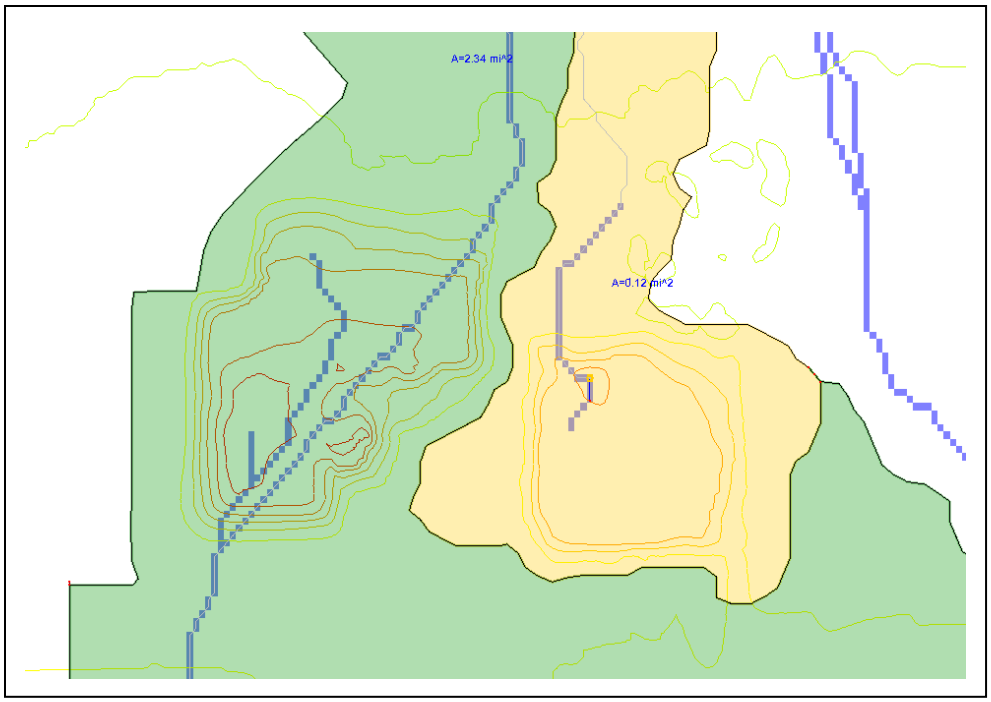
WMS

v. 11.0

WMS 11.0 Tutorial

DEM Delineation – Tc, Basin IDs, and Smoothing

Model manmade and natural drainage features



Objectives

Learn to manipulate the default watershed boundaries by using time of concentration arcs, manually editing the boundaries, using shapefiles to delineate the boundaries, and smoothing the boundaries to make them more accurately represent the watershed.

Prerequisite Tutorials

- DEM Delineation

Required Components

- Data
- Drainage
- Map

Time

- 15–20 minutes

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1 Introduction

When working with DEMs, determining time of concentration (Tc), delineating basin boundaries by hand or by importing shapefiles, and smoothing basin boundaries are all techniques and tools that can be used to create more realistic simulations. WMS has tools for manipulating DEM delineation results in order to accurately represent the actual watershed drainage basins.

This tutorial teaches how to manipulate DEM data for more accurate drainage analysis by discussing and demonstrating how to use time of concentration arcs, manual basin delineation, shapefiles, and boundary smoothing 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-tc-ids-smooth**demdel-tc-ids-smooth*\ directory and select "stream-arcs-final.wms".
6. Click **Open** to exit the *Open* dialog import the project.

The project should appear similar to Figure 1.

