In the last lab, we went through how to open ArcMap, add data, navigate through layers, and use basic selection and symbology features to subset and display our data. In this lab, you will build on that knowledge and learn about data frames, basic projections, attribute records, and more symbology. You'll also learn about how to *geoprocess* your data - that is, how to analyze it in a geographic context.

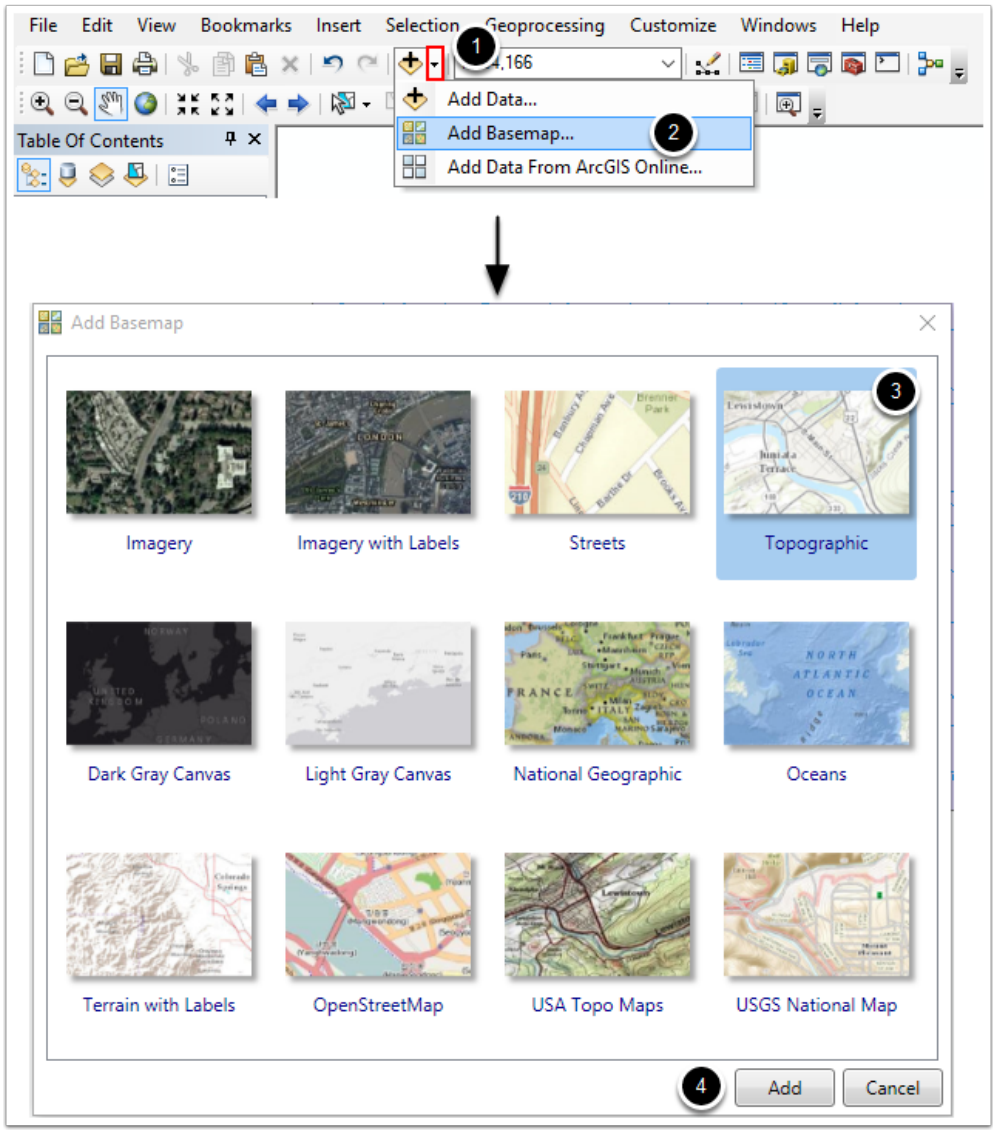
1. Start with your last map document

Open up the map document you used in the first lab - we'll continue where we left off.

To begin with, let's add some additional context to our map, to help us understand what we're looking at. Sometimes, it's nice to have a simple map with just a few layers, but other times it can be very helpful to have information about what surrounds your data - even if it's purely *cartographic* to help you as the analyst understand the context your data lives in.

We'll add this context using *basemaps*. Fittingly, this is accessed through the add data menu.

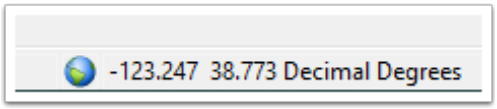
1. Click the dropdown arrow on the Add Data button. It's small - if you accidentally click the main button, just click cancel and try again.
2. Select *Add Basemap*
3. Take a look at the available basemaps for a moment. Then select *Topographic* by clicking on it.
4. Click *Add*.



1.1 It takes time to load.

Sometimes, adding a basemap can take quite a bit of time, as can navigating around while you have one - you'll know ArcMap is still rendering because you'll see a little spinning globe in the bottom right hand corner - if it disappears, then you know ArcMap is either done, or you've done something that cancelled the operation, such as clicking into the main map window.

Once it's loaded, pan and zoom around your map a bit to see how the basemap changes based on your current scale and extent.

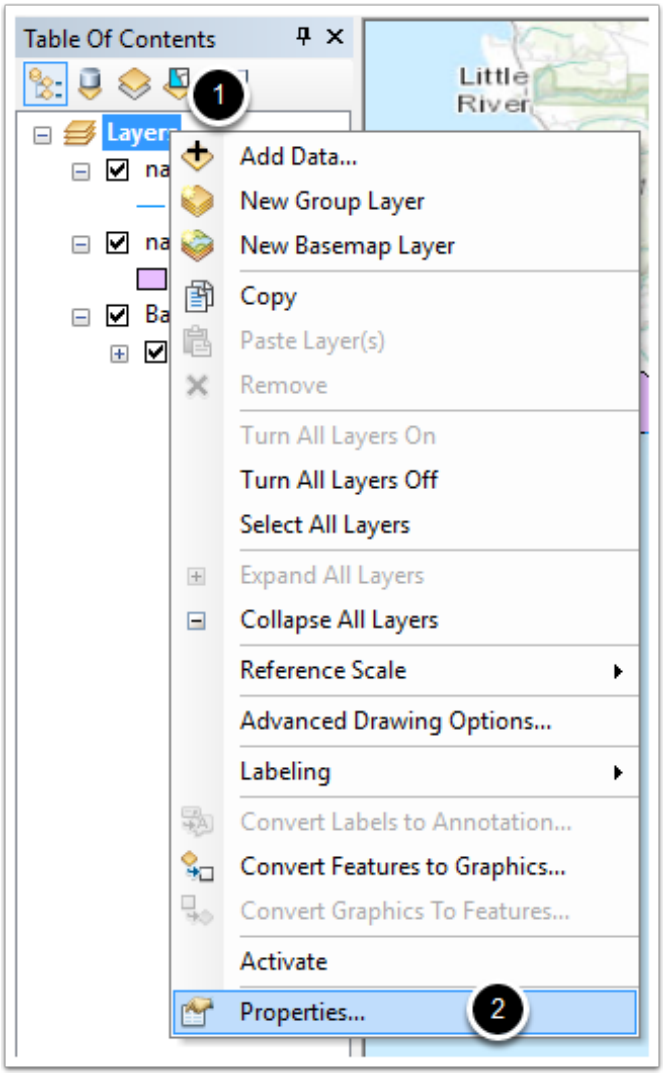


1.2 Speeding up the rendering

When basemaps are active, we can *often*, but not always based on your map document's contents, speed up rendering by changing the *coordinate system or projection* on the *data frame.*

The *Layers* element at the root of your Table of Contents is your data frame. Any single data frame is simply a collection of layers that render together in the same continuous geographic space. If you want to show another place or extent simultaneously, you'll do it by adding an additional data frame (which we won't do in this exercise). Data frames control the *coordinate system or projection* for the whole map - a projection is how we display the world's curved surface on flat surfaces like computer screens and sheets of paper. Each layer can have its own projection, but to display correctly on your screen, ArcGIS temporarily converts the data layers to the projection of the data frame the layer is in. Let's access the data frame properties and take a look.

1. Right click on *Layers* in your Table of Contents
2. Click on *Properties*



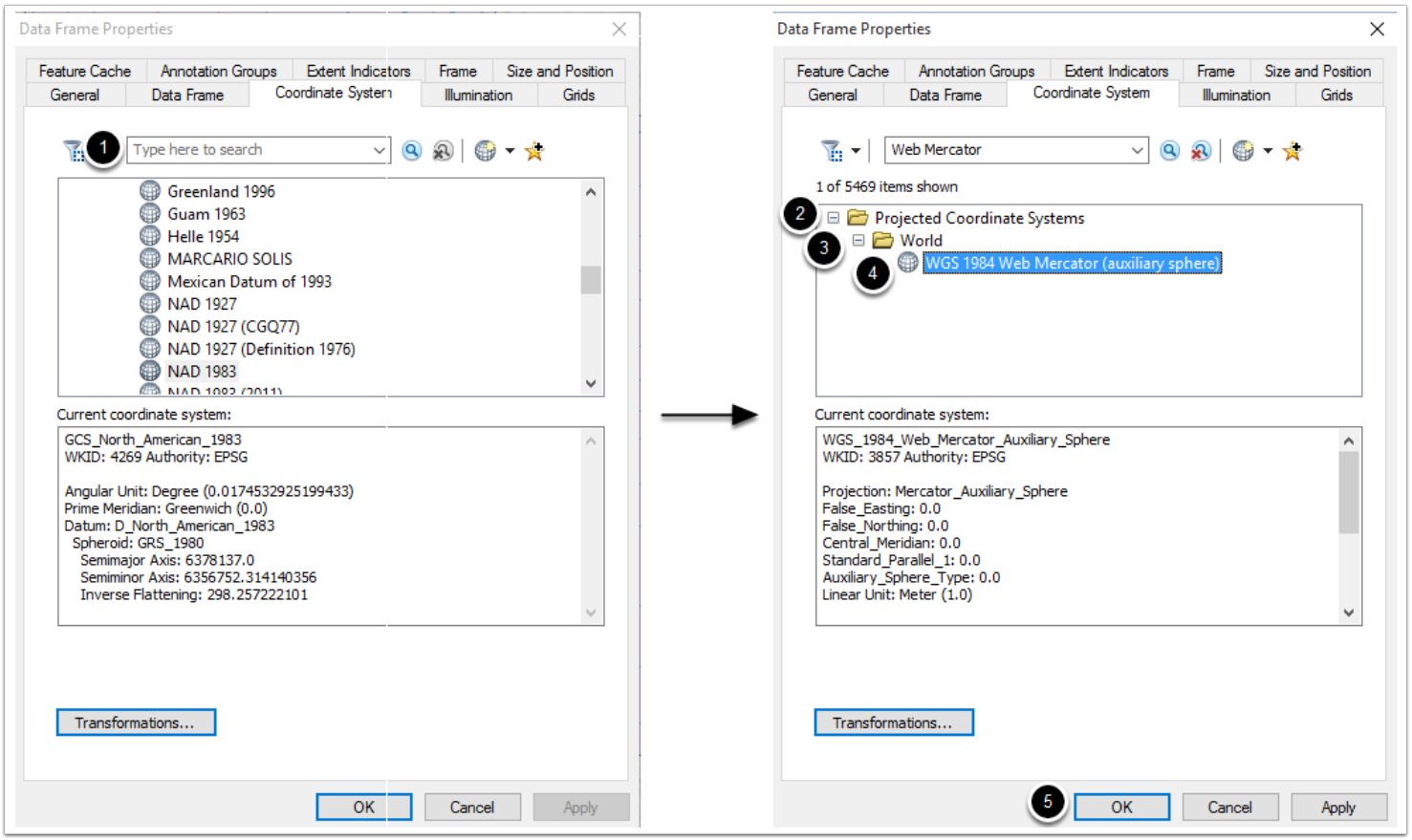
1.3 Data frame properties

The data frame has many different options and properties you can set - most of these don't apply here, but by default ArcGIS should take you to the Coordinate System tab. If yours doesn't open there, click to that tab now. It's also highlighting the current coordinate system (often called projection as a shorthand) in the list and telling us about it in the box below.

To change the coordinate system (and the corresponding distortion applied to the data), we'll simply select a new one in the upper box. To speed the rendering of the map, we'll choose the coordinate system that basemaps come in: *WGS 1984 Web Mercator*. As you learn more about projections, that name will means something, but for now we just need to find it.

1. Type *Web Mercator* in the box that says "Type here to search" then hit the *Enter* key on your keyboard to search
2. When the results come up, expand the *tree control* next to *Projected Coordinate Systems* to see the nested results by clicking the plus sign next to it so it becomes a minus sign
3. Do the same for the subitem *World* that appears
4. Click on *WGS 1984 Web Mercator (auxiliary sphere)* to select that projection
5. Click the *OK* button to save the coordinate system for the data frame. This won't change your underlying data - just how it's displayed right now.

