zone 3 (0-30 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter to a depth of 30 cm. NULL values are presented where data are incomplete or not available.
34	Soil Organic Carbon (g C per square meter)	soc0_100	soc_0_100	Soil organic carbon stock estimate (SOC) in standard zone 4 (0-100 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter to a depth of 100 cm. NULL values are presented where data are incomplete or not available.
35	Soil Organic Carbon (g C per square meter)	soc0_150	soc_0_150	Soil organic carbon stock estimate (SOC) in standard zone 5 (0-150 cm depth). The concentration of organic carbon present in the soil expressed in grams C per square meter to a depth of 150 cm. NULL values are presented where data are incomplete or not available.
36	Soil Organic Carbon (g C per square meter)	soc0_999	soc_0_999	Soil organic carbon stock estimate (SOC) in total soil profile (0 cm to the reported depth of the soil profile). The concentration of organic carbon present in the soil expressed in grams C per square meter for the total reported soil profile depth. NULL values are presented where data are incomplete or not available.
37	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_5s	thick_0_5_soc	Thickness of soil components used in standard layer 1 or standard zone 1 (0-5 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
38	Thickness (cm) used in the Soil Organic Carbon calculation	tk5_20s	thick_5_20_soc	Thickness of soil components used in standard layer 2 (5-20 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
39	Thickness (cm) used in the Soil Organic Carbon calculation	tk20_50s	thick_20_50_soc	Thickness of soil components used in standard layer 3 (20-50 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
40	Thickness (cm) used in the Soil Organic Carbon calculation	tk50_100s	thick_50_100_soc	Thickness of soil components used in standard layer 4 (50-100 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
41	Thickness (cm) used in the Soil Organic Carbon calculation	tk100_150s	thick_100_150_soc	Thickness of soil components used in standard layer 5 (100-150 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
42	Thickness (cm) used in the Soil Organic Carbon calculation	tk150_999s	thick_150_999_soc	Thickness of soil components used in standard layer 6 (150 cm to the reported depth of the soil profile) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
43	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_20s	thick_0_20_soc	Thickness of soil components used in standard zone 2 (0-20 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
44	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_30s	thick_0_30_soc	Thickness of soil components used in standard zone 3 (0-30 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
45	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_100s	thick_0_100_soc	Thickness of soil components used in standard zone 4 (0-100 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.

	A	B	C	D
46	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_150s	thick_0_150_soc	Thickness of soil components used in standard zone 5 (0-150 cm) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
47	Thickness (cm) used in the Soil Organic Carbon calculation	tk0_999s	thick_0_999_soc	Thickness of soil components used in total soil profile (0 cm to the reported depth of the soil profile) expressed in cm (weighted average) for the Soil Organic Carbon calculation. NULL values are presented where data are incomplete or not available.
48	Map Unit summed component percentage (representative value) for Soil Organic Carbon calculations (metadata)	musumcpcts	mu_sum_comppct_r_soc	The sum of the comppct_r (SSURGO component table) values used in the soil organic carbon calculation for the map unit. Useful metadata information. NULL values are presented where data are incomplete or not available.
49	National Commodity Crop Productivity Index - CORN and SOYBEANS	nccpi2cs	nccpi2_corn_soybeans	National Commodity Crop Productivity Index for Corn and Soybeans (weighted average) for major earthy components. Values range from .01 (low productivity) to .99 (high productivity). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
50	National Commodity Crop Productivity Index - SMALL GRAINS	nccpi2sg	nccpi2_small_grains	National Commodity Crop Productivity Index for Small Grains (weighted average) for major earthy components. Values range from .01 (low productivity) to .99 (high productivity). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
51	National Commodity Crop Productivity Index - COTTON	nccpi2co	nccpi2_cotton	National Commodity Crop Productivity Index for Cotton (weighted average) for major earthy components. Values range from .01 (low productivity) to .99 (high productivity). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
52	National Commodity Crop Productivity Index - OVERALL	nccpi2all	nccpi2_overall	National Commodity Crop Productivity Index that has the highest value among Corn and Soybeans, Small Grains, or Cotton (weighted average) for major earthy components. Values range from .01 (low productivity) to .99 (high productivity). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
53	National Commodity Crop Productivity Index - map unit percent earthy major components (metadata)	pctearthmc	mapunit_percent_earthy_mc	The National Commodity Crop Productivity Index map unit percent earthy is the map unit summed comppct_r for major earthy components. Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). Useful metadata information. NULL values are presented where data are incomplete or not available.
