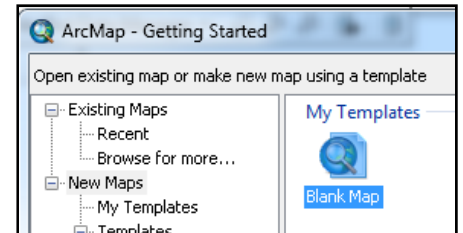# MN LiDAR Data Packet Workshop
Exercise #2 – Working with Mosaics and Tools

This exercise will familiarize you with the mosaicked Geodatabase files produced as part of the Minnesota Elevation Mapping Project. You will learn the details of the data and how to use some of the custom developed tools.
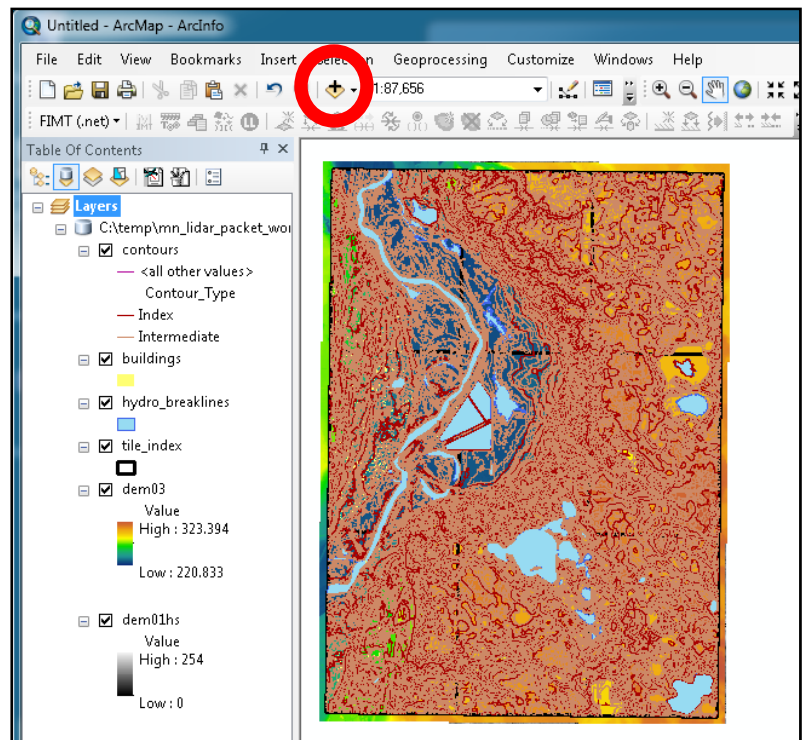
All data is stored in the **C:\temp\mn_lidar_packet_workshop** folder, referred to from this point forward as the "**Workshop**" folder.

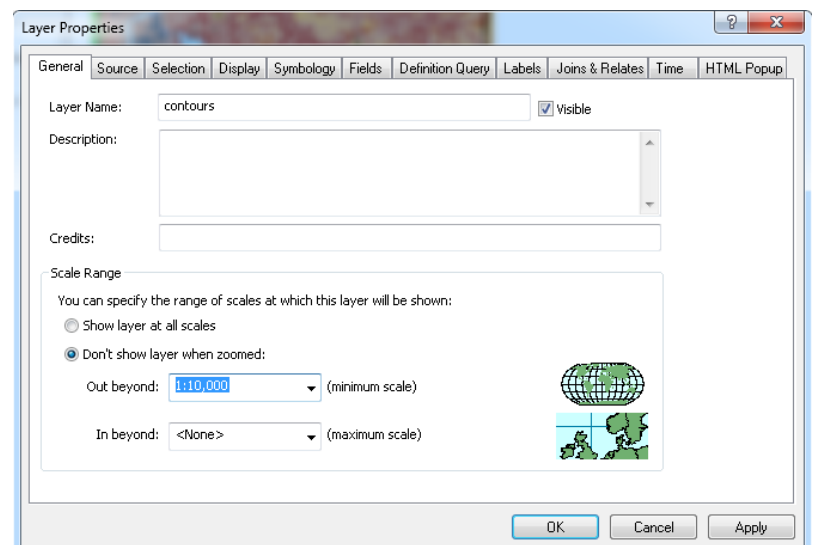1) Start this exercise by opening a new Blank Map in *ArcMap*.

