The following was presented at DMT'13
(June 2-5, 2013, Golden, CO).

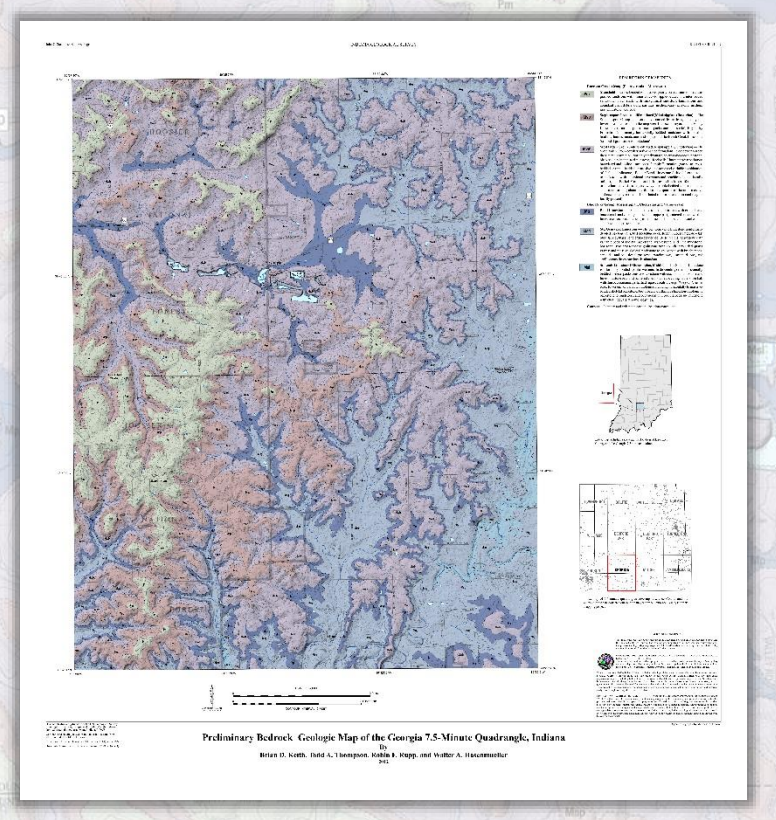
The contents are provisional and will be
superseded by a paper in the
DMT'13 Proceedings.

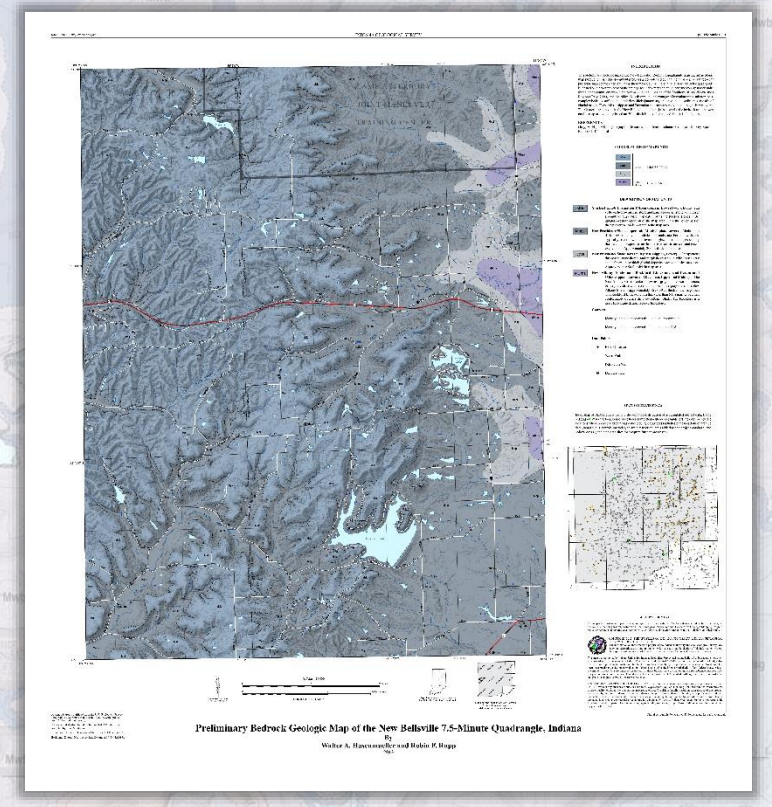
See also earlier Proceedings (1997-2012)
http://ngmdb.usgs.gov/info/dmt/

Semi-Automated Base Map Creation

Digital Mapping Techniques 2013

Colorado School of Mines, Golden, Colorado

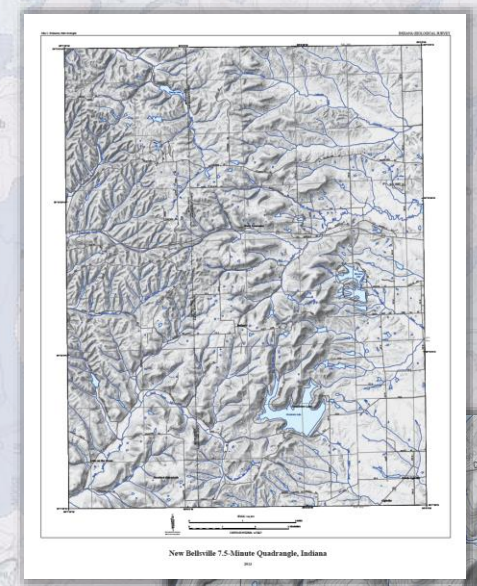


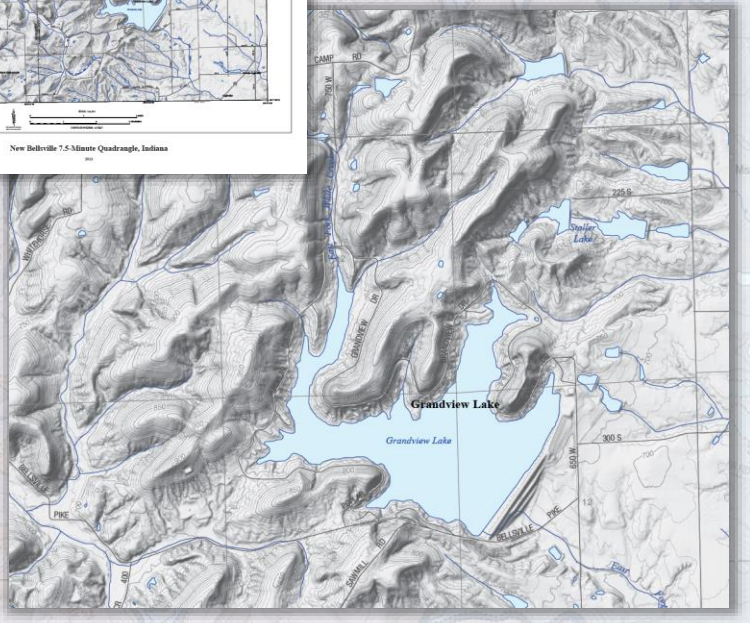


Indiana Geological Survey
Cartographic Coordinator
Matt Johnson

Why does the IGS create custom base maps?

1. Incorporate the latest GIS data
   - LiDAR DEMs / Contours / Shading
   - Centerlines
   - Hydrography
   - Orthophotography
2. Custom field work maps
3. Cartographic appearance
4. Vector base map data can accompany geologic map geodatabases





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Indiana Geological Survey

How are the base maps created?

1. ArcGIS 10.1
   - Custom script to clip individual quads
   - Shading and slope images
   - Contours (*including depressions*)

2. Adobe Illustrator
   - Styling of map (FGDC Standard)
   - Cartographic type placement

3. Adobe Photoshop
   - Shaded relief creation
   - Final contour placement

4. Adobe InDesign
   - Layout of map

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Indiana Geological Survey

ArcGIS 10.1

1. Geodatabase of up-to-date base data
2. Elevation data
   - Mosaic Dataset of LiDAR DEMs (1.5m)
   - National Elevation Dataset when there is no LiDAR coverage
3. Custom Script (DMT 2012 - "Making the US Topo – A Process Discussion" by Bob Davis)
   - Only input needed from user is:
     1. Location to save new base map geodatabase
     2. Name of the 7.5 minute quad
     3. Contour Interval (5ft or 10ft)
4. Image Analysis
   - Creation of shading and slope images
5. Final step is to export parts
   - All vector data is exported to an illustrator file
   - Shading and slope images are exported as tiffs

