Introduction

ArcScan is another way to get digital data that can be used in GIS. The ArcScan can generate digital data in vector format from a scanned image. The ArcScan extension in ArcGIS is designed for vectorization, which means converting raster data to vector data. The process of vectorization (tracing) can be performed either manually or automatically.

Manual vectorization requires that the user trace the raster that is subject to conversion. The automated procedure requires that you generate features for the entire raster based on settings that you specify. ArcScan provides an efficient way to streamline this integration when compared to traditional techniques, such as digitizing.

Since ArcScan is designed to work with editing, users must start an edit session to activate the ArcScan toolbar. This means that all the editing tools and commands can be used in conjunction with the ArcScan tools and commands. ArcScan uses editing settings, such as the snapping environment and target templates and layers.

ArcScan is a powerful tool and it is available as an add-on component of the ArcGIS Desktop suite. Licensed as a separate extension, ArcScan works within the ArcMap environment and relies on its own user interface, which supports the tools and commands used for the vectorization process.

Important Note 1: ArcScan can vectorize any raster format supported by ArcGIS as long as it is represented as a bi-level image. If you have more than one band image you have to integrate one band only.

Important Note 2: if you want to make your multiband only 1 band, you have to do the following:

- Add to ArcMap the 1 band only from the multiband image
- Export the 1 band (Data/Export) and call it a new name
- Launch ArcToolbox/Spatial Analyst/Reclass/Reclassify
- Reclassify the one band image into two classes.

Scenario: You are a hydrogeologist and you are interested in converting the georeferenced image from Azraq Basin into a vector digital data file format. This conversion will allow you to view the stream system as a vector layer and then use it in you analysis in your project.

To use the ArcScan in this lesson you need to use the rectified image "**Rec_Stream.tif**" from your folder. The image represents stream system in the central part of Azraq Jordan. The main duty is to perform an automatic conversion with high precision from raster into vector.
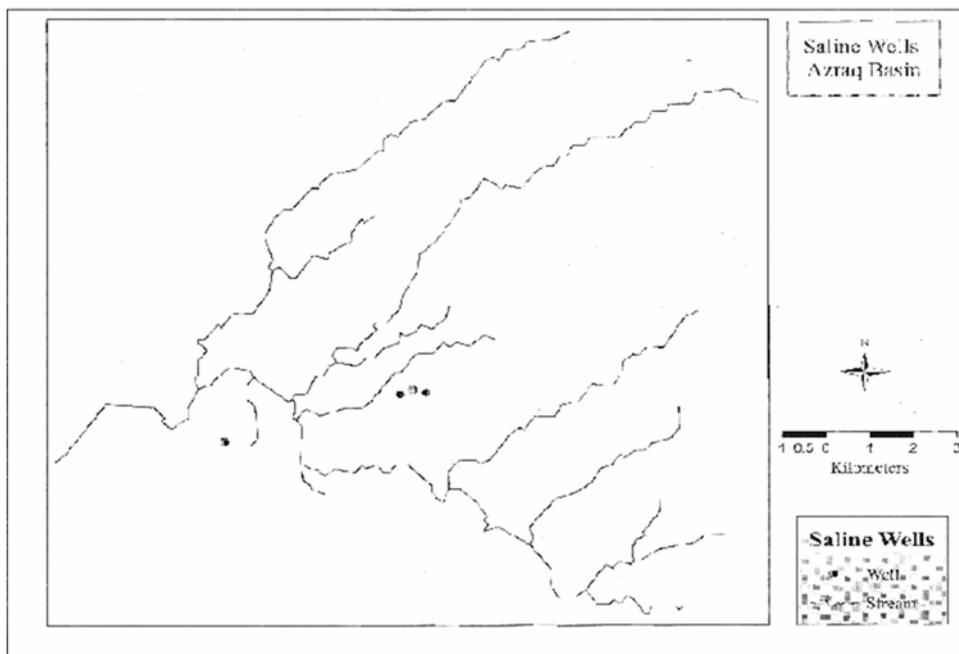
Data Requirement

1. **Rec_Stream.tif**, the image exist in \\Data\Image folder
2. Create a line file and call it **Stream.shp** and save it in \\Data\Vector folder
3. ArcScan toolbar to vectorize the **Rec_Stream.tif**

Data Integration

1. Start ArcMap
2. Click Add Data/connect to Ch06
3. Browse to \\Data\Image folder and select **Rec_Stream.tif**
4. Click Add

Result: The **Rec_Stream.tif** (consists of 1 band) is added to the TOC.