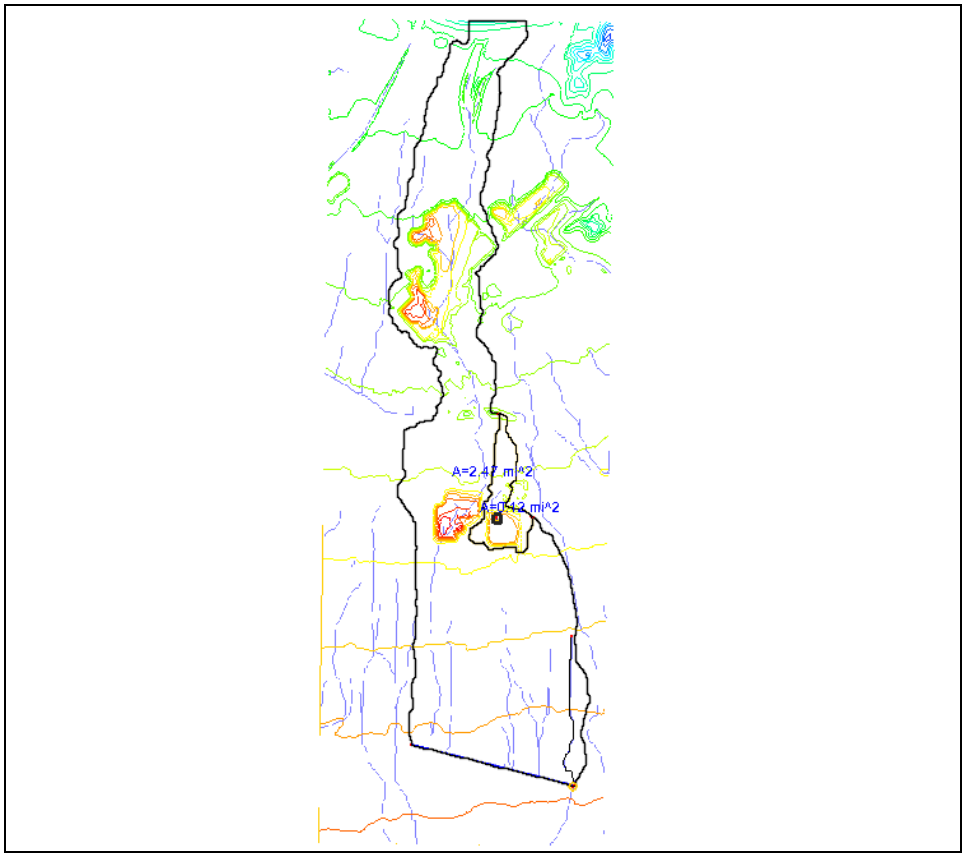

Figure 1 Initial project

3 Time of Concentration Arcs

After DEM cells are assigned to drainage basins, WMS can use the DEM flow directions to automatically create an arc in each basin that represents the longest flow path. This is especially useful for developing times of concentration.

1. Switch to the **Drainage** module.
2. Select *DEM* | **Compute Basin Data** to bring up the *Units* dialog.
3. Click **Drain Data Compute Opts...** to bring up the *Drainage Data Computation Options* dialog.
4. Below the list, turn on *Create Tc Coverage* and click **OK** to close the *Drainage Data Computation Options* dialog.
5. Click **OK** to close the *Units* dialog and complete the calculations.

This process may take a few moments, depending on the speed of the computer.

6. Turn off "86666671 (Converted)" in the Project Explorer.
7. Select the new "Time Computation" coverage in the Project Explorer to make it active.

The Tc arcs generated for each one of the drainage basins should be visible (Figure 2).