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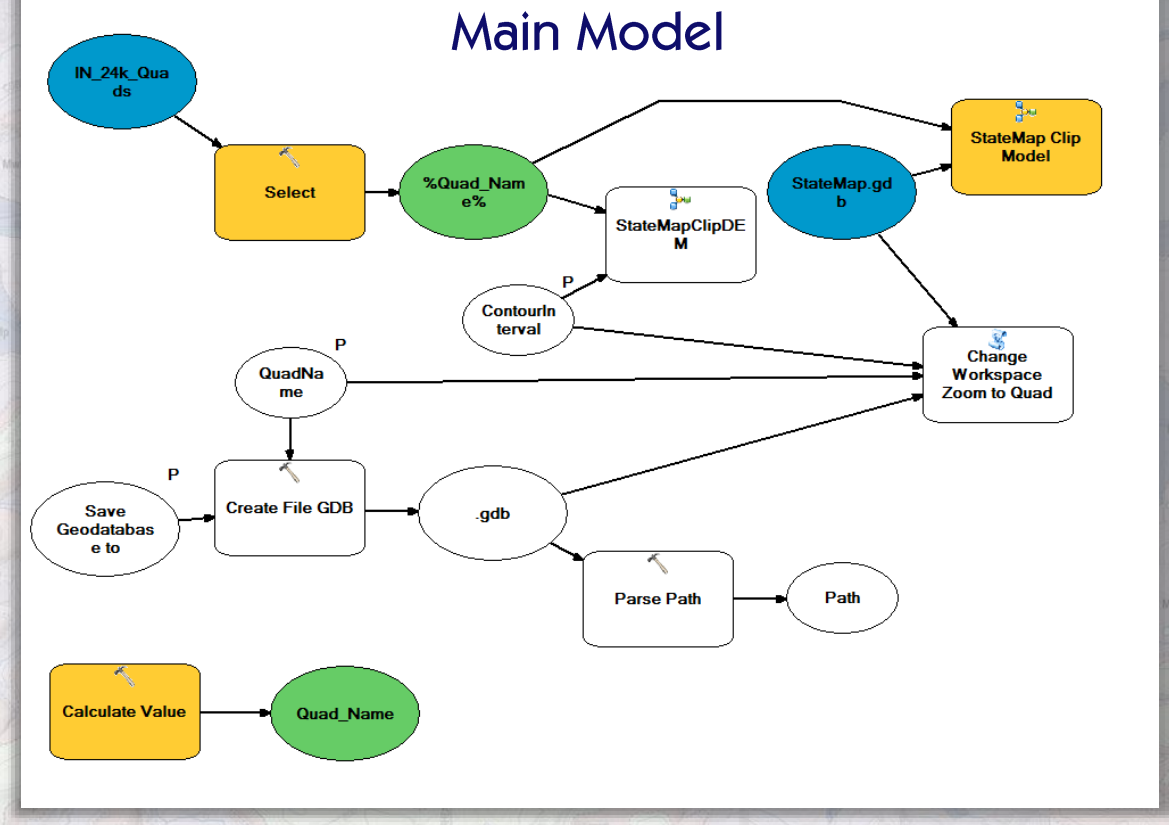
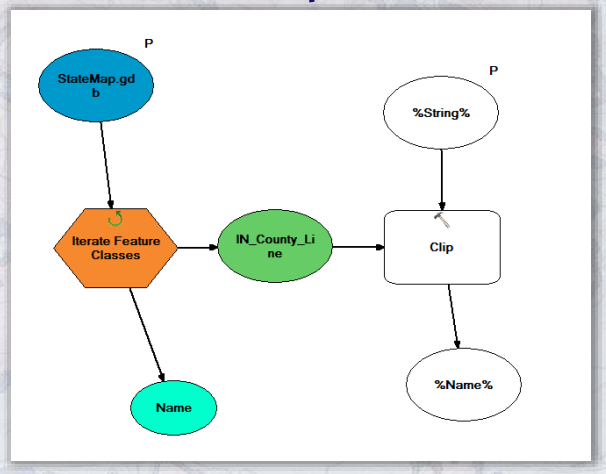
Custom Script

(Model Builder & Python)

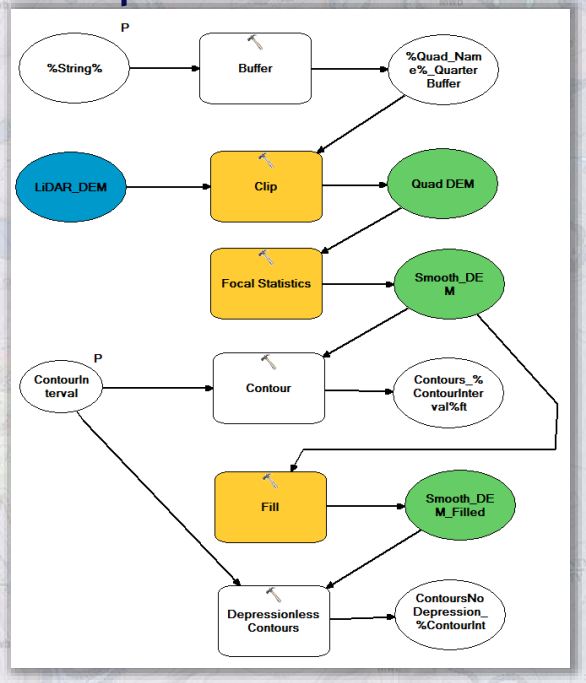
Main Model



Vector Clip Model



DEM Clip & Contour Creation



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Custom Script (Model Builder & Python)

Python Script

```
import arcpy
mxd = arcpy.mapping.MapDocument("CURRENT")
old_path = ""
new_path = ""
quad = ""
contour_interval = ""

old_path = arcpy.GetParameterAsText(0)
new_path = arcpy.GetParameterAsText(1)
quad = arcpy.GetParameterAsText(2)
contour_interval = arcpy.GetParameterAsText(4)

arcpy.AddMessage("contour_interval value is " + contour_interval)

mxd.replaceWorkspaces(old_path, "FILEGDB_WORKSPACE", new_path, "FILEGDB_WORKSPACE")
df = arcpy.mapping.ListDataFrames(mxd, "Layers")[0]
lyr = arcpy.mapping.ListLayers(mxd, "IN_24k_Quads", df)[0]
arcpy.SelectLayerByAttribute_management(lyr, "NEW_SELECTION",
                                        "NAME = 'quad'")
df.zoomToSelectedFeatures()
arcpy.SelectLayerByAttribute_management(lyr, "CLEAR_SELECTION")

contours = new_path + "\\" "Contours_" + contour_interval + "ft"

inFeatures = contours

arcpy.AddField_management(inFeatures, "Type", "TEXT", "", "", "10")

addLayer = arcpy.mapping.Layer(contours)
arcpy.mapping.AddLayer(df, addLayer, "BOTTOM")

contourLyr = "Contours_" + contour_interval + "ft"

if contour_interval == “10”:

 whereClause = "Contour = 0 OR Contour = 50 OR Contour = 100 OR Contour = 150 OR Contour = 200 OR Contour = 250 OR Contour = 300 OR Contour = 350 OR Contour = 400 OR Contour = 450 OR Contour = 500 OR Contour = 550 OR Contour = 600 OR Contour = 650 OR Contour = 700 OR Contour = 750 OR Contour = 800 OR Contour = 850 OR Contour = 900 OR Contour = 950 OR Contour = 1000 OR Contour = 1050 OR Contour = 1100 OR Contour = 1150 OR Contour = 1200 OR Contour = 1250 OR Contour = 1300 OR Contour = 1350 OR Contour = 1400 OR Contour = 1450 OR Contour = 1500 OR Contour = 1550 OR Contour = 1600 OR Contour = 1650 OR Contour = 1700 OR Contour = 1750 OR Contour = 1800 OR Contour = 1850 OR Contour = 1900 OR Contour = 1950 OR Contour = 2000 OR Contour = 2050 OR Contour = 2100 OR Contour = 2150 OR Contour = 2200 OR Contour = 2250 OR Contour = 2300 OR Contour = 2350 OR Contour = 2400 OR Contour = 2450 OR Contour = 2500"

if contour_interval == “5”:

 whereClause = "Contour = 25 OR Contour = 50 OR Contour = 75 OR Contour = 100 OR Contour = 125 OR Contour = 150 OR Contour = 175 OR Contour = 200 OR Contour = 225 OR Contour = 250 OR Contour = 275 OR Contour = 300 OR Contour = 325 OR Contour = 350 OR Contour = 375 OR Contour = 400 OR Contour = 425 OR Contour = 450 OR Contour = 475 OR Contour = 500 OR Contour = 525 OR Contour = 550 OR Contour = 575 OR Contour = 600 OR Contour = 625 OR Contour = 650 OR Contour = 675 OR Contour = 700 OR Contour = 725 OR Contour = 750 OR Contour = 775 OR Contour = 800 OR Contour = 825 OR Contour = 850 OR Contour = 875 OR Contour = 900 OR Contour = 925 OR Contour = 950 OR Contour = 975 OR Contour = 1000 OR Contour = 1025 OR Contour = 1050 OR Contour = 1075 OR Contour = 1100 OR Contour = 1125 OR Contour = 1150 OR Contour = 1175 OR Contour = 1200 OR Contour = 1225 OR Contour = 1250 OR Contour = 1275 OR Contour = 1300 OR Contour = 1325 OR Contour = 1350 OR Contour = 1375 OR Contour = 1400 OR Contour = 1425 OR Contour = 1450 OR Contour = 1475 OR Contour = 1500 OR Contour = 1525 OR Contour = 1550 OR Contour = 1575 OR Contour = 1600 OR Contour = 1625 OR Contour = 1650 OR Contour = 1675 OR Contour = 1700 OR Contour = 1725 OR Contour = 1750 OR Contour = 1775 OR Contour = 1800 OR Contour = 1825 OR Contour = 1850 OR Contour = 1875 OR Contour = 1900 OR Contour = 1925 OR Contour = 1950 OR Contour = 1975 OR Contour = 2000 OR Contour = 2025 OR Contour = 2050 OR Contour = 2075 OR Contour = 2100 OR Contour = 2125 OR Contour = 2150 OR Contour = 2175 OR Contour = 2200 OR Contour = 2225 OR Contour = 2250 OR Contour = 2275 OR Contour = 2300 OR Contour = 2325 OR Contour = 2350 OR Contour = 2375 OR Contour = 2400 OR Contour = 2425 OR Contour = 2450 OR Contour = 2475 OR Contour = 2500"

arcpy.AddMessage("WhereClause = " + whereClause)

arcpy.AddMessage("Selecting all Index contours.")

arcpy.SelectLayerByAttribute_management(contourLyr, "NEW_SELECTION", whereClause)

arcpy.AddMessage("Adding Index to attribues of selected features.")

arcpy.CalculateField_management(contourLyr, "Type", '"Index"', "PYTHON")

arcpy.AddMessage("Switching selection to Regular contours")

arcpy.SelectLayerByAttribute_management(contourLyr,"SWITCH_SELECTION")

arcpy.AddMessage("Adding Regular to attribues of selected features.")

arcpy.CalculateField_management(contourLyr, "Type", '"Regular"', "PYTHON")

arcpy.AddMessage("Selecting features in contours layer that share a line segment with nodepress contours.")

arcpy.SelectLayerByLocation_management (contourLyr, "SHARE_A_LINE_SEGMENT_WITH", noDepressContour)
arcpy.AddMessage("Adding Yes to attribues of selected features.")
arcpy.CalculateField_management(contourLyr, "Depress", '"Yes"', "PYTHON")
arcpy.AddMessage("Switching selection to lines that do not share a segment.")
arcpy.SelectLayerByAttribute_management(contourLyr,"SWITCH_SELECTION")
arcpy.AddMessage("Adding No to attribues of selected features.")
arcpy.CalculateField_management(contourLyr, "Depress", '"No"', "PYTHON")
arcpy.AddMessage("Clearing selection of contours")
arcpy.SelectLayerByAttribute_management(contourLyr, "CLEAR_SELECTION")

arcpy.AddMessage("Setting MXD to page layout and setting scale to 24k.")
```


