



# TRAINING MODULE

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## MAKING LANDSLIDE POTENTIAL MAP AND BANJIR BANDANG HAZARD MAP USING ArcGIS 10.0

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*Version 2.1*





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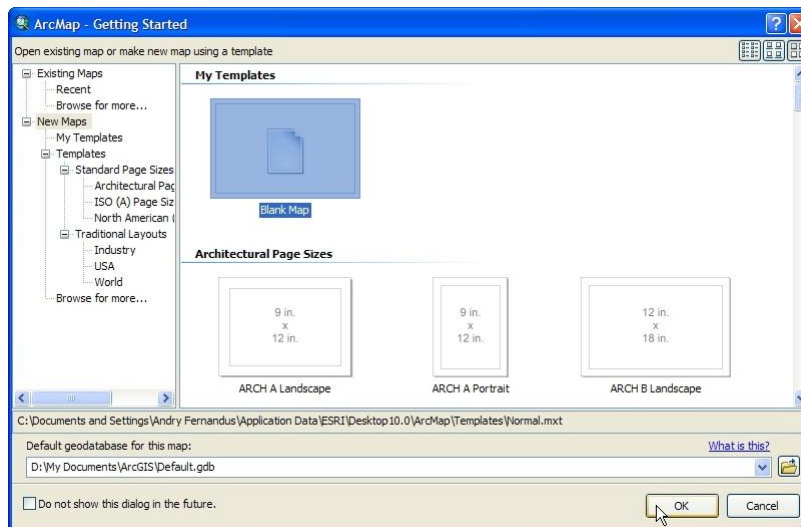
## I. Data Preparation


At this part, it will be shown the stages of process on preparing all types of data which required in making of landslide potential and banjir bandang hazard map.

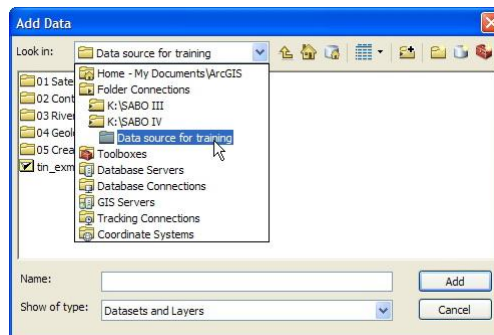
### I.1. Digitize landslide region and micro-topography using satellite image

#### Step 1. Open ArcMap

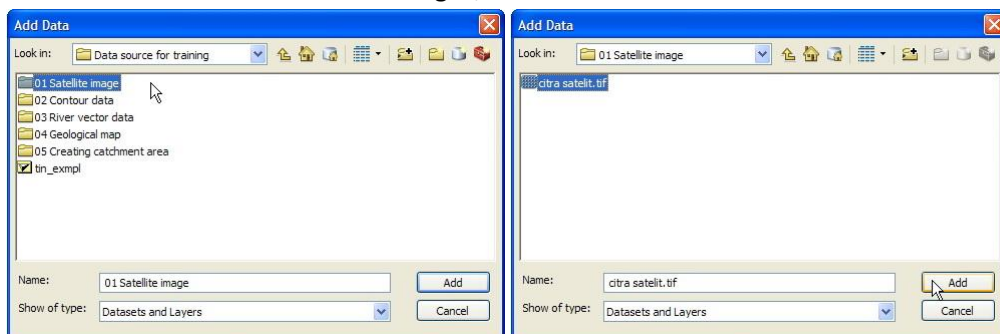
- 1) Run ArcMap  ArcMap 10 .
- 2) Window of “ArcMap - Getting Started” will open. At this window, click New Maps → Blank Map then click OK.



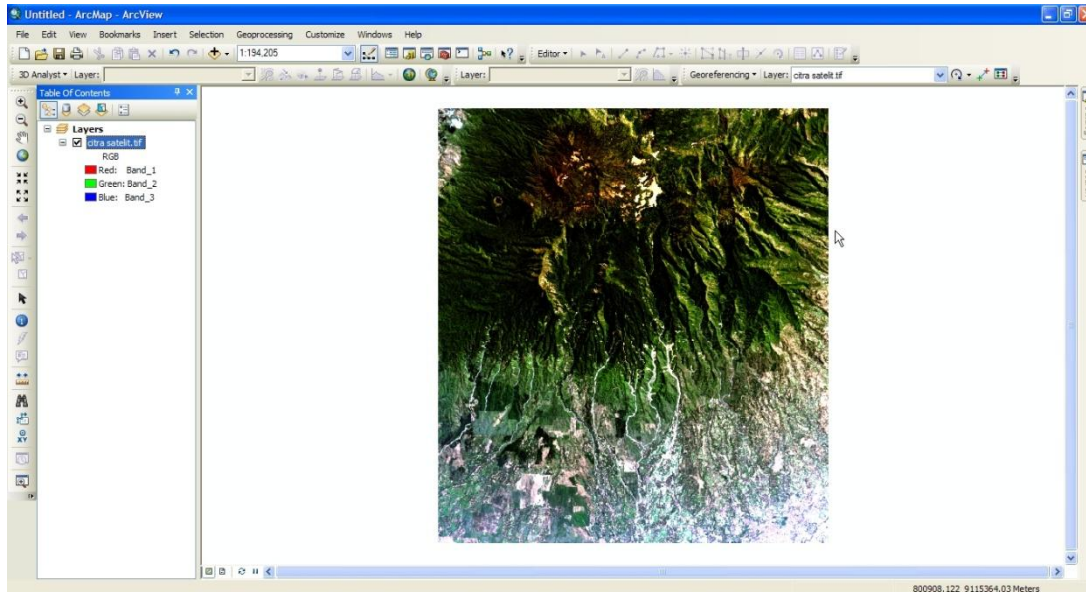
- 3) ArcMap’s workspace will appear. At toolbar Standard, click Add Data  button. Window of Add Data will appear. At the part of Look in, move the pointer to folder: Data source for training.



