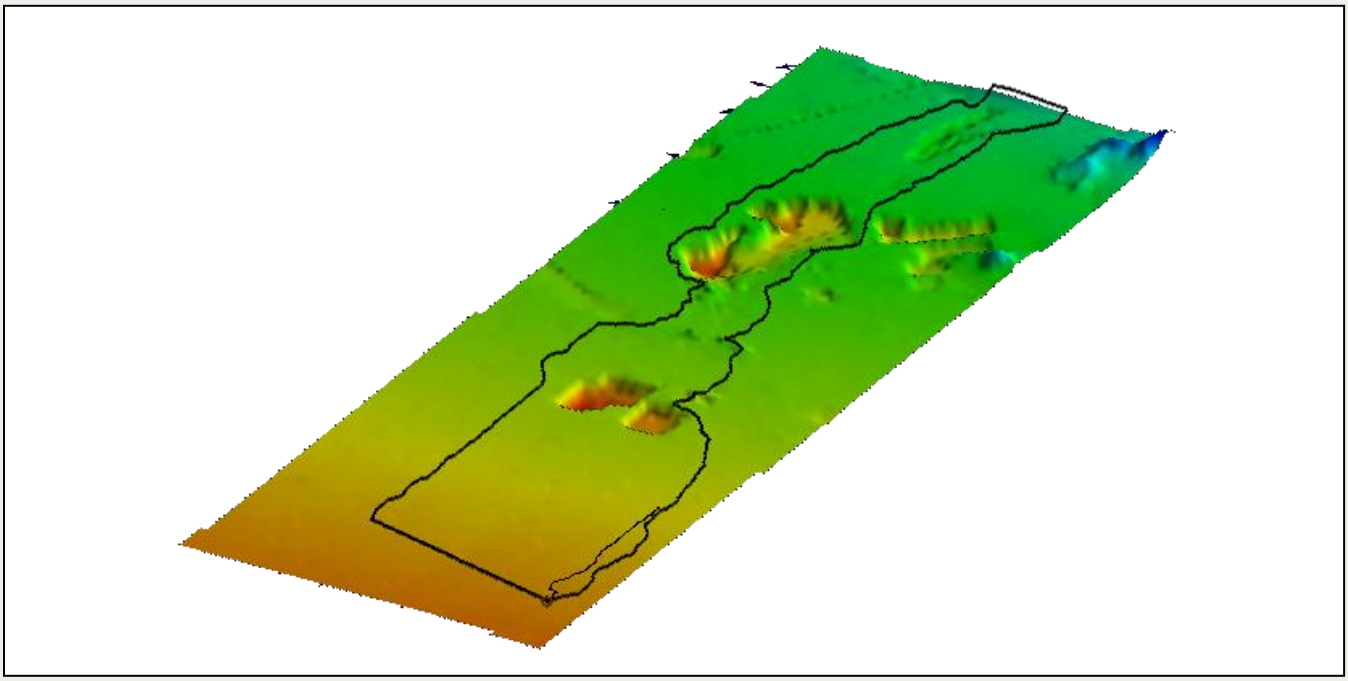
WMS 11.2 Tutorial

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 *Ctrl-N* or select *File* | **New…** to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click **Don't Save** 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. Click **Open** to bring up the *Open* dialog.
5. Browse to the *demdel-depression-points**demdel-depression-points*\ directory and select "stream-arcs.wms".
6. Click **Open** to exit the *Open* dialog and import the project.

The project should appear similar to Figure 1.

