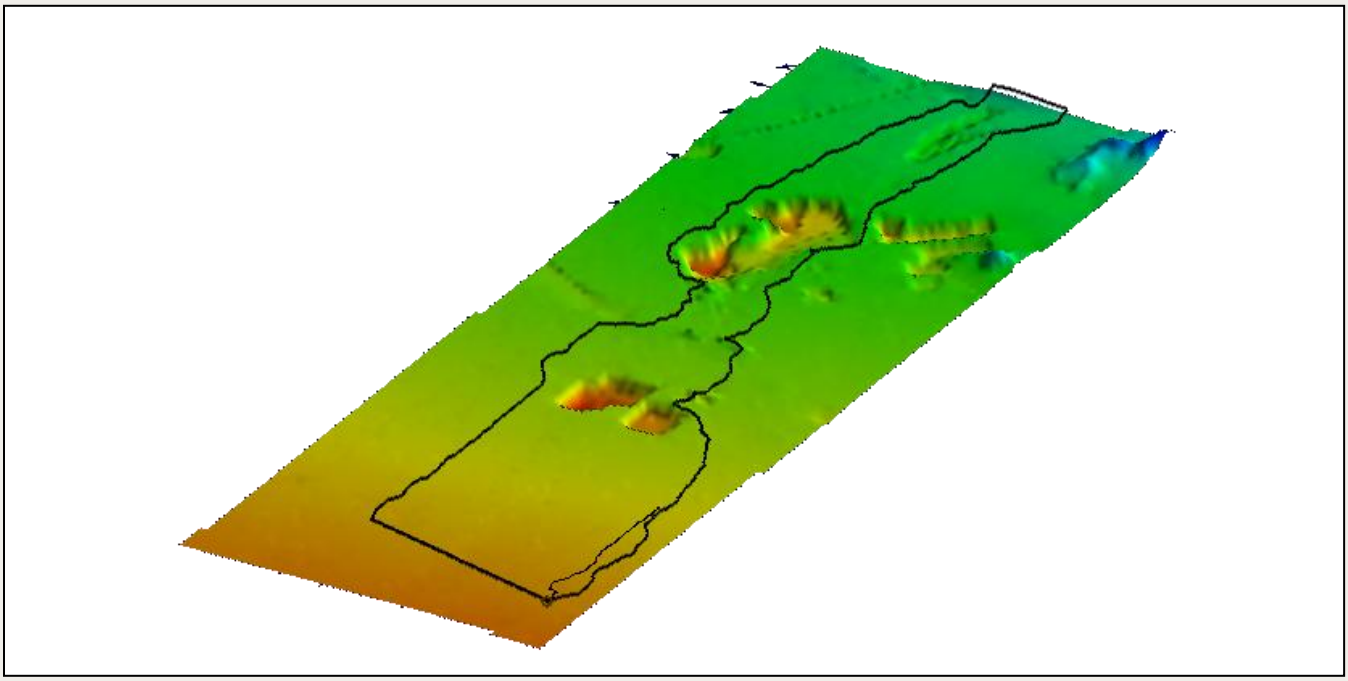
WMS 11.4 Tutorial

DEM Delineation – Depression Points

Model manmade and natural drainage features



Objectives

Learn to manage depression points within a watershed and use them to alter stream paths.

Prerequisite Tutorials

- DEM Delineation

Required Components

- Data
- Drainage
- Map

Time

- 15–20 minutes

1 Introduction

Some terrain features are not well represented in DEMs, especially if the DEM resolution is coarse. This can lead to erroneous automated watershed delineation. In addition, it may be desirable to evaluate future alterations in terrain that result from development scenarios. WMS has tools for manipulating DEM delineation results in order to accurately represent the actual watershed drainage basins.

Sometimes it is necessary to add stream arcs to a basin to represent water that accumulates along, in, or behind man-made objects such as roads, canals, dams, dikes, or levees. These often disrupt the natural flow of watersheds, acting as a barrier that collects water, creating a man-made stream or collection pond. The water collected in these locations needs to be added into the watershed in order to properly model the hydrology. Stream arcs can be used to edit flow directions associated with the DEM, routing water into the proper drainage basins.