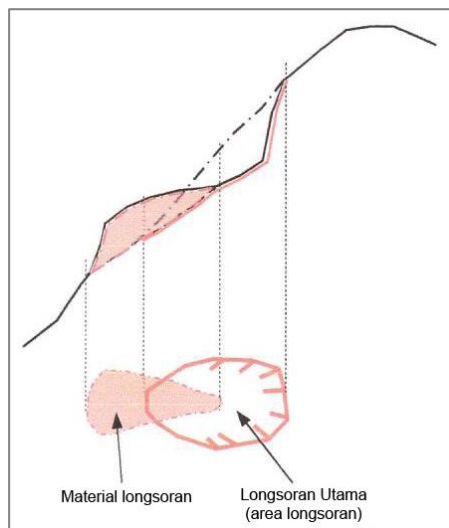
- 4) Double click to folder “01 Satellite image”, then choose file “citra satelit.tif”. Click Add button.



5) The view will appear as below.

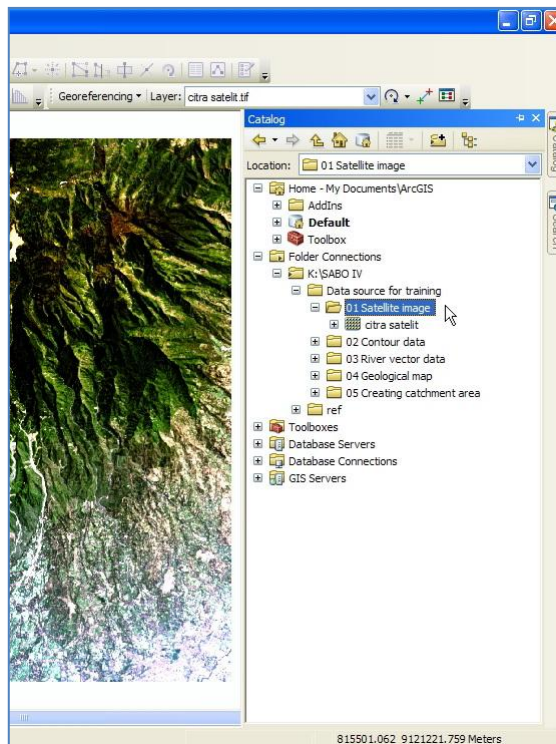


Step 2. Making data of past landslide events.

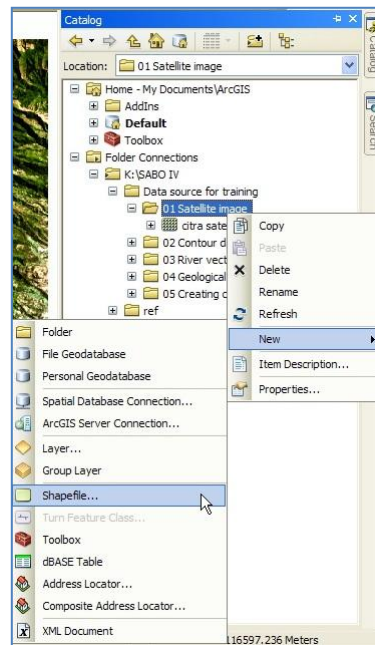


The picture above is a cross sectional view of the topography of hill with landslide. If the topography is interpreted from above, for example using satellite image, it is possibly that there will be two results of interpretation, which are interpretation of “landslides material” and interpretation of “major landslides”. The things that should be interpreted and digitized are only a part of “major landslide or landslide region”.

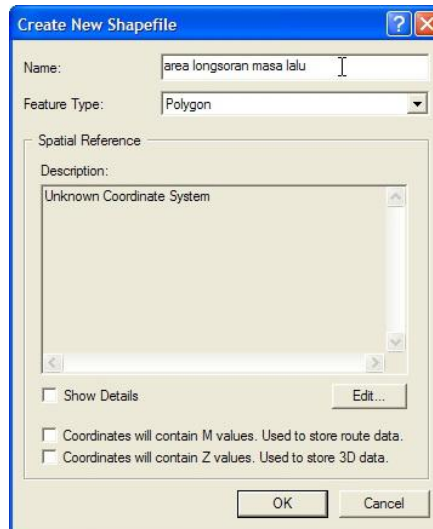
- 1) At ArcMap workspace, move cursor to Catalog button. And the Catalog window will appear automatically.
- 2) Click symbol + at the Folder Connections, symbol + at Data source for training, and choose the folder: 01 Satellite Image.