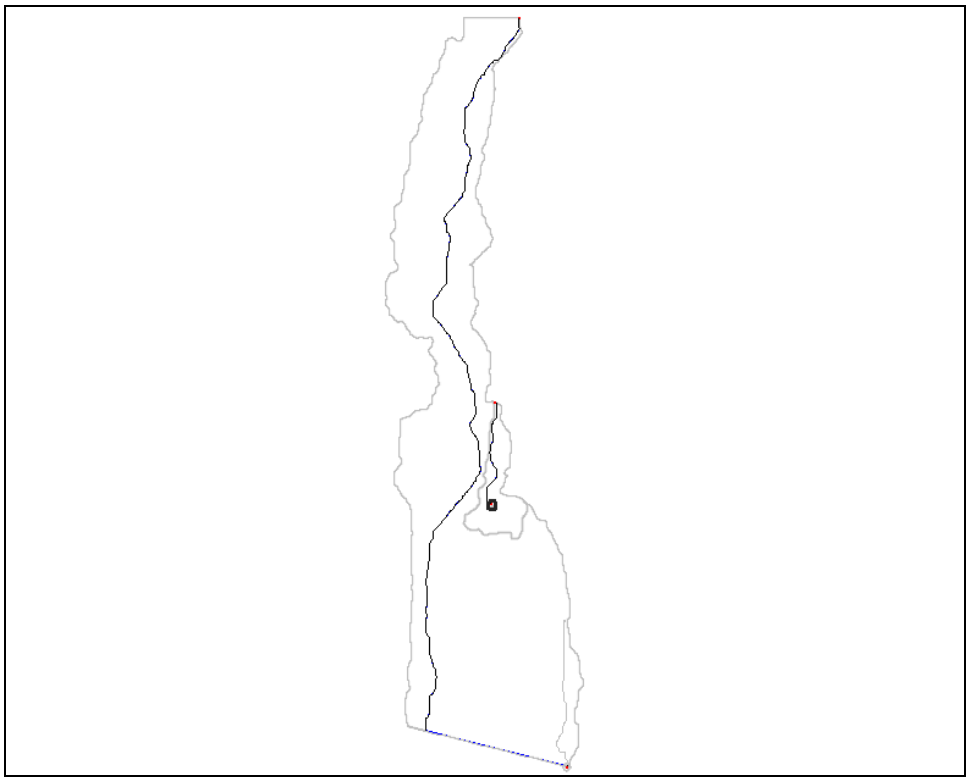

Figure 2 The Tc arcs are visible

4 Basin Boundary Delineation

In some situations, it is more effective to delineate drainage basins by hand or to import basin boundaries from a GIS or CAD file.

1. Select "Drainage" in the Project Explorer to make it active.
2. Right-click on "GIS Data" in the Project Explorer and select **Add Shapefile Data…** to bring up the *Select shapefile* dialog.
3. Select "basin_ poly.shp" and click **Open** to import the shapefile and exit the *Select shapefile* dialog.
4. Turn on "86666671 (Converted)" in the Project Explorer.
5. **Zoom** in to the area indicated by the blue box in Figure 3.

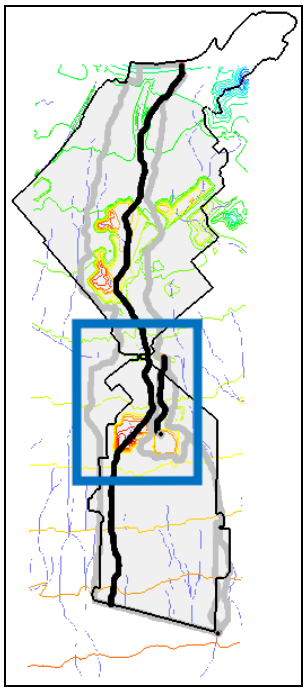

Figure 3 Zoom to Basin Boundary

This shapefile contains a more accurate representation of the drainage basin boundaries that exist in this urban area. Notice that the delineation does not exactly match the actual basin boundaries shown in the shapefile (Figure 4). The data from the shapefile can be used to manually update the basin boundaries.

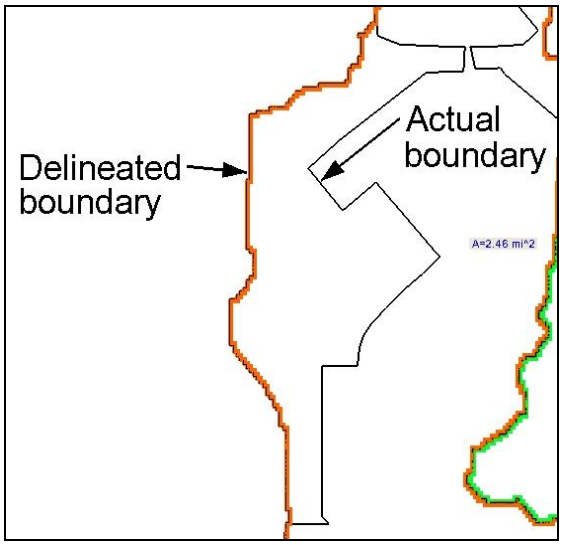

Figure 4 Discrepancy in basin boundaries

6. Switch to the **Map** module.
7. Select the **Create Feature Arc** tool.
8. Select *Feature Objects* | **Attributes…** to bring up the *Feature Arc Type* dialog.
9. In the *Type* section, select *Generic* and click **OK** to close the *Feature Arc Type* dialog.

10. Begin an arc by clicking on the vertex shown in Figure 5 (WMS will automatically snap to the existing arc).

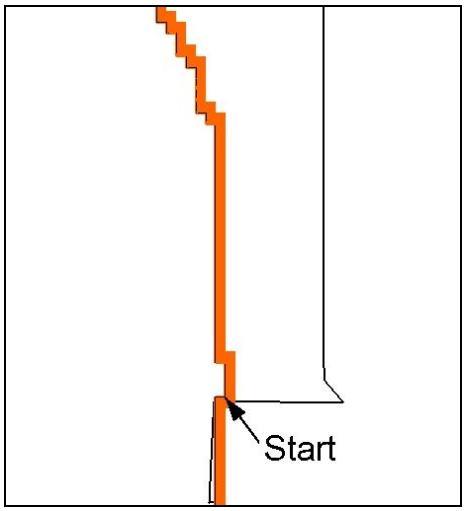

Figure 5 Start the boundary arc here

11. Digitize an arc along the actual boundary arc, ending the arc by double-clicking when the actual boundary arc intersects the delineated boundary arc again (Figure 6).