2) Add the contents of the mosaicked feature classes stored in the Geodatabase named **Elevation_data.gdb**. Add the following layers and set their symbolization as follows:

   a. **Buildings** - Yellow fill, no outline (Sun symbol)

   b. **Contours** - Create a Category legend using **Contour_Type** field

   c. **Hydro_Breaklines** - Light blue fill, blue outline (Lake symbol)

   d. **Tile_Index** - No fill, thick black outline

   e. **DEM03** - choose a color ramp of your choice
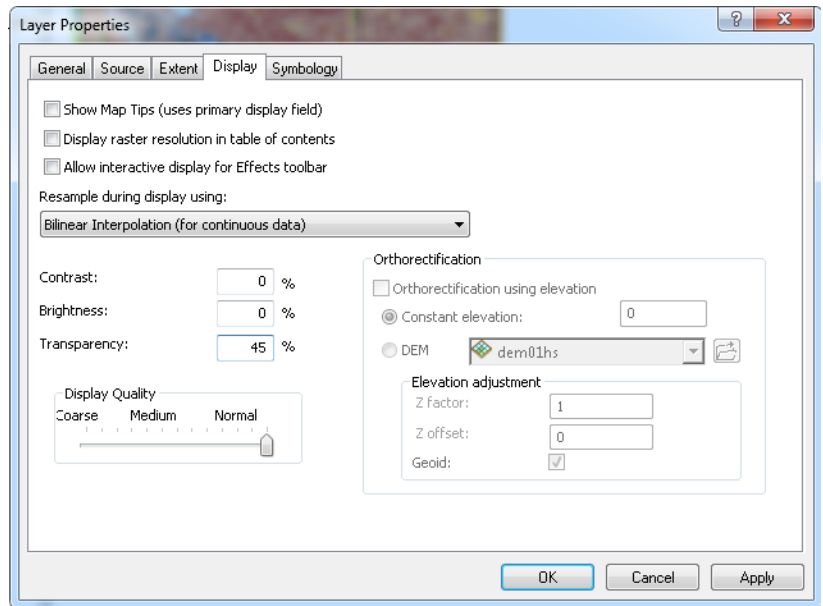
   f. **DEM01HS** - no action necessary

3) Turn on all of the layers.

4) You'll notice that the contours tend to clutter things, so right-click the **Contours** layer name and choose **Properties.**

5) Click the **General** tab.

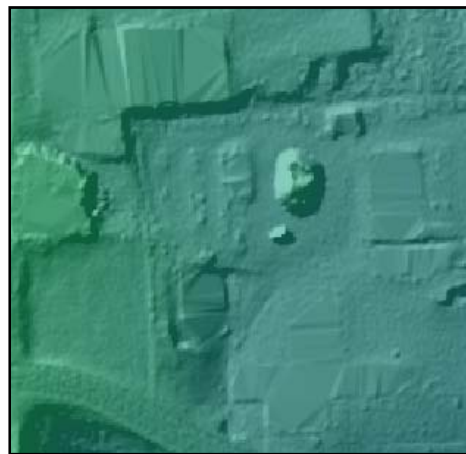6) Set the **Scale range** to not show the layer if out beyond **1:10,000**

7) Click **OK.**

8) Your next effort will be to make a color terrain map. Make sure that the **DEM01HS** layer is situated *below* the **DEM03** Layer in the table of contents.

9) Right-click the DEM03 layer name and choose **Properties**.

10) In the **Display** tab set the Resample option to **Bilinear Interpolation for continuous data.**

11) Set the Transparency to **45%.**

12) Click **OK**. Your display will change, showing you a color terrain perspective that has some pseudo 3d display.

13) As you zoom in and out you can see various types of terrain features that show up quite well using this display.

14) Improve the display even more by opening the Properties of the **DEM01HS** layer, clicking the Display tab, and setting it to **Bilinear Resampling** as well. This will present a smoother display.

15) Now take a minute to examine the building footprints. How they are represented in this data?

If you said planar (nearly flat) you're correct.