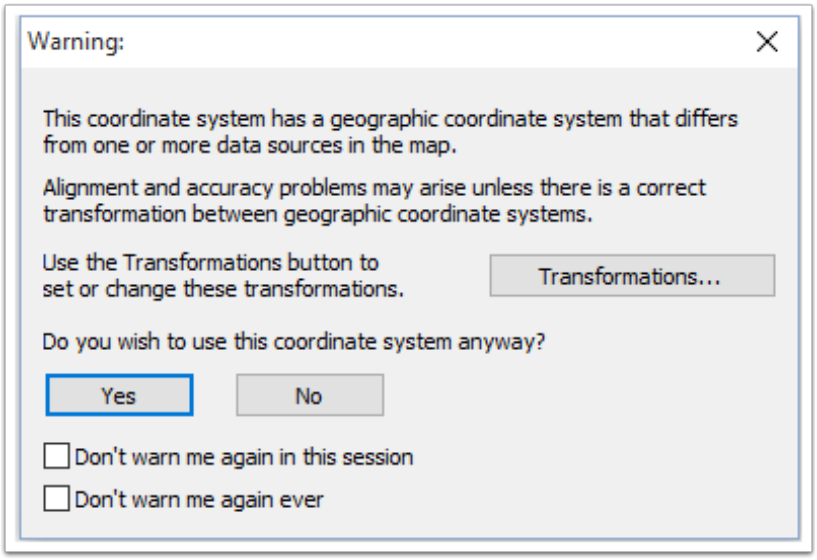
As a note, this process isn't necessarilt something you need to do all the time - it's a convenience to make basemaps perform faster. When you start finalizing your work, you should change the map projection back to something more appropriate.



1.4 Warning!

When you click OK, you'll see a warning pop up regarding alignment and accuracy issues - this has to do with the underlying *datum* (source location and parameters) of the coordinate systems of the datasets and the map documents. It's fine to get this warning, but understand that what it's trying to tell

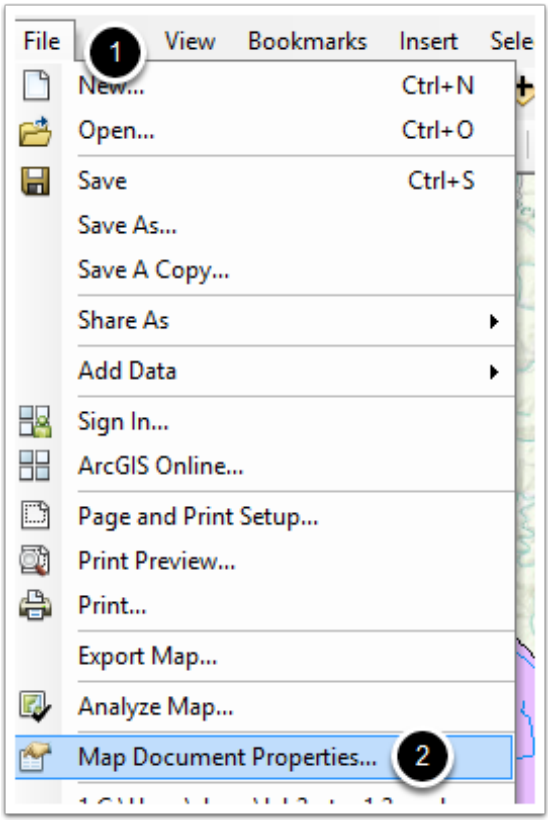
us is that some of our data may misalign on the map - since it's purely cartographic in this instance, that's fine for now. Click *Yes* to continue.



1.5 A little more housekeeping

While we're changing map document parameters, let's change our *default geodatabase.* The default geodatabase is where ArcGIS puts analysis items by default. It is good to know where this is and have it in your project's working directory so that if you have any questions as to the lineage of your data, you can find anything that was part of your analysis.

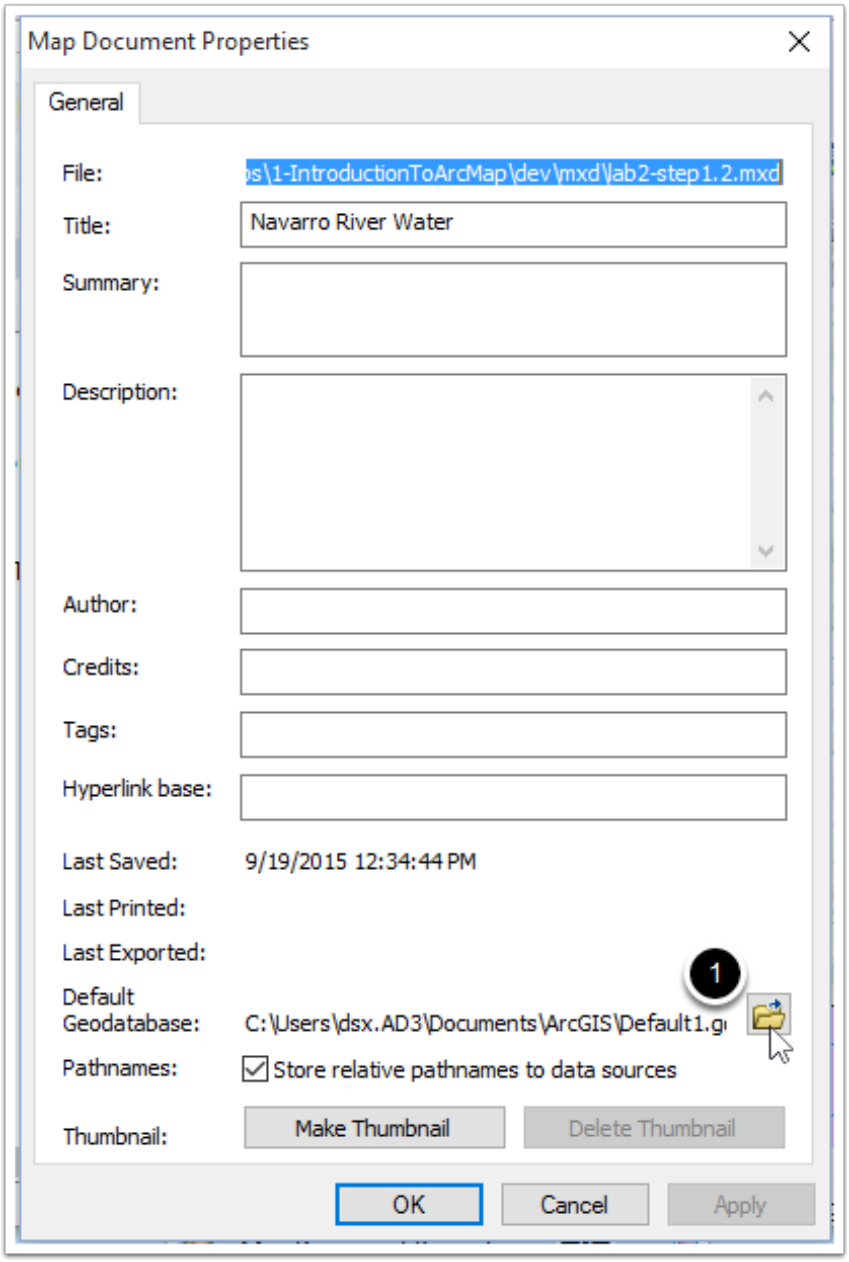
1. Open the file menu
2. Click *Map Document Properties*



1.6 Changing the default Geodatabase

Remember this dialog from earlier? We're going to do something different with it now. Down near the bottom is the *Default Geodatabase* option - since we're in the Map Document Properties dialog, this means the setting is specific to this map document. If we open a new map document, it can have a different default geodatabase.

1. Click the *Browse* button next to the *Default Geodatabase* option (looks like a folder)

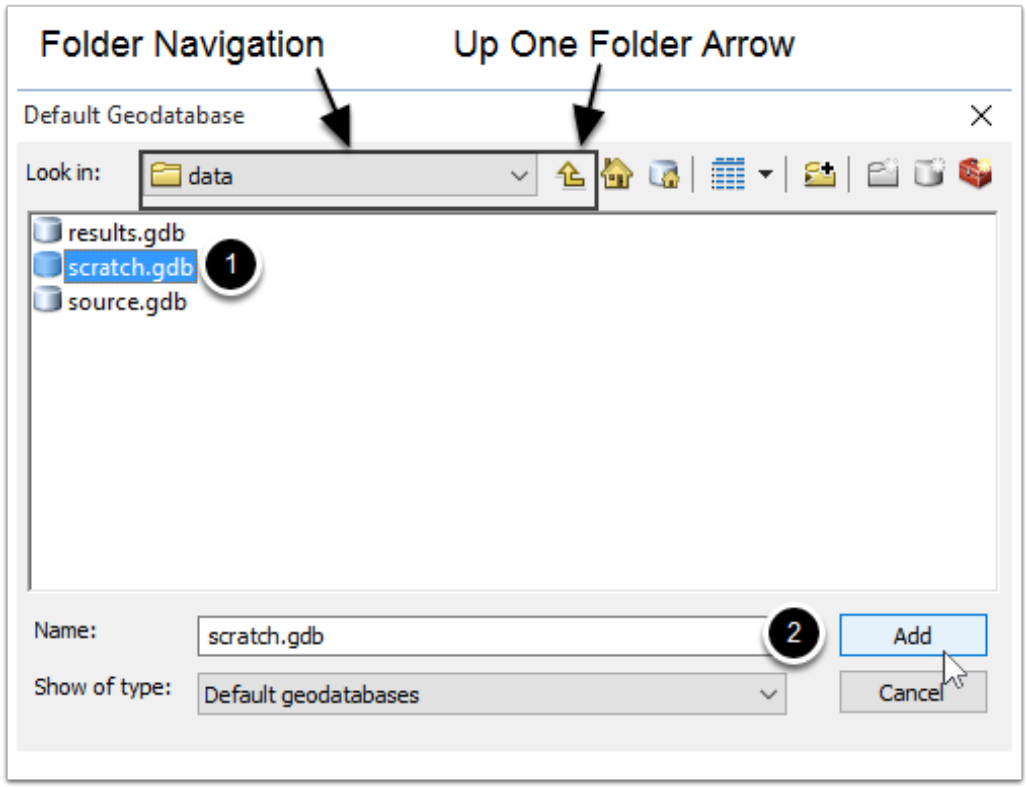


1.7 Find your scratch geodatabase

ArcGIS will open a geodatabase picker (notice the *Show of type* option at the bottom). If you've been strictly following this lab, then it's going to try showing you the contents of the *source* geodatabase since we used that recently. Instead, navigate up one folder to your data folder (recall the *up one folder* arrow if you don't know how).

1. Click on your *scratch* geodatabase (scratch.gdb). Don't double click to open it though - just a single click.
2. Then click *Add.*
3. Click *OK* out of the Map Document Properties dialog (not shown).

ArcGIS will now put working products in that scratch geodatabase where we can find them later.

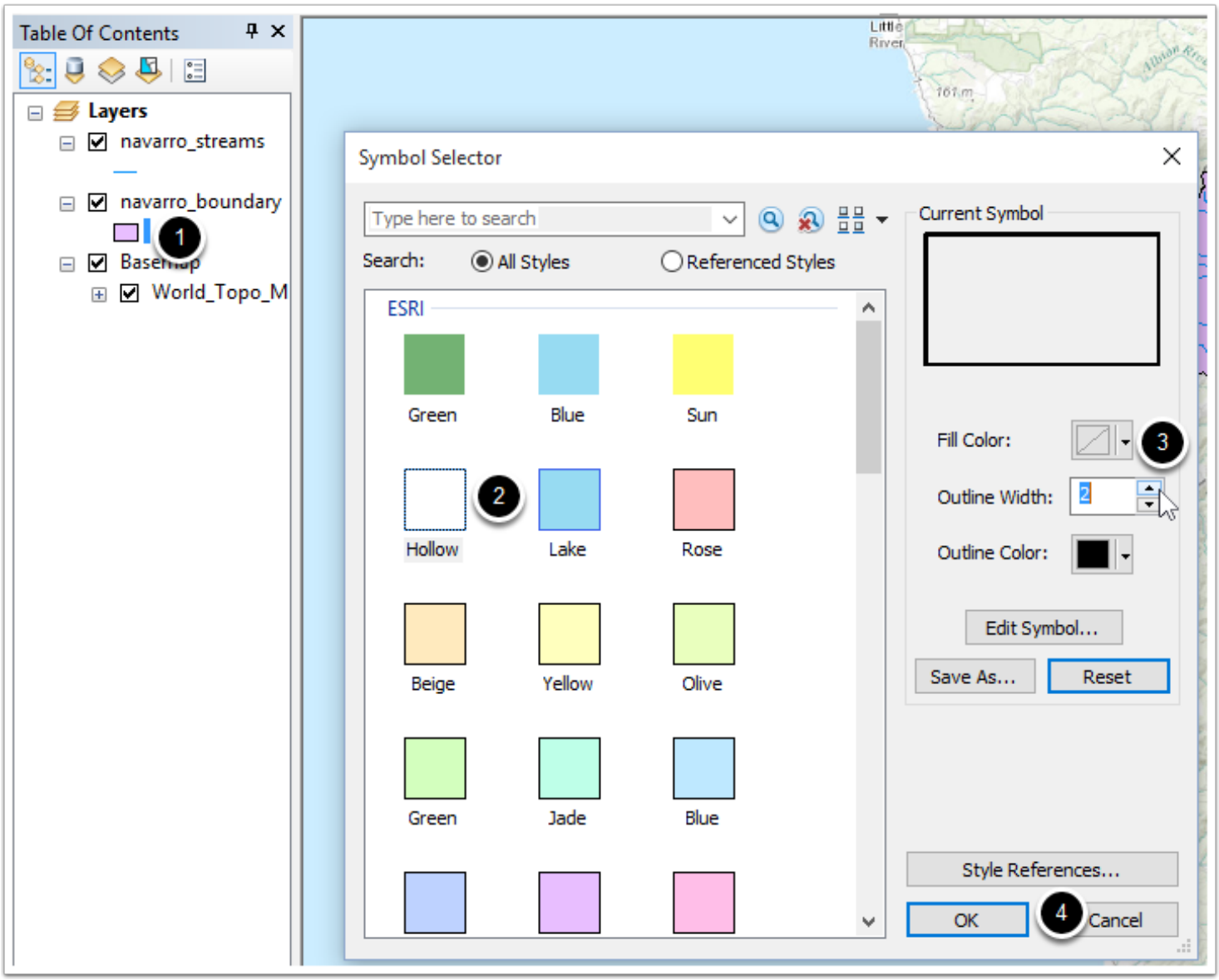


1.8 Changing symbology again

Let's make it easier to use that context we just added to our map document. *navarro_boundary* has been filled with a color, but now that we have a basemap, we want to see what's *under it* (as shown in the layer *stacking order* in the table of contents - higher layers are drawn on top of lower layers and cover them up).