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Custom Script (Explained)

Base Map Template MXD
- Labeling and classifications preset

Custom script user input
- Geodatabase location
- 7.5-minute quad name
- Contour Interval

Geodatabase created
- Named same as 7.5-minute quad
- Placed where user specified

7.5 quad clip
- 7.5-minute quad is selected from base data and exported to new base map database

Data clip
- Data within base map database clipped to 7.5-minute quad and added to new geodatabase

DEM clip and contours
- 7.5-minute quad is buffered ¼ mi
- Buffered extent used to clip DEM for the map area
- Create contours

Change workspace
- Python script
- Changes the base map template MXD to look at the new database for source data

Zoom to map area
- Python script
- Selects the 7.5-minute quad and zooms to the selection

Add contour type field
- Python script adds field for adding "Index" or "Regular" contour attribute and depression field

Add contour layer to map
- Python script adds data to map document

Update contour type attributes
- Python script adds "Index" or "Regular"
- Contour interval is used to calculate
- Depression–Y or N

Sets map scale
- Python script switches to Page Layout view and sets the scale to 1:24k
- Map is ready for export (vector)

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Demo

Custom Script

Image Analysis Window

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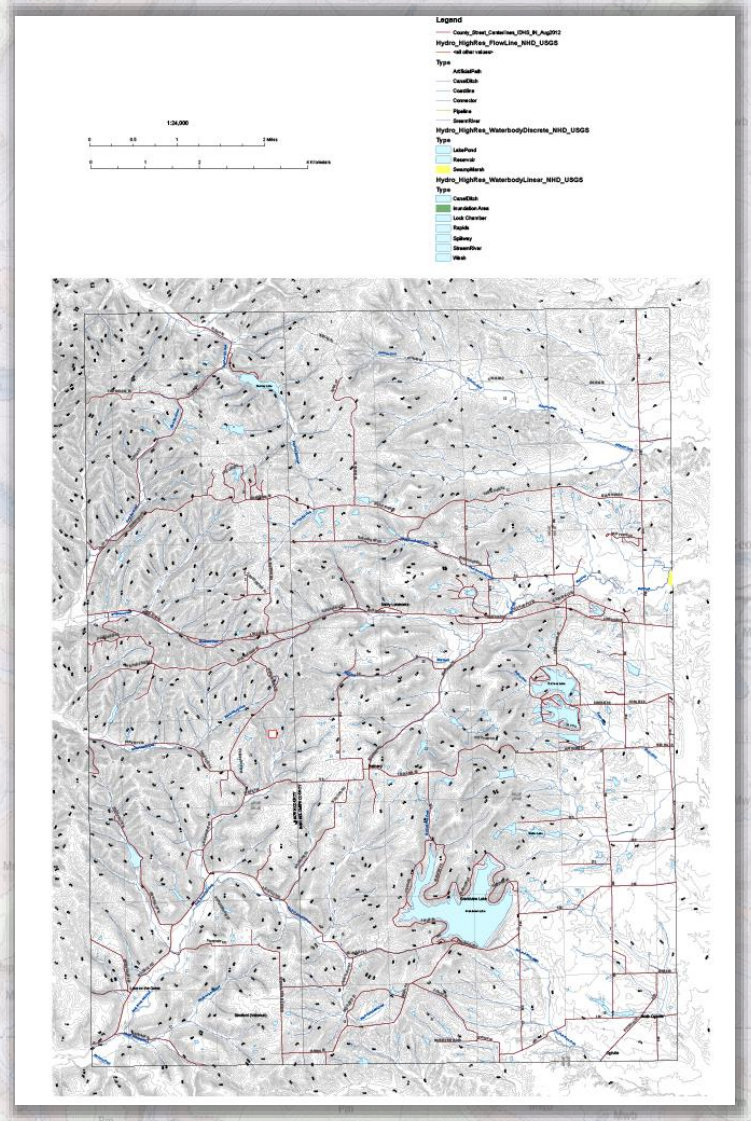
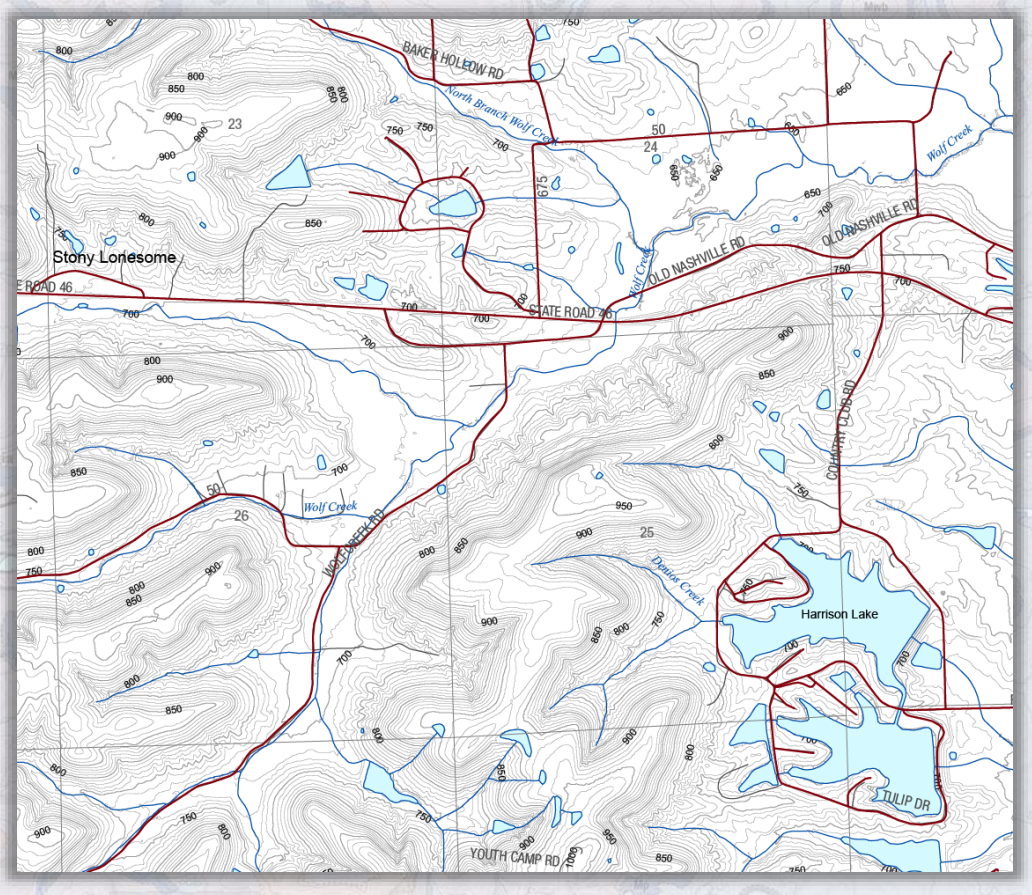
Indiana Geological Survey

Adobe Illustrator – Original export





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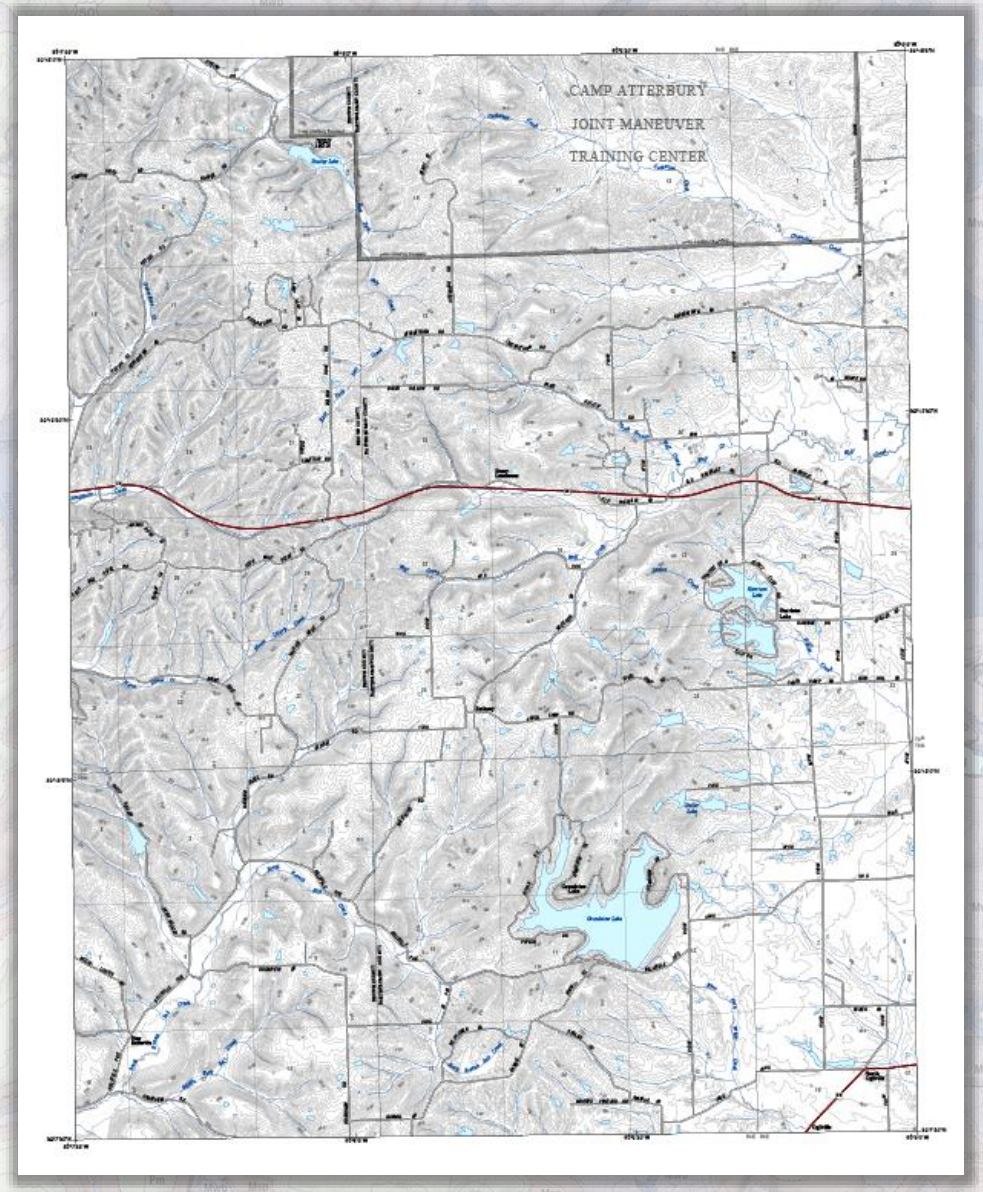
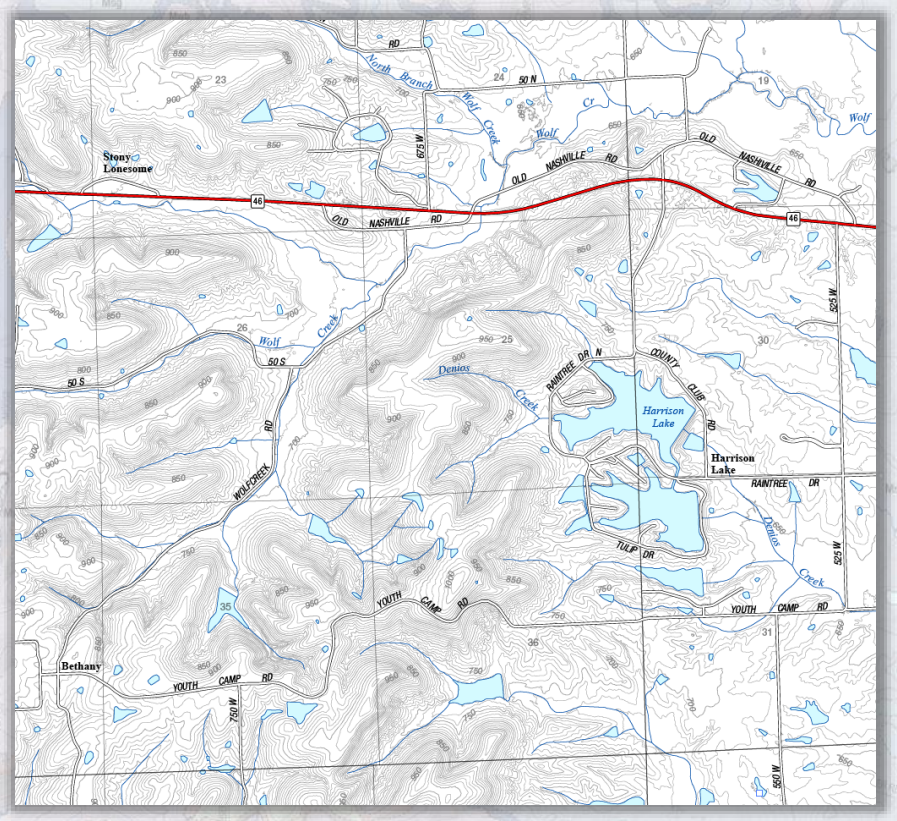
Adobe Illustrator – After Styling