16) Use the **Add Data** button to add the layer file 2008 FSA Color Aerial Photography - Web Service.lyr from the Workshop folder. Good air photos will help you interpret the elevation data.
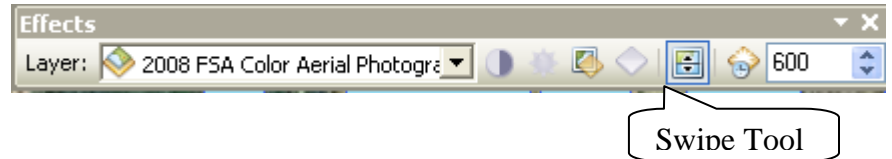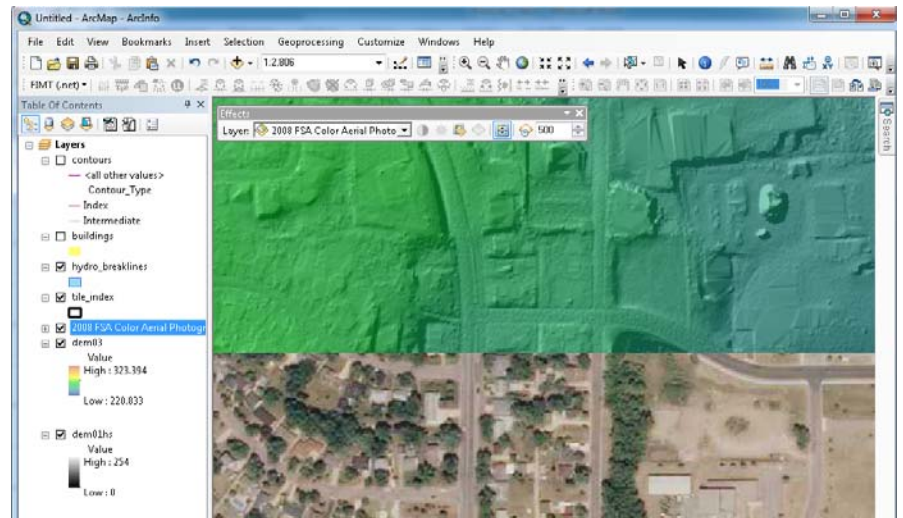
17) Set up the display so you can use the **Swipe** tool to see what's underneath raster layers. Go to Customize | Toolbars and choose the **Effects** toolbar.

18) Set the Layer in the Effects toolbar to the **2008 FSA Color Aerial Photography**.

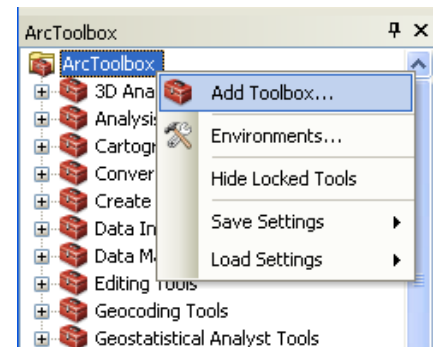19) Click the **Swipe** tool.

Swipe Tool

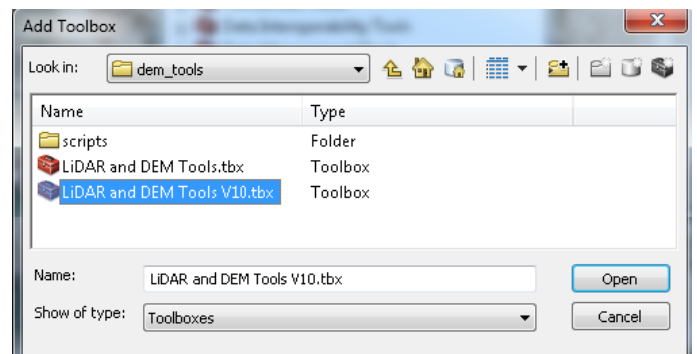20) Now hold the tool over the View, press your left mouse button, and drag.

21) Time to move on to the LiDAR and DEM Tools toolbox. Add the toolbox to ArcToolbox by first opening ArcToolbox.