5. In the TOC/R-click **Rec_Stream.tif**/Properties/Symbology tab
6. Under **Show**: highlight the Unique Values (you see the image consists of 255 classes) Click OK to exit the dialog box

Note: Your duty is to make the image to have only two classes (0, 1).
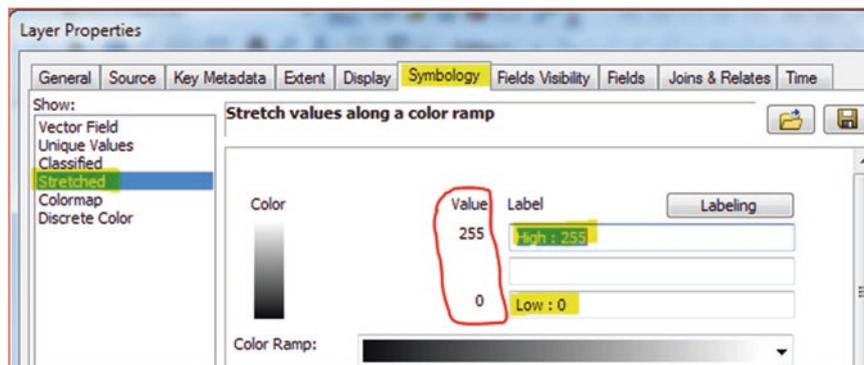
Make a Bi-level Image with 2-Classes by Reclassification

This step aims to reclassify the **Rec_Stream.tif** image into two classes permanently

7. Click on the ArcToolbox ⬛ button on the Standard Toolbar and place it in the left panel
8. R-click an empty place in the ArcToolbox/click Environment/click Workspace
9. Fill it as below
10. Current Workspace: \\Ch06\Data\Image
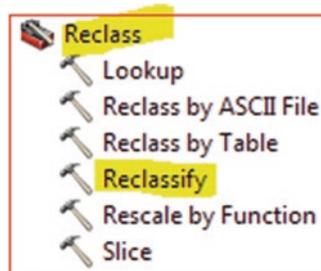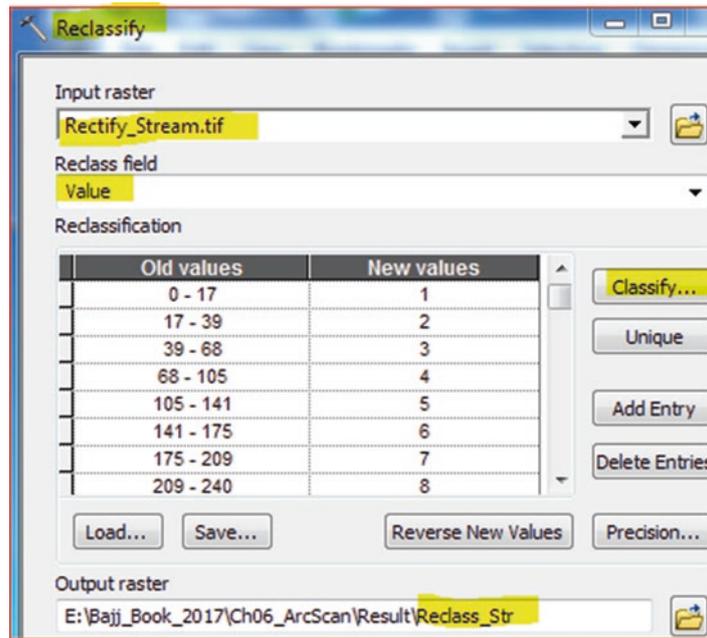11. Scratch Workspace: \\Result
12. Click OK
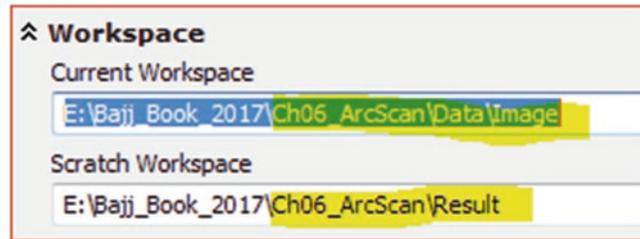
Use Reclassify Tool to Make the Image to Have Two Classes (0, 1)

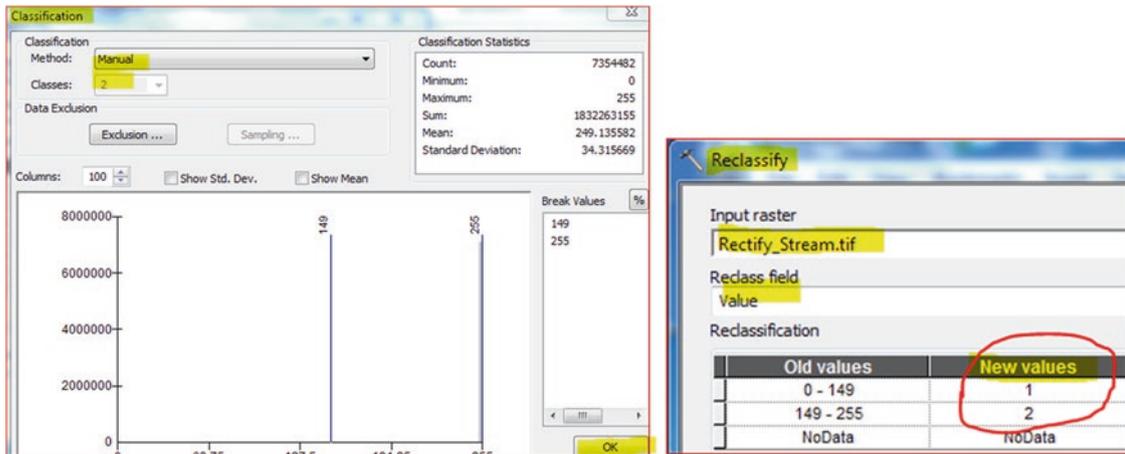Note make sure the Spatial Analyst Extension is checked