1. Double click the colored box underneath *navarro_boundary* in the table of contents - your color may be different than shown here.
2. The *Symbol Selector* dialog box will open up - you saw this before in the last lab. Click the *Hollow* option in the second row.
3. Make the outline thicker so it stands out on top of the basemap. The *patches* in the main selection area can be used as is, or we can modify them once we select one. In this case, *Hollow* made the polygon's *fill* completely transparent, and set the outline to a thin black line. Click the up arrow next to *Outline Width* twice so it's set to 2.
4. Click *OK* to save your changes.

Note: Feel free to play around with the symbology as you see fit! The lab is trying to guide you through many things and make sure you don't get lost, but I encourage you to take a longer look at anything you'd like to understand further and play with the options. If you're worried - just save your work first so you can go back to where you departed from the lab's instructions.

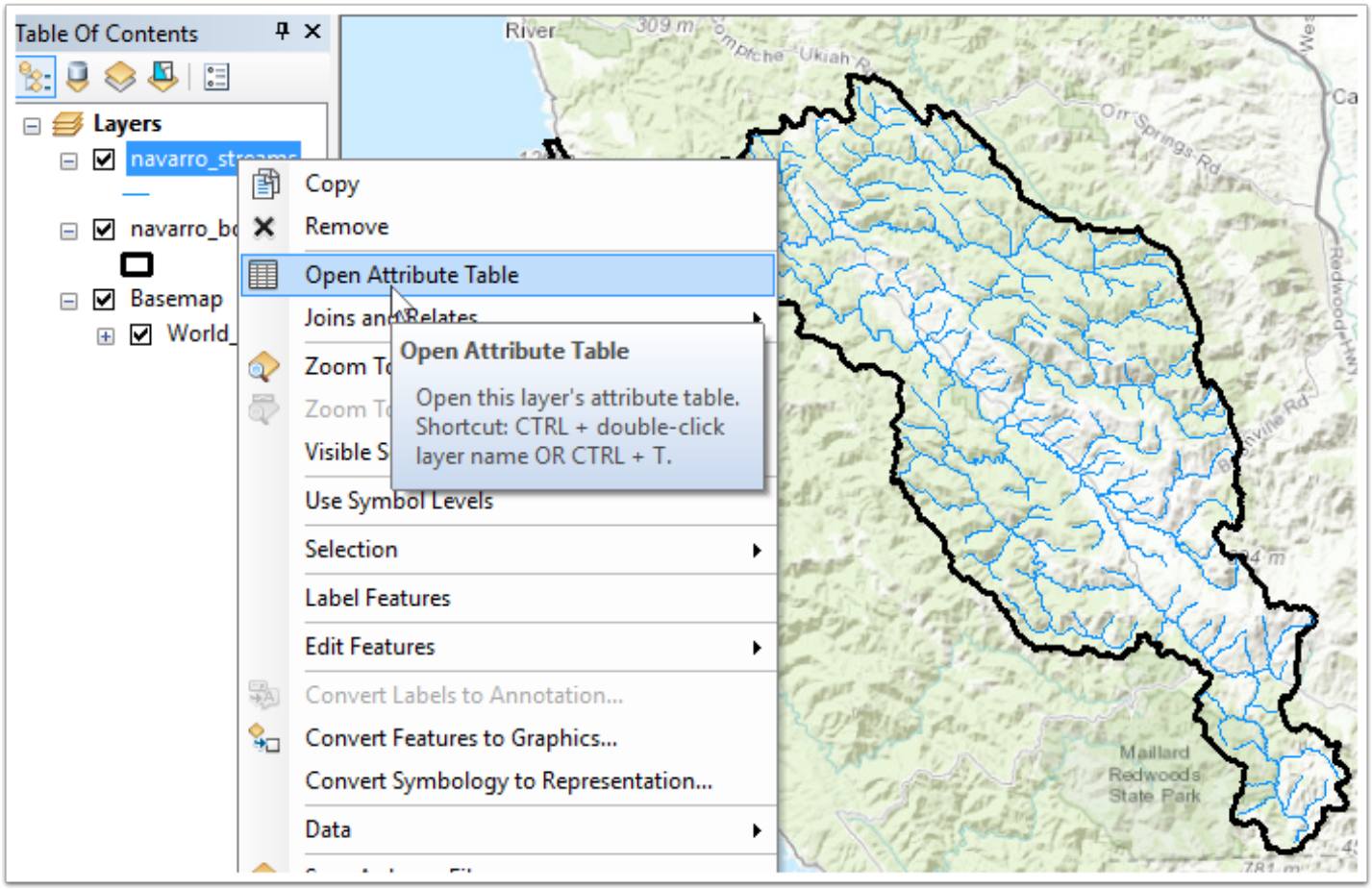


2. Browsing attributes

If *spatial* information, ie: the location of specific features and the drawing of those features on screen, is half of GIS, then the other half is *attribute* information. Attributes are common to all database-linked data systems - the simplest in this style would be an excel spreadsheet with attributes defining the columns and each row being a specific *record*. GIS works the same way. When we used the *Identify* tool, we pulled up the attribute information for the features we had clicked on. Now, we'll take a look at all of the attributes for our feature class.

1. Right click on *navarro_streams* in your Table of Contents

2. Click *Open Attribute Table* in the menu that comes up



2.1 The attribute table

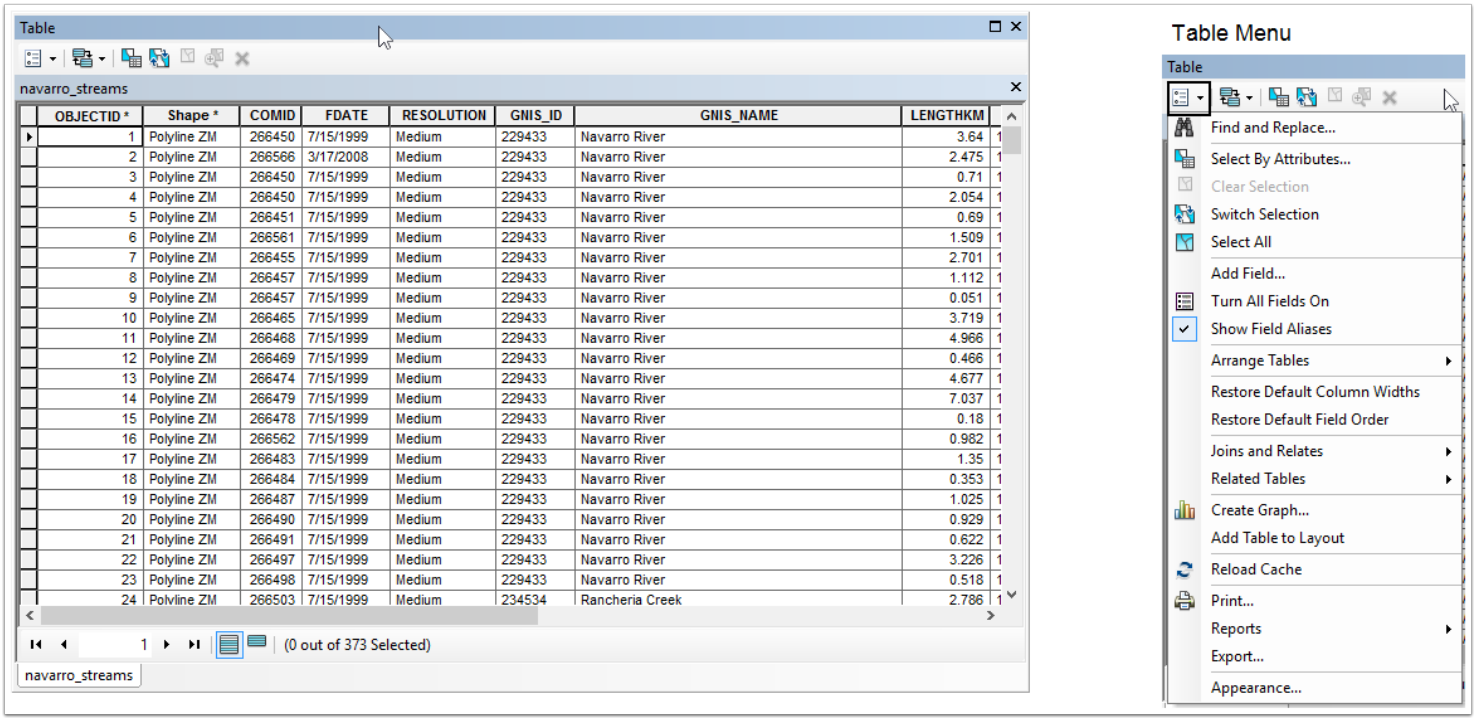
The *Table* window will pop up - this window/pane is dockable, similar to the Search and Table of Contents panes. Each column in the attribute table corresponds to an individual attribute that can be read for an individual feature. Note the *OBJECTID* field (column). It is a numerical, sequential field added automatically to ensure we can reference each record individually with a unique ID number. NHDPlus data also has the *COMID* field, assigned during the creation of the records. COMID is the field that is used by other NHDPlus data to reference records.

Now, note the more understandable fields, such as GNIS_NAME and LENGTHKM. What do you think each of these fields mean? Explore the other attributes in the table too. Where could you find out what each of these fields represents?

There is also a *Shape* field, where ArcGIS stores the spatial information about each feature. It's accessible through the attributes this way, though it will only display as a word or two in the table (in this

case, as *Polyline ZM*). From Python and other programming environments, you can access feature information by loading this attribute.

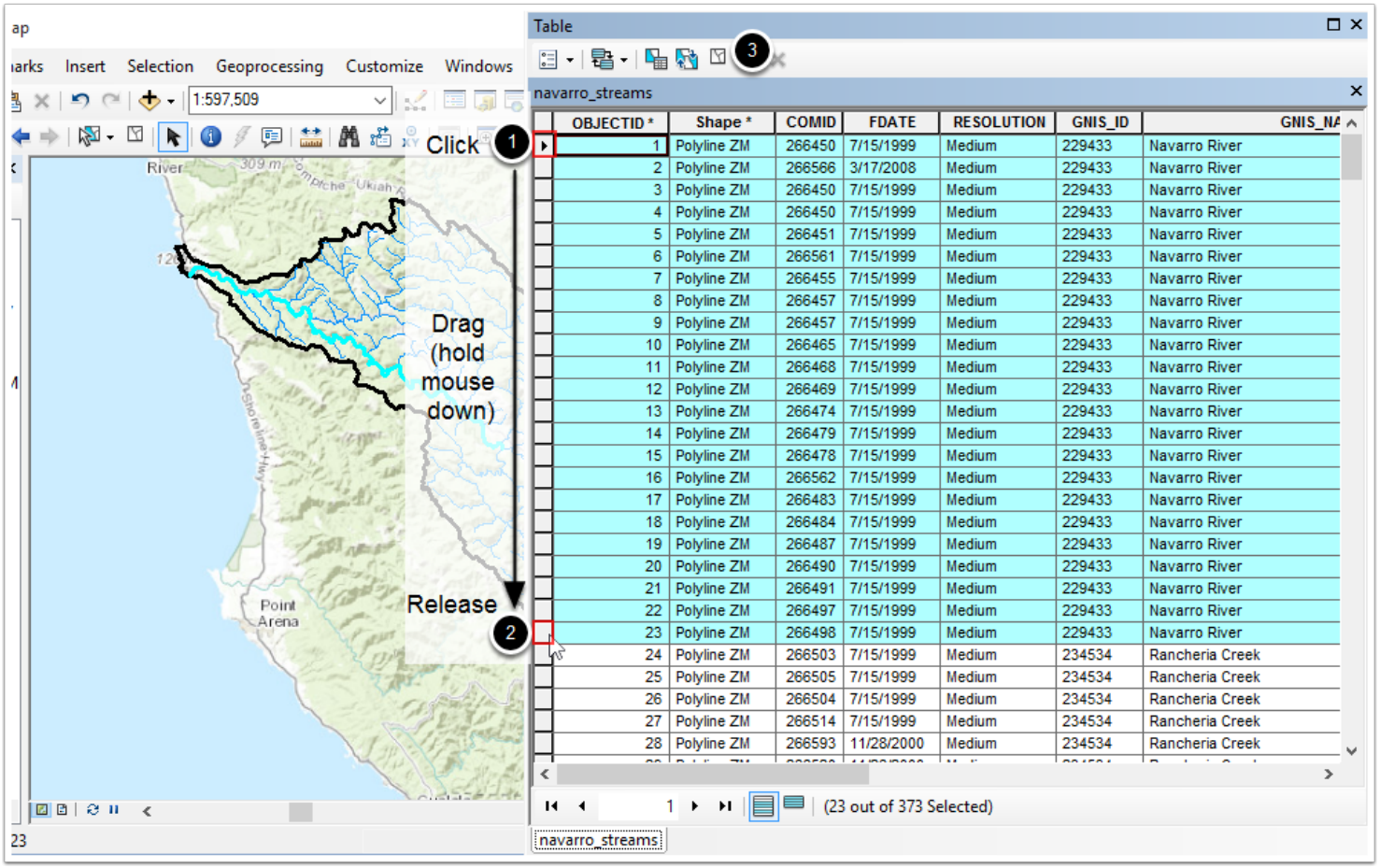
Finally, hover your mouse over some of the different tool buttons to see what they do. Then, click on the top left icon (see righthand screenshot) to bring up the table menu - we won't use any of these items right now, but take a look at what options are available in here.