22) Right-click on the ArcToolbox header and selecting **Add Toolbox.**

23) Select the **LiDAR and DEM Tools V10.tbx** file from the Workshop \DEM_TOOLS folder and click **Open.**
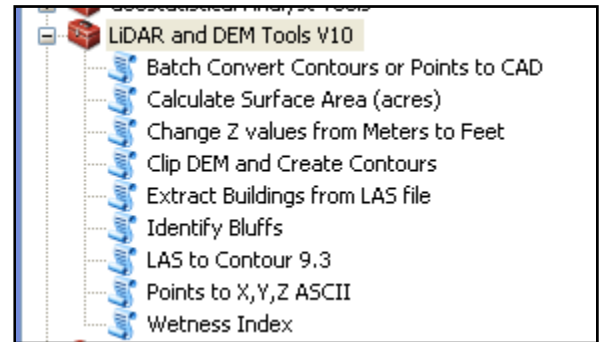
24) Start by using the **Clip DEM and Create Contours** tool to create an extract of the DEM that we will hypothetically share with a County engineer who uses CAD.

To adhere to her request, we'll change the projection of the output to LeSueur County Coordinates (feet) and the elevation values to feet.

A sample clip boundary is provided in the WORKING.GDB named **DEM_cookie_cutter**. Use the **Add Data** button add this layer.

25) Now open **LiDAR and DEM Tools V10 | Clip DEM and Create Contours.** Either navigate to it in ArcToolbox or use the **Search** tab to find it.

26) Drag the **DEM_cookie_cutter** from the TOC into the Input Feature Class.

27) Drag the **DEM03** into the Raster Input.

28) Make the Raster Output **somewhere OTHER THAN a Geodatabase!** (It needs to be in GRID format so that it can be ingested by CAD).

29) Save the Contour Output in our **working.gdb.**
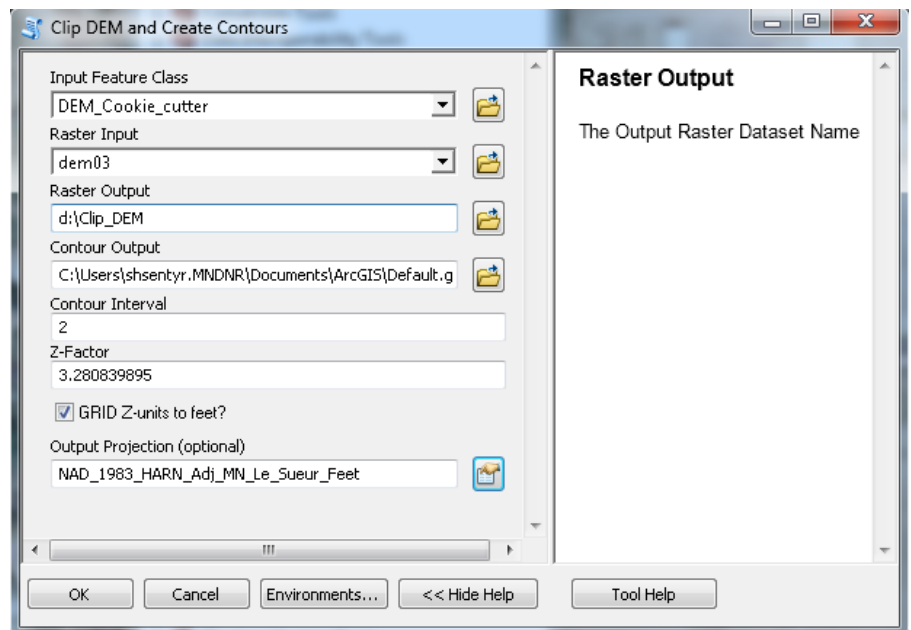
30) Keep the Contour Interval **2.**

31) Check the box **GRID Z-units to feet.** This will automatically set a Z-factor of 3.28 . . .

32) Select the Output Projection to **Projected Coordinate Systems | County Systems | Minnesota | US Feet | NAD 1983 HARN Adj MN Le Sueur (US Feet).**

33) Click **OK.** Processing may take a minute or two.

34) Now let's calculate the true surface area of the area. Most area calculations are created based on a 2D surface. In flat areas this suffices, but in steep areas area calculations can be off by quite a bit. Area calculation will be much more accurate using a) an elevation surface to determine the slope of the land, then 2) determining surface area based on the size of the cell and the slope.