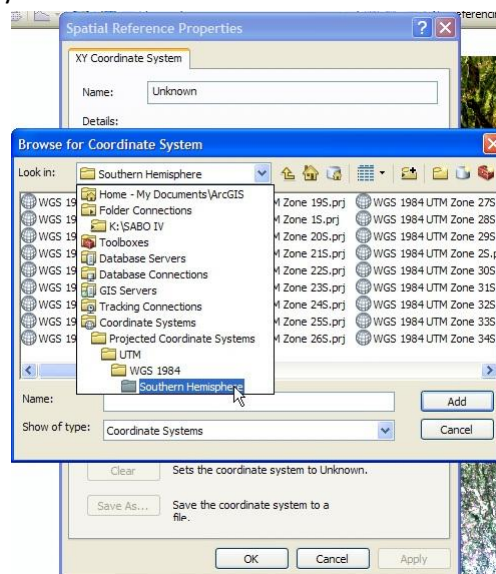
- 3) Right click on the folder: 01 Satellite image, move cursor to New, then click Shapefile.



- 4) At Create New Shapefile window, at text box Name, fill in: “area longsor masa lalu” and at text box Feature Type, fill in: Polygon.



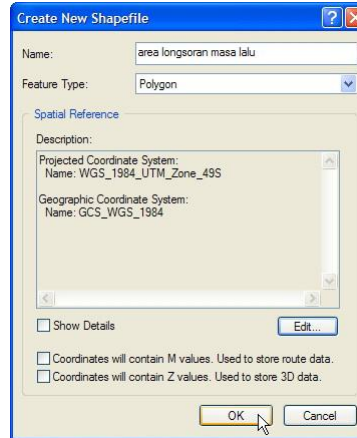
- 5) To choose the coordinate and projection system of a spatial data, click Edit button at Create New Shapefile window.
- 6) At the Spatial Reference Properties window, click Select button.
- 7) At Browse for Coordinate System window, follow the steps as shown in the folder below: Projected Coordinate System → UTM → WGS 1984 → Southern Hemisphere.





- 8) Select “WGS 1984 UTM Zone 49S”, then click Add button at Browse for Coordinate System window, click OK button at Spatial Reference Properties window, and click OK at Create New Shapefile window.

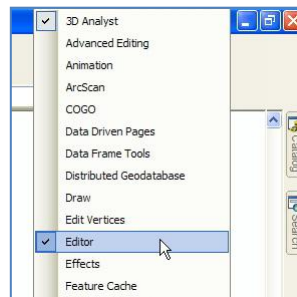
All of spatial data that use in this training module are using UTM 49S system coordinate (Jember area) with WGS 1984 system projection.



- 9) A new shapefile will automatically enter to the ArcMap workspace.




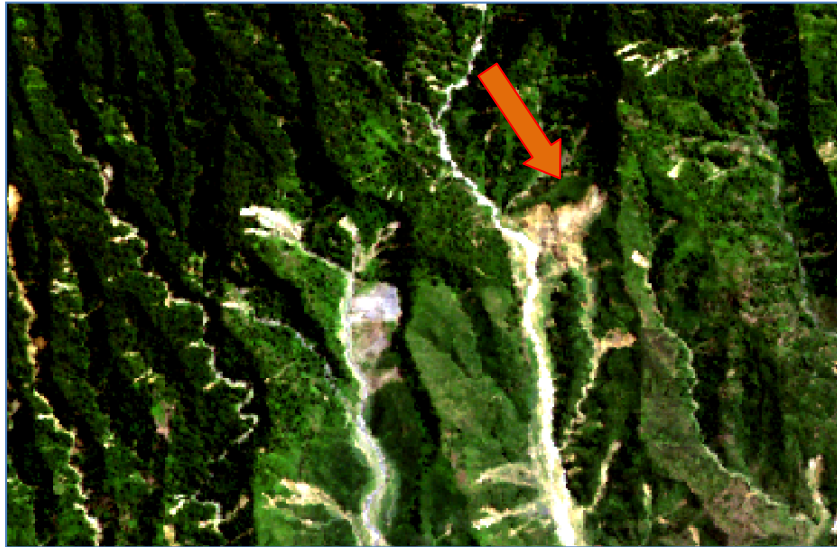
- 10) To make or edit spatial data, we need Editor tool. If ArcMap workspace does not have toolbar Editor yet, right click on blank random area at ArcMap workspace, then click Editor.



- 11) Then Editor toolbar will appear as below. This toolbar can be placed in specific locations in ArcMap workspace, in order to make ArcMap workspace more properly.



- 12) On toolbar Tool, click Zoom In button , move cursor to some specific area of the upstream of Jember river and zoom it in as seen in the picture below.




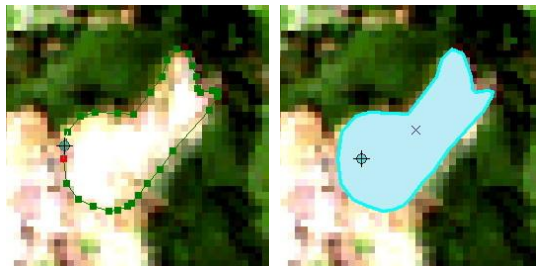
- 13) Spatial data of “area longsoran masa lalu.shp” is made by interpret and digitize an area of landslide using satellite image. The area that pointed by an arrow as shown in the picture above is the predictable area of the landslides.

To start digitizing the landslide area, at the Editor toolbar, click Editor and click Start Editing.