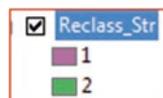13. ArcToolbox/Spatial AnalystTools/Reclass/D-click Reclassify Tool

14. Fill the Reclassify dialog box as below
15. Input raster **Rec_Stream.tif**
16. Reclass field **Value**
17. Output raster \\Result\Reclass_Str.tif
18. Click Classify

19. Method: Manual
20. Classes: 2
21. Click OK/OK

**Result**: The **Reclass_Str.tif** is added into TOC and now it is a bi-level raster with 2-classes.

Reclassification of the Image

Now, you are going to classify the **Reclass_Str.tif** into a two classes with black and white color

22. R-click **Reclass_Str.tif**/Zoom to Layer
23. R-click the **Reclass_Str.tif**/Properties/Symbology tab/select "Classified" under the Show window.

24. Under "Label" change the first value to **0** and second value to **1** and make sure the symbol of the 0 label is black and the symbol of 1 label is white.
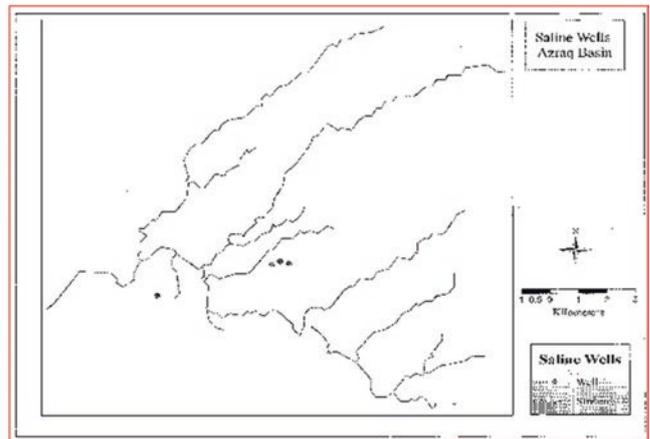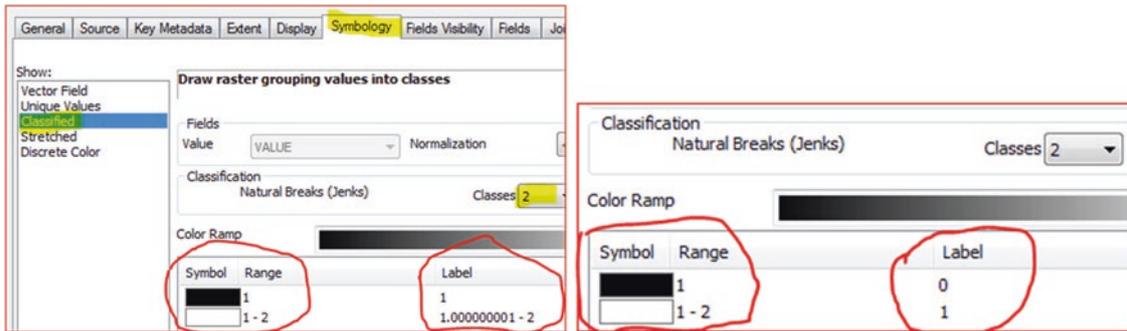
Result: The **Reclass_Str.tif** image display in 2 classes 0 (black) is ink and 1 (white) no ink.

Prepare the Image for Vectorization

Prior to vectorization you have to **Activate ArcScan**

26. Click **Customize menu/**point to **Extensions/**check **ArcScan**
27. Click **Customize menu**/point to **Toolbars/**click **ArcScan**



Result: The ArcScan toolbar display with the "**Reclass_Str**" image in the ArcScan window.

Create a Blank Shapefile

This step is to create a line shapefile to be used during vectorization

28. In Catalog window/R-click \\Result folder/New/Shapefile
29. Name: **Stream.shp**
30. Feature type: **Polyline**
31. Click Edit

32. Click Add Coordinate System [icon] dropdown arrow
33. Click Import
34. Browse to \\Ch06\Data\Image folder and select "**Rectify_Stream**.tif"/Add
35. OK/OK

Result: The "**Stream.shp**" is now registered in Palestine_Grid, which is customized Transverse Mercator and will be integrated into the TOC.
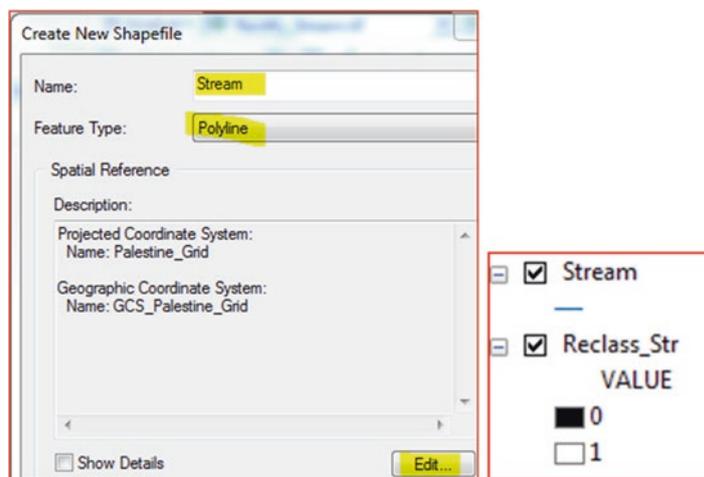
Raster Cleanup

