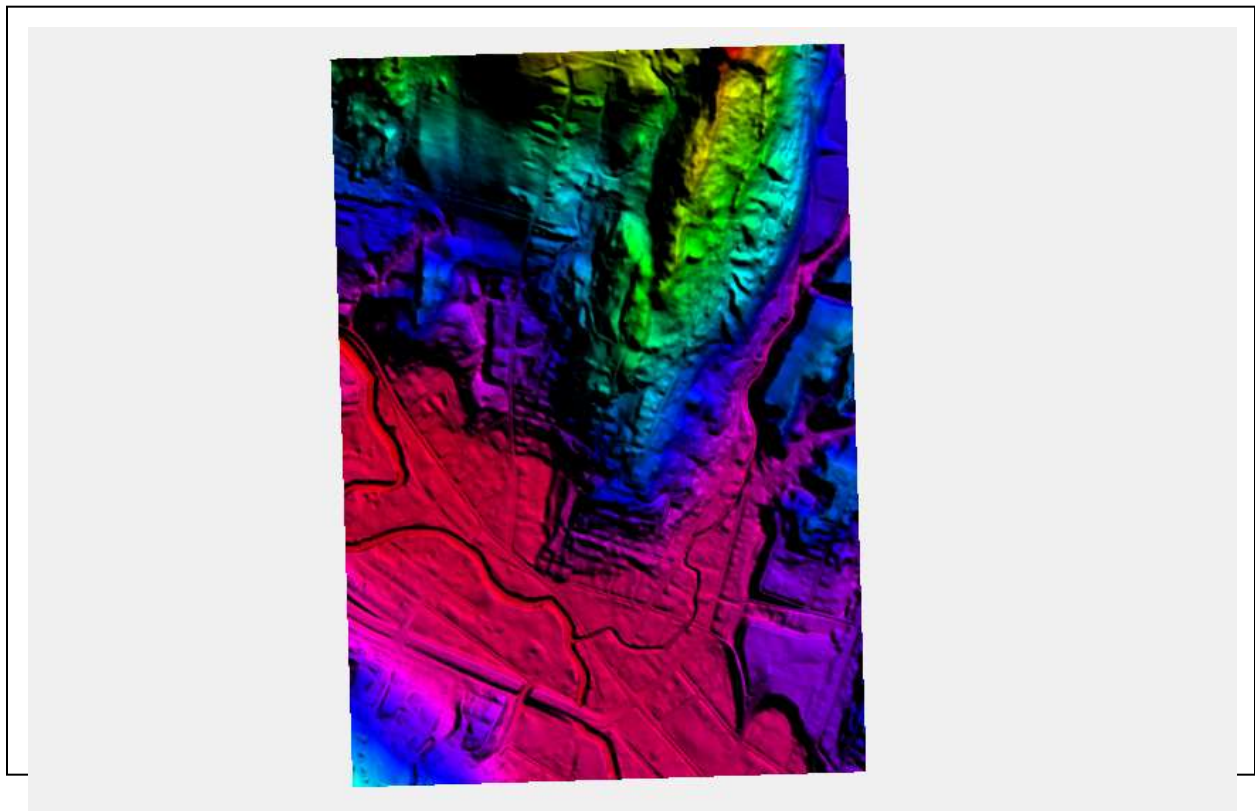*SMS 12.1 Tutorial*
Working with Rasters

Objectives

This tutorial teaches how to import a Raster, view elevations at individual points, change display options for multiple views of the data, show the 2D profile plots, and interpolate data to a mesh.

Prerequisites	Requirements	Time
• Overview Tutorial	• Raster Module • Map Module • Mesh Module	• 20-30 minutes

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1 Introduction

A raster consists of a matrix of pixels or cells stored and displayed in a grid formation (rows and columns). Each cell contains a value representing a type of information such as elevation or land use. Rasters can be digital aerial photographs, images from satellites, scanned digitized pictures or even scanned maps.

In this example, the raster that will be used is a surface map containing elevation data. However, rasters can also be used as base maps (usually scanned maps and images or satellite imagery) and thematic maps (usually containing information such as land use or vegetation).