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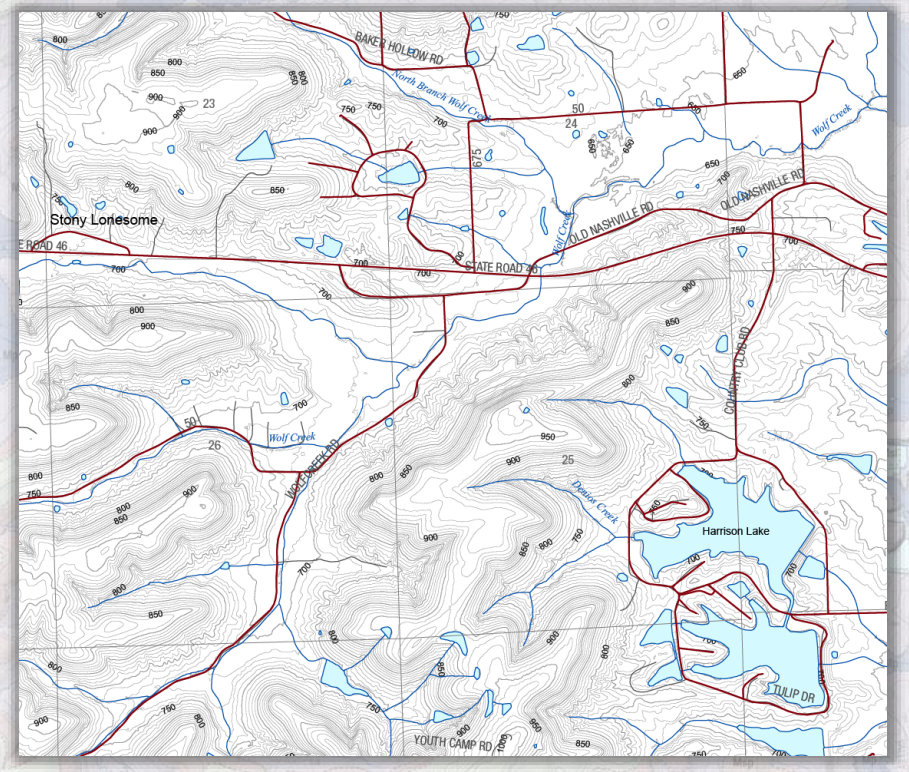
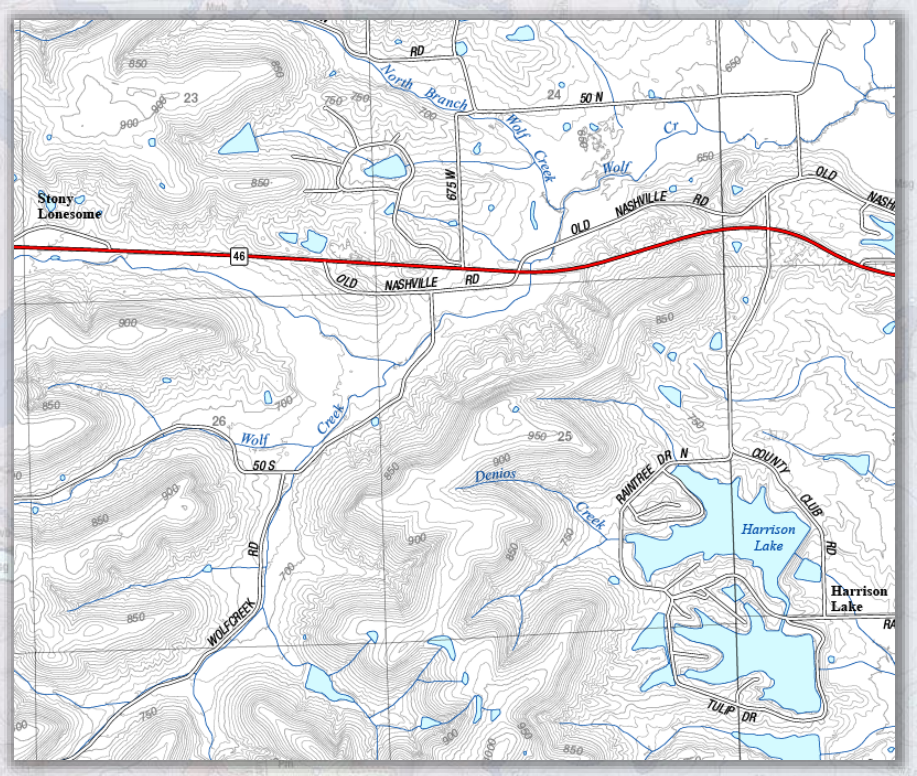
Adobe Illustrator – Before & After Styling





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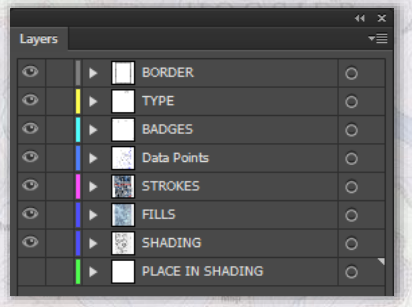
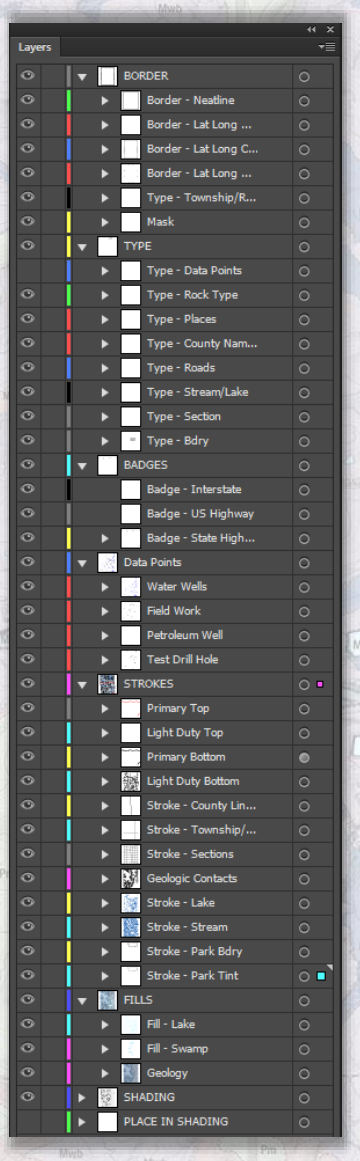
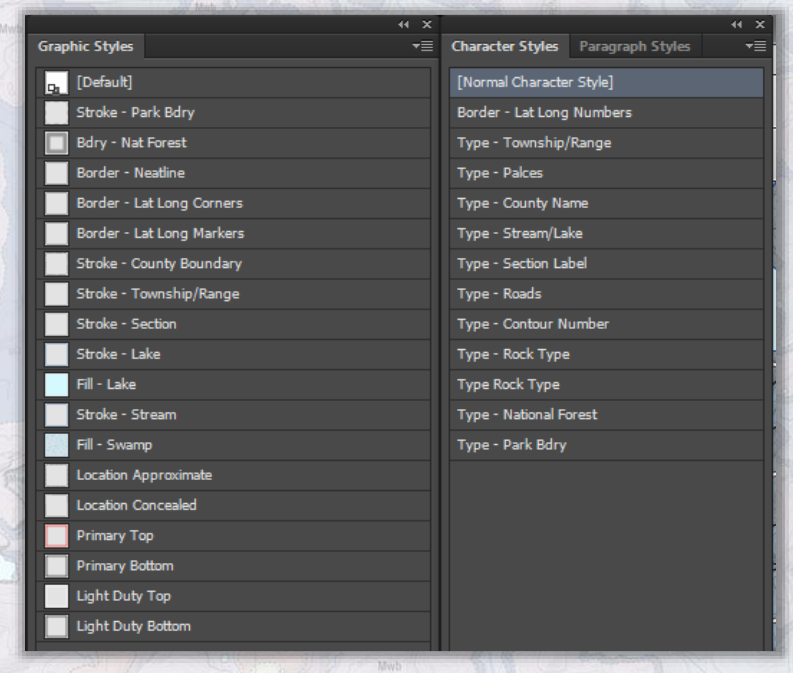
Adobe Illustrator – Layer & Style Structure