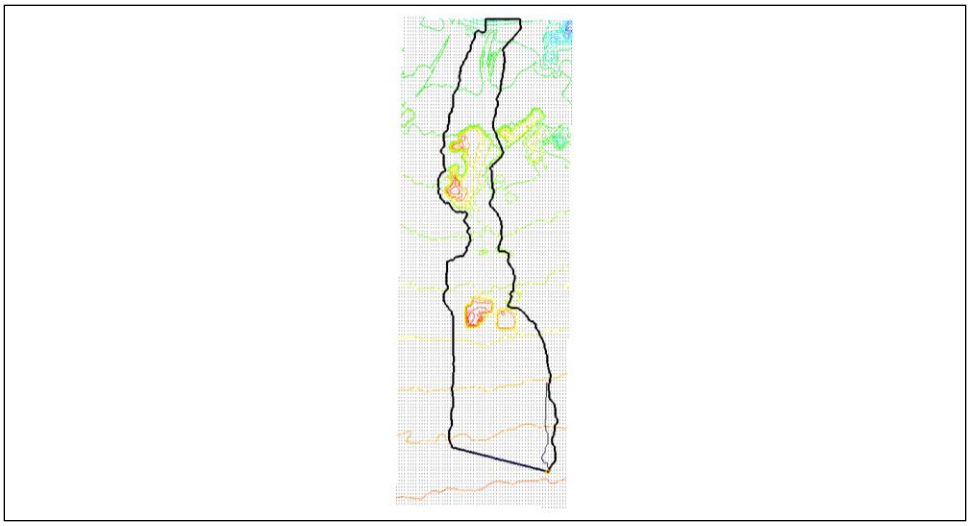


Figure 1 Initial project

3 Setting the Depression Attribute

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

1. Click **Display Options** to bring up the *Display Options* dialog.
2. Select “DEM Data” from the list on the left.
3. On the *DEM* tab, turn off *Points* and *Stream*.
4. Turn on *Depression Cells* and *Flow Accumulation*.
5. Enter “1” as the *Point Display Step*.
6. Click **OK** to close the *Display Options* dialog.
7. **Zoom** in to the area indicated by the blue box in Figure 2.

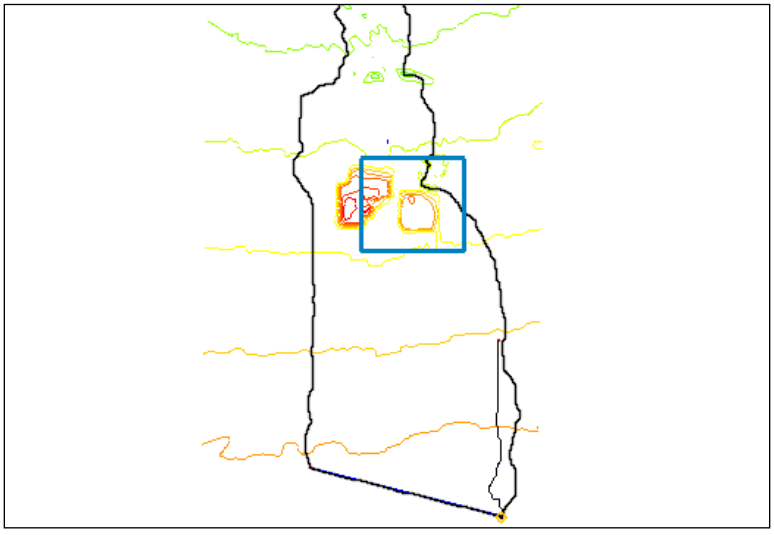


Figure 2 Zoom to depression

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** in to 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.

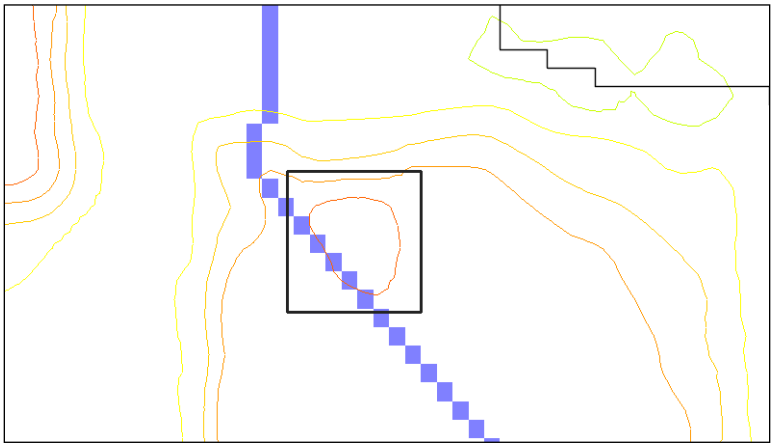


Figure 3 Zoom to depression pit

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. Switch to the **Terrain Data** module.
10. Using the **Set contour min/max** tool, click and drag a box around the orange/red contour range as shown in Figure 4.