This tutorial teaches how to manipulate DEM data for more accurate drainage analysis by discussing and demonstrating how to use depression points to manipulate basin delineation.

2 Getting Started

Starting WMS new at the beginning of each tutorial is recommended. This resets the data, display options, and other WMS settings to their defaults. To do this:

1. If necessary, launch WMS.
2. If WMS is already running, press the **Ctrl-N** key combination or select from the *Menu* bar, the *File* | **New…** menu item to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click the **Don't Save** button to clear all data.

The *Graphics Window* of WMS should refresh to show an empty space. Now open the project file by doing the following:

4. From the *Macro* bar, click the **Open** macro to bring up the *Open* dialog.
5. Browse to the *demdel-depression-points**demdel-depression-points*\ directory and select "stream-arcs.wms".
6. Click the **Open** button to exit the *Open* dialog and import the project.

The project should appear similar to Figure 1.

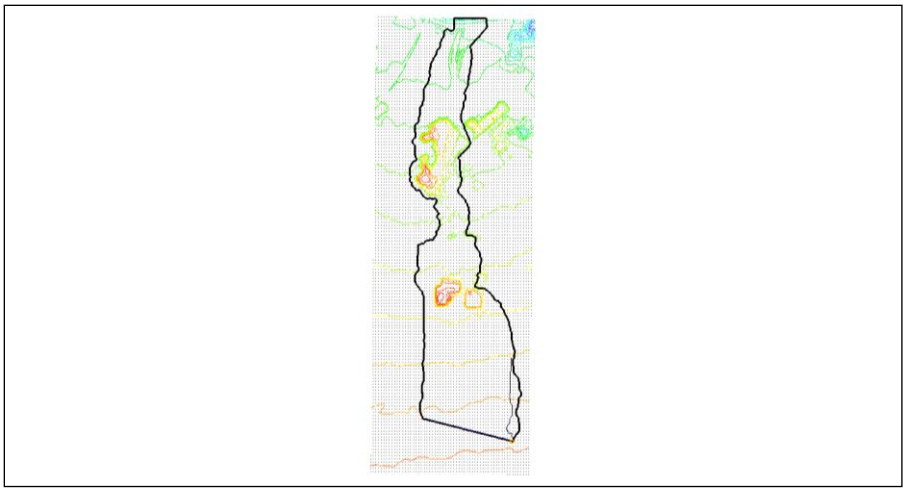


Figure 1: Initial project

3 Setting the Depression Attribute

DEM delineation for depressions requires that the low point of the depression be identified as a depression point.

1. From the *Macro* bar, click the **Display Options** macro to bring up the *Display Options* dialog.
2. From the list on the left, select the “DEM Data” item.
3. On the *DEM* tab on the right, turn off the *Points* and *Stream* checkboxes.
4. Turn on the *Depression Cells* and *Flow Accumulation* checkboxes.
5. For the *Point Display Step,* enter “1”.
6. Click the **OK** button to close the *Display Options* dialog.
7. From the *Static* tool bar, use the **Zoom** tool into the area indicated by the blue box in Figure 2.

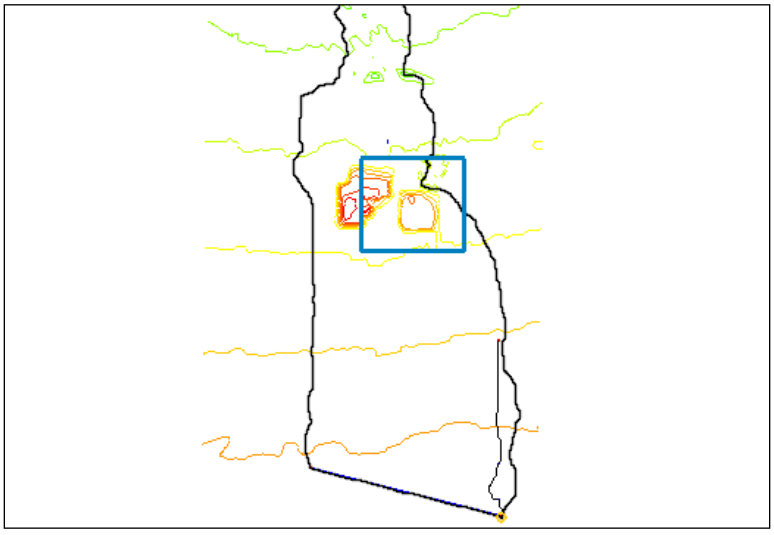


Figure 2: Zoom to depression

The contours show that there is a depression here, but the flow accumulations indicate that flow comes in one side and exits the other side of the depression. This occurs because TOPAZ forces flow movement by filling all depressions when processing DEM elevations.