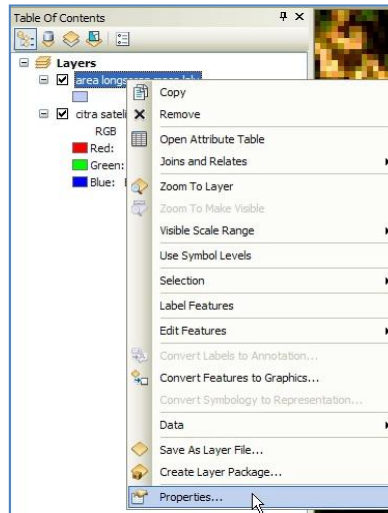
- 14) On the right of ArcMap workspace, it will appear a window named Create Features, and Construction Tools at the bottom part. Click “area longsoran masa lalu” layer, and at Construction Tools, select Polygon.



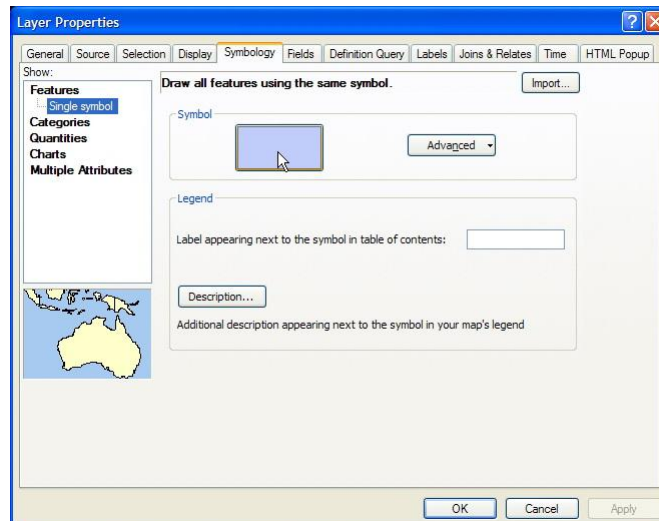
- 15) Click icon  (Straight Segment) on Editor toolbar.
- 16) The example of landslide area digitizing process is shown as the picture on the left side. Press F2 button on the keyboard to finish the digitization (the picture at the right side).



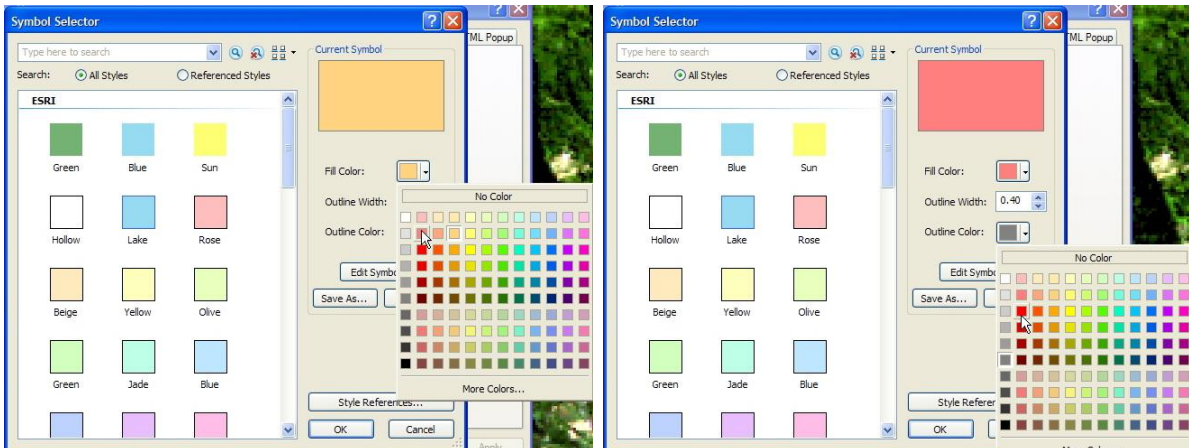
- 17) Do the interpretation and digitization process of landslide area for the whole scope of study area by using satellite image.
- 18) If the interpretation and digitization process of landslide area is done, click Editor button, click Save Edits button, then click stop Editing. By this time, all of the digitized data are already stored in the “area longsoran masa lalu.shp” data.
- 19) To change the data view of “area longsoran masa lalu.shp”, right click on “area longsoran masa lalu” layer, then click Properties.



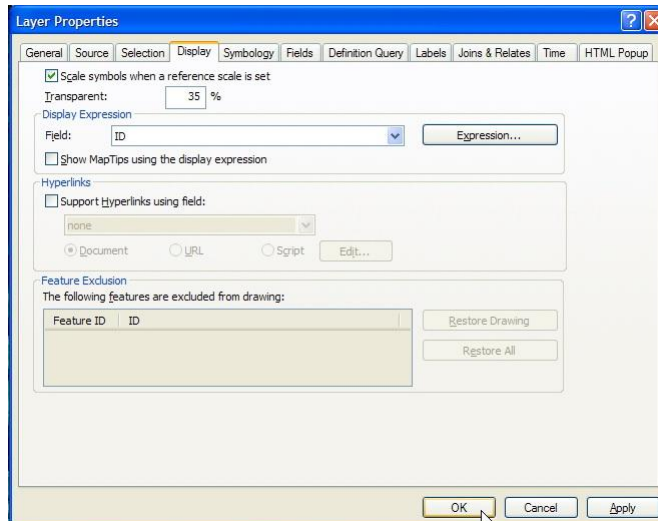
- 20) On Layer Properties window, click Symbology tab. Click Symbol button which shown as below.