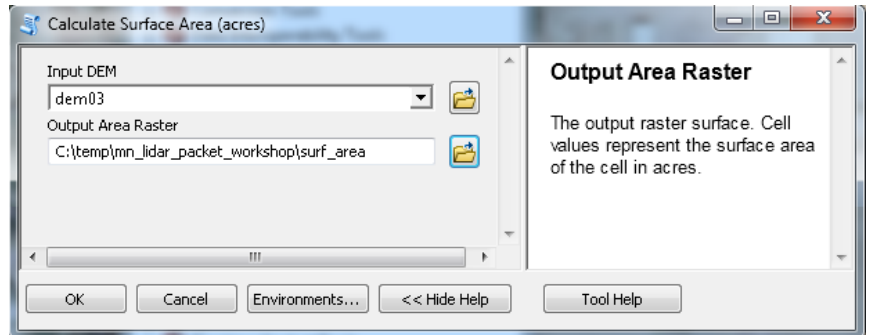35) Open the tool **Calculate Surface Area (acres)** from ArcToolbox or find it using the **Search** tab.
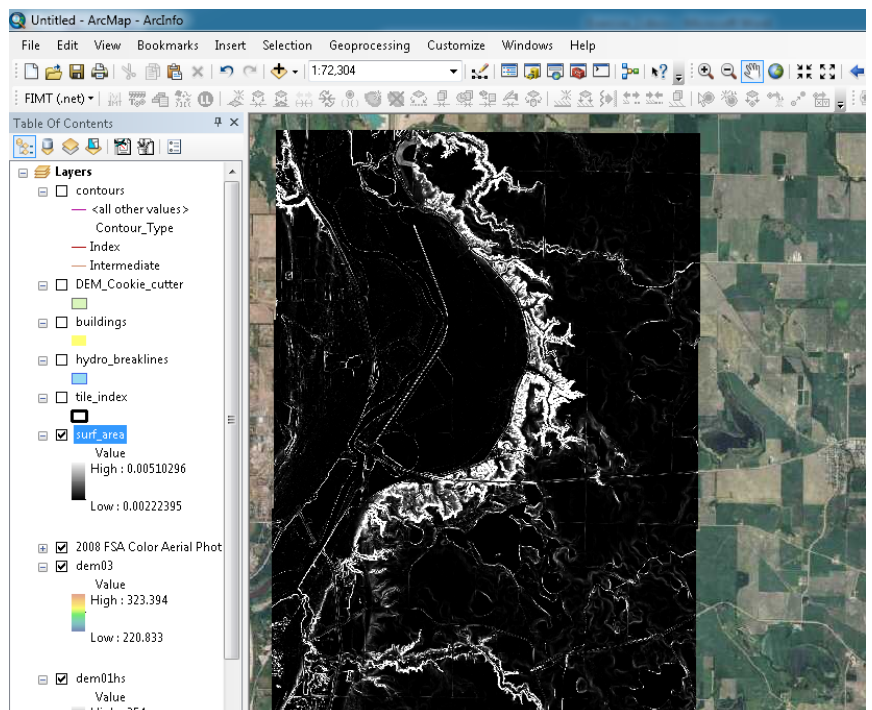
36) Drag DEM03 into the Input DEM.

37) Create a grid called **Surf_Area** in the Workspace folder.

38) Click **OK.**

39) Once finished, the tool will add the resulting grid to the TOC.

Notice that the values range from 0.0051 to 0.0022239. The cell size of this DEM is 3x3 meters or 9 square meters. That translates into 0.0022239 (9 * 0.0002471). So, the low end represents flat areas and the high end represents steep areas.
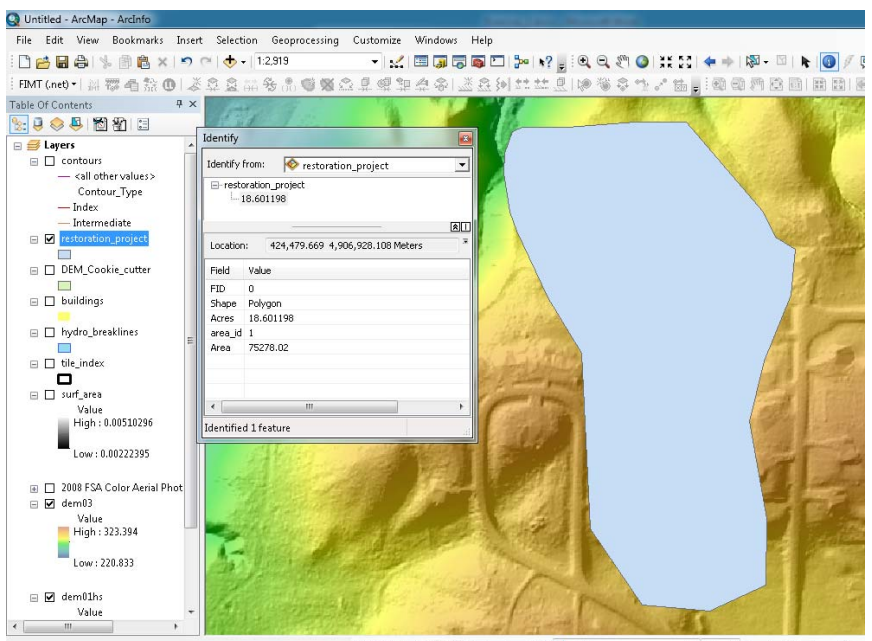