8. **Zoom** into the area with the lowest elevation contour line, as indicated by the black box in Figure 3.

Note that contours may not appear exactly as in the image.

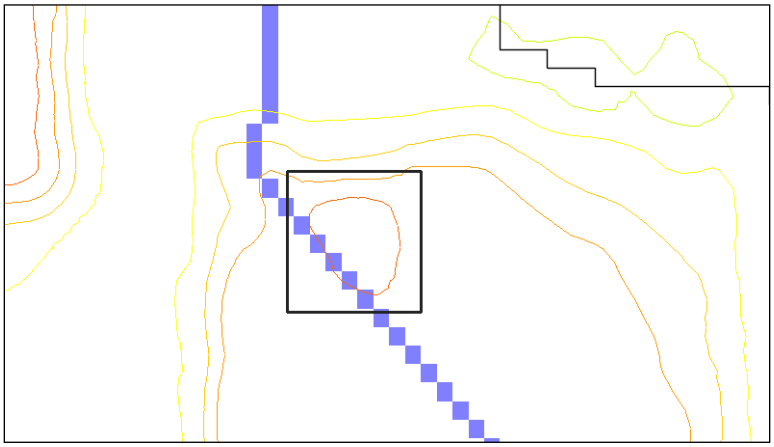


Figure 3 Zoom to depression pit

Within this contour lies the lowest elevation DEM point representing the bottom of the gravel pit. The DEM point with the lowest elevation must be identified so that it can be defined as a depression point in the DEM point attributes. Use the **Set contour min/max** tool to help indicate the lowest elevation point within this area by changing the contour range minimum and maximum values for viewing in this area.

9. From the *Modules* bar, switch to the **Terrain Data** module.
10. From the *Dynamic* tool bar, using the **Set contour min/max** tool, click and drag a box around the orange/red contour range as shown in Figure 4.

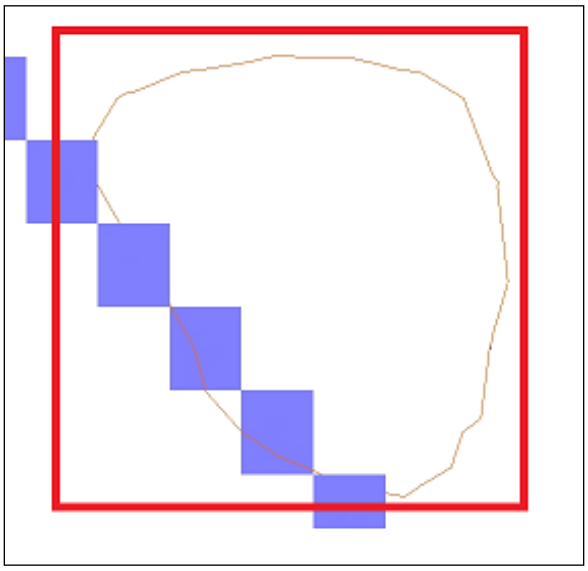


Figure 4: Selection Box for Set contour min/max Tool

11. From the *Dynamic* tool bar, using the **Select DEM points** tool, drag a box around the red contour in the center area to highlight the DEM points in that area.

Notice the now-visible DEM point near the center of the red contour area (Figure 5).

12. Using the **Select DEM points** tool, select the highlighted point as shown in Figure 5.

This DEM point has an elevation of "212.5064" (*IJ* coordinates of 185, 292). This is visible in the *Properties* window.