2.2 Making a selection from the table

Now, let's use the table to locate features on the map. We want to see which features represent the mainstem Navarro River. If your table isn't sorted sequentially, then right click on the header of the OBJECTID field and select *sort Ascending* so that you see the table sorted as in the screenshot.

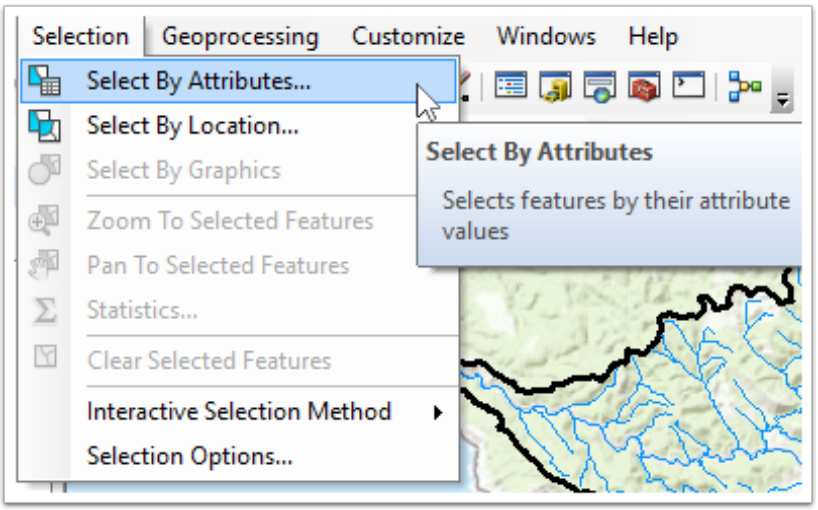
1. Then to select the records (and have them show in your main data view), click next to the first record in the unnamed column to the left of OBJECTID - hold the mouse button down after your click.
2. Drag your mouse down through all the records until you get to the one with OBJECTID 23 (the last one with GNIS_NAME=Navarro River). Release the mouse button here. You'll see the records highlighted with your selection color in the table view and in the map view. This shows us which features on our map correspond to features in our data table!
3. When you're done exploring, click the *Clear Selection* button either in the table window or in the main map window.



2.3 A different way

Let's create that same selection a different way, and one that's very common, especially if you need to do something more complex than selecting sequential records. We're going to use the *Select By Attributes* tool. Similar to the *Select By Location* tool which creates a selection based on spatial relationships, *Select By Attributes* gives us a selection based on the attribute information of a feature class. Both are core tools for interactive GIS and have important placement in the interface as a result.

1. Open the selection menu in the main ArcMap window
2. Click *Select by Attributes*



2.4 Select By Attributes

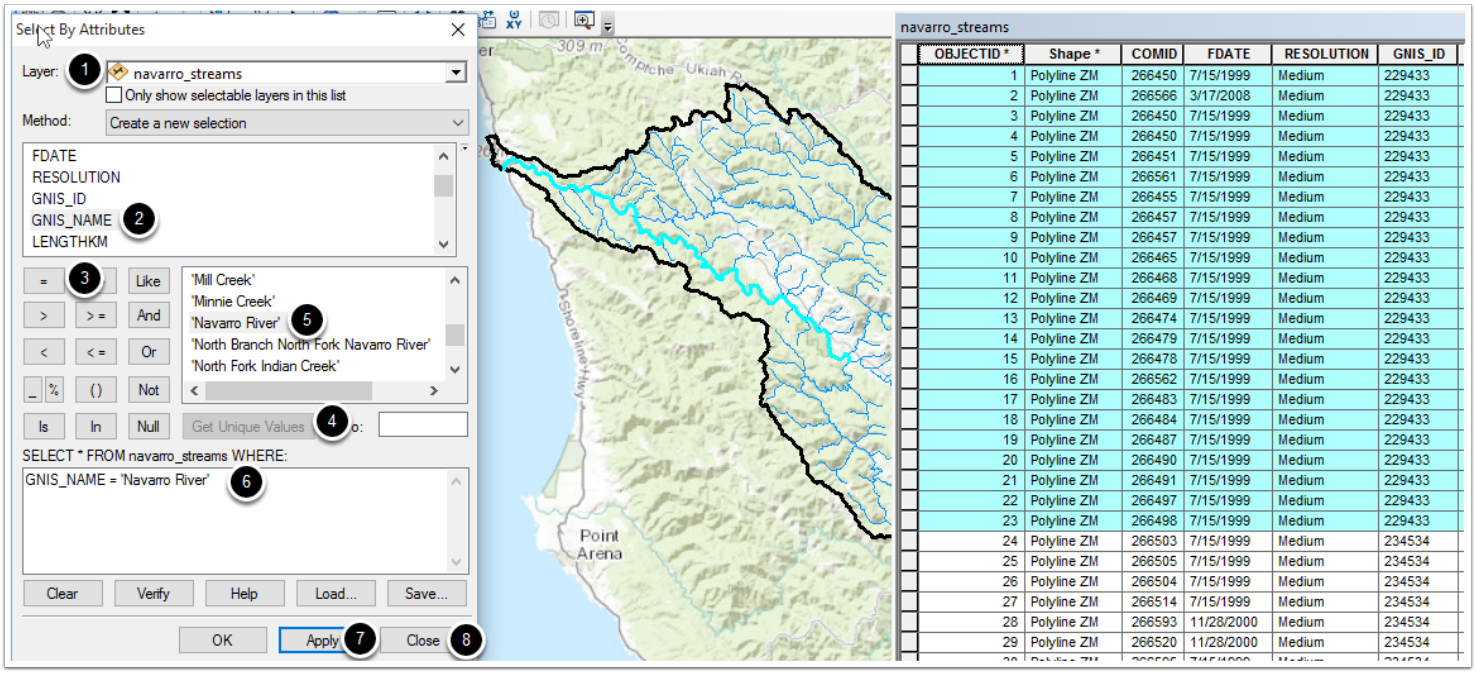
Select By Attributes gives us a set of controls to create a *query* to use to select our attributes. These queries are similar to ones you would have used if you have worked with other database applications (such as Microsoft Access, SQL Server, MySQL, etc). You can manually type a query once you are comfortable and familiar with ArcGIS (see location of item number 6 in screenshot), or you can use the controls that ArcGIS gives us to create the query - recommended while you get used to the syntax.

We want to select all of the stream records that are part of the mainstem Navarro River - aka, where the *GNIS_NAME* attribute is set to *Navarro River*. We'll use these controls to create a query ArcGIS can understand to do that.

1. First, we need to select the layer to create the query on. Select *navarro_streams* in the dropdown. Leave the item below it (*Method)* at its default of *Create a new selection*.
2. This box allows us to add fields to our query. Scroll down and find *GNIS_NAME* in the box. Then double click on it to add it to our query. Notice it appears in the bottom box.

3. Now we need to add a *relationship operator*. In this case, we want records where an attribute is equal to a certain value, so which one would we use? Click on the equals sign (=) to add it to the box below. It appears after *GNIS_NAME.*
4. Now, we need to say what value we're looking for. We could type it, but it has special syntax. Let's have ArcGIS help us. Leaving *GNIS_NAME* selected in the upper box, click the *Get Unique Values* button.
5. The box above the button will populate with all of the different values in the *GNIS_NAME* field. Scroll down until you see *'Navarro River'*. Double Click on it to add it to the query below. Why is it surrounded by single quotes?
6. Now we have our complete query string - above the box, ArcGIS put the query *boilerplate*: SELECT * FROM navarro_streams WHERE. All we had to add was the conditional statements to identify the records of interest. We can now edit and modify this statement as we like. In this case, it should already say *GNIS_NAME = 'Navarro River'* - which is what we want, so we'll leave it alone.
7. Click *Apply* to preview the selection on the map. Notice that the selection appears in the map window and in the attribute table when you run it. If the selection didn't select what we wanted, we could refine it and try again with the Apply button. It looks good though, so we'll leave it alone.
8. Click *Close* to close the *Select By Attributes* window. If you clicked *OK* instead, your selection query would be re-run. Either is fine.

Feel free to explore your map, but when you are done, clear your selection (using a button that should now be familiar). You can also close the attribute table window now.

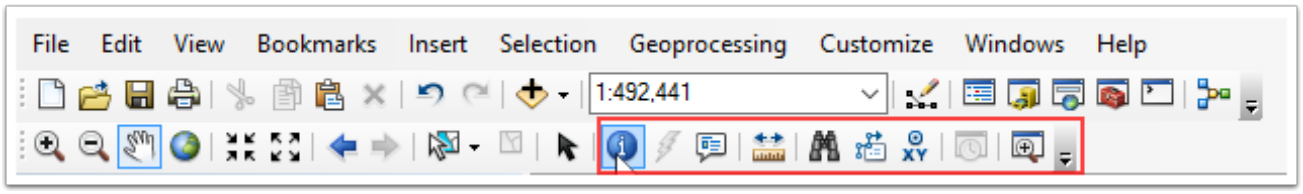


OBJECTID *	Shape *	COMID	FDATE	RESOLUTION	GNIS_ID
1	Polyline ZM	266450	7/15/1999	Medium	229433
2	Polyline ZM	266566	3/17/2008	Medium	229433
3	Polyline ZM	266450	7/15/1999	Medium	229433
4	Polyline ZM	266450	7/15/1999	Medium	229433
5	Polyline ZM	266451	7/15/1999	Medium	229433
6	Polyline ZM	266561	7/15/1999	Medium	229433
7	Polyline ZM	266455	7/15/1999	Medium	229433
8	Polyline ZM	266457	7/15/1999	Medium	229433
9	Polyline ZM	266457	7/15/1999	Medium	229433
10	Polyline ZM	266465	7/15/1999	Medium	229433
11	Polyline ZM	266468	7/15/1999	Medium	229433
12	Polyline ZM	266469	7/15/1999	Medium	229433
13	Polyline ZM	266474	7/15/1999	Medium	229433
14	Polyline ZM	266479	7/15/1999	Medium	229433
15	Polyline ZM	266478	7/15/1999	Medium	229433
16	Polyline ZM	266562	7/15/1999	Medium	229433
17	Polyline ZM	266483	7/15/1999	Medium	229433
18	Polyline ZM	266484	7/15/1999	Medium	229433
19	Polyline ZM	266487	7/15/1999	Medium	229433
20	Polyline ZM	266490	7/15/1999	Medium	229433
21	Polyline ZM	266491	7/15/1999	Medium	229433
22	Polyline ZM	266497	7/15/1999	Medium	229433
23	Polyline ZM	266498	7/15/1999	Medium	229433
24	Polyline ZM	266503	7/15/1999	Medium	234534
25	Polyline ZM	266505	7/15/1999	Medium	234534
26	Polyline ZM	266504	7/15/1999	Medium	234534
27	Polyline ZM	266514	7/15/1999	Medium	234534
28	Polyline ZM	266593	11/28/2000	Medium	234534
29	Polyline ZM	266520	11/28/2000	Medium	234534

2.5 Some other ways to browse data and find records by attributes

We've gone through numerous ways to locate and subset your data now. There are a few other ways to do this that I want you to play with a bit, but we won't walk you through - you'll figure them out on your own. The tools in question are in the boxed section of the toolbar in the screenshot. Hover over tools to see their names and a bit about what they do. For this step, try using the *HTML Popup* and *Find* tools a bit. You will find each useful at some point in your GIS use.