40) OK, time to use what you've just created to find true surface area. Let's say you are restoring an eroded streambank. You've hired a contractor to do the work, and you pay them based on total acres treated.

Use the **Add Data** button to add the polygon feature class called **RestorationProject.shp** from the Workshop folder.

41) Turn it on and zoom to the extent of the feature class.

42) Use the **Info** tool to list the attributes of this feature.

The 2D area of the polygon is 18.6 acres.

43) To get the true surface area of this polygon sum up the values of the Surface_Area raster within the polygon. Search for and open the **Spatial Analyst | Zonal | Zonal Statistics as Table** tool.
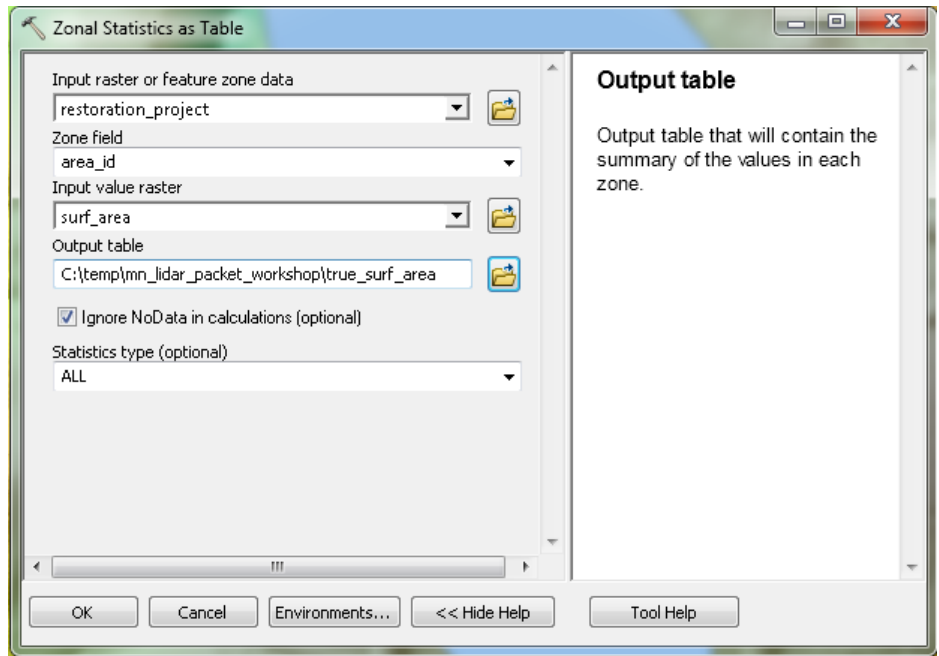
44) Drag the **Restoration_Project** layer from the TOC into the Input Raster.

45) Keep the Zone_field **area_id.**

46) Drag the **surf_area** grid you created into the Input value raster.

47) Save the output table into the Workshop folder and call it **true_surf_area.**

48) Keep all other settings the default and click O**K.**

49) The output table will be added to your project. Open it. The true surface area of this polygon is 19.86 acres, more than an acre difference between the planar surface area.