This step is necessary to clean the unwanted information in the **Reclass_Str** in order to perform the vectorization. Raster cleanup will delete any objects or text in the image that required to be removed. The current **Reclass_Str** image includes the following that need to be deleted

- Border of the study area
- 4-wells
- Title in a border
- Scale bar
- Legend
- North arrow

This step is essential to the vectorization process especially if you want to run the automatic generating feature. The final step of the image cleaning is to keep only the stream network. The stream then will be converted into vector shapefile.
To start raster cleanup session, you must meet the following two requirements for using ArcScan.

a. Having a vector in editing mode and a raster layer
b. The raster layer should be symbolized in two values (classes).

Once the cleanup session is started, the **Raster Cleanup** menu commands will be available.

Remove the Undesired Objects in the Image

First Approach

36. In the TOC/R-click Stream/Edit Features/Start Editing
37. Once you start editing the **Reclass_Str.tif** raster will be activated in the **ArcScan** window

38. Click the **Raster Cleanup** menu on the ArcScan toolbar/click **Start Cleanup**
39. Click the **Raster Cleanup** menu on the ArcScan toolbar and point to **Raster Painting** toolbar

**Result**: The **Raster Painting** toolbar will be displayed.

Note: The **Raster Painting** toolbar supports **9 tools** designed for drawing and erasing raster cells. In this exercise, we are going to use only 2-tools the "**Erase tool**" and the "**Magic Erase tool**" . The Erase tool can delete cells and you can erase small areas in the raster by clicking with the tool and larger areas by clicking and dragging the erase cursor over a series of raster cells. The **Magic Erase tool** allows you to erase connected cells. You can drag a box around a series of connected cells to erase them. All connected cells that are completely within the box are removed.

Using Erase Tool

40. Click an Erase tool on the Raster Painting toolbar and then click on the **Erase size** tool and select the **largest size**
41. Zoom in to the upper right corner of the outer border
42. Place the Eraser tool on the upper point corner of the outer border and start erasing the border
43. Once you finished erasing the border, erase the border of Saline Well text
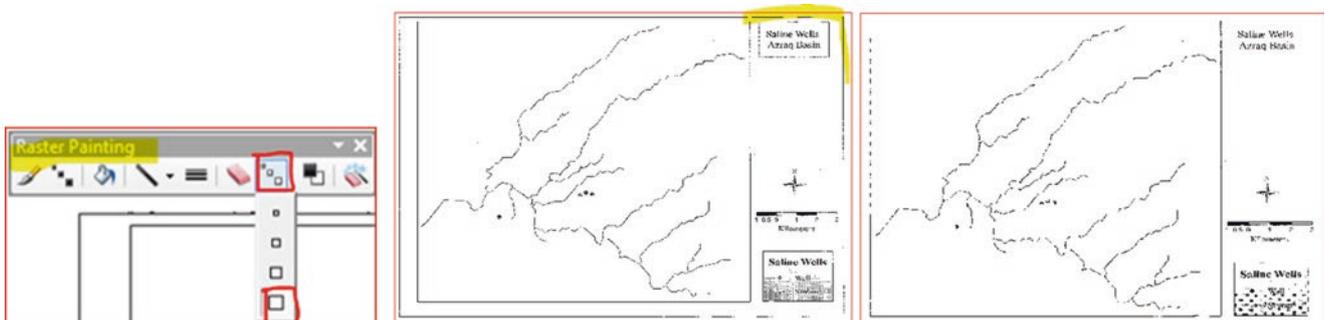
Result: The outer border and the border of the text are now erased.