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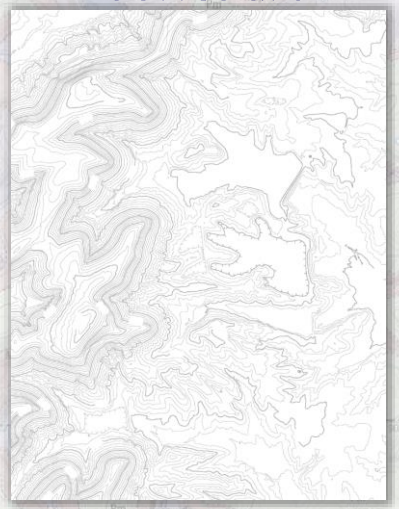
Adobe Photoshop

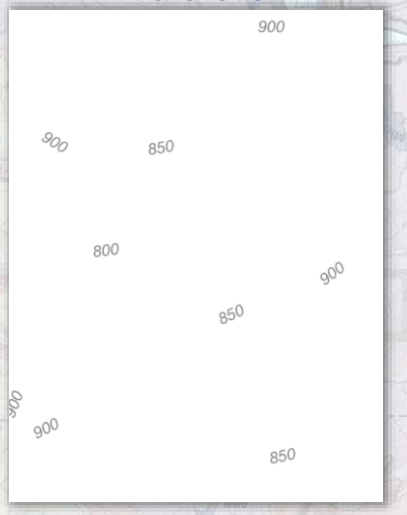
Shading

Slope

Contours



Labels



Final Shading

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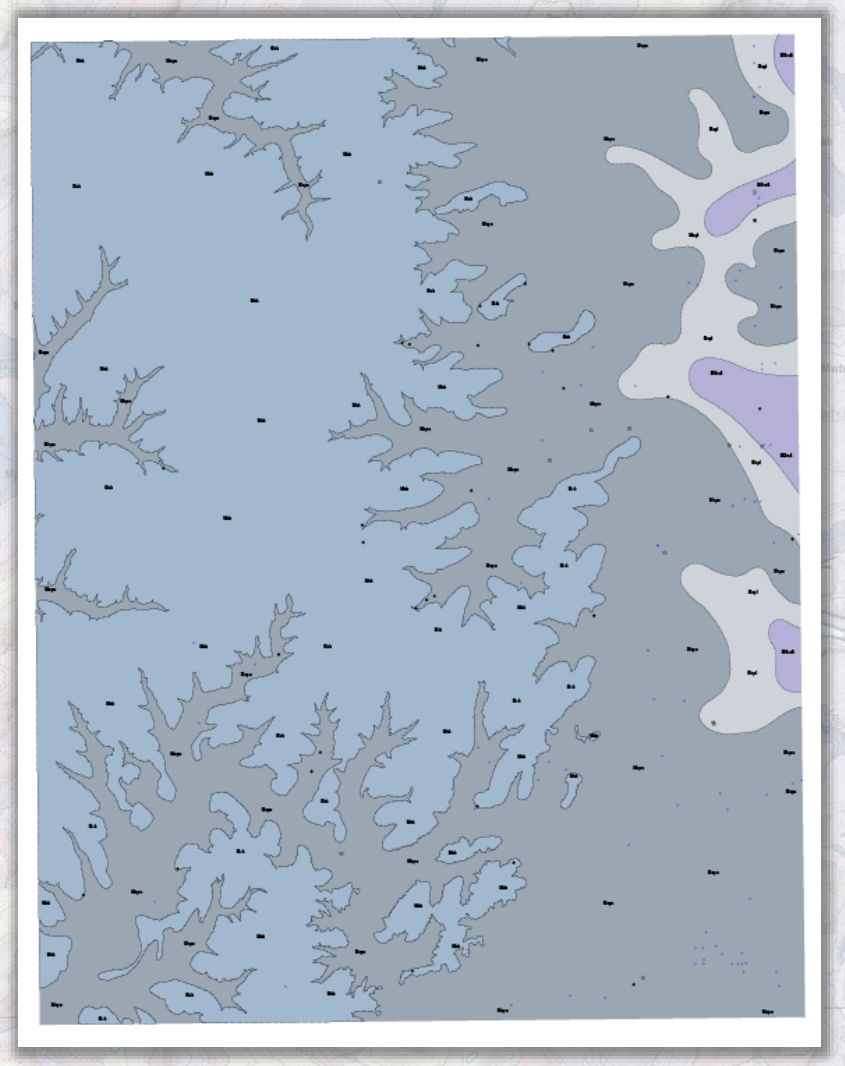
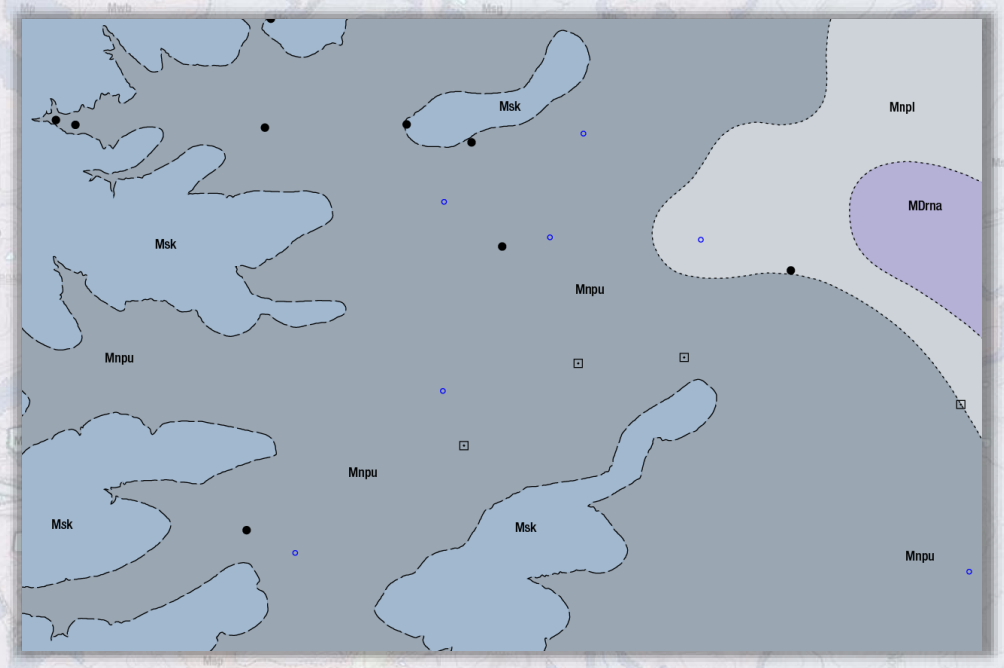
Adobe Illustrator – Add geologic data





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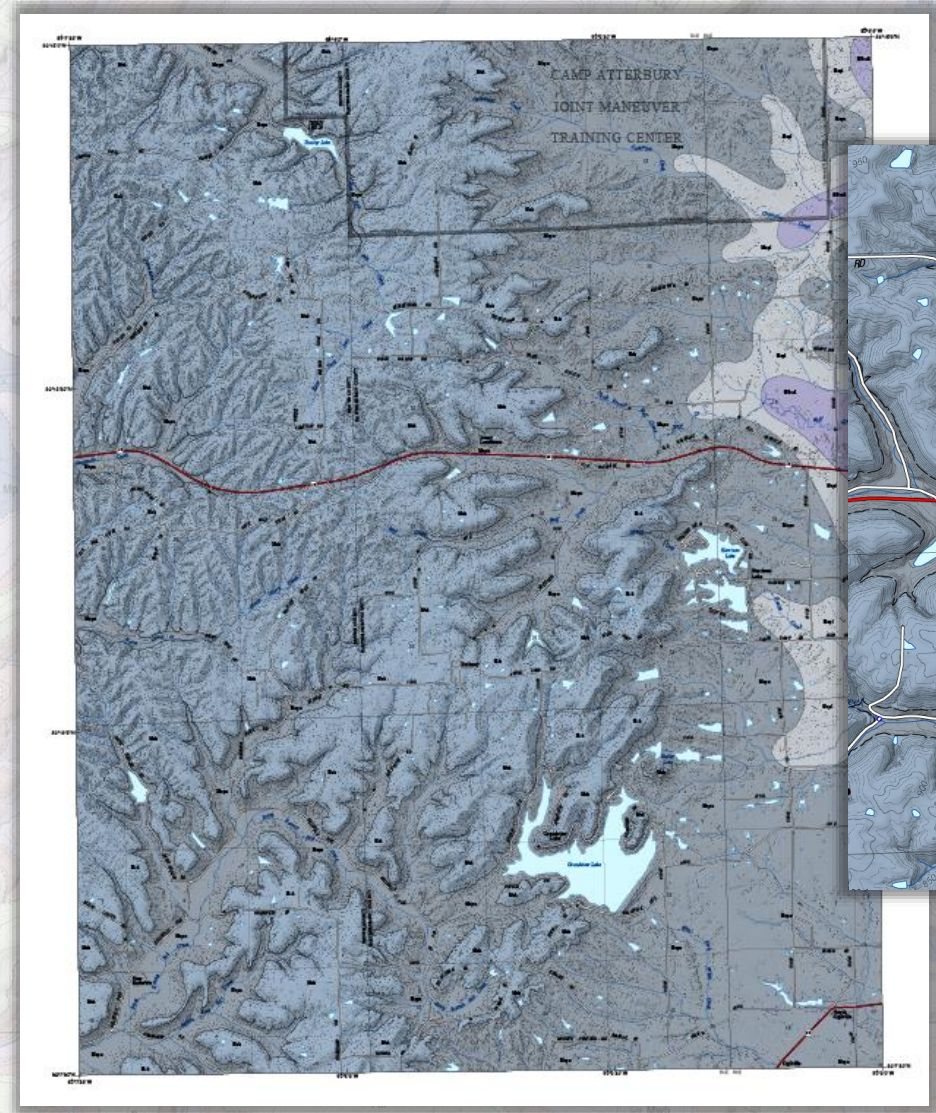
Adobe Illustrator – Final Quad