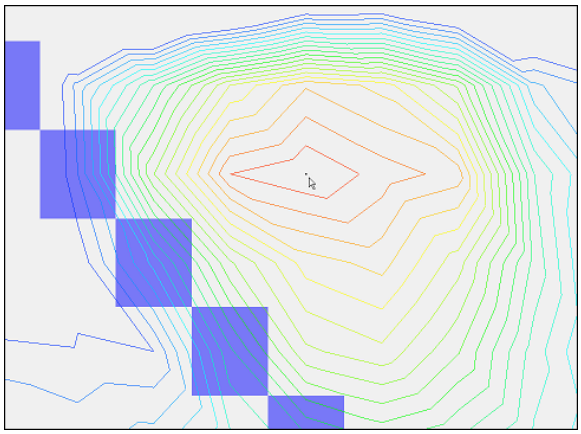


Figure 5: Select DEM Point

13. From the *Menu* bar, select *DEM* **| Point Attributes** to bring up the *DEM Point Attributes* dialog.
14. In the *Attributes* section, turn on the *Depression point* checkbox.
15. Click the **OK** button to close the *DEM Point Attributes* dialog.
16. Using the **Set contour min/max** dynamic tool, right-click anywhere in the Graphics Window and select the **Clear Min/Max Contour Ranges** context menu item.

4 Running TOPAZ

TOPAZ (TOpographic PArameteriZation) is built for the automated analysis of digital landscape topography.

1. In the *Modules* bar, switch to the **Drainage** module.
2. From the *Menu* bar, select the *DEM* **| Compute Flow Direction/Accumulation…** menu item to bring up the *Flow Direction/Accumulation Run Options* dialog.
3. Click the **OK** button to accept the defaults, close the *Flow Direction/Accumulation Run Options* dialog and bring up the *Units* dialog.
4. Click the **OK** button to accept the defaults, close the *Units* dialog and bring up the *Model Wrapper* dialog. Allow the tool to run to completion.
5. Once TOPAZ finishes running, turn on the *Read solution on exit* checkbox and click the **Close** button to load the solution and exit the *Model Wrapper* dialog.

6. Use the **Zoom** static tool to zoom to the extents of the depression, if necessary.

TOPAZ allows flow from the depression to go to the low point rather than “filling” the depression once the depression point attribute is assigned.

5 Creating an Outlet Point

1. From the *Dynamic* tool bar, using the **Create outlet point** dynamic tool, create an outlet point in the flow accumulation cell containing the lowest DEM point (as selected in section 4 see Figure 6).

This is the cell with the DEM point elevation of “212.5064”. The visuals in the WMS Graphics Window may vary slightly from the figures in the tutorial.

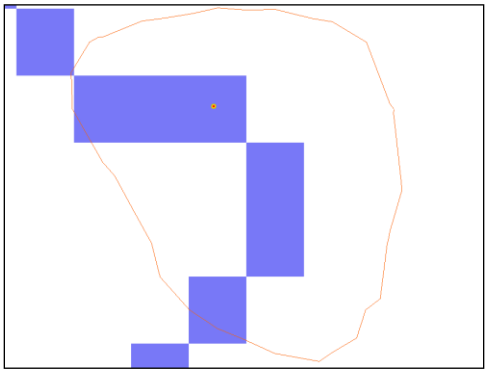


Figure 6: Location of the outlet point

6 Creating a Stream Arc

1. In the *Modules* bar, switch to the **Map** module.
2. Select the **Create Feature Arc** dynamic tool.
3. Select the *Feature Objects* | **Attributes…** menu item to bring up the *Feature Arc Type* dialog.
4. In the *Type* section, select the *Stream* radio button and click the **OK** button to close the *Feature Arc Type* dialog.
5. Create the arc shown in Figure 7, clicking on the outlet point to begin the arc and double-clicking to end it in the lower flow accumulation cell.

The arc may not be visible after ending the arc if it is hidden behind the display of DEM flow accumulations.

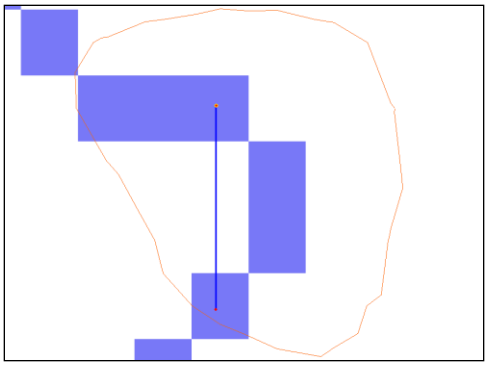


Figure 7: Depression arc

7 Delineating the Basin for the Depression Point

1. Switch to the **Drainage** module.
2. Select the *DEM* | **Define Basins** menu item.
3. Select the *DEM* | **Basins** → **Polygons** menu item.
4. Select the *DEM* | **Compute Basin Data** menu item to bring up the *Units* dialog.
5. Click the **OK** button to accept the defaults and close the *Units* dialog.