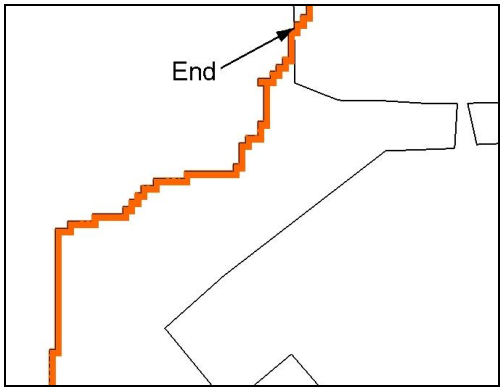

Figure 6 End the boundary arc here

12. Turn off "GIS Data" in the Project Explorer.
13. Using the **Select Feature Arc** tool, select and delete the arc segment representing the original delineated boundary.
14. Right-click on "Drainage" and select **Zoom to Layer.**
15. Right-click on "Drainage" and select **Build Polygon.**
16. Click **OK** to use all arcs.
17. Right-click on "86666671 (Converted)" and select **Display Options…** to bring up the *Display Options* dialog.
18. Select "DEM Data" from the list on the left.
19. On the *DEM* tab, turn off *Fill Basin Boundary Only* and click **OK** to close the *Display Options* dialog.

Notice that the drainage basins assigned to DEM cells no longer match up with the new drainage basin boundary polygon that was created. This must be corrected in order to properly compute geometric properties of the drainage basin based on the DEM data by using the **Compute Basin Data** command.

20. Switch to the **Drainage** module.
21. Select *DEM* | **Polygon Basin IDs → DEM.**
22. Select *DEM* | **Compute Basin Data** to bring up the *Units* dialog.
23. Click **Drain Data Compute Opts…** to bring up the *Drainage Data Computation Options* dialog.
24. Below the list, turn off *Create TC coverage* and click **OK** to close the *Drain Data Computation Options* window.
25. Click **OK** to close the *Units* window and compute the basin data.
26. Click **OK** if notice(s) appear regarding basin edges being encountered.

In this case, the messages do not indicate an actual problem because the drainage basin boundary was manually manipulated.

5 Smoothing Boundaries

1. Select "Drainage" to make it active.
2. **Zoom** in to any section of the basin boundary.

Notice that the boundary arcs are not smooth because they are formed by tracing the square DEM cells. WMS allows redistribution of vertices to smooth these boundaries for reporting and presentation purposes.

3. Select the **Select Feature Arc** tool.
4. Select *Edit* | **Select All**.
5. Select *Feature Objects* | **Redistribute…** to bring up the *Redistribute Vertices* dialog.
6. In the *Arc Redistribution* section, enter "30.0" as the *Average Spacing*.
7. Click **OK** to close the *Redistribute Vertices* dialog.

Notice that the basin boundaries are now much smoother (Figure 7).

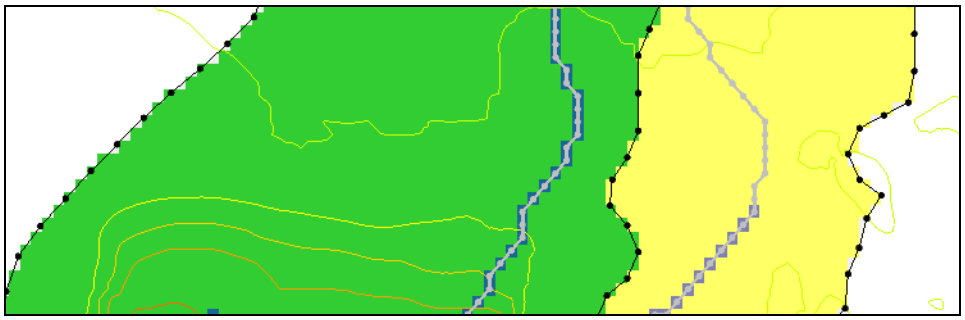

Figure 7 The basin boundaries are smoother

6 Conclusion

This concludes the "Watershed Modeling – Advanced DEM Delineation Techniques" tutorial. Key topics discussed and demonstrated include:

- Developing time of concentration according to the longest flow path.
- Mapping polygons representing drainage basins to the DEMs.
- Manual basin delineation.
- Smoothing results for reporting and presentations.

These tools can be used for many different scenarios where the automated delineation does not yield the expected results. Feel free to continue to experiment, or exit the program.