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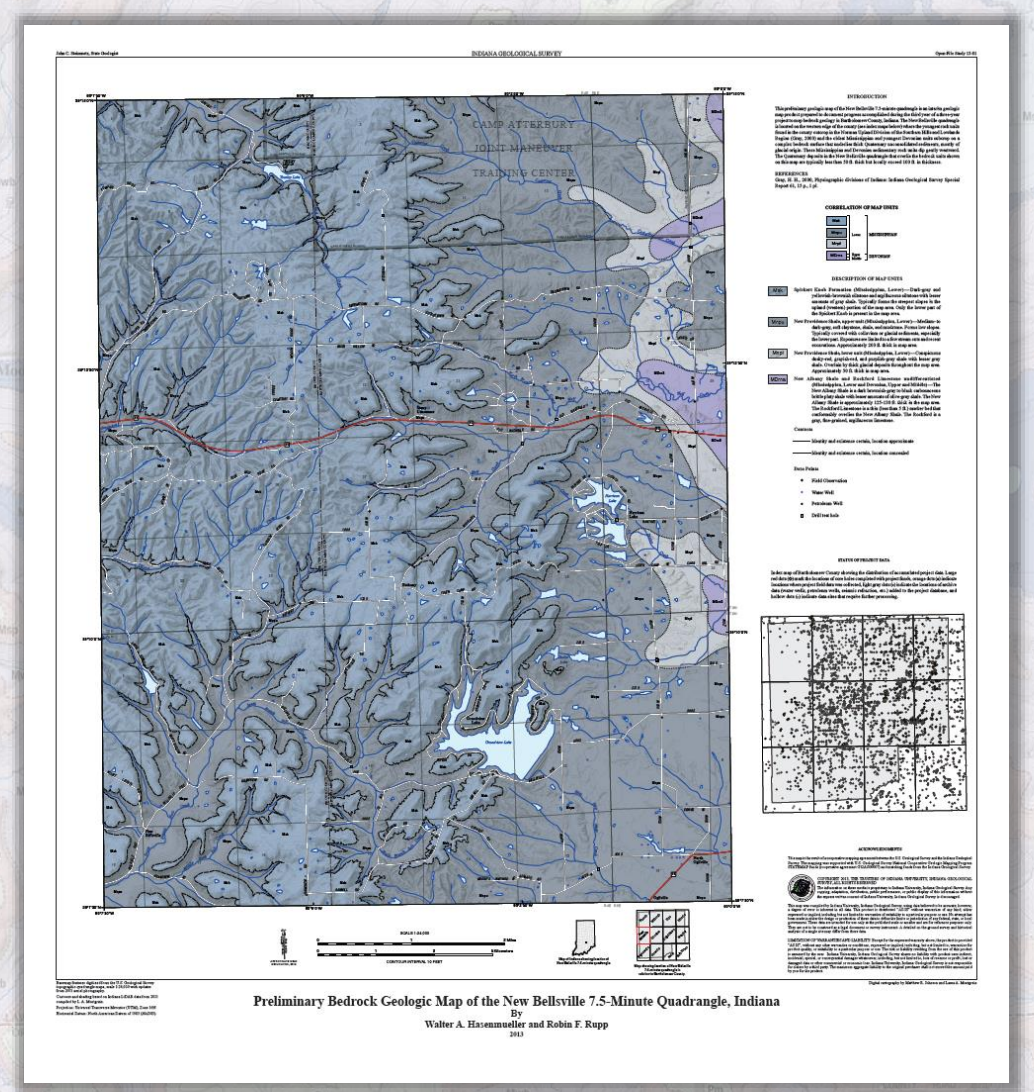
Adobe InDesign –Map Layout



INTRODUCTION

This preliminary geologic map of the New Bellsville 7.5-minute quadrangle is an interim geologic map product prepared to document progress accomplished during the third year of a three-year project to map bedrock geology in Bartholomew County, Indiana. The New Bellsville quadrangle is located on the western edge of the county (see index maps below) where the youngest rock units found in the county outcrop in the Norman Upland Division of the Southern Hills and Lowlands Region (Gray, 2000) and the oldest Mississippian and youngest Devonian units subcrop on a complex bedrock surface that underlies thick Quaternary unconsolidated sediments, mostly of glacial origin. These Mississippian and Devonian sedimentary rock units dip gently westward. The Quaternary deposits in the New Bellsville quadrangle that overlie the bedrock units shown on this map are typically less than 50 ft. thick but locally exceed 100 ft. in thickness.

REFERENCES

Gray, H. H., 2000, Physiographic divisions of Indiana: Indiana Geological Survey Special Report 61, 15 p., 1 pl.

CORRELATION OF MAP UNITS

Msk	Lower	MISSISSIPPIAN	
Mnpu			
Mnpl			
MDrna	Upper Middle	DEVONIAN	

DESCRIPTION OF MAP UNITS

Msk **Spickert Knob Formation (Mississippian, Lower)**—Dark-gray and yellowish-brownish siltstone and argillaceous siltstone with lesser amounts of gray shale. Typically forms the steepest slopes in the upland (western) portion of the map area. Only the lower part of the Spickert Knob is present in the map area.

Mnpu **New Providence Shale, upper unit (Mississippian, Lower)**—Medium- to dark-gray, soft claystone, shale, and mudstone. Forms low slopes. Typically covered with colluvium or glacial sediments, especially the lower part. Exposures are limited to a few stream cuts and recent excavations. Approximately 200 ft. thick in map area.

Mnpl **New Providence Shale, lower unit (Mississippian, Lower)**—Conspicuous dusky-red, grayish-red, and purplish-gray shale with lesser gray shale. Overlain by thick glacial deposits throughout the map area. Approximately 50 ft. thick in map area.

MDrna **New Albany Shale and Rockford Limestone undifferentiated (Mississippian, Lower and Devonian, Upper and Middle)**—The New Albany Shale is a dark brownish-gray to black carbonaceous brittle platy shale with lesser amounts of olive-gray shale. The New Albany Shale is approximately 125-130 ft. thick in the map area. The Rockford Limestone is a thin (less than 5 ft.) marker bed that conformably overlies the New Albany Shale. The Rockford is a gray, fine-grained, argillaceous limestone.

Contacts

——— Identity and existence certain, location approximate

- - - - - - - - Identity and existence certain, location concealed

Data Points

- Field Observation
- Water Well
- Petroleum Well
- Drill test hole

Semi-Automated Base Map Creation

How are the base maps created?

Matt Johnson
Indiana Geological Survey

Base Map Creation Time

1. Clipping data and prepping for vector export
   ~30 minutes
2. Creating and exporting shading and slope
   ~15 minutes
3. Styling and label placement in Illustrator
   ~2-3 hours
4. Photoshop shading and contour steps
   ~15 mins

Base Map Total
~ 3-4 hours

---

5. Adding geologic data and cleanup
   ~1-2 hours
6. Final layout
   ~1 hour

Project Total
~ 7 hours

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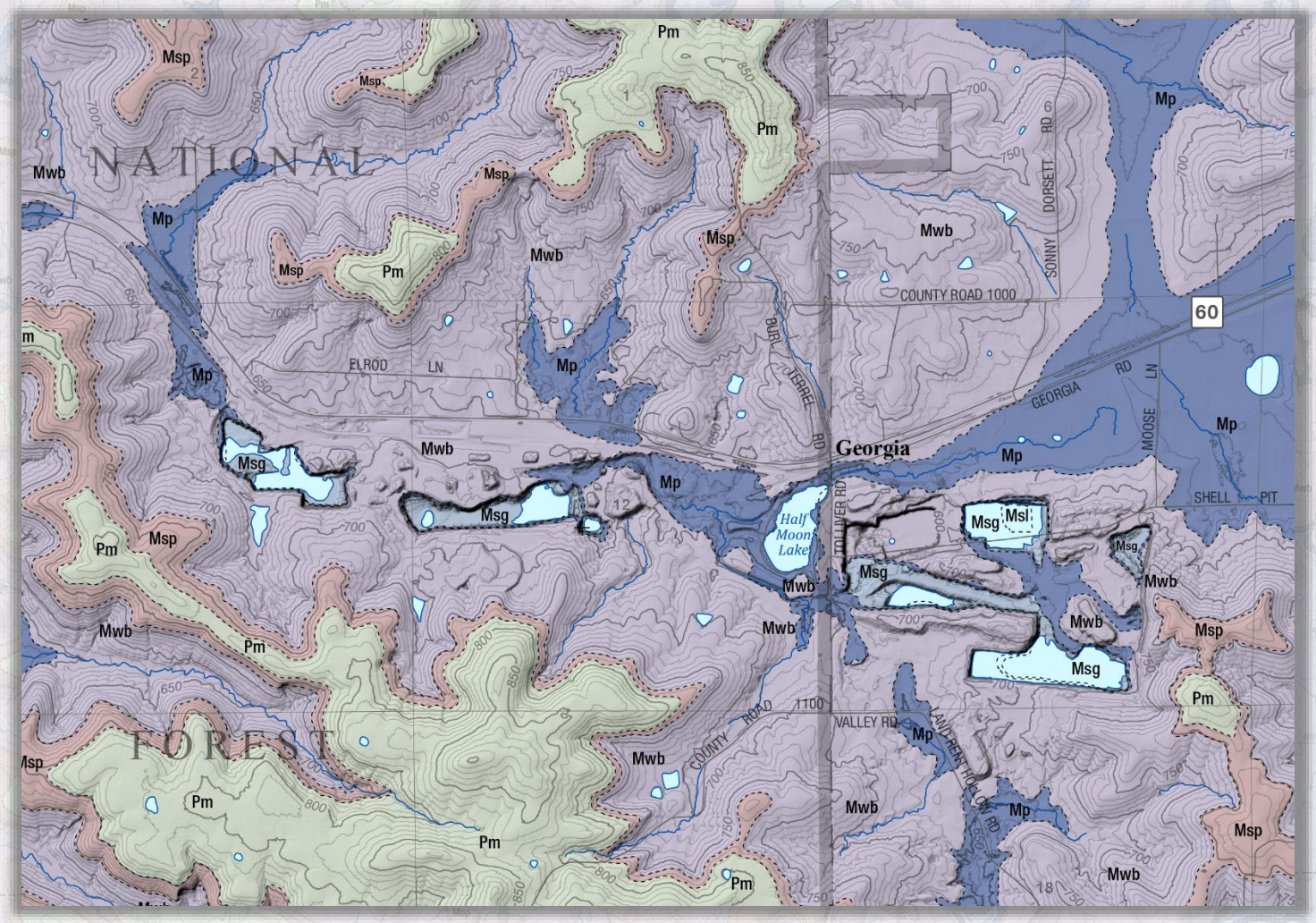
Examples – Match Hydro to LiDAR