Using Magic Erase Tool

44. Click the Magic Erase tool .
45. Click the Magic Erase tool and drag a rectangle around the text of Saline Well Azraq Basin to erase it.
46. Use the Magic Erase tool again to drag a rectangle around north arrow, scale, legend, and the 4 wells to erase them
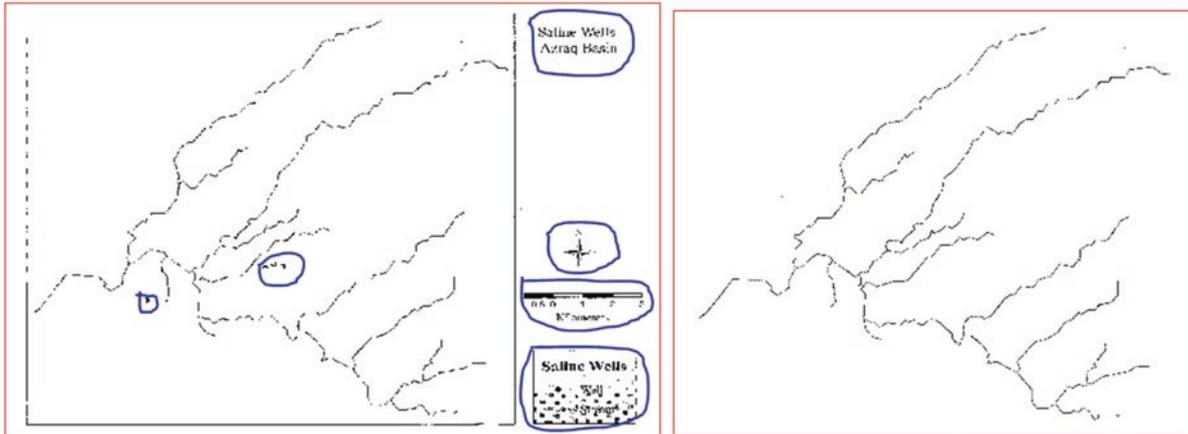
Result: All the obsjects are now erased.

47. Click the **Raster Cleanup** menu on the ArcScan toolbar and point to **Stop Cleanup** toolbar
48. Click Yes to Save your Raster Cleanup edits

Second Approach

49. Click the **Raster Cleanup** menu on the ArcScan toolbar and point to **Start Cleanup** toolbar

50. Click Select Connected Cells button in ArcScan Toolbar
51. Click on the catchment border, and the border of the catchment area will be selected and turn to cyan color
52. Click Raster Cleanup menu on the ArcScan toolbar/Erase Selected Cells

Result: All the border will be removed.
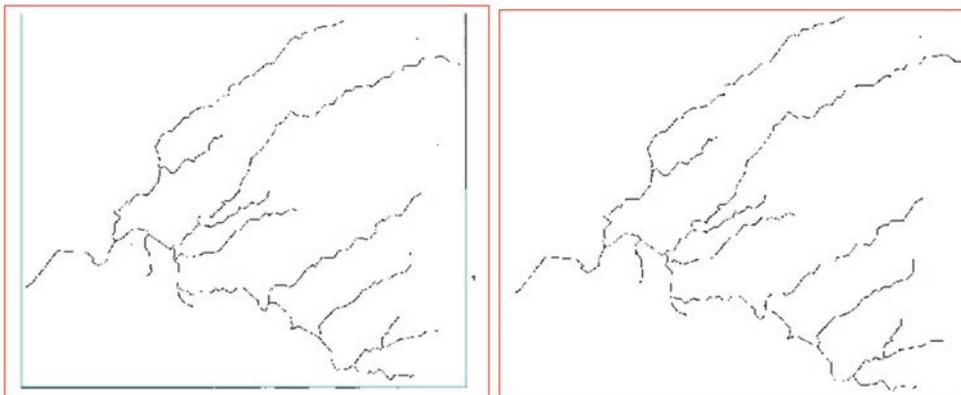
53. Select Raster Cleanup/Save/
54. Select Raster Cleanup again/Stop Cleanup

Result: The raster now has been cleaned and it is ready for vectorization.

Vectorization

This step allows you to convert the raster into a vector. There are two ways to vectorize the image: Interactive and Automatic Vectorization.

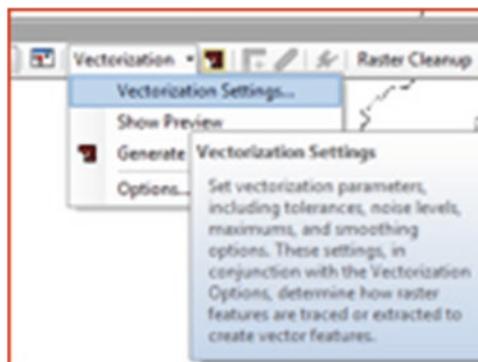## Interactive Vectorization (Vectorization Trace)

Interactive vectorization involves the manual creation of features assisted by the ability to snap to raster cells and utilization of the raster tracing and shape recognition tools. It is used when a user wants total control of the vectorization process or needs to vectorize a small area of the raster image. This approach allows a higher level of flexibility since you can use the ArcScan trace tools or the Create Features window construction tools and Editor toolbar sketch construction methods to generate features. You are going to trace one tributary (as seen below) to learn how to use this technique.


Vectorization Trace
Before starting the **vectorization trace** make sure you are still in editing mode.