2 Loading the Raster

To start, load a Digital Elevation Model (DEM) file into SMS. SMS creates a raster object is the GIS module to represent this DEM.

To open a raster in SMS,

1. Select *File* / **Open.** The *Open* dialog should appear.

2. In the *Open* dialog, browse to the folder directory *Rasters\Data Files*. This folder will be in the same location as all the other SMS tutorial folders that were downloaded when installing SMS.

3. Select the raster file named "GunnersBrook.tif" and click **Open**. Once the file is open, the data should look like Figure 1.
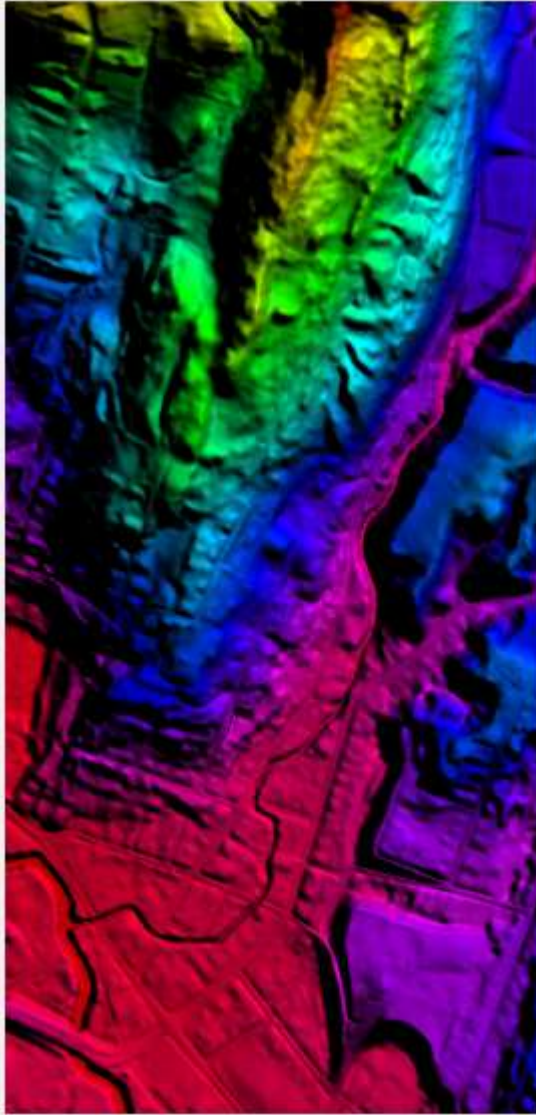
Figure 1   Raster

3   Setting the Projection

Like all objects in SMS, rasters should be referenced to a projection to locate the data in the physical world. The projection may come from the raster file or from an associated file. In this case (a geotif file) the projection is included in the file and has been set to State Plane Coordinates, with the zone set to Vermont. The units are set to feet. To verify this:

1. Click *Display* | **Projection…**. The *Display Projections* dialog will appear.

2. Click on the **Set Projection…** button to specify the display projection. The *Select Projections* dialog appears.

3. Make sure the *Projection* is set to "State Plane Coordinate System", *Zone* is set to "Vermont (FIPS 4400)", *Datum* to "NAD83", and set the *Planar Units* to "FEET (U.S. SURVEY)". Click **OK** to close the *Select Projection* dialog.

4. Back in the *Display Projection* dialog, verify that the *Units* in the *Vertical* section are also "Feet (U.S. SURVEY)" and click **OK**.

4   Changing the Display

SMS offers two methods for displaying the data in the raster (in this case elevations). These include an image of the shaded surface (this is a 2D display visible only in plan view) and a display of a sampling of the points that make up the surface. The default is a 2D image as shown in Figure 1.

The shading method employed to generate the image can be controlled by the user. SMS allows the user to choose between Atlas, Color Ramp, Global and HSV shaders. To change the shader:

1. Select *Display* | **Display Options** or select the **Display Options** icon. This will open the *Display Options* dialog.

2. In the dialog, if it is not already selected, click on *GIS* in the menu bar on the left side of the dialog.

3. At the bottom of the dialog, in the *Shader* combo box, select the "Color Ramp Shader" option and click **OK**.

SMS updates the display of the image to use a different set of colors.