Rowid	AREA_ID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	1	8357	75213	0.002224	0.003328	0.001104	0.002377	0.000172	19.865896

50) For your last task, project all the tiled contours to LeSueur county coordinates and convert them to AutoCAD format. Open the **Batch Convert Contours or Points to CAD tool**. Note: This tool allows you to project and covert either the contours or the Bare Earth Points. Due to time constraints you'll just project and convert the contours.
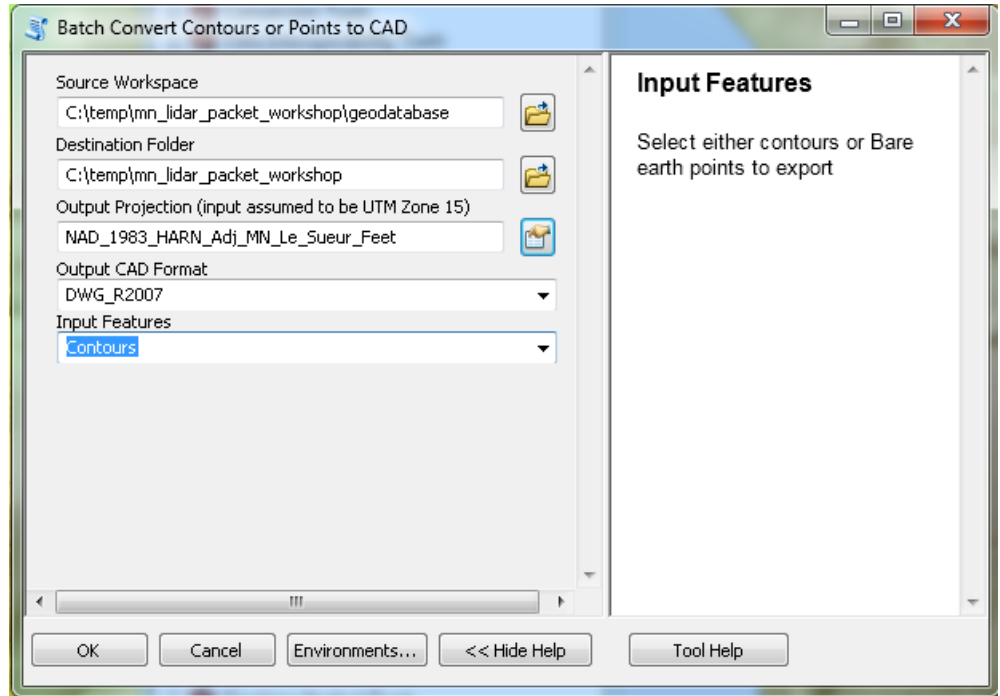
51) Set the Source Workspace to **…Workshop \ Geodatabase**. (The tool needs to know where the tiled geodatabases are.)

52) Set the Destination Folder to \..**Workshop.** (The tool creates shapefiles as output.)

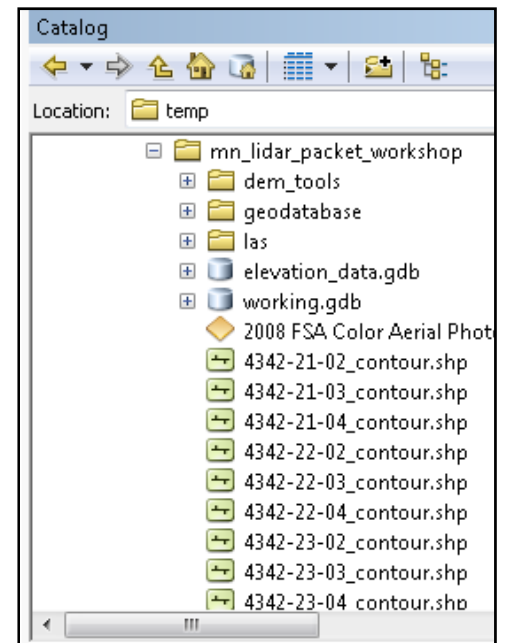**53)** Set the Output projection to **Le Sueur_feet.**

54) Set the Output CAD to **DWG_2007.**

55) Set the Input Features to **Contours.** (Bare Earth Points take a *really* long time to process).

56) Click **OK.** It will take several minutes to produce the outputs.

57) Click the **Catalog** tab to open it (or the ArcCatalog button if the tab is missing) and explore the new files that were created in the Workshop space.

58) Nice work! You send the data off to your County engineer, who is thrilled with the data. Your work here is done.

59) If you have some extra time, explore other LiDAR and DEM tools in the toolbox. If not, close out of ArcMap. You have now completed Exercise 2.

Download these training materials from
ftp.dnr.state.mn.us/pub/gisftp/2011_GISLIS/mn_lidar_packet_workshop.zip
And extract to c:\temp.