1. Choose **Vectorization Setting** from the **Vectorization menu** at **ArcScan Tool**


2. The Vectorization Setting dialog box display should be changed in the following:
   a. Intersection solution: None
   b. Maximum Line Width: 10
   c. Keep the rest without modification

   Then Click Apply\Close
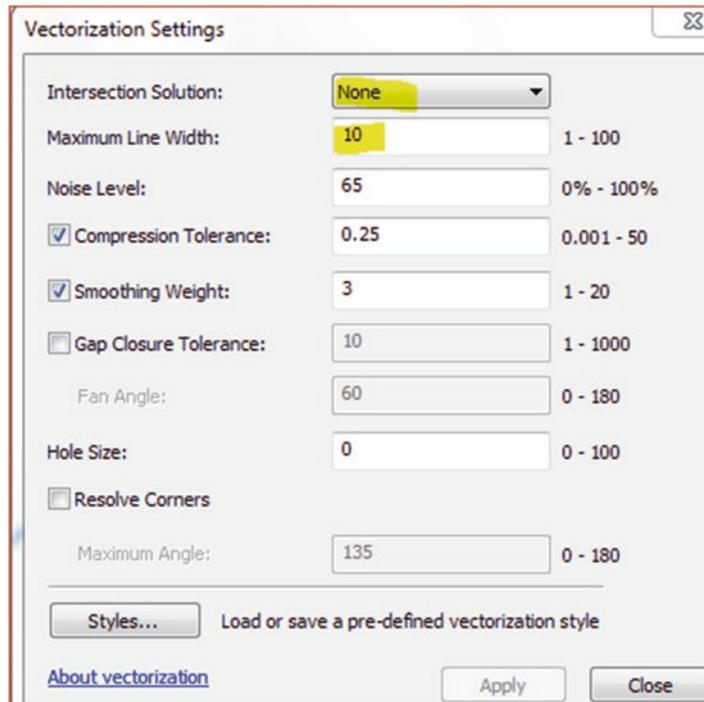
Raster Snapping

3. Click the Raster Snapping Options icon on the ArcScan toolbar to open the Raster Snapping dialog box. Under Raster Snapping Options
   (a) Set the maximum line width value to 10.
   (b) Accept the rest as default
   (c) Click OK
4. Zoom around the top of the first stream
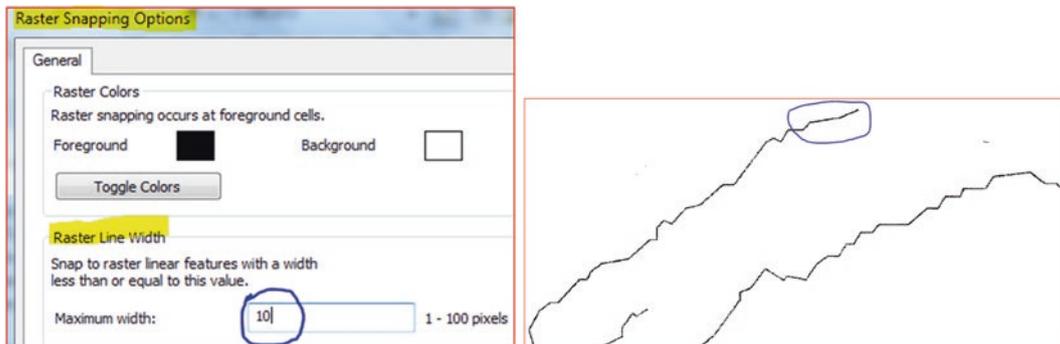
5. To create lines, click the **Stream feature** template in the *Create Features* window

Vectorization Trace

6. Click the **Vectorization Trace** tool icon on the *ArcScan* toolbar
7. Hold the 'S' letter on the keyboard and click at the beginning of the stream, and continue clicking along the stream
8. Zoom in or use the Pan icon to move to the next stream segment
9. When you have reached the end of the intersection with other stream of the raster double click or press F2 to finish the sketch (**It will appear Cyan**)
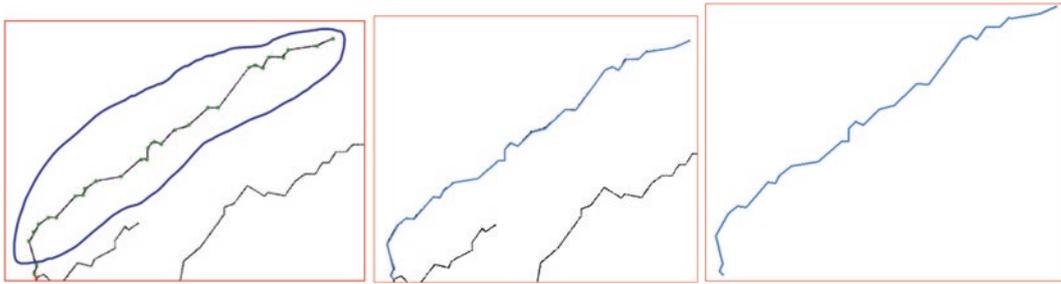
Note 1: the 'S' letter means **suspend the automatic tracing** and it is used when you encounter a break in the line of the image.

Note 2: in order to continue digitizing the tributary you have to use the Snapping toolbar. The Snapping toolbar is armed with four snapping types: points, end, vertex, and edges. Snapping icons allows you to create features that connect to each other with minimum errors.