- 21) Afterward, a window of Symbol Selector will appear. Select Fill Color: Medium Coral Light, and Outline Color: Mars Red, which shown as below, then click OK button.



- 22) To change the transparent view of a layer, click Display tab at Layer Properties window, then fill the transparency value into Transparent text box, for examples 35%. Click OK button on Layer Properties window.

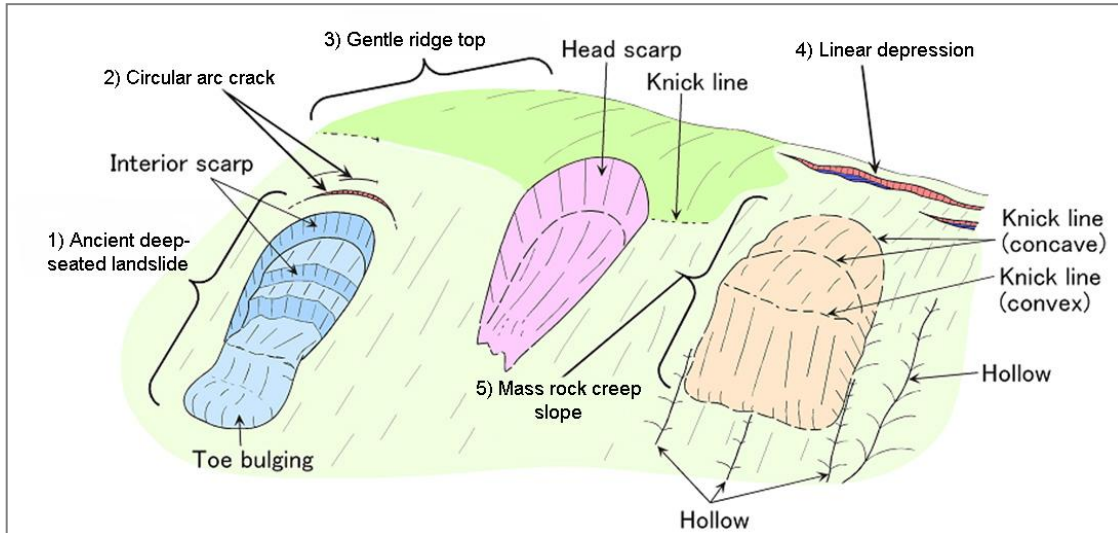


- 23) Due to the need of training, we later will use data of “area longsoran masa lalu ref.shp” which located inside the folder: Ref.

### Step 3. Making micro-topography data

There are five types of micro-topography elements. The five elements will be illustrated as follow:

- 1) Ancient deep-seated landslide
- 2) Circular arc crack
- 3) Gentle ridge top
- 4) Linear depression
- 5) Mass rock creep slope




Similar to the process of making data of “area longsor masa lalu”, in the process of making micro-topography data, we need satellite image to interpret and digitize the micro-topography elements which appropriate with the characteristics of micro-topography elements as described above.

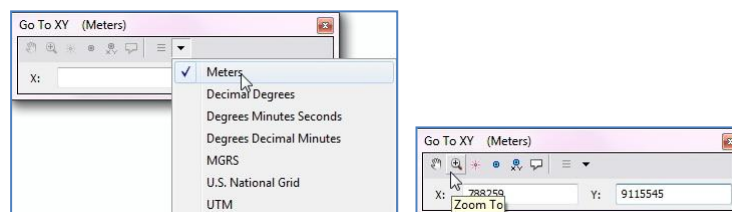
- 1) From several micro-topography elements, in this training we will make one of micro-topography elements i.e. Circular arc crack. The data is made by refer to the procedure of Step 2.


The data then is stored at folder: Data source for training\01 Satellite image, and have the following information: Name: “retakan busur lingkar”; Feature Type: Polyline; XY Coordinate System: WGS\_1984\_UTM\_Zone\_49S.

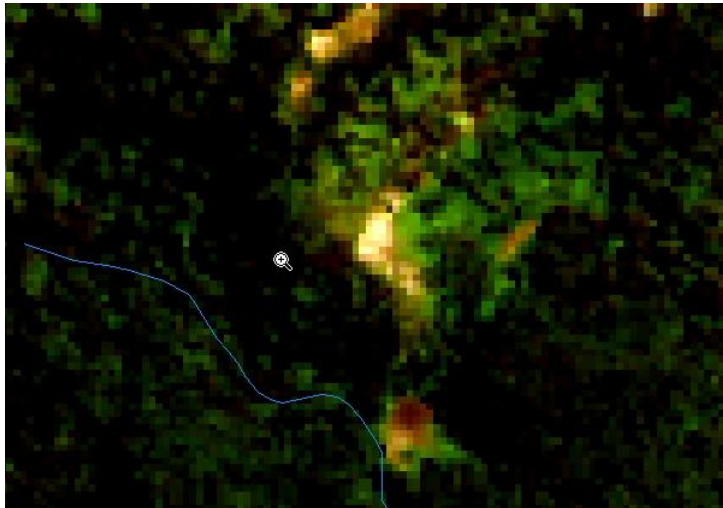
- 2) After the data making is done, the shapefile is automatically entered to the ArcMap workspace.



- 3) Click “Go To XY” button  which located on Tools toolbar. At combo button, select Meters. Fill the value of coordinates in the text box X and Y which are 788259;911545. Click Zoom To button. The display view will automatically move towards to the location which appropriate with the real coordinate.