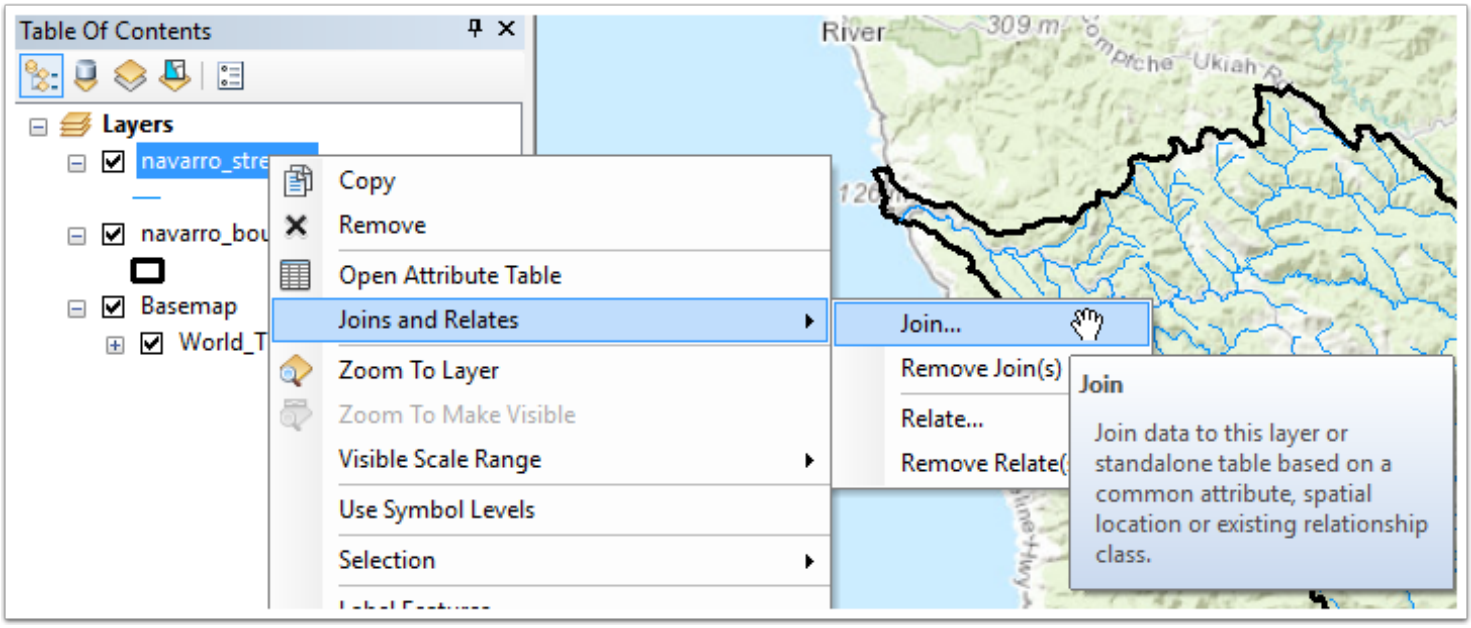
If you have time, explore the other tools in this section as well - they are all great in various situations, but we won't go through them individually.



3. Adding New Attributes

Just as there are many ways to select features in ArcGIS, there are many ways to add new attributes to your data for further use in your *geoprocessing* and analysis workflows. To start with, we'll add in some third party attributes via a *join*. Joins attach new attributes to an existing table by looking up rows in another table that have a common field value (such as an ID field). Remember that *COMID* field we talked about earlier that other NHDPlus tables use - we'll use that to construct a join.

1. Bring up the menu on the *navarro_streams* layer - remember how?
2. Go to the *Joins and Relates* submenu
3. Click *Join* in the flyout box.

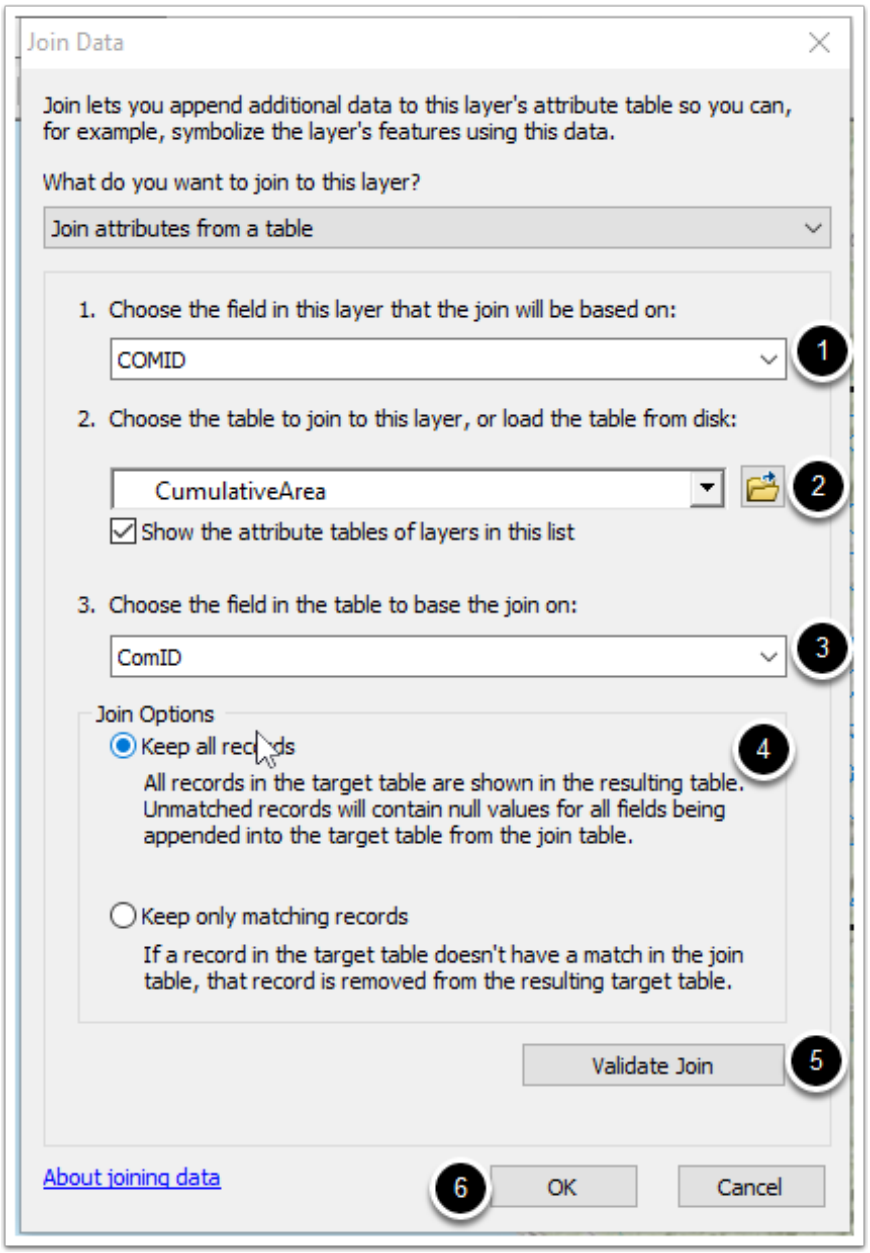


3.1 Joining Data

The *Join Data* dialog will appear. In this case, we're going to attach a table of precomputed drainage area information per stream segment. The table is in your *source* geodatabase - you'll need to find it in a moment.

1. As I mentioned before, we'll use the COMID attribute as our common attribute to look up. Select it from item number 1
2. Use the browse button in item number 2, to find the lookup table. Navigate to your *source* geodatabase and open the table *CumulativeArea*

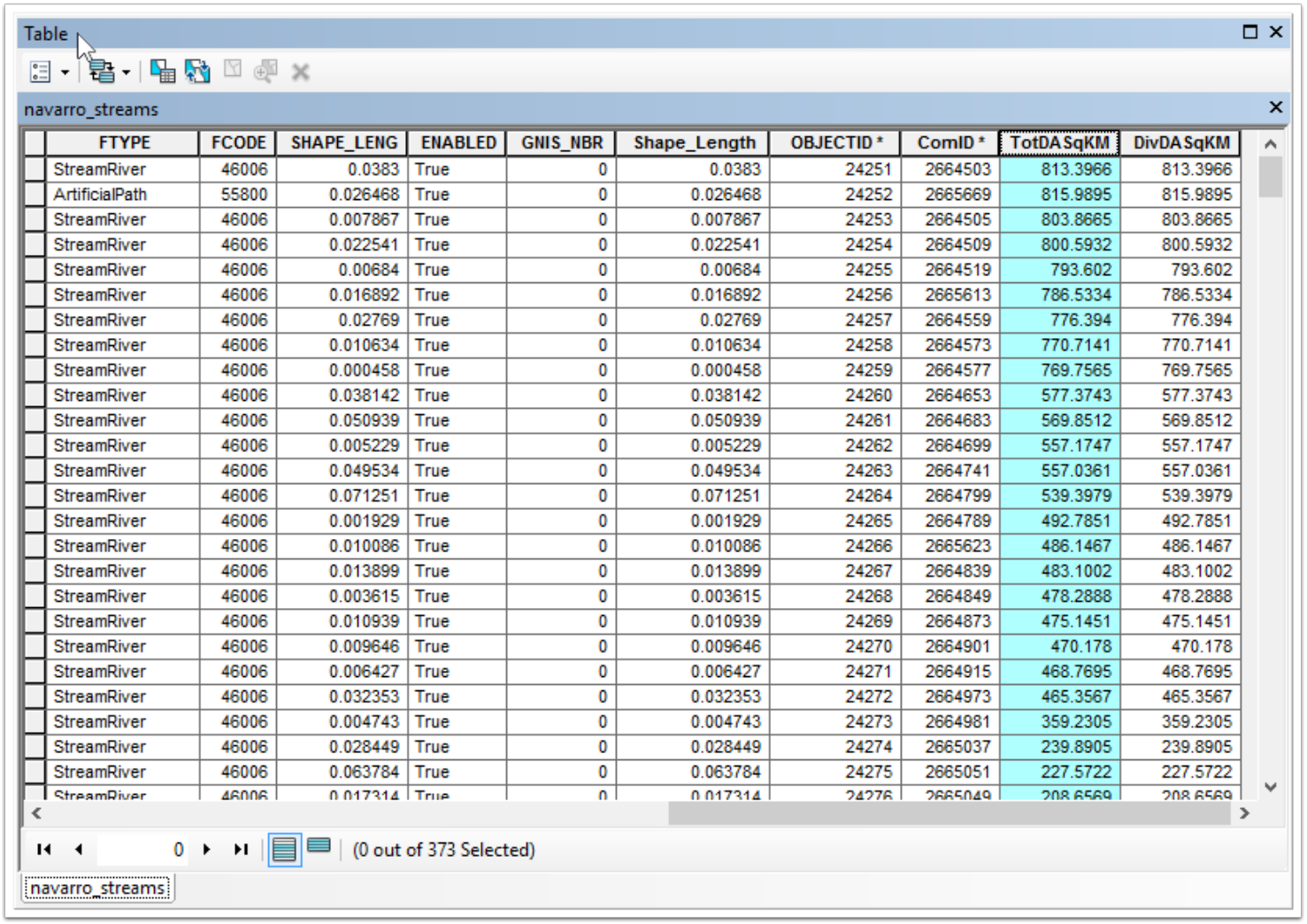
3. Item 3 will populate with available fields with the same datatype in the *join table (*item #2). Which field do you think we should use after looking through the list? Since it should have the same values as our original table, we'll use ComID.
4. Have it *Keep all records* in the *Join Options* section. We want all of our rivers to still be available even when there is no attribute information to attach from our join table.
5. Click *Validate Join* to confirm that we matched our tables correctly. It warns that three records don't have a match - this is OK - if no records had matches, we'd need to check if we selected the right tables and fields. Close the validation box.
6. Click *OK* to finish the join.



3.2 The new attribute table

Open the attribute table for *navarro_streams* again. Scroll over to the right side of the table and you'll see the joined attributes appended to the end. The field *TotDASqKM* has the total drainage area in square kilometers for each segment. Try selecting some individual records and looking at the corresponding feature in the map window - do these values make sense in their geographic distributions?

Now that we have these values joined, they stay joined within this map document (but not anywhere else). If we want a new feature class with these attributes permanently appended, we'd have to export the feature class now. We won't do this right now, but it is a common need.