Snapping Toolbar

10. On the Editor toolbar in ArcMap/click drop-down editor and point to Snapping and check *Snapping* toolbar.

11. On the *Snapping* toolbar, click the **Snapping** menu and confirm that **Use Snapping** is checked.
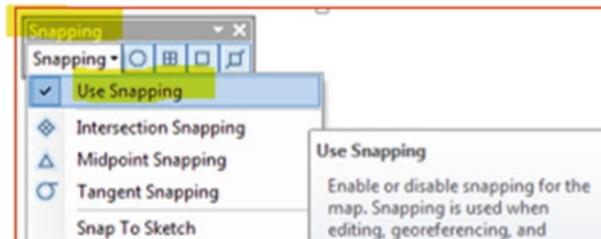

12. Click the Vertex Snapping [ ] button

13. When you finish digitizing the whole the designated tributary/in TOC/R-click Stream/Open Attribute Table

Result: You see the segments of the stream that you digitized. Because you are going to use the automatic digitizing, you are going to delete the stream.
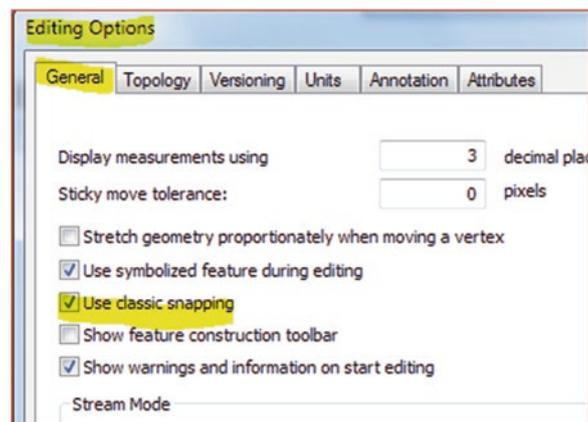
14. Highlight the record in the attribute table and click the Delete Selected ![X] button
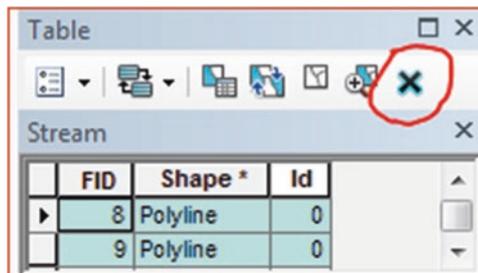
15. R-click "Stream"/click Editor/**Stop Editing**

Note: You can shift to classical snapping by doing the following:

16. Click the Editor menu and click Options.
17. Click the General tab and check Use classic snapping, and click OK to exit the dialog box

Comment: this method requires lot of time especially if there are many lines to be digitized and too much gaps.

Automatic Vectorization

This method will allow user to convert automatically, the image into vector. This approach is faster and reduces the time of processing.

18. Click the **Editor** menu on the *Editor* toolbar and click **Start Editing**.
19. Choose **Stream.shp** and click **OK**.
20. Click the **Vectorization** menu on ArcScan toolbar/point to **Vectorization Settings**
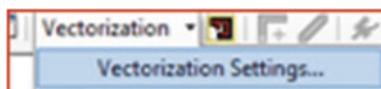
21. Click the **Vectorization** menu on ArcScan toolbar/point to **Vectorization Settings**
22. Change the **Intersection Solution** to **Geometrical**
23. Click **Style** change it to **Contour/OK**
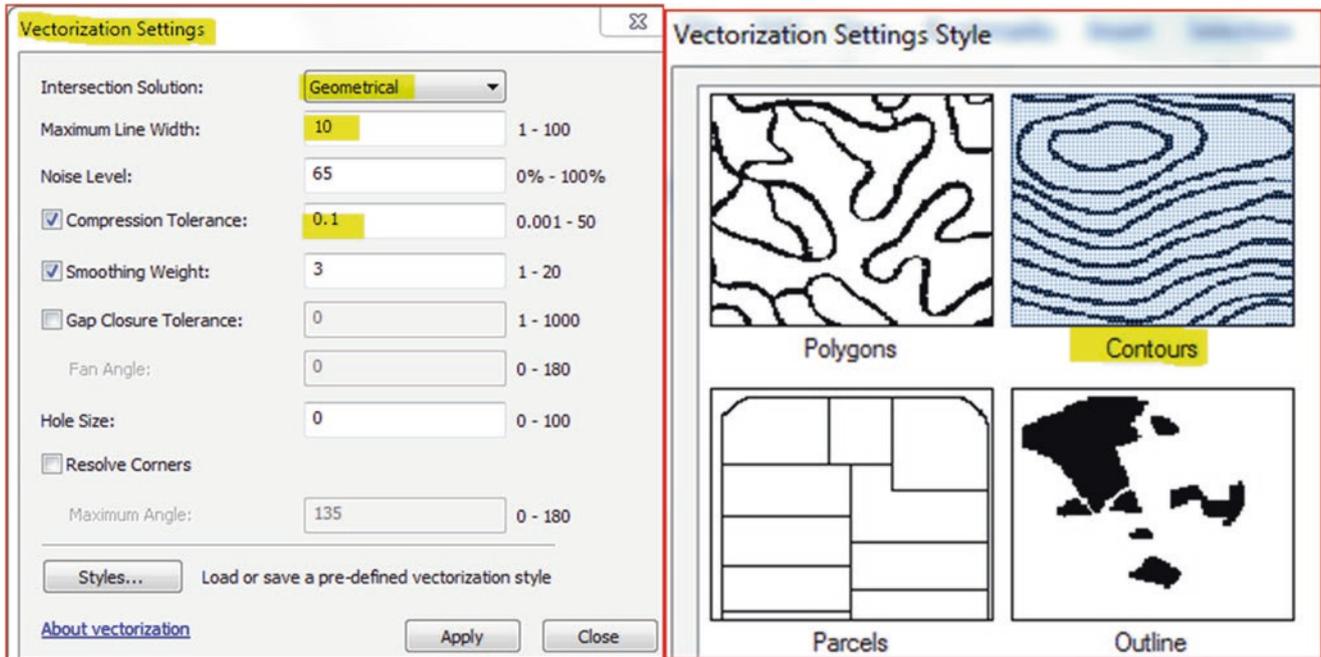
24. Change the **Maximum Line Width** value to 10.
25. Change the **Compression Tolerance** value to 0.1.
26. Click **Apply** to update the settings.
27. Click **Close** to the **Vectorization Setting** dialog box