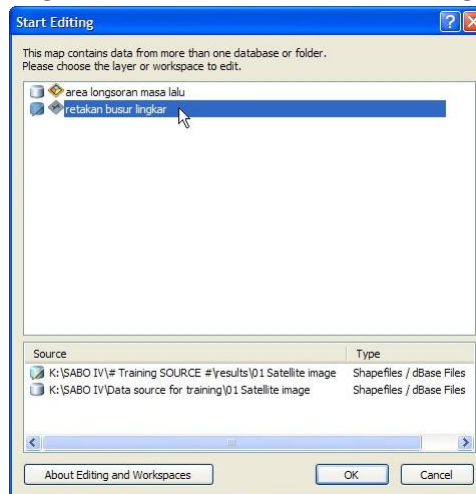
- 4) On Tool toolbar, click Zoom In button , and zoom in as below.



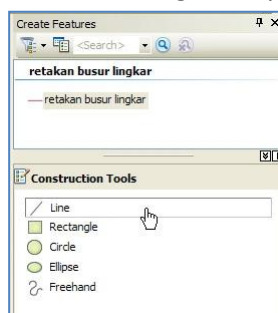
- 5) To start the digitization of circular arc crack, on Editor toolbar, click Editor and click Start Editing.  
 6) If there is more than one layer on the Table of Contents, the Start Editing window will automatically appear. The upper of Start Editing window shows some of layers that can be edited and located at the Table of Contents, whereas the bottom shows the location of folders which contains the layers.


Select “retakan busur lingkar” layer then click OK.

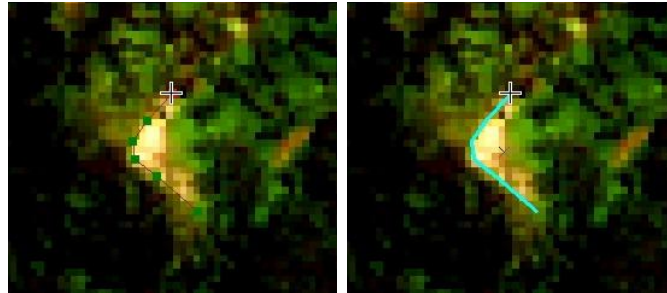
[Another options is by doing double click on “retakan busur lingkar” layer]




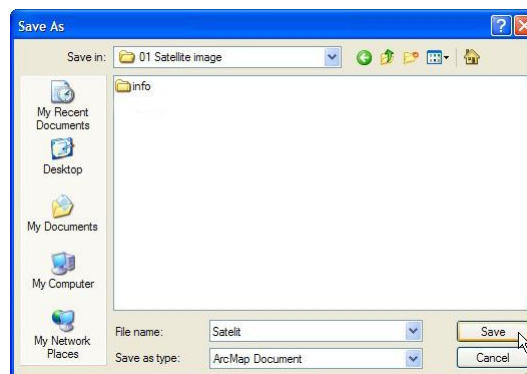
- 7) At the right side of the ArcMap workspace, a window of Create Features and Construction Tools will be appeared. Click “retakan busur lingkar” layer, and click Line at Construction Tools.



- 8) Click Straight Segment button  on Editor toolbar, and then start the digitization process.
- 9) The example of digitization process of circular arc crack is shown as the left side picture. Press button F2 on the keyboard to finish digitizing (right side picture).




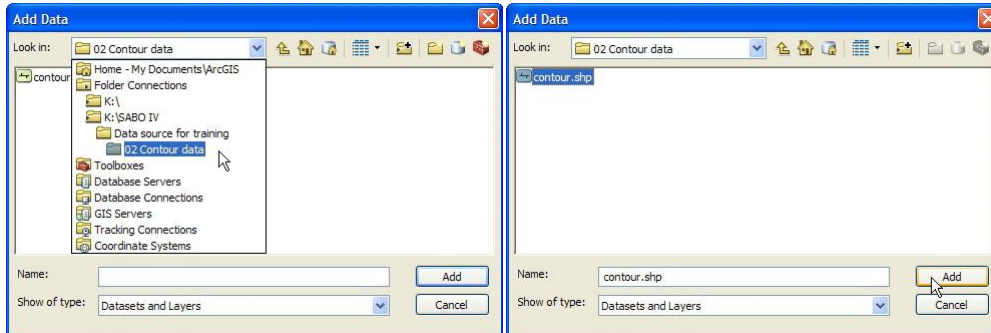
- 10) Do the interpretation and digitization of circular arc crack in the whole scope of study area using satellite image assistance.
- 11) If the interpretation and digitization process of circular arc crack is done, click Editor button, click Save Edits button and then click Stop Editing button. By this time, all the results of digitization are stored in the data of “retakan busur lingkar.shp”.
- 12) In some scope of study area, there are possibly two or more micro-topography elements. For the other micro-topography elements, do the steps of making micro-topography data refer to step 1 to 11 above.
- 13) Due to the need of this training, we will use micro-topography data that are “punggung bukit rata ref.shp”, “rayapan batu massal ref.shp”, “retakan busur lingkar ref.shp”, which are stored in the folder: Ref.
- 14) To store your project work, click Save  button on Standard toolbar, or click Ctrl+S button on the keyboard. Save the MXD file to the folder: 01 Satellite image, name it “Satelit”, then click Save button.