The 2D image display of the raster is only visible in plan view. In order to view the data in 3 dimensions, and display the raster data as point cloud:

1. Select *Display* | **Display Options** or select the **Display Options** icon.

2. Click on *GIS* in the menu bar on the left side of the dialog.

3. Select the *Display as 3D points* option.

4. Click on *General* in the menu bar on the left side of the dialog.

5. Turn off the *Auto z-mag* toggle box and enter "10.0" as the *Z magnification* factor.

6.   Click **OK** to close the *Display Options* dialog.

7. Select the **Rotate** tool then click and drag in the graphics window. Notice how the elevation can now be seen.

8. Click on the **Plan View** macro to return to the original view.

9. For the rest of the tutorial, use the 2D image of the raster. Select the **Display Options** 📷 icon to bring up the *Display Options* dialog.

10. In the *GIS* tab of the dialog, toggle on the *Display as 2D image* option and choose the "HSV Shader" option then click **OK**.

5   2D Profile Plot

SMS can show 2D profile plots using an observation coverage. This is done by doing the following:

1. In the Project Explorer, right-click on the "Map Data" tree entry and select **New Coverage** from the menu. This opens the *New Coverage* dialog.

2. In the dialog, select "Observation" from the list of coverage types, enter "Observation" as the *Coverage Name*, and click **OK** to close the dialog and created a new coverage in the Project Explorer.

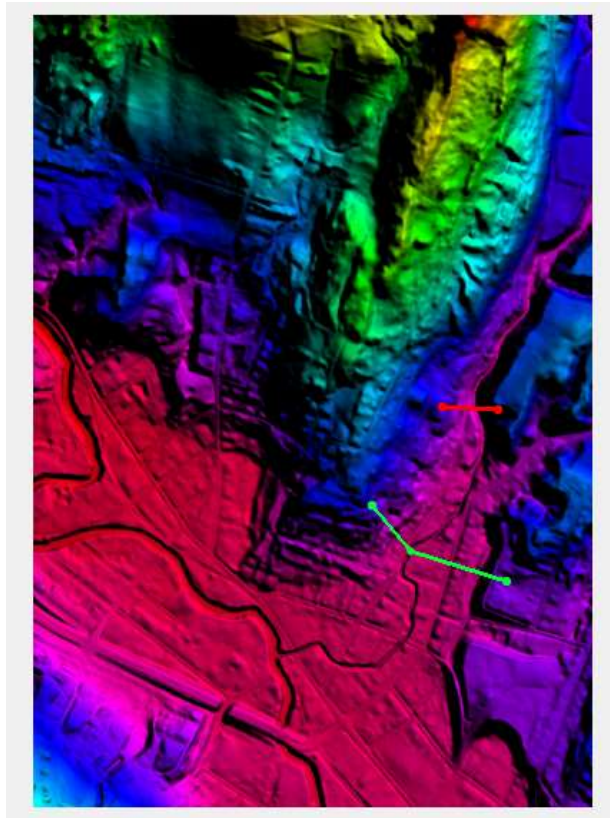3. Click on the "Observation" coverage to make sure it is the active coverage.

Figure 2   Observation Arc

4. Using the **Create Feature Arc** 📐 tool, create two arcs as shown in Figure 2. Normally create the arcs by clicking from left to right across a channel (when looking downstream). In this case, that means the arcs are created from right to

left. The order controls how the data will be displayed in a plot. SMS will display
arrows pointing away from the arc which correspond to the view direction (into the
board) when the plot is created.

5. After creating the arcs, select *Display | **Plot Wizard**. This will open up the *Plot
    Wizard*.

6. Choose "Observation Profile" as the *Plot Type*. Click on the **Next** button to
    proceed to step 2 of the wizard.

7. Under the section *Coverage*, select which observation arcs to display in the plot. In
    this case, leave both arcs turned on.

8. Under the *Dataset(s)* section, select the *Specified* option. Select the
    "GunnersBrook.tif" dataset to make it active. Leave the *Plot tolerance* to "0.0" m.
    The plot tolerance allows for points to become clearer in the plot as it puts a
    tolerance on how many points can be displayed.