54	Root Zone Depth (cm) - earthy major components	rootznemc	root_zone_cc_depth_earthy_mc	Root zone depth is the depth within the soil profile that commodity crop (cc) roots can effectively extract water and nutrients for growth. Root zone depth influences soil productivity significantly. Soil component horizon criteria for root-limiting depth include: presence of hard bedrock, soft bedrock, a fragipan, a duripan, sulfuric material, a dense layer, a layer having a pH of less than 3.5, or a layer having an electrical conductivity of more than 12 within the component soil profile. If no root-restricting zone is identified, a depth of 150 cm is used to approximate the root zone depth (Dobos et al., 2012). Root zone depth is computed for all map unit major earthy components (weighted average). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.

	A	B	C	D
55	Root Zone Available Water Storage (mm) - earthy major components	rootznaws	root_zone_cc_aws_earthy_mc	Root zone (commodity crop) available water storage estimate (RZAWS) , expressed in mm, is the volume of plant available water that the soil can store within the root zone based on all map unit earthy major components (weighted average). Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
56	Droughty Soil Landscapes - earthy major components	droughty	drought_vulnerable_soil_landscapes	Drought vulnerable soil landscapes comprise those map units that have available water storage within the root zone for commodity crops that is less than or equal to 6 inches (152 mm) expressed as "1" for a drought vulnerable soil landscape map unit or "0" for a non-droughty soil landscape map unit or NULL for miscellaneous areas (includes water bodies). It is computed as a weighted average for major earthy components. Earthy components are those soil series or higher level taxa components that can support crop growth (Dobos et al., 2012). Major components are those soil components where the majorcompflag = 'Yes' (SSURGO component table). NULL values are presented where data are incomplete or not available.
57	Potential Wetland Soil Landscapes	pwsl1pomu	pwsl1_percent_of_mapunit	"Potential Wetland Soil Landscapes" (PWSL) is expressed as the percentage of the map unit that meets the PWSL criteria. The hydric rating (soil component variable “hydricrating”) is an indicator of wet soils. For version 1 (pwsl1), those soil components that meet the following criteria are tagged as PWSL and their comppct_r values are summed for each map unit. Soil components with hydricrating = 'YES' are considered PWSL. Soil components with hydricrating = “NO” are not PWSL. Soil components with hydricrating = 'UNRANKED' are tested using other attributes, and will be considered PWSL if any of the following conditions are met: drainagecl = 'Poorly drained' or 'Very poorly drained' or the localphase or the otherph data fields contain any of the phrases "drained" or "undrained" or "channeled" or "protected" or "ponded" or "flooded". If these criteria do not determine the PWSL for a component and hydricrating = 'UNRANKED', then the map unit will be classified as PWSL if the map unit name contains any of the phrases "drained" or "undrained" or "channeled" or "protected" or "ponded" or "flooded". For version 1 (pwsl1), waterbodies are identified as "999" when map unit names match a list of terms that identify water or intermittent water or map units have a sum of the comppct_r for "Water" that is 80% or greater. NULL values are presented where data are incomplete or not available.
58	Map Unit summed component percentage (representative value) (metadata)	musumcpct	mu_sum_comppct_r	The sum of the comppct_r (SSURGO component table) values for all listed components in the map unit. Useful metadata information. NULL values are presented where data are incomplete or not available.
59	[1]Dobos, R. R., H. R. Sinclair, Jr, and M. P. Robotham. 2012. National Commodity Crop Productivity Index (NCCPI) User Guide, Version 2. USDA-NRCS. Available at: ftp://ftp-fc.sc.egov.usda.gov/NSSC/NCCPI/NCCPI_user_guide.pdf.			