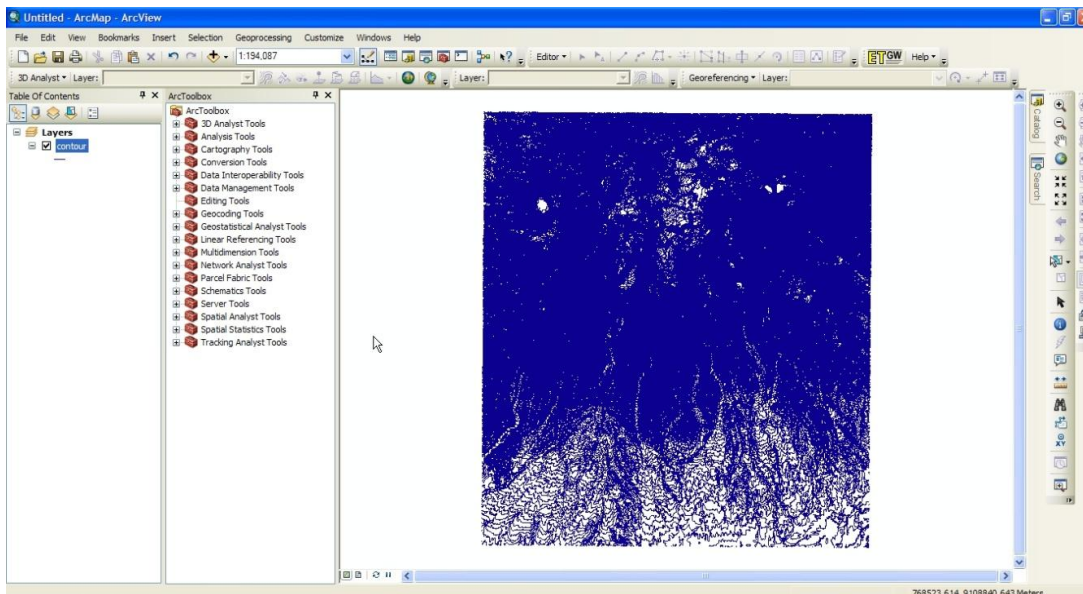
## 1.2. The processing of topographic data

### Step 1. Making of TIN and DEM

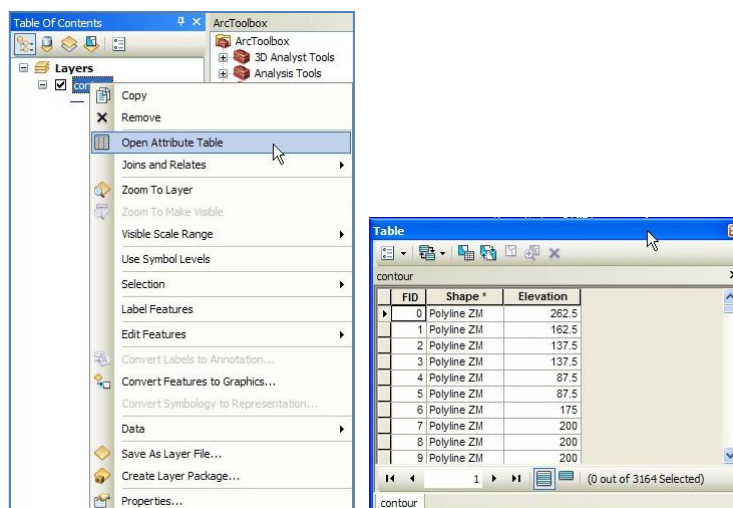
- 1) Open or run ArcMap and choose Blank Map.
- 2) On Standard toolbar, click Add Data  button. Next will appear Add Data window.
- 3) On Look in combo box, point to the folder: Data source for training/02 Contour data. Choose file "contour.shp" and click Add button.



- 4) The figure below is the display after the data is entered.



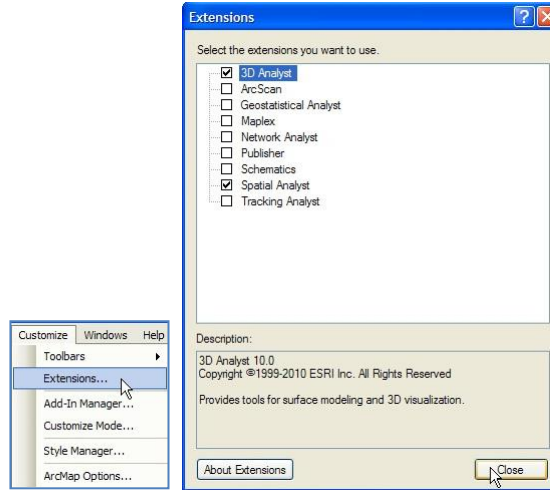
- 5) To see the attribute data that is contain in contour data, right click "contour" layer, then click Open Attribute Table. The figure on the bottom right shows the attribute that contain in "contour" layer that is elevation data.






Click symbol “x” on the upper right corner of Table window to close the display of attribute data.

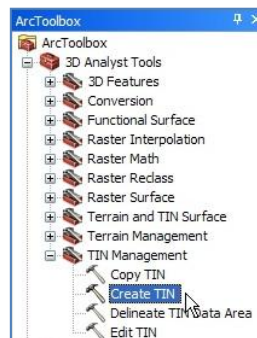
- 6) To make or to edit contour data, we need 3D Analyst extension. Click Customize on the ArcMap main menu, and then click Extensions. On the Extensions window, click/check the 3D Analyst and Spatial Analyst extension. Click Close button.