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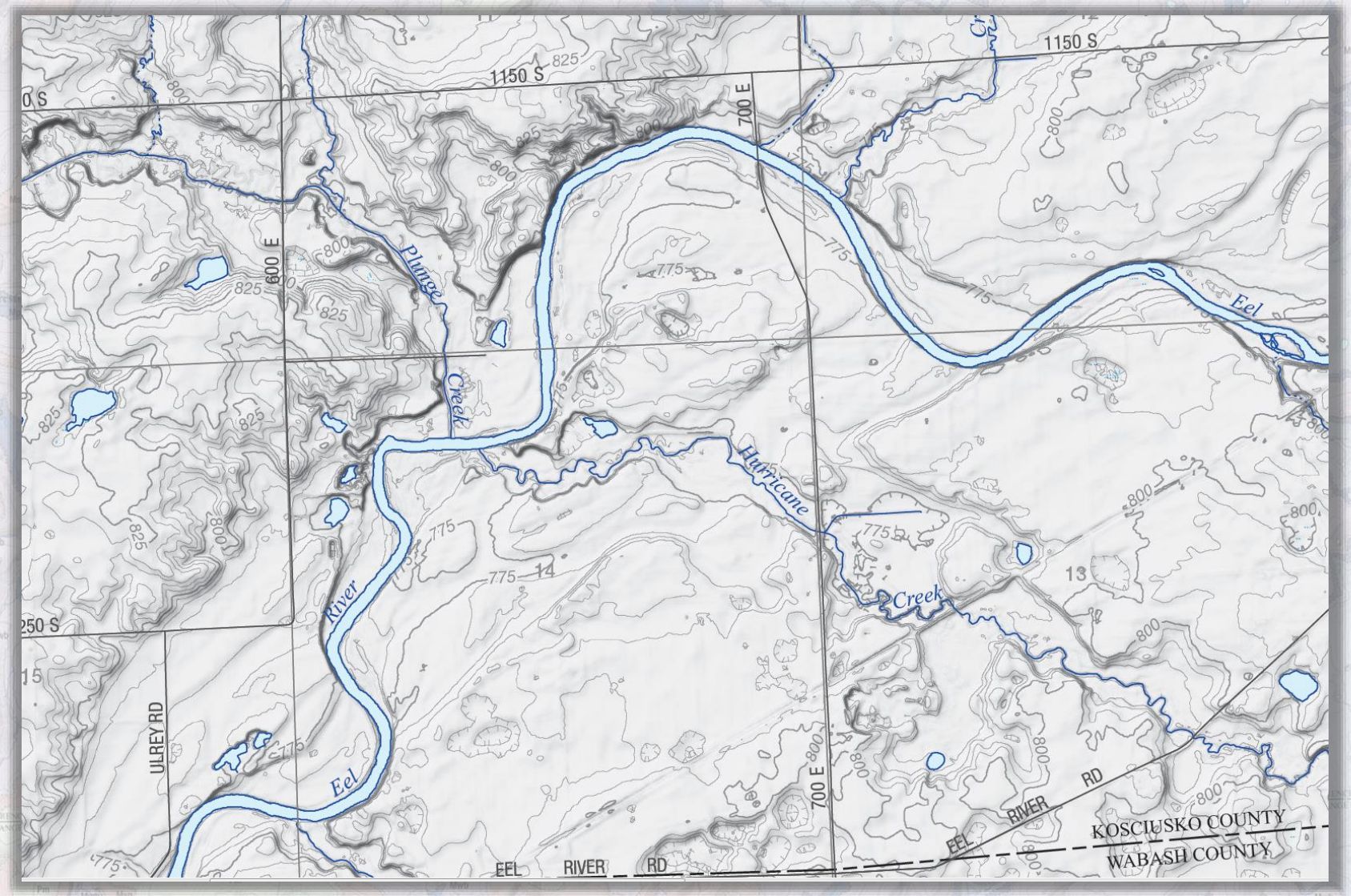
Examples – Local Hydro Available



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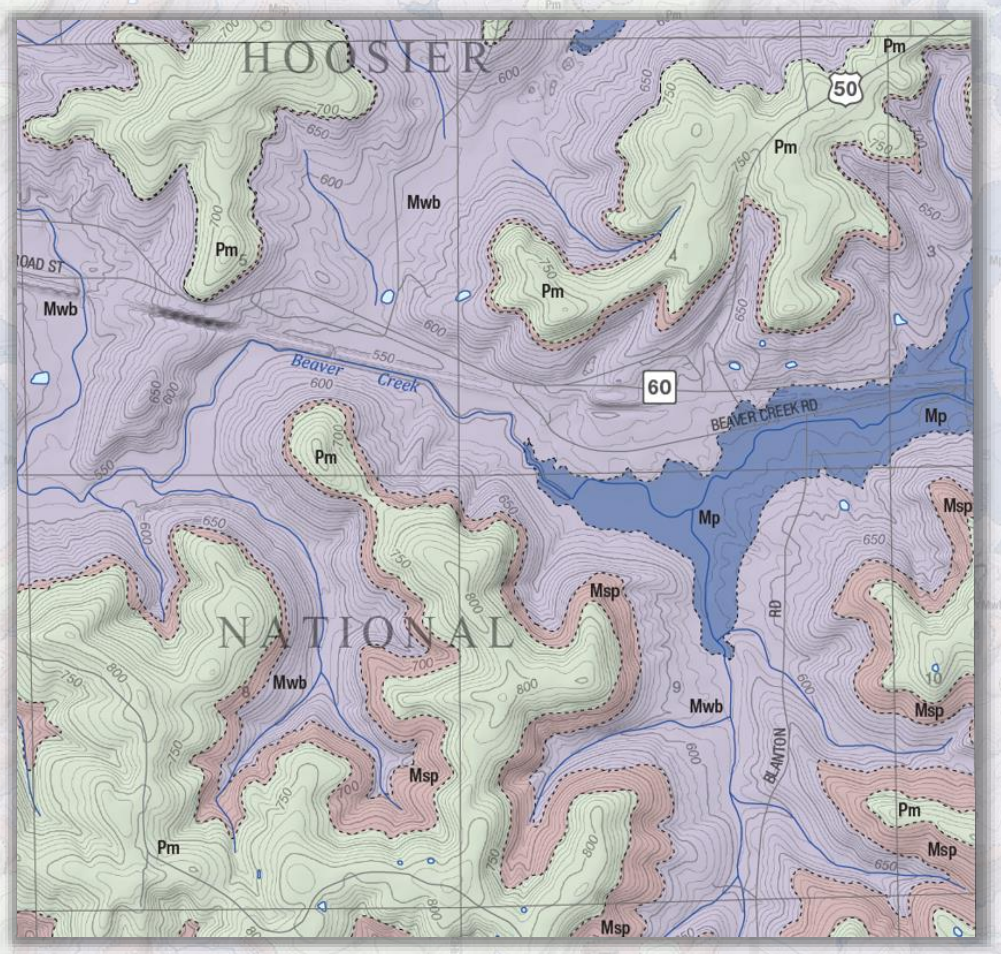
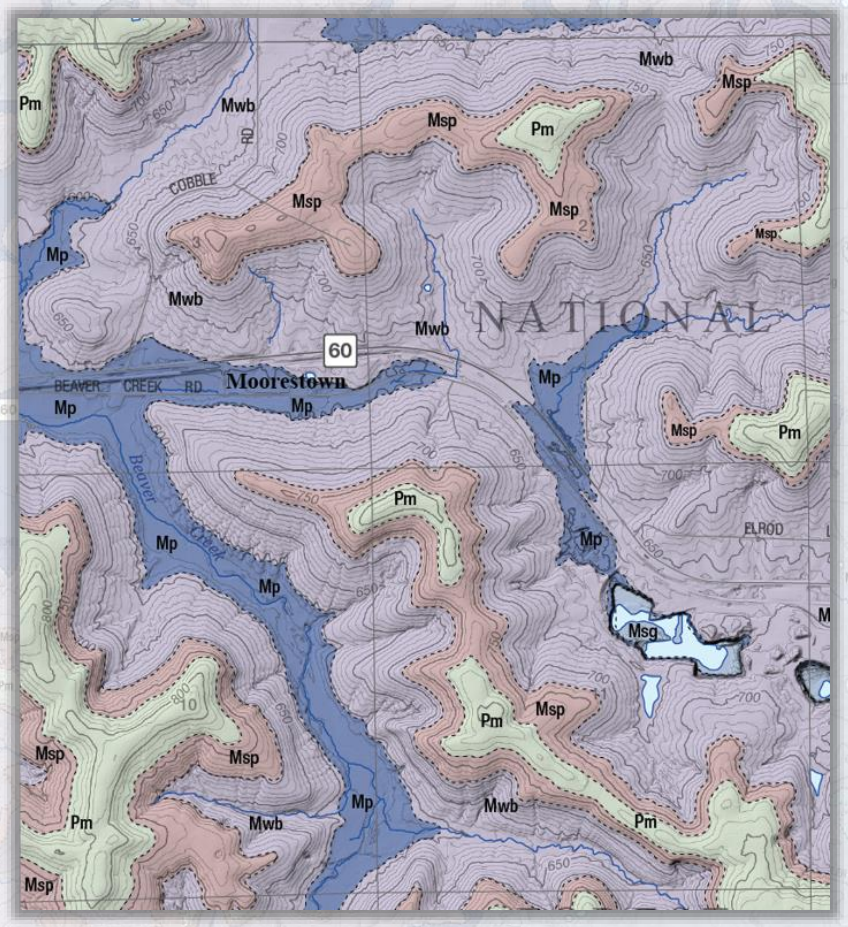
Examples – NED vs LiDAR