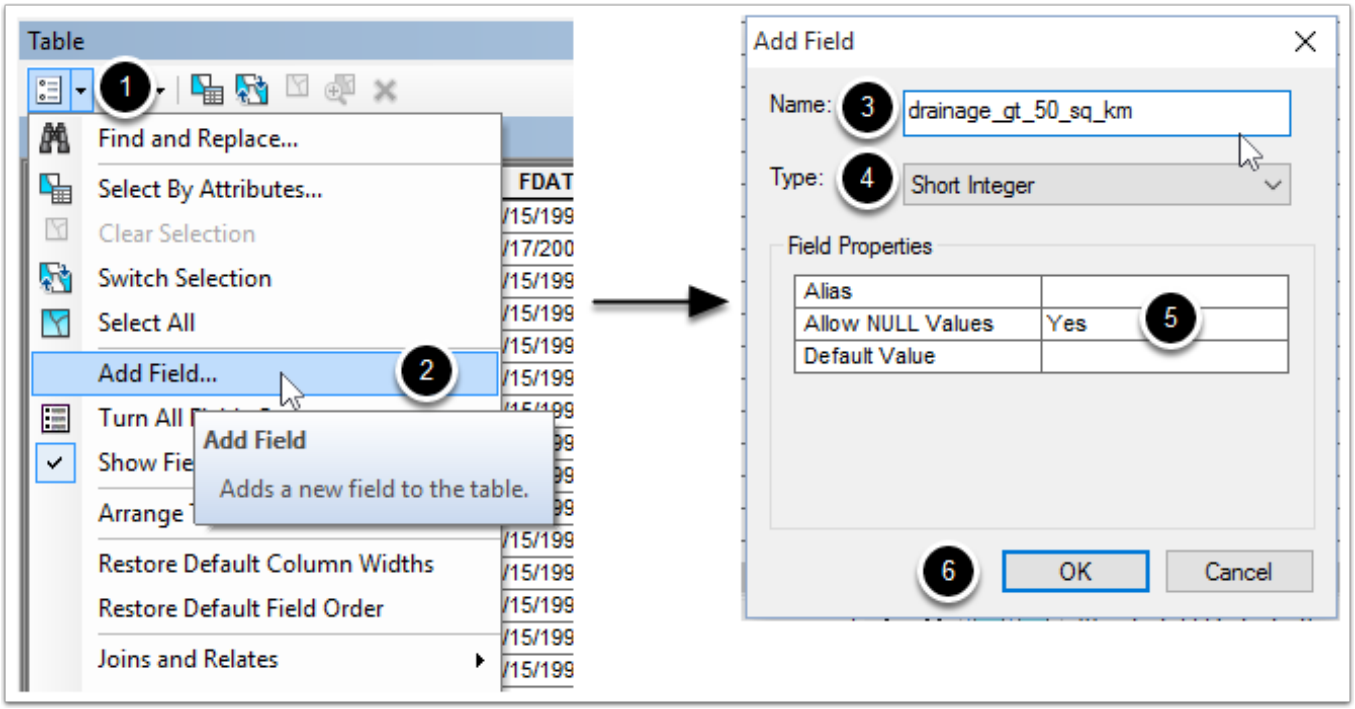


FTYPE	FCODE	SHAPE_LENG	ENABLED	GNIS_NBR	Shape_Length	OBJECTID *	ComID *	TotDASqKM	DivDASqKM
StreamRiver	46006	0.0383	True	0	0.0383	24251	2664503	813.3966	813.3966
ArtificialPath	55800	0.026468	True	0	0.026468	24252	2665669	815.9895	815.9895
StreamRiver	46006	0.007867	True	0	0.007867	24253	2664505	803.8665	803.8665
StreamRiver	46006	0.022541	True	0	0.022541	24254	2664509	800.5932	800.5932
StreamRiver	46006	0.00684	True	0	0.00684	24255	2664519	793.602	793.602
StreamRiver	46006	0.016892	True	0	0.016892	24256	2665613	786.5334	786.5334
StreamRiver	46006	0.02769	True	0	0.02769	24257	2664559	776.394	776.394
StreamRiver	46006	0.010634	True	0	0.010634	24258	2664573	770.7141	770.7141
StreamRiver	46006	0.000458	True	0	0.000458	24259	2664577	769.7565	769.7565
StreamRiver	46006	0.038142	True	0	0.038142	24260	2664653	577.3743	577.3743
StreamRiver	46006	0.050939	True	0	0.050939	24261	2664683	569.8512	569.8512
StreamRiver	46006	0.005229	True	0	0.005229	24262	2664699	557.1747	557.1747
StreamRiver	46006	0.049534	True	0	0.049534	24263	2664741	557.0361	557.0361
StreamRiver	46006	0.071251	True	0	0.071251	24264	2664799	539.3979	539.3979
StreamRiver	46006	0.001929	True	0	0.001929	24265	2664789	492.7851	492.7851
StreamRiver	46006	0.010086	True	0	0.010086	24266	2665623	486.1467	486.1467
StreamRiver	46006	0.013899	True	0	0.013899	24267	2664839	483.1002	483.1002
StreamRiver	46006	0.003615	True	0	0.003615	24268	2664849	478.2888	478.2888
StreamRiver	46006	0.010939	True	0	0.010939	24269	2664873	475.1451	475.1451
StreamRiver	46006	0.009646	True	0	0.009646	24270	2664901	470.178	470.178
StreamRiver	46006	0.006427	True	0	0.006427	24271	2664915	468.7695	468.7695
StreamRiver	46006	0.032353	True	0	0.032353	24272	2664973	465.3567	465.3567
StreamRiver	46006	0.004743	True	0	0.004743	24273	2664981	359.2305	359.2305
StreamRiver	46006	0.028449	True	0	0.028449	24274	2665037	239.8905	239.8905
StreamRiver	46006	0.063784	True	0	0.063784	24275	2665051	227.5722	227.5722
StreamRiver	46006	0.017314	True	0	0.017314	24276	2665049	208.6569	208.6569

3.3 Adding a field

Now, we want to add a field to our data table to subset the streams by drainage area. We want to know which streams have a drainage area of more than 50 square kilometers. From the attribute table,

1. Open the menu
2. Click *Add Field*
3. In the box that pops up, give the new field the name *drainage_gt_50_sq_km.* We're going to give this field a value of 1 for streams with a drainage area of over 50 square kilometers, and 0 for all of the rest.
4. Give it a Type of *Short Integer* since we're going to just have values of 1 and 0.
5. Set *Allow NULL Values* to *Yes.* All of the values will initially be NULL.
6. Click *OK* to add the field

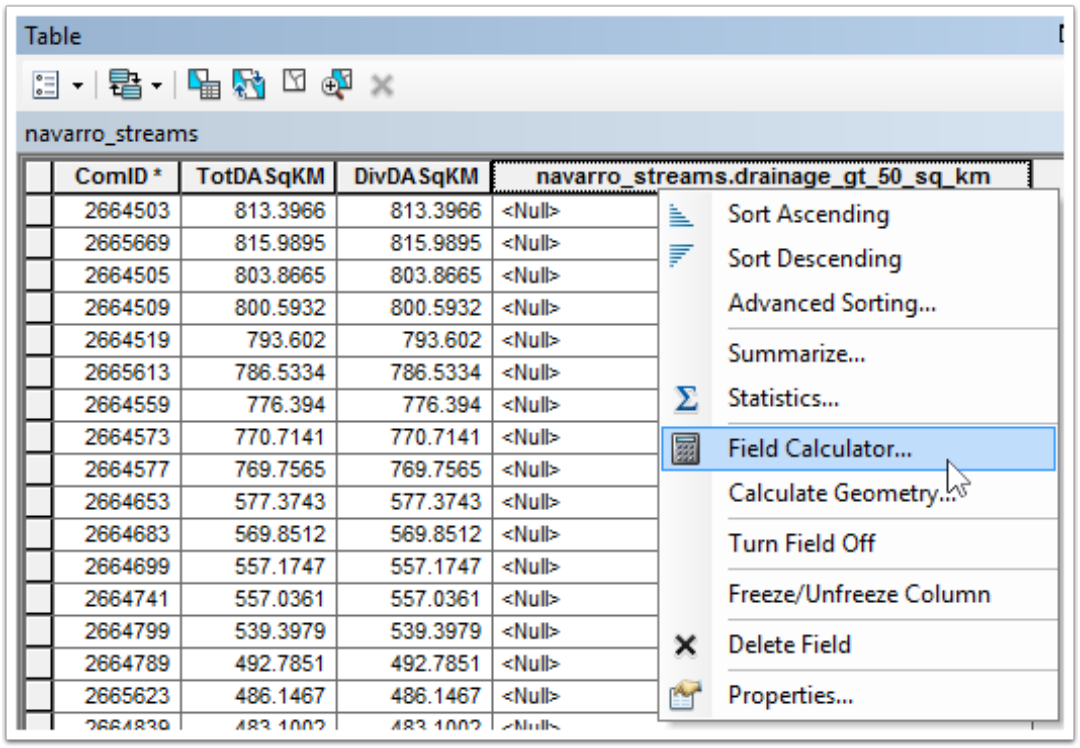


3.4 Giving the field a value

Now, we want to use the *Field Calculator.* This tool helps us attach values to fields programmatically. It can do anything from basic to complicated value assignment of attributes - we'll do a very simple calculation now.

1. Right click on the header of the new field we just added

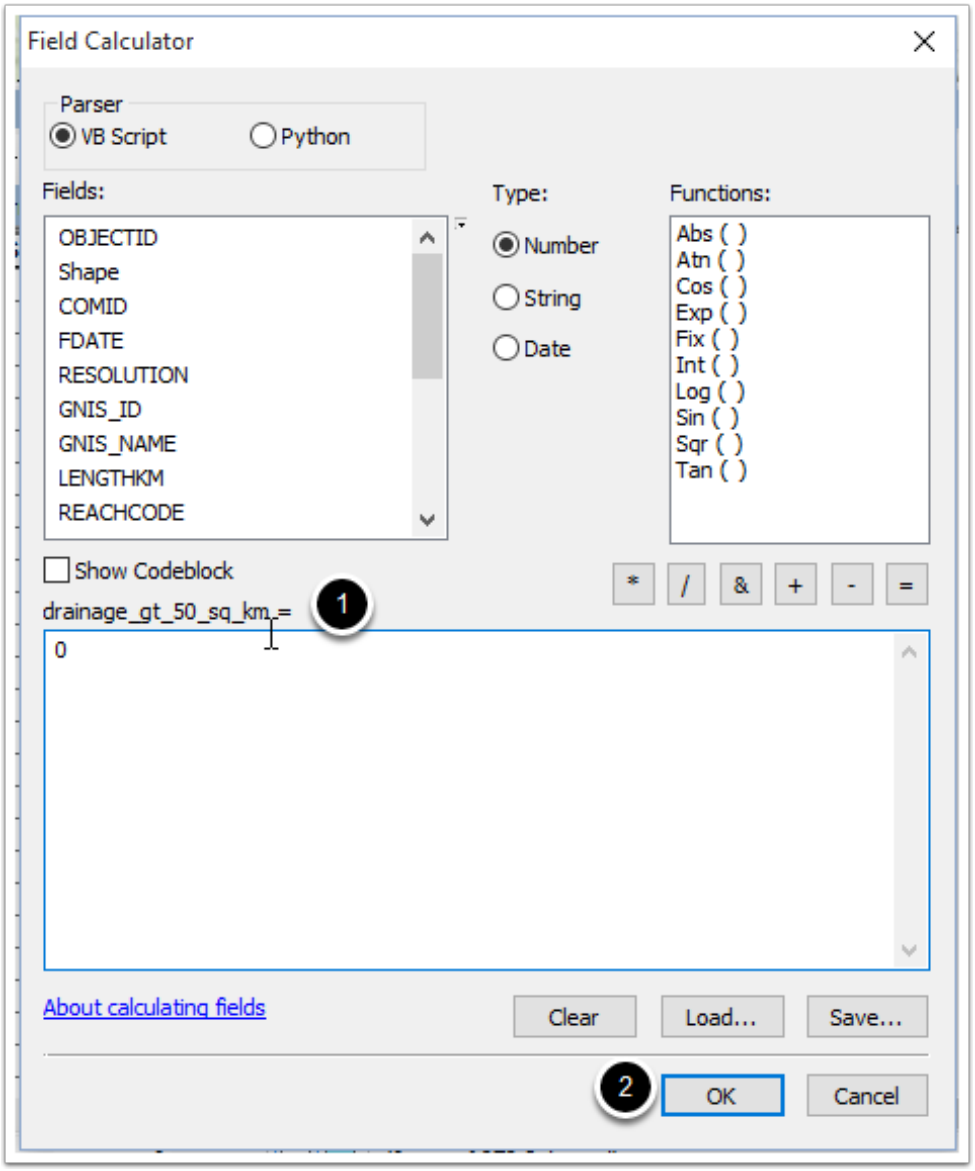
2. Select *Field Calculator.* A warning box about running this outside of an edit session will pop up - read through it, but we'll proceed anyway.



3.5 Field calculator

The Field Calculator gives us plenty of power to add fields. It might look somewhat similar to *Select By Attributes*. In this case, we're just going to assign all of our records a value of 0 - meaning that they don't have a large drainage area, regardless of size - we'll then overwrite the value for the areas larger than 50 square kilometers in a few steps.

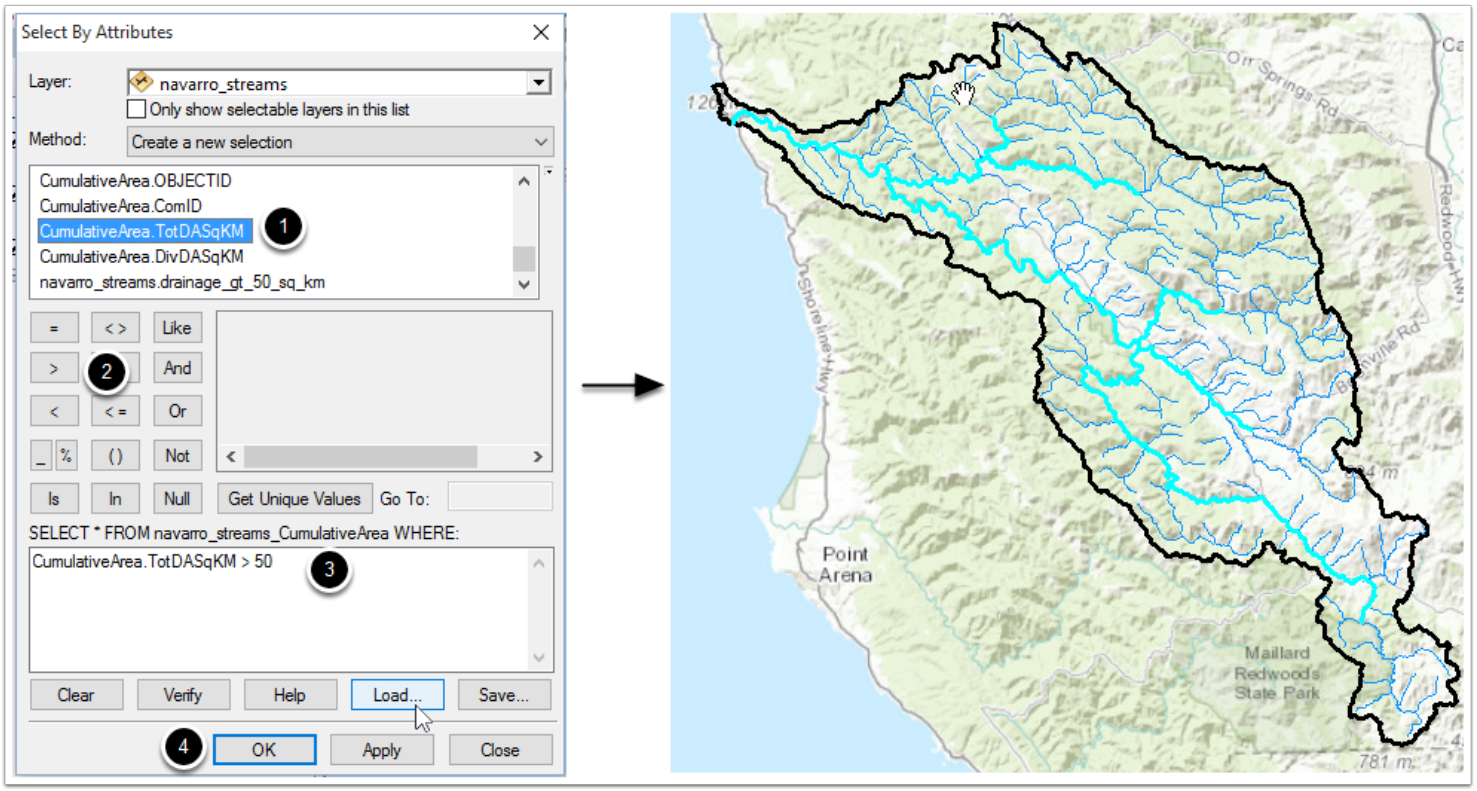
1. In the bottom box, right below where it says "*drainage_gt_50_sq_km =*" just type a zero.
2. Then click OK.