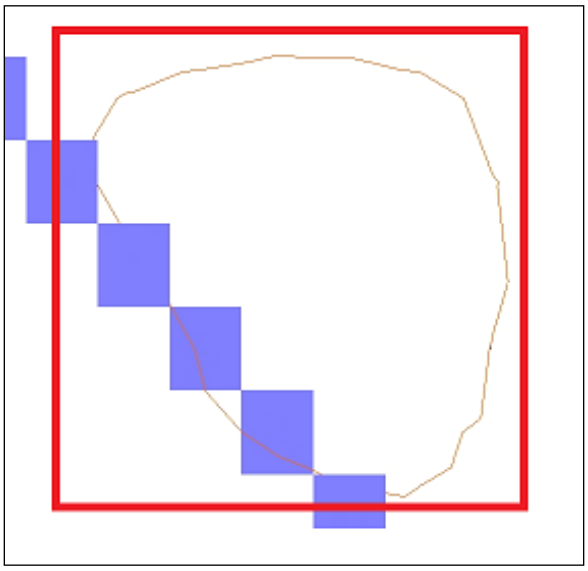


Figure 4 Selection Box for Set contour min/max Tool

11. 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 section of the WMS screen.

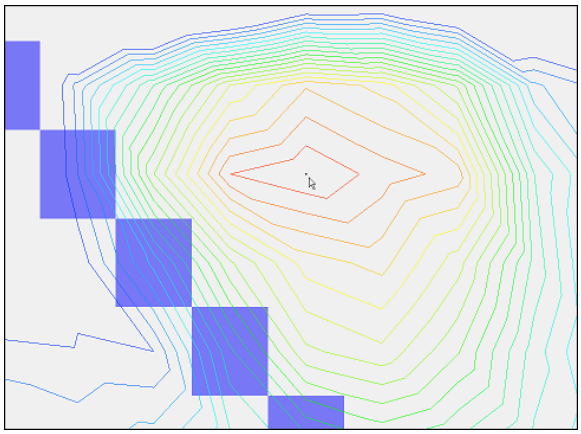


Figure 5 Select DEM Point

13. Select *DEM* **| Point Attributes** to bring up the *DEM Point Attributes* dialog.
14. In the *Attributes* section, turn on *Depression point* and click **OK** to close the *DEM Point Attributes* dialog.
15. Using the **Set contour min/max** tool, right-click anywhere in the Graphics Window and select **Clear Min/Max Contour Ranges**.

4 Running TOPAZ

1. Switch to the **Drainage** module.
2. Select *DEM* **| Compute Flow Direction/Accumulation…** to bring up the *Flow Direction/Accumulation Run Options* dialog.
3. Click **OK** to close the *Flow Direction/Accumulation Run Options* dialog and bring up the *Units* dialog.
4. Click **OK** to close the *Units* dialog and bring up the *Model Wrapper* dialog.
5. Once TOPAZ finishes running, turn on *Read solution on exit* and click **Close** to exit the *Model Wrapper* dialog.
6. **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. Using the **Create outlet point** 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.