Show Preview

28. Click the **Vectorization** in **ArcScan Tool** point to **Show Preview**
29. The **Show Preview** is displayed in the map
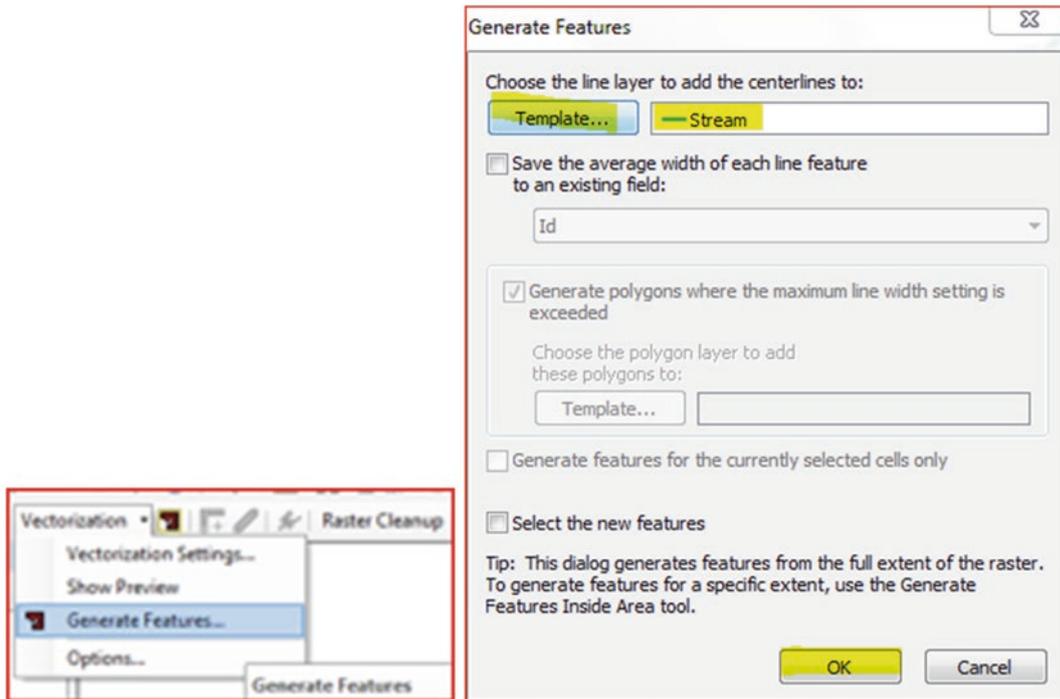

30. **Vectorization** in **ArcScan Tool** uncheck **Show Preview**

Note: if you see any think is not erased, use the previous steps and erase it.

Generate Features

31. Go to **Vectorization** menu and point to **Generate Features**
32. The **Stream** template became the active line feature template
33. Click OK

34. The Generate Feature command adds the centerlines to **Stream.shp** and the streams is generated
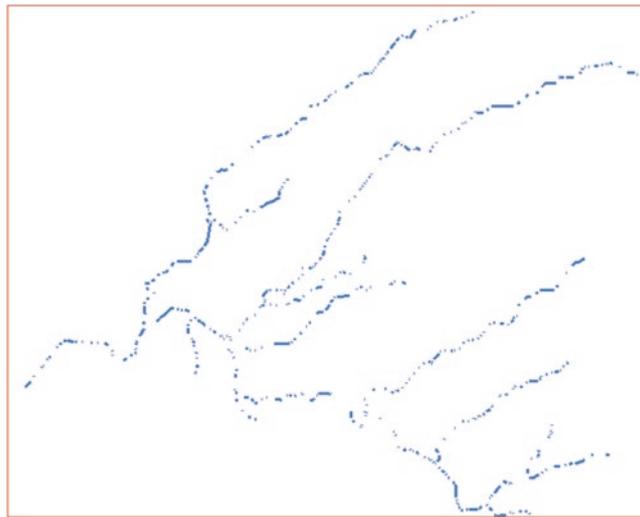
1. Go under **Editor** and select **Stop Editing**

Result: The stream is digitized.