Notice that the flow accumulation cells adjusted to the path of the new stream (Figure 8).

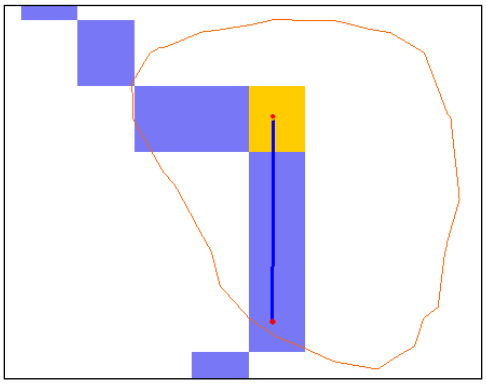


Figure 8: Flow accumulation cells adjusted to location of stream

8 Computing the Storage Capacity Curve

WMS will use the DEM cells that are part of a selected drainage basin to compute a storage capacity curve given a water surface elevation.

1. Switch to the **Hydrologic Modeling** module.
2. Using the **Select outlet** dynamic tool, select the outlet at the depression.
3. Select the *Calculators* | **Detention Basins…** menu item to bring up the *Detention Basin Hydrograph Routing* dialog.
4. Click the **Define…** button to bring up the *Storage Capacity Input* dialog.

5. In the field below *Use DEM,* enter “803.0”.
6. Click the **OK** button to close the *Storage Capacity Input* dialog and bring up the *Detention Basin Analysis* dialog.

This dialog lists elevation values from the base elevation up to 803 feet of elevation. Along with the elevation values, the computed storage values should also be listed.

7. Click the **OK** button to close the *Detention Basin Analysis* dialog.

The curve displayed in the *Detention Basin Hydrograph Routing* dialog is the computed storage-elevation curve for the depression pit (Figure 9).

8. Click the **OK** button in the Detention Basin Hydrograph Routing dialog.

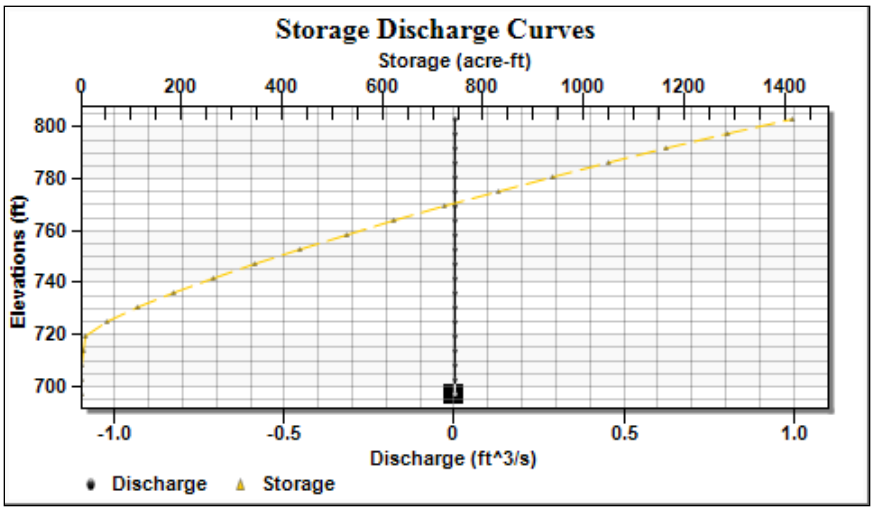


Figure 9: Storage discharge curve

9 Conclusion

This concludes the “DEM Delineation – Depression Points” WMS tutorial. These tools can be used for many different scenarios where the automated delineation does not yield the expected results.

The following basin delineation features were discussed and demonstrated:

- Using stream arcs to manipulate basin delineation
- Manipulating depressions

Feel free to continue to experiment with these tools or exit the program.