3.6 Select by Attributes again

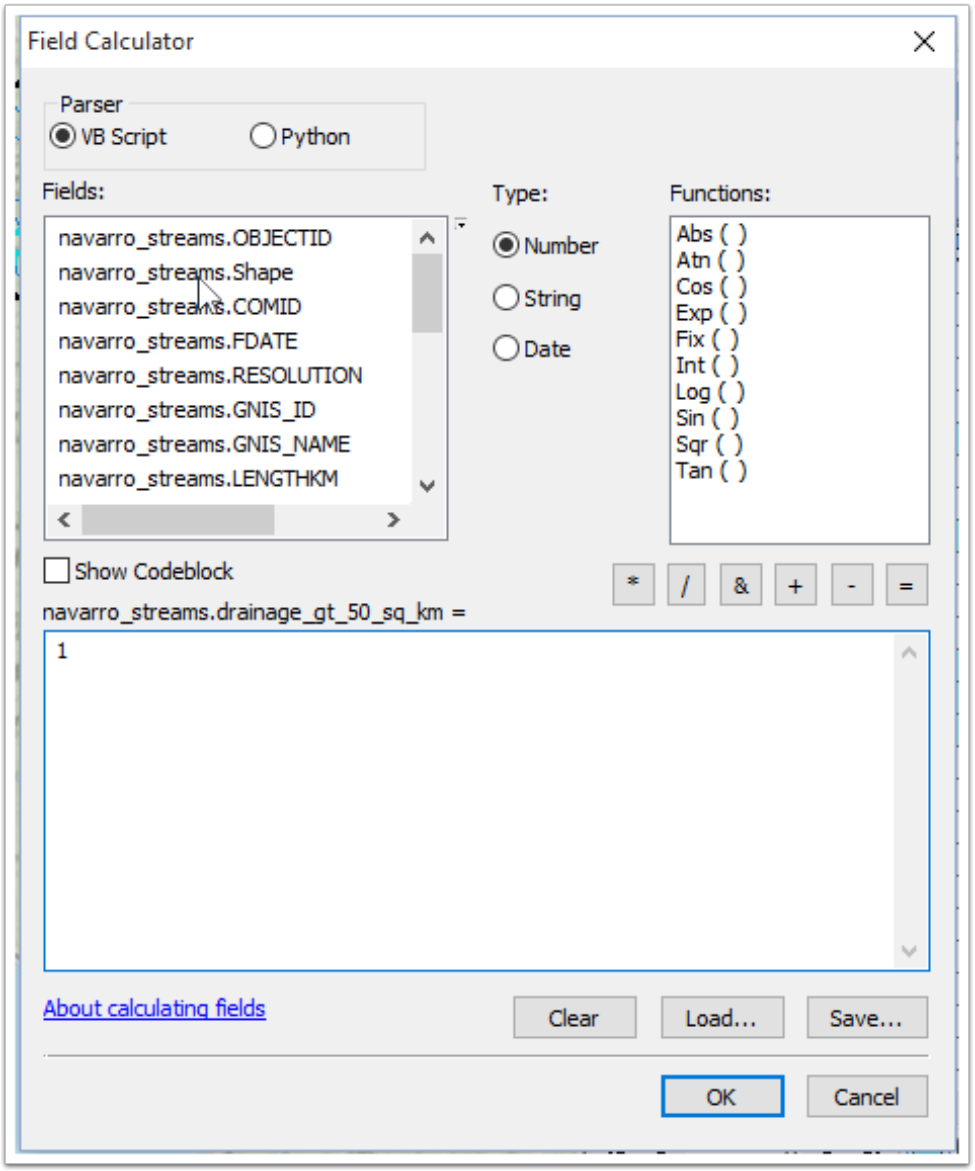
Now, select by attributes all of the streams with values in the *TotDASqKM* field greater than 50. Use the same process you used previously for select by attributes, but this time you'll need to manually type in the value. When the dialog is open:

1. Find *CumulativeArea.TotDASqKM* in the box of fields and double click on it to add it to the query
2. Click on the > sign in the *operators* selection area.
3. Type *50* at the end of the query in the bottom box. Does this query look right?
4. Click *OK* to run your selection



3.7 Field Calculator Again

Now, with the selection active, run the field calculator on the same field as before (our new field). This time place *1* in the bottom box instead of zero so the values get assigned to 1. Run the field calculation.

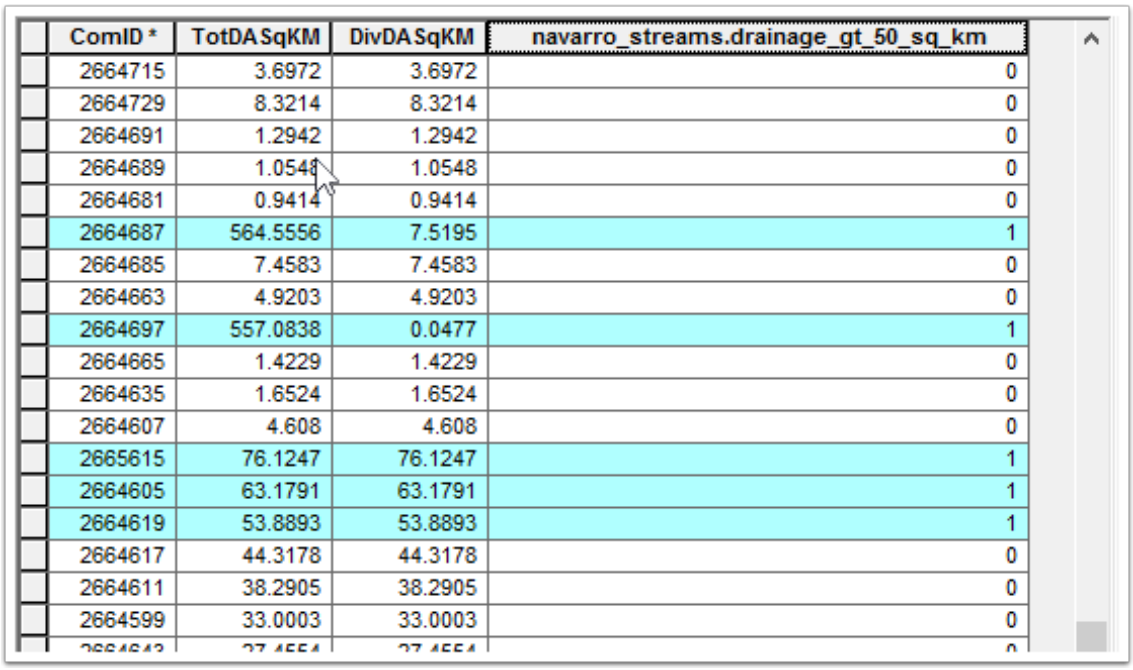


3.8 Inspect our results

What happened here? If we take a look through the results, most of them are still zero, but all of the selected records have a value of 1 now. This is what we wanted, but what do you think happened inside ArcGIS to make this work?

Remember from before that most tools in ArcGIS only operate on the selected set. This includes the Field Calculator. In this case, what we did to use that was set a default value of zero for all of the records, then gave just the records that met our criteria the value of 1.

As a bonus, can you figure out how to do that same operation without involving Select By Attributes? Hint: It's all within Field Calculator after you add the field, but it involves using Python or VBScript.

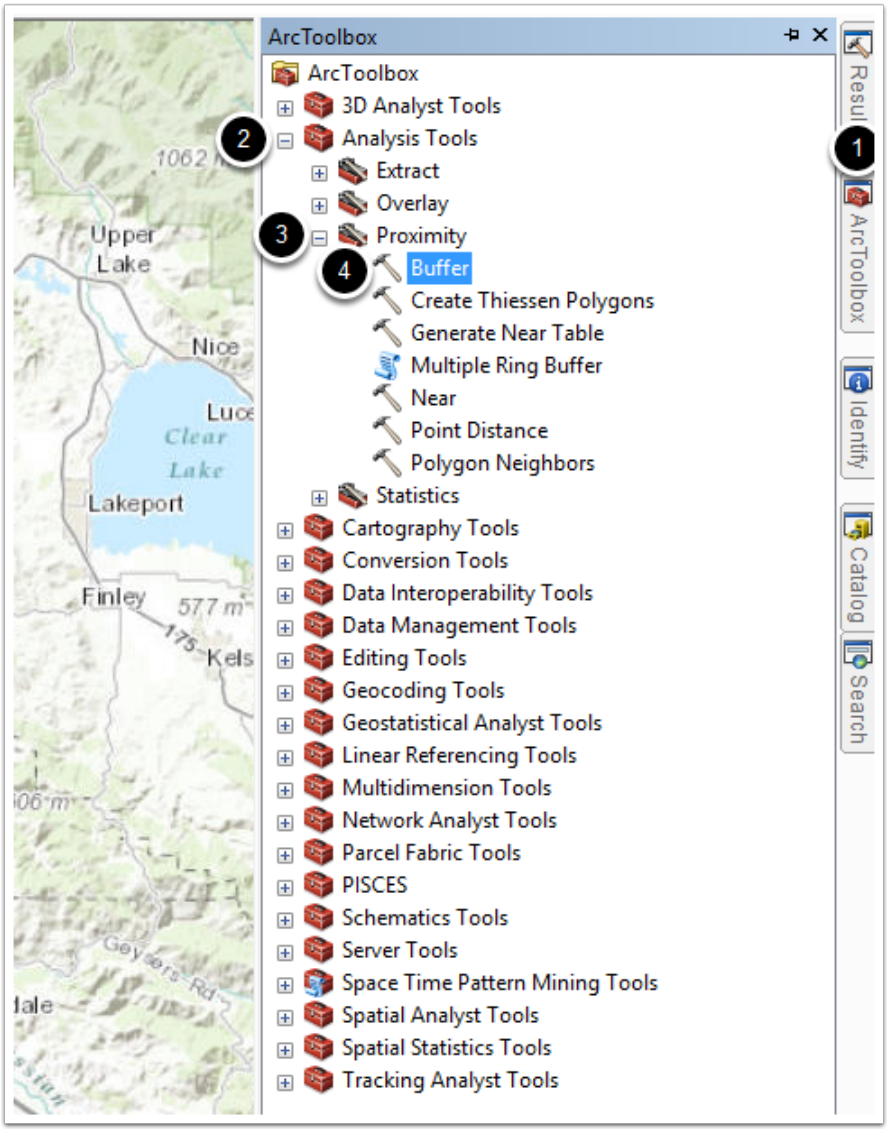


ComID *	TotDASqKM	DivDASqKM	navarro_streams.drainage_gt_50_sq_km
2664715	3.6972	3.6972	0
2664729	8.3214	8.3214	0
2664691	1.2942	1.2942	0
2664689	1.0548	1.0548	0
2664681	0.9414	0.9414	0
2664687	564.5556	7.5195	1
2664685	7.4583	7.4583	0
2664663	4.9203	4.9203	0
2664697	557.0838	0.0477	1
2664665	1.4229	1.4229	0
2664635	1.6524	1.6524	0
2664607	4.608	4.608	0
2665615	76.1247	76.1247	1
2664605	63.1791	63.1791	1
2664619	53.8893	53.8893	1
2664617	44.3178	44.3178	0
2664611	38.2905	38.2905	0
2664599	33.0003	33.0003	0

4. Geoprocessing

Leave your selection active now. We're going to get a new set of features representing the area within 100 meters of the river. We want to find out what soils are near the portions of the watershed with large flows. To accomplish this, we'll need to do some *geoprocessing* which happens from a new set of tools that you haven't directly used yet.

