

Calculating Geometry and Drainage Density

In order to calculate drainage density for a basin or sub-basin, you must first ensure that you have the lengths of all channels within the basin's boundaries (rivers, streams, etc.), as well as the area for the entire basin. Drainage density is calculated using the formula:

$$\text{Drainage Density} = \frac{\text{total length channels (m)}}{\text{basin area (m}^2\text{)}} = \text{m}^{-1}$$

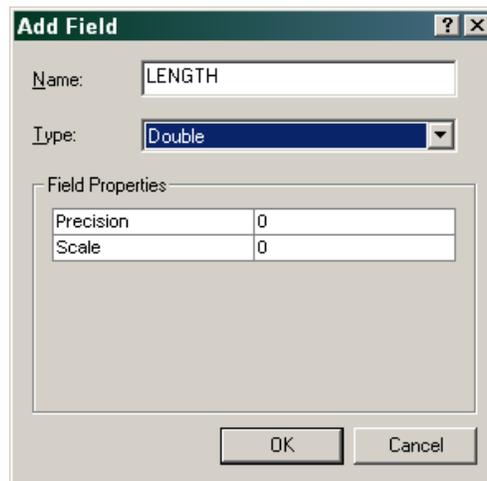
The procedure below outlines the steps for calculating drainage density in ArcGIS 10.

Note: It is important that the data you are working with is in a projected coordinate system with relevant units. Using unprojected data as input for these calculations will yield incorrect results.

Step 1 Adding Fields

Open ArcMap and add the stream and basin files you are working with to the map document. Right-click the stream layer's name in the table of contents and select *Open Attribute Table*. Examine the attribute table to determine if there is a field containing length values. If a length field does not exist, this property can be calculated with minimal effort using the steps below:

- Click the *Table Options* icon () and select *Add Field*.
- Enter a short, descriptive name for the field and choose a data type of *Double*. Click OK.



Add Field

Name: LENGTH

Type: Double

Field Properties

Precision	0
Scale	0

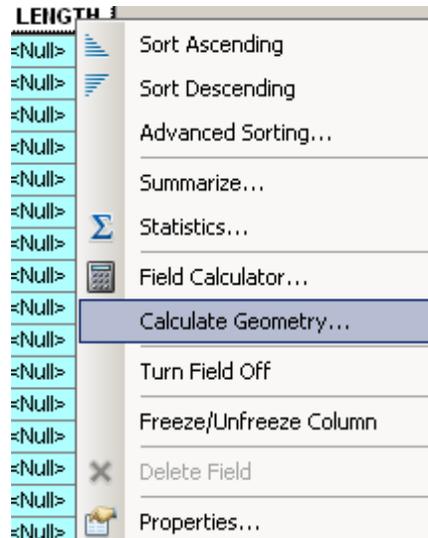
OK Cancel

Step 2 Calculating Geometry

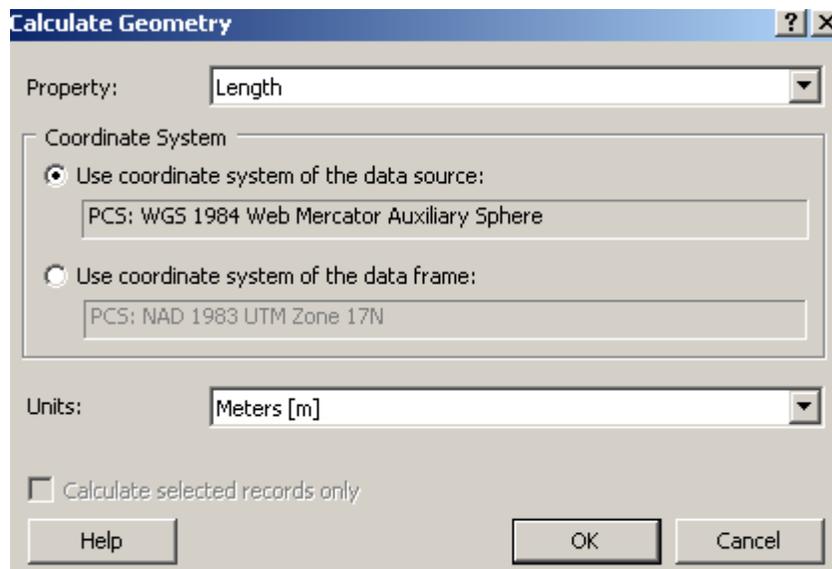
Geometry calculations must be performed in an active editing session. Editing sessions are initiated using the *Editor* toolbar. If you do not see the *Editor* toolbar on your screen, access the *Customize* menu and select *Toolbars > Editor*. The toolbar should appear on your screen.



Click *Editor > Start Editing* to initiate an editing session. Return to the attribute table and highlight your new field by clicking on the column heading. Right-click and select *Calculate Geometry*



Set the *Property* field to *Length*. Select the desired coordinate system and units. Click OK. The length of each line segment is calculated and entered in to the attribute table. Click the *Editor* drop down arrow and select *Stop Editing*. Save your edits when prompted.



Repeat the steps above to add an AREA field to your basin attribute table, start an editing session, and set the Property to Area in the Calculate Geometry dialog.

You will likely want to add a field for the final results of your calculation as well; repeat step 1 above to add a DENSITY field with a double data type to your basin attribute table.