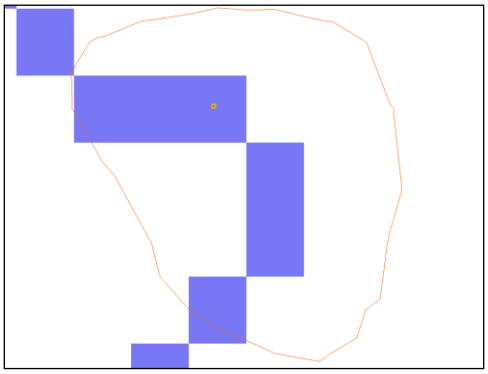


Figure 6 Location of the outlet point

6 Creating a Stream Arc

1. Switch to the **Map** module.
2. Select the **Create Feature Arc** tool.
3. Select *Feature Objects* **| Attributes…** to bring up the *Feature Arc Type* dialog.
4. In the *Type* section, select *Stream* and click **OK** 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.

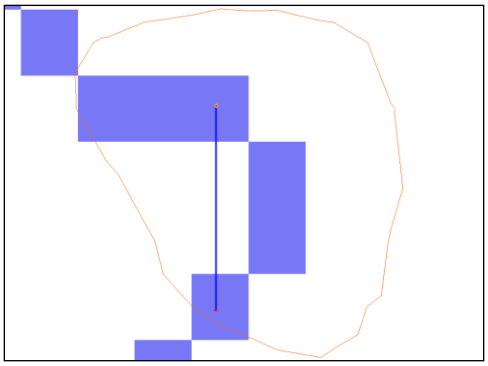


Figure 7 Depression arc

7 Delineating the Basin for the Depression Point

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

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

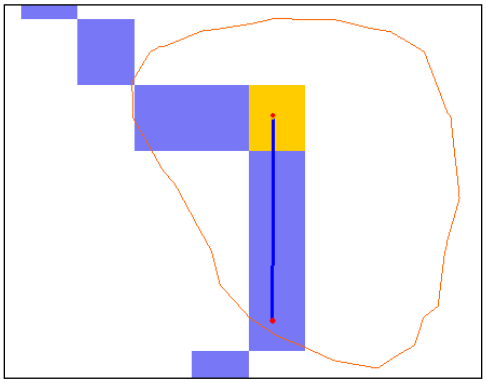


Figure 8 Flow accumulation cells adjusted to location of stream

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** tool, select the outlet at the depression.
3. Select *Calculators* **| Detention Basins…** to bring up the *Detention Basin Hydrograph Routing* dialog.
4. Click **Define…** to bring up the *Storage Capacity Input* dialog.
5. Enter “803.0” in the field below *Use DEM*.
6. Click **OK** 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 **OK** 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 **OK** in the *Detention Basin Hydrograph Routing* dialog.

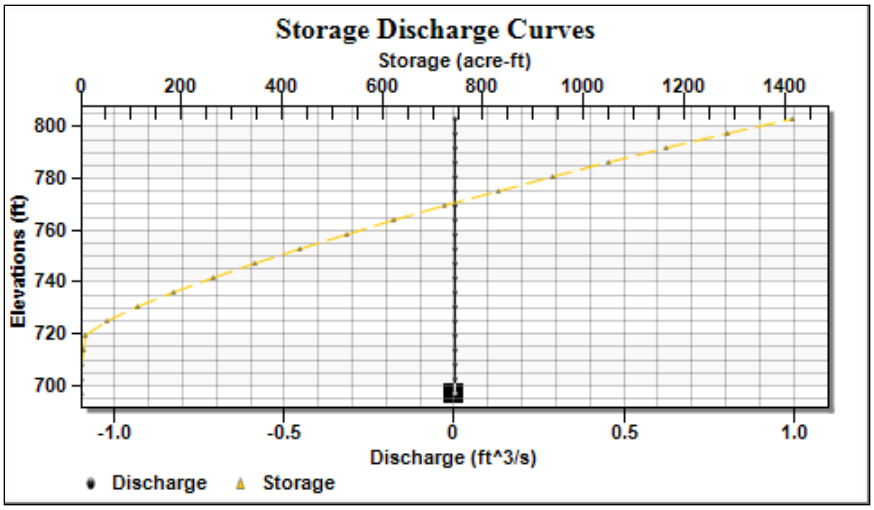


Figure 9 Storage discharge curve

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.