9. Click **Finish** to display the profile plots.

Notice the two different plots one for each arc. The plots window will be displayed at the
top and the graphics window on the bottom. If desired, maximize one window and
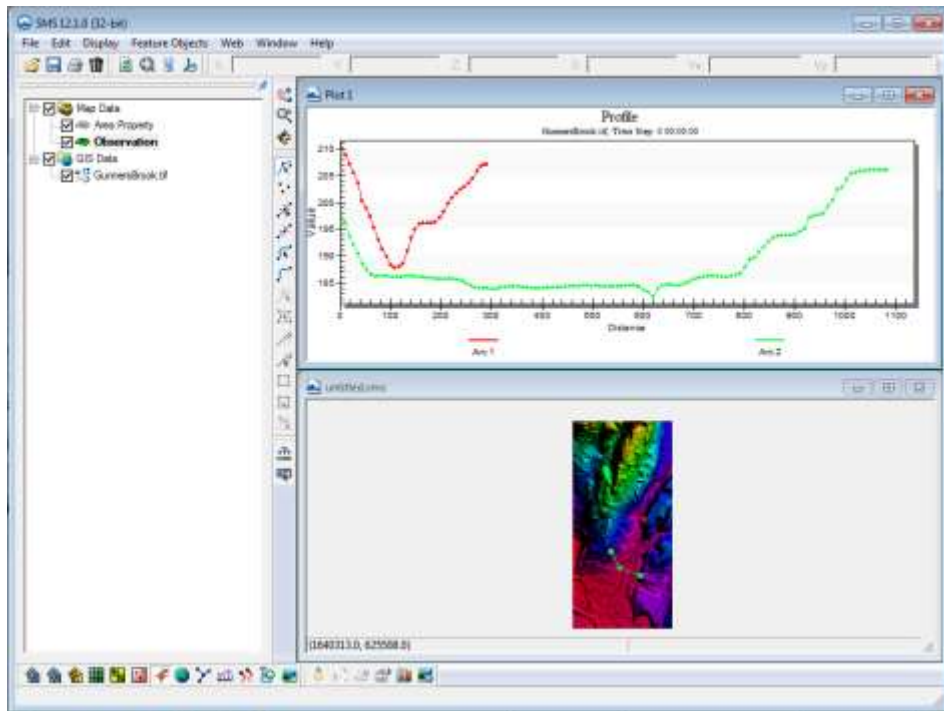minimize another one to better view either window.

Figure 3   Profile plot for arcs

10. Using the **Select Feature Point** 🡇 tool, select one of the nodes of either arc.

11. Drag the node around over the raster data. Notice how the plot will change while moving and releasing the nodes.

12. Right-clicking in the plot window and selecting **Plot Data** from the menu. This opens the *Data Options* dialog at *Plot Wizard– Step 2 of 2*.

13. Change the *Plot tolerance* to "1.0" m and Click **OK**. Notice how the points displayed on the plots are now coarser (spaced further apart) because the tolerance was increased.

14. Close the *Plot 1* window by clicking on the [x] button and maximize the graphics window by clicking the [□] button.

15. Click on the **Frame** 🔍 macro to frame the data.

6   Raster to Mesh Interpolation

The Raster data can also be interpolated to other geometric objects in an SMS project such as a mesh.

6.1   Reading a Mesh

Refer to other tutorials to create a mesh. For this tutorial, to read in a previously created mesh:

1. Select *File* / **Open.** The *Open* dialog should appear.

2. In the *Open* dialog, select the file named "GunnersBrook_mesh.h5" and click **Open**. Once the file is open, the data should like Figure 4.
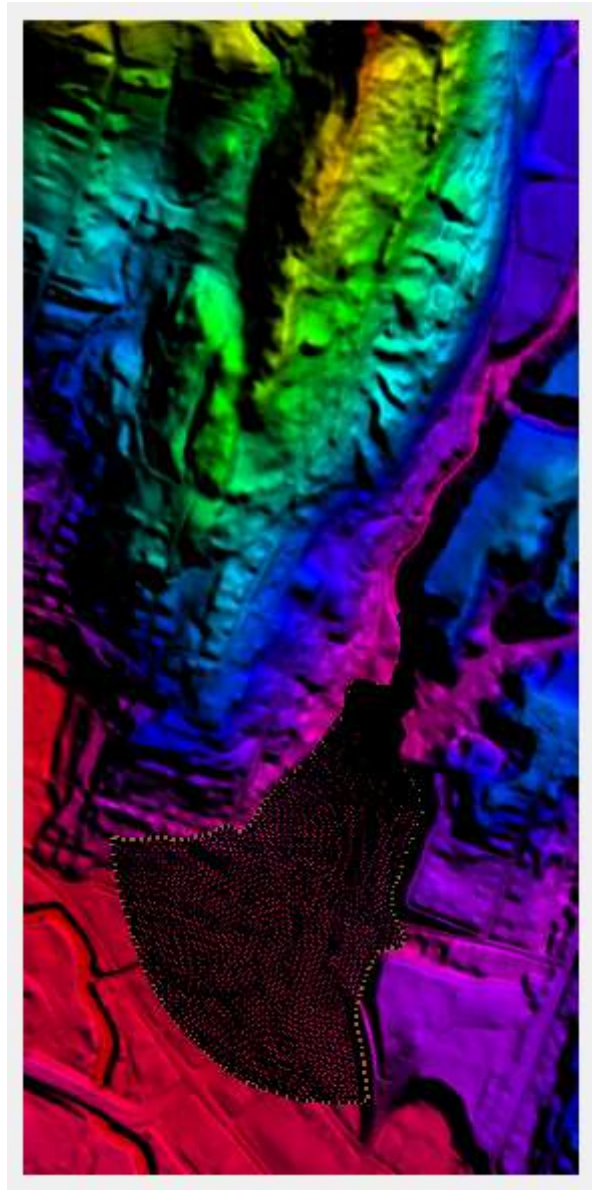
Figure 4   Mesh over the raster

1. Click on the "GunnersBrook" item under Mesh Data to make it active and switch to the Mesh Module.

2. Use the **Zoom** tool to zoom in on any area of the mesh.

3. Use the **Select Mesh Node** tool and select a mesh. Note that the elevation for the node is "0.0".

4. Select several other mesh nodes. Note that the elevation is "0.0" for all the points in the mesh.

6.2   Interpolating Raster elevations to Mesh

Now that a mesh exists, the can interpolate elevations to that mesh using the elevations stored as raster data.

1. Right-click on "GunnersBrook.tif" item under the "GIS Data" folder and select *Interpolate* | **2D Mesh** from the menu.

Notice that a new dataset name "GunnersBrook.tif" has been created under the "GunnersBrook" mesh item.

2. Click on the **GunnersBrook** mesh object to make the Mesh module active.

3. Select the *Data* | **Map Elevation…** command. The *Select Dataset* dialog will appear.

4. In the *Select Dataset* dialog, select the dataset named "GunnersBrook.tif" and click **Select**. The *New Function* dialog should appear.

5. In the dialog, accept the dataset name of "new_elevation" and click **OK.**

The raster elevations have now been assigned to the mesh. There are multiple ways to view the elevation in the mesh.

1. Use the **Select Mesh Point** tool to select individual nodes to see the assigned elevation.

2. Click on the **Display Option** 🔽 macro to bring up the *Display Options* dialog.

3. In the dialog, select the "2D Mesh" option from the list on the left if not already active.

4. Toggle on the *Contours* option then click on the *Contours* tab.

5. Change the *Contour Method* to "Color Fill" and click **OK** to close the *Display Options* dialog.

6. Use the **Rotate** 🔄 tool to view how the elevations were mapped to the mesh.

7   Operating on a Raster

SMS contains options to perform other operations using a raster object. To experiment with these get started by first completing the following:

1. Toggle off Mesh Data in the Project Explorer.

2. Click on the **Plan View** 🔧 macro to return to plan view.

7.1 Trimming a Raster

The available raster may be larger than what is needed for a project. Such is the case in this exercise. Trimming a raster results in a smaller region to work with an can improve efficiency. To trim the raster, complete the following:

1. Make the "Area Property" coverage active.

2. Using the **Create Feature Arc** 🖋 tool, click out a simple polygon as in Figure 5 below.
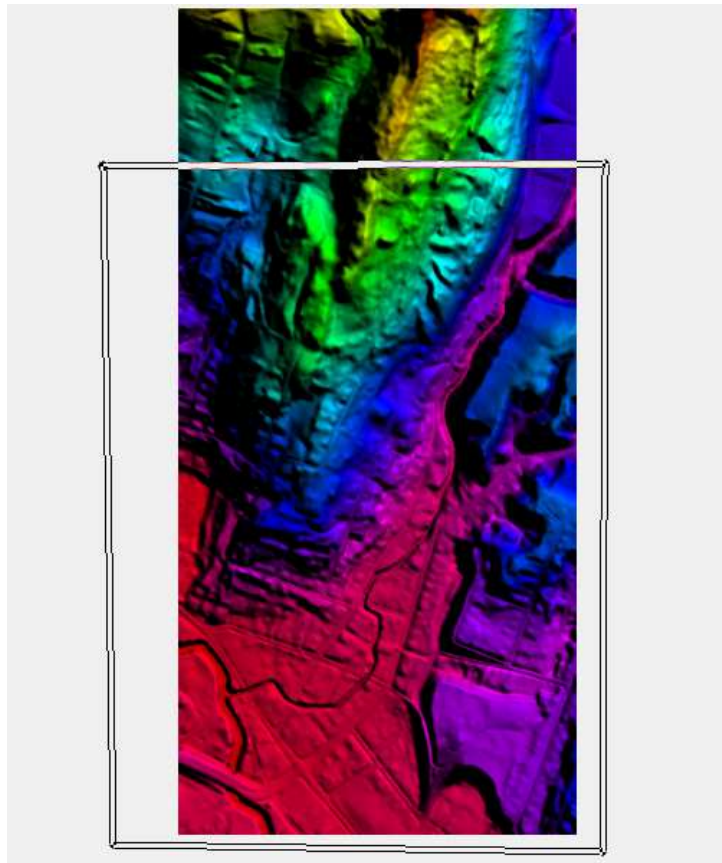

Figure 5   Simple polygon for trimming a raster

3. Use the *Feature Objects | **Build Polygons*** command.

4. Using the **Select Feature Polygon** 🔲 tool, select the polygon.

5. Right-click on "GunnersBrook.tif" in the project explorer and select the *Convert To |* **Trimmed Raster** command.

6. In the *SaveAs* dialog, name the trimmed raster as "GunnersBrook_trim.tif" and click **Save**.

7. In the Project Explorer, turn off the "Area Property" and "GunnersBrook.tif" items. Notice the trimmed raster in the main graphics window.

7.2   Merging Rasters

SMS allows rasters to be merged together. Do this by:

1. Select *File* / **Open** to bring up the *Open* dialog.

2. In the *Open* dialog, select the raster file named "StevensBranch.tif" and click **Open**. This will load a second raster file. The graphics window should appear similar to Figure 6.
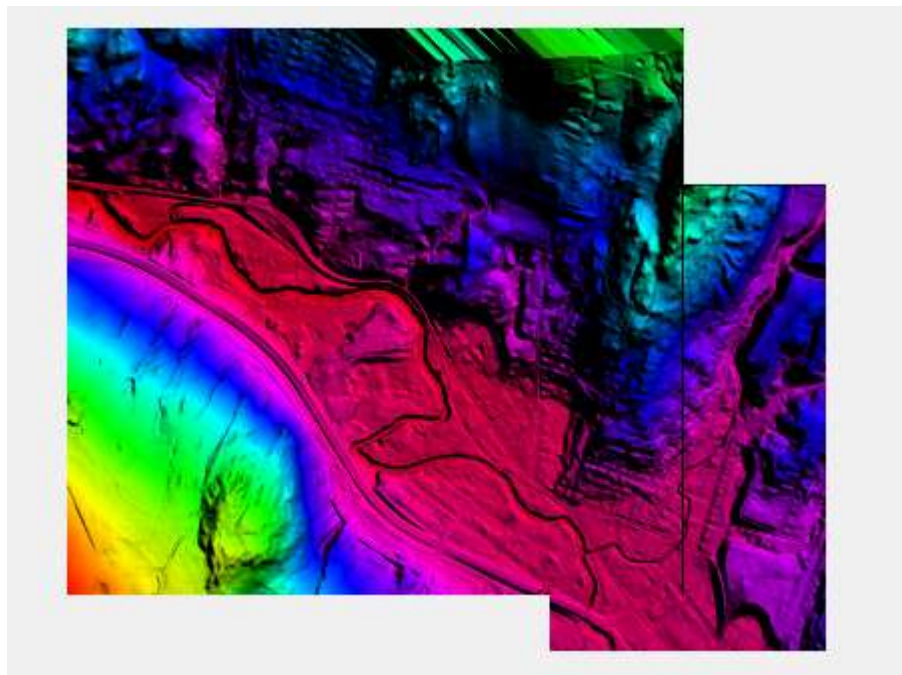