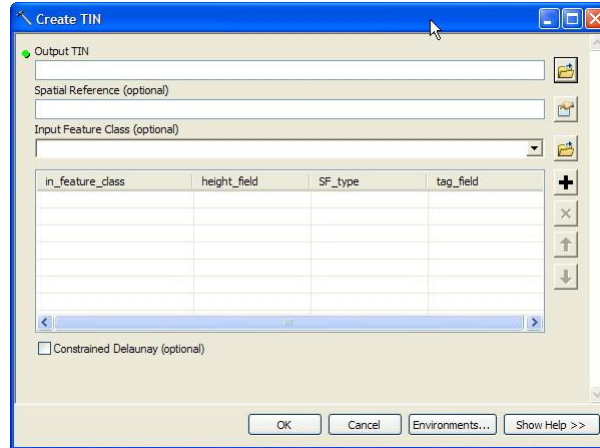
- 7) To display Toolbox 3D Analyst, click ArcToolbox Window  button. Next will appear ArcToolbox window that contains various analyst tools.




- 8) TIN (Triangulated Irregular Network) is model of topology data vector based that is used to represent terrain. To make a TIN, on the ArcToolbox window, click symbol + on 3D Analyst Tools → TIN Management, double click Create TIN.

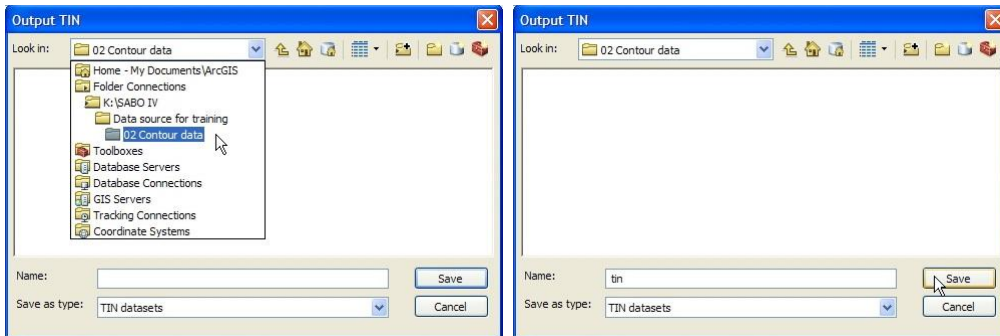



9) Next will appear Create TIN window.



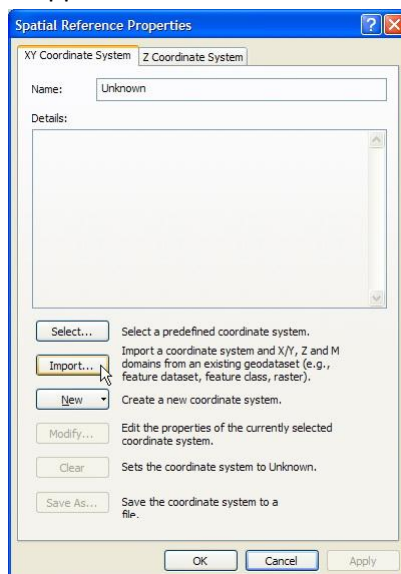
10) Click  button on the Output TIN text box. Next will appear Output TIN window.

11) On Look in combo box, point to the folder: Data source for training/02 Contour data. On the Name text box, write "tin", and then click Save button.

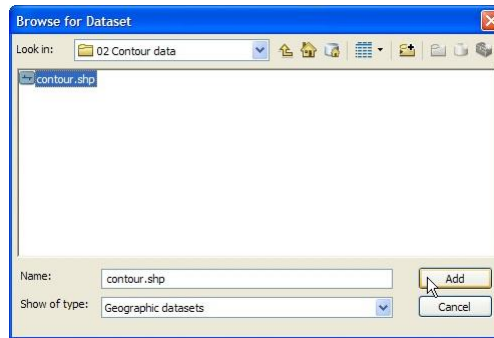


12) Click  button on the Spatial Reference text box, on Create TIN window. Next will appear Spatial Reference Properties window.

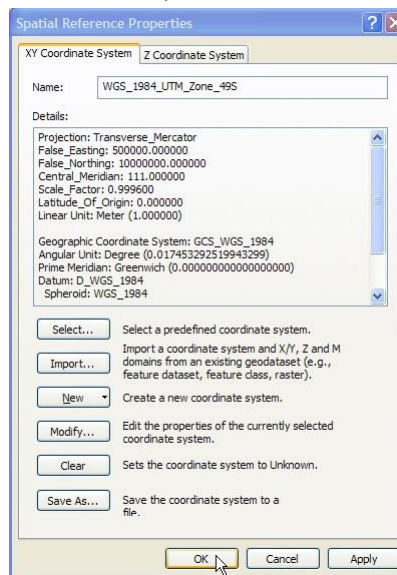
Click Import button. Next will appear Browse for Dataset window.



- 13) On the Look in com box, point to folder: Data source for training/02 Contour data, click “contour.shp” data, and then click Add button.



- 14) Click OK button on Spatial Reference Properties window.



- 15) On Input Feature Class combo box, on Create TIN window, choose “contour” layer.