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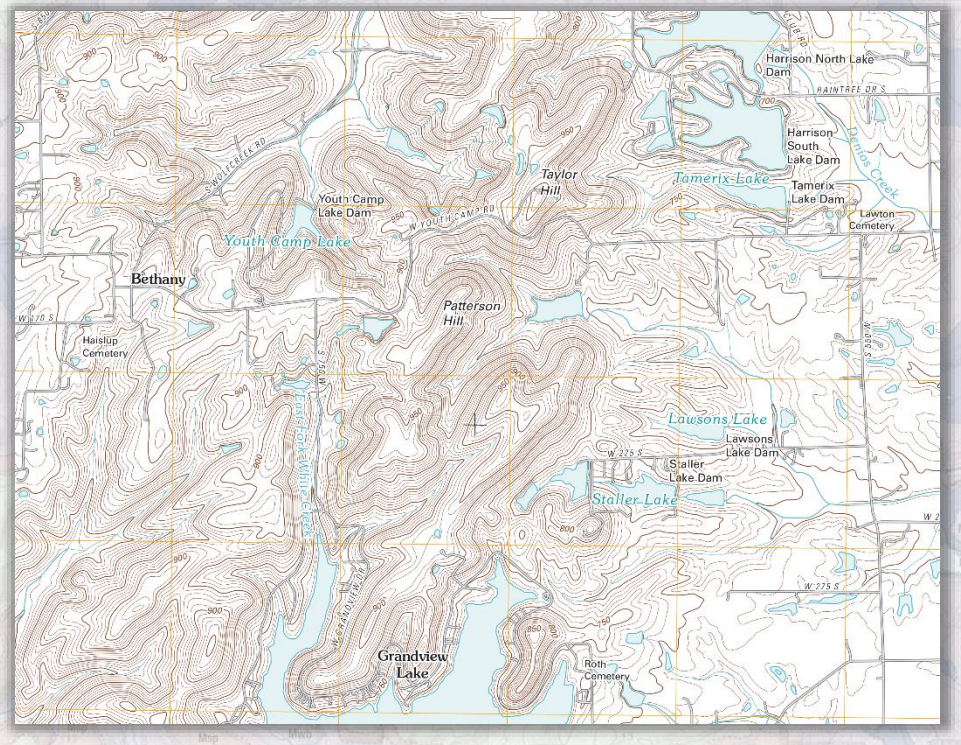
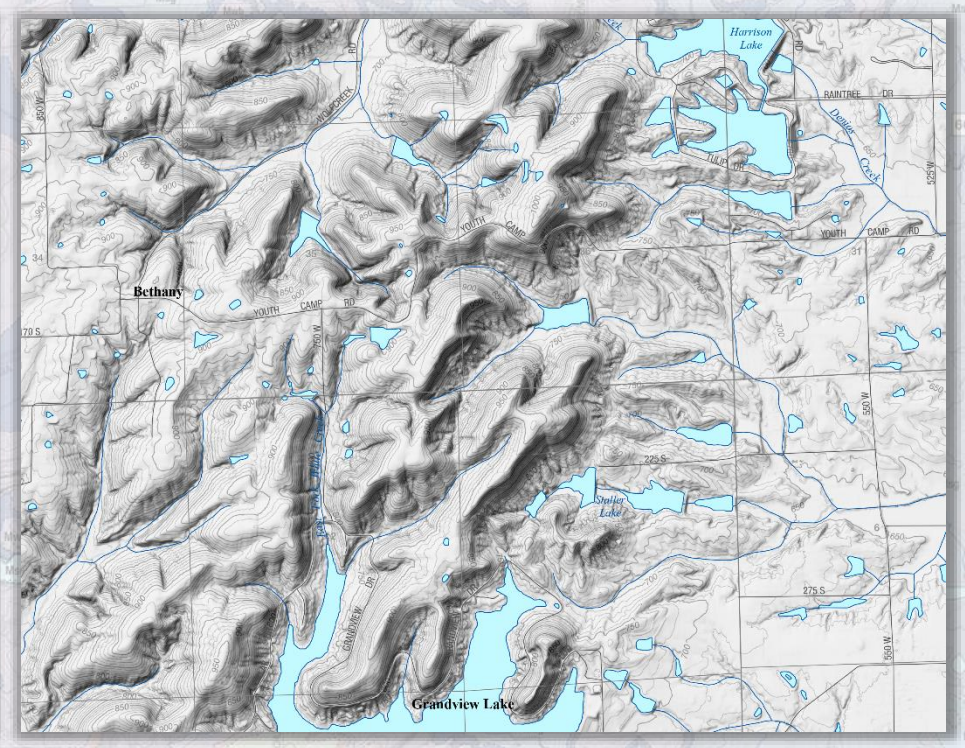
Examples – US Topo vs IGS Base





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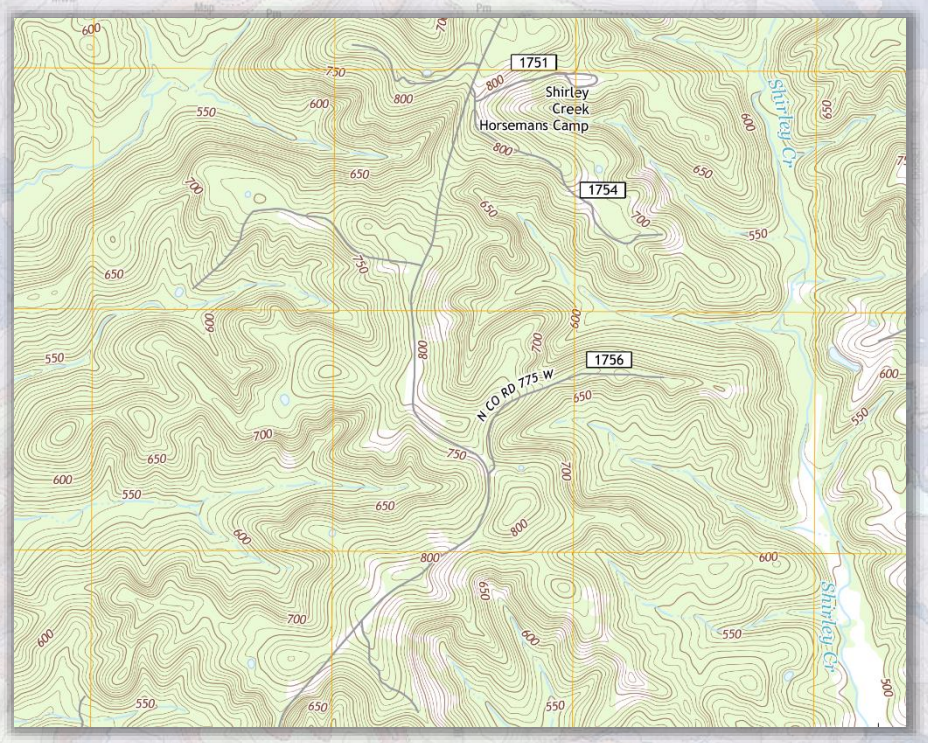
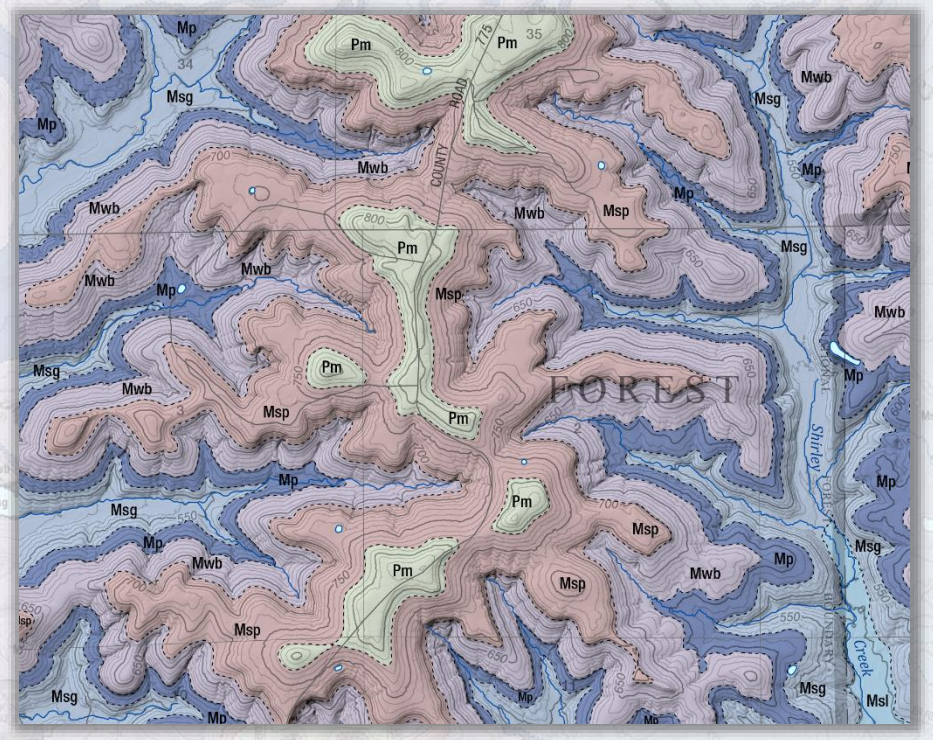
Examples – US Topo vs IGS Base





Matt Johnson
Indiana Geological Survey

Questions / Comments

Indiana Geological Survey
Cartographic Coordinator
Matt Johnson – Mrj21@indiana.edu
http://mapdesigntechniques.wordpress.com