Figure 6   Raster objects to be merged

3. Select the "GunnersBrook.tif" item to make it active then press the *Ctrl* key and select the "StevensBranch.tif" item.

4. Right-click on either selected item and use the *Convert To* / **Merged Raster** command.

5. In the *Save As* dialog, name the merge raster "Barre.tif" and click **Save**.

6. In the Project Explorer, toggle off all GIS items except for Barre.tif to see the merged raster.

7.3   Converting a Raster to Feature Contours

There are two options for converting raster contours to feature arcs. For this tutorial, use the option to create an arc at a specified contour value (elevation). Do this by:

1. Right-click on the "Barre.tif" item and select the *Convert To* | **Feature Contours at Given Elevation** command. The *Create Contour Arc* dialog will appear.

2. Enter "615" in the *Create Contour Arcs* dialog and click **OK**.

A new map coverage will appear with an arc along the 615 foot contour elevation as seen in Figure 7.
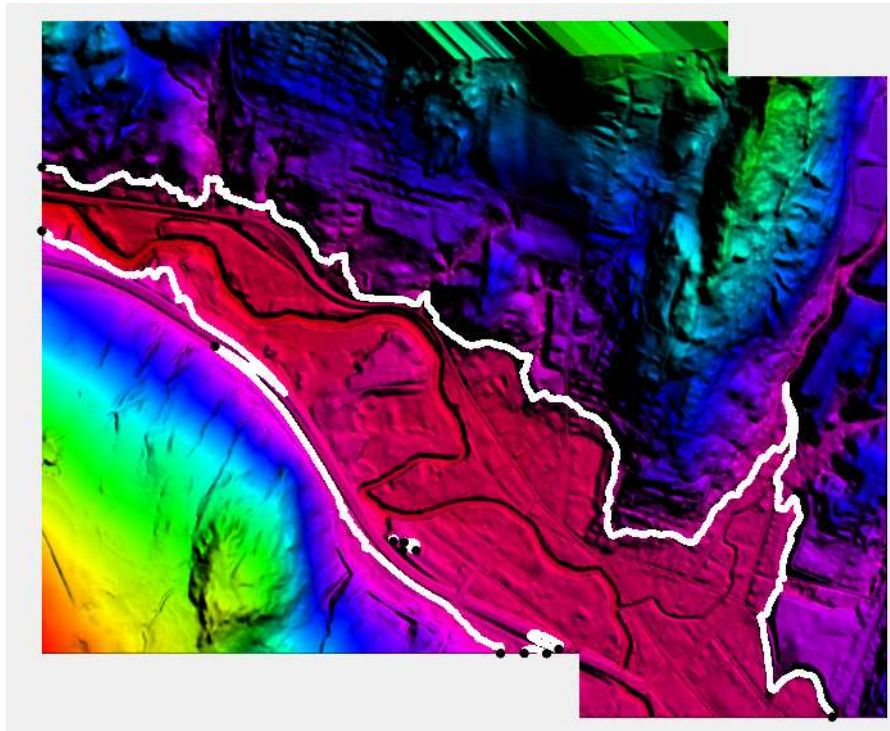

Figure 7   Contours generated from a raster

8   Conclusion

This concludes the Raster tutorial. Users may wish to experiment some more of the features in SMS or may close SMS at this point.