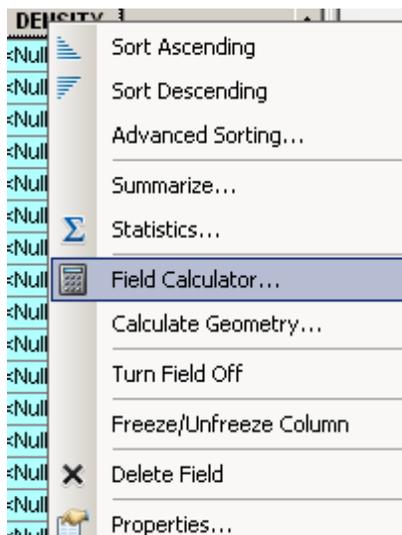
Step 3 Using the Field Calculator

The field calculator is provided for use when you wish to calculate a property that is not related to the geometry of the data. As mentioned above, we know that drainage density is equal to the total length of all channels within the basin divided by the total area of the basin:

$$\text{Drainage Density} = \frac{\text{total length channels (m)}}{\text{basin area (m}^2\text{)}} = \text{m}^{-1}$$

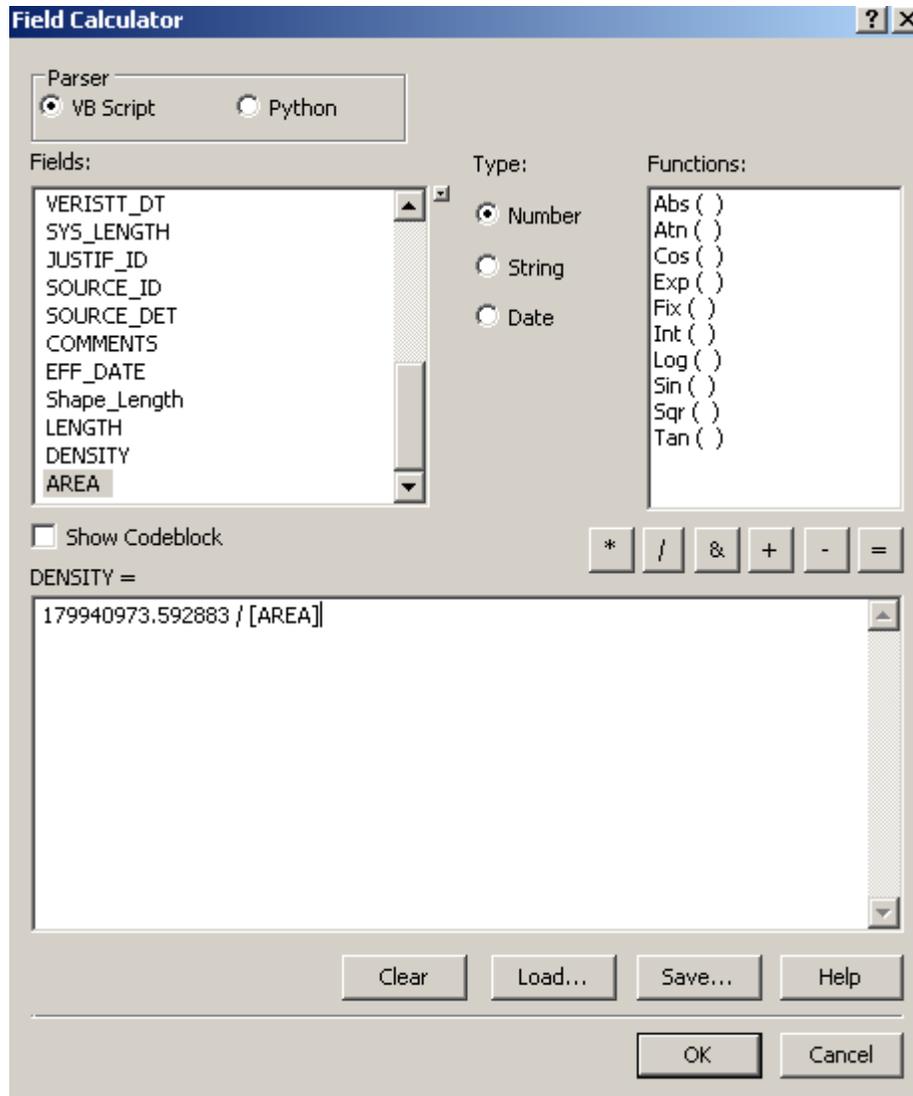
You can see from the equation that you are required to sum the lengths of the channels calculated in Step 2. It is not necessary to do so manually; instead, open the attribute table that is associated with your channels, right-click on the LENGTH field and select *Statistics*. The resulting dialog provides general statistics for the LENGTH field, including the sum of its values. Make note of the total sum for use in the next step.

Start an editing session and open the basin attribute table. Right-click on the DENSITY field and select *Field Calculator*.



In the Field Calculator:

- a. Enter the total channel length
- b. Click the division sign to enter it into the expression
- c. Double-click the AREA field in the *Fields* list so that it is entered into the expression box.
- d. Click OK. The drainage density will be calculated and entered in the basin attribute table.
- e. Click *Editor > Stop Editing* and save your edits when prompted.



You should now have a field in your basin attribute table displaying the drainage density for each individual basin.