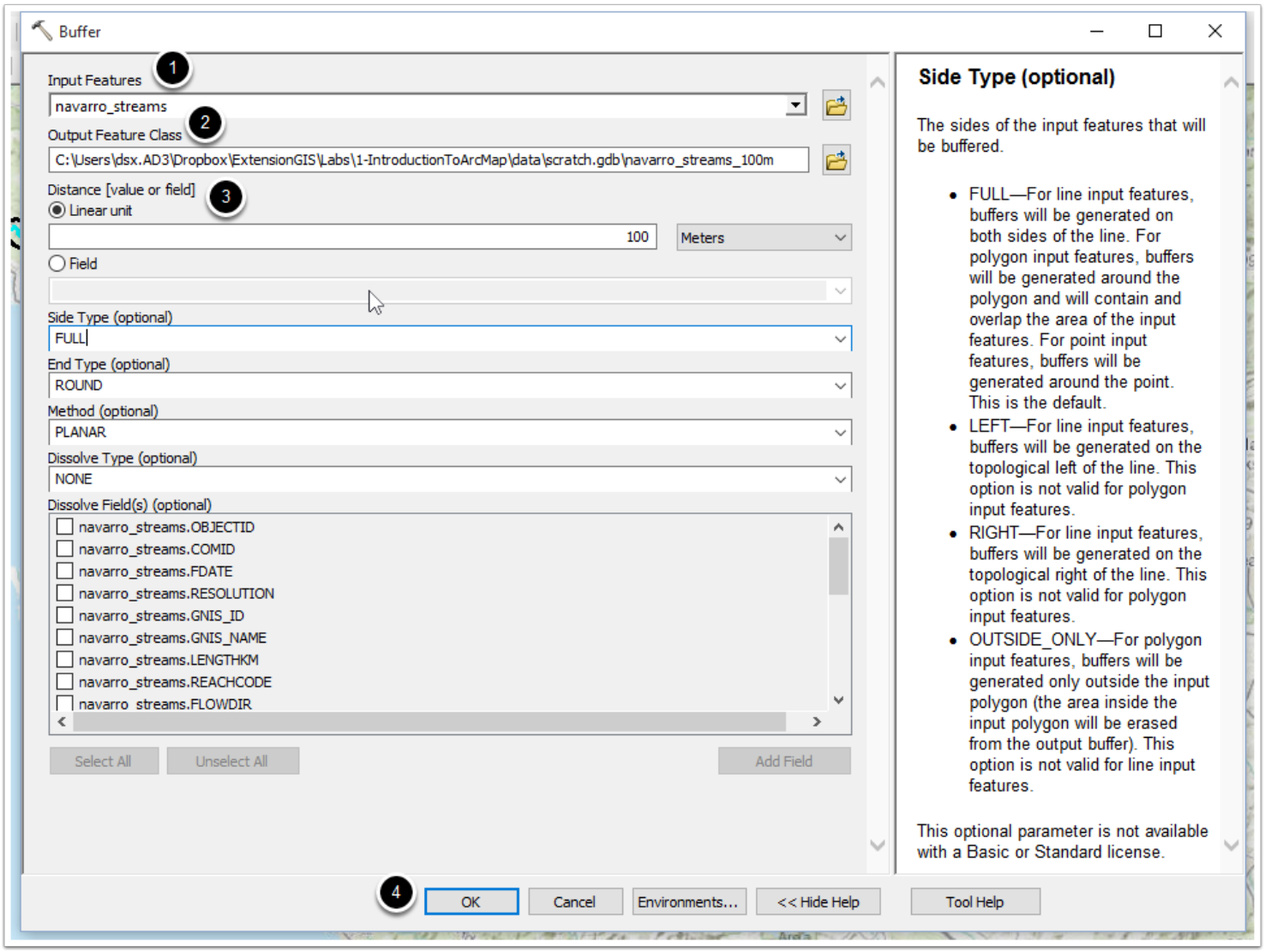
1. Click the *ArcToolbox* tab to have the ArcToolbox pane fly out.
2. Expand the tree under *Analysis Tools*
3. And then again under *Proximity*
4. Then double click *Buffer* to open the Buffer Tool.



4.1 The Buffer tool

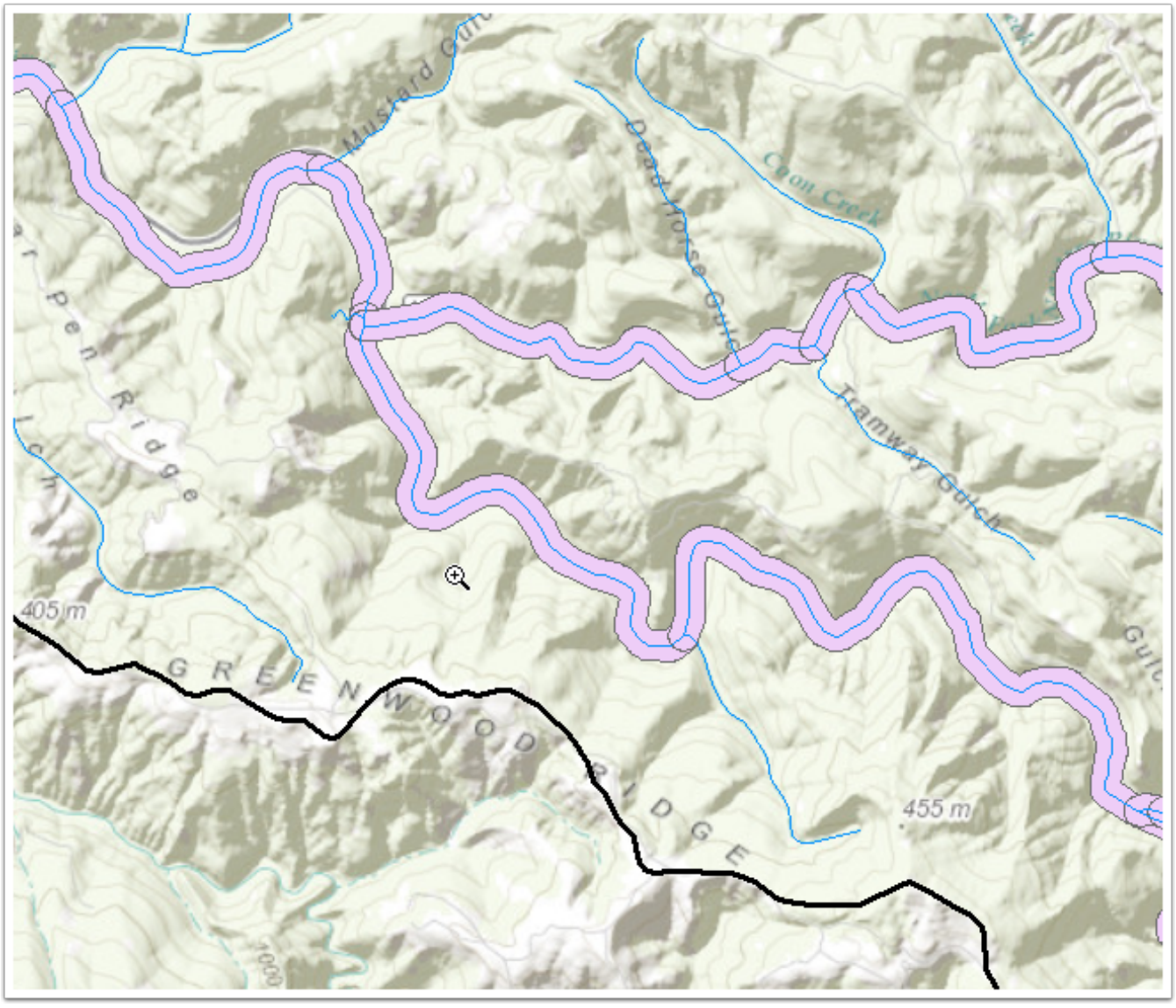
This a *geoprocessing tool* called *Buffer.* Most geoprocessing tools will have a similar format, with a set of parameters for input, based on the tool. If you click the *Show Help* button at the bottom, you'll get the contextual help flyout on the right, which shows you help for the item you're currently entering, or for the tool at large. The Buffer tool takes features we already have and gives us new features with a specified distance added around them. In this case, we'll use it to create polygons representing 100m to the side of each stream. (bonus - what makes this problematic in a GIS setting?)

1. Select *navarro_streams* from the *Input Features* dropdown - we're going to create the buffers around that
2. ArcGIS will create a default output feature class in our default geodatabase. Leave the location the same (in your scratch geodatabase), but rename the output feature class to *navarro_streams_100m.*
3. Set *Linear unit* to 100 meters.
4. Click OK to run the geoprocessing tool. It will run in the background with a slider at the bottom of your main ArcMap window, then it will put the results into your table of contents. Feel free to change the symbology and layer order as you see fit.


Buffer
Input Features
1
navarro_streams
Output Feature Class
2
C:\Users\dsx.AD3\Dropbox\ExtensionGIS\Labs\1-IntroductionToArcMap\data\scratch.gdb\navarro_streams_100m
Distance [value or field]
3
Linear unit
100
Meters
Field
Side Type (optional)
FULL
End Type (optional)
ROUND
Method (optional)
PLANAR
Dissolve Type (optional)
NONE
Dissolve Field(s) (optional)
navarro_streams.OBJECTID
navarro_streams.COMID
navarro_streams.FDATE
navarro_streams.RESOLUTION
navarro_streams.GNIS_ID
navarro_streams.GNIS_NAME
navarro_streams.LENGTHKM
navarro_streams.REACHCODE
navarro_streams.FLOWDIR
Select All
Unselect All
Add Field
Side Type (optional)
The sides of the input features that will be buffered.
FULL—For line input features, buffers will be generated on both sides of the line. For polygon input features, buffers will be generated around the polygon and will contain and overlap the area of the input features. For point input features, buffers will be generated around the point. This is the default.
LEFT—For line input features, buffers will be generated on the topological left of the line. This option is not valid for polygon input features.
RIGHT—For line input features, buffers will be generated on the topological right of the line. This option is not valid for polygon input features.
OUTSIDE_ONLY—For polygon input features, buffers will be generated only outside the input polygon (the area inside the input polygon will be erased from the output buffer). This option is not valid for line input features.
This optional parameter is not available with a Basic or Standard license.
4
OK
Cancel
Environments...
<< Hide Help
Tool Help

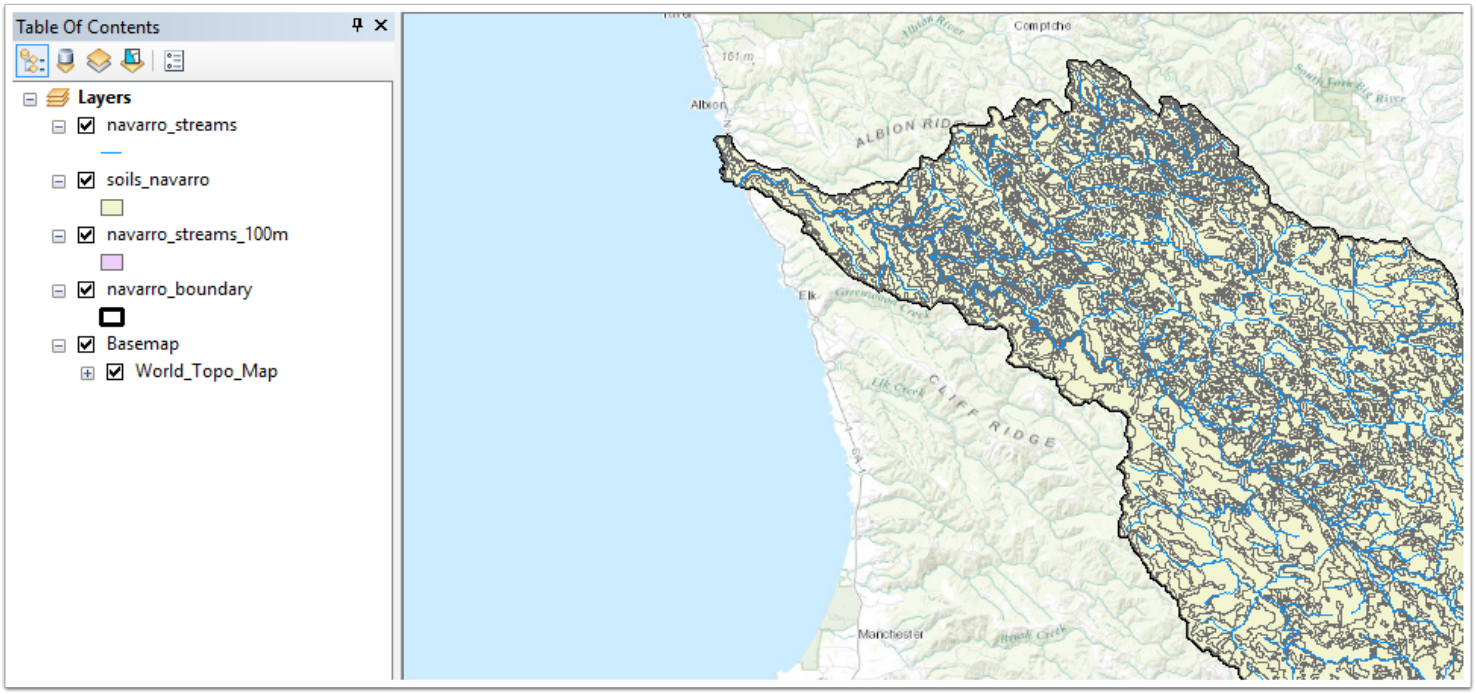
4.2 Explore

Zoom in and explore the new data you've just created. Why are there rounded spots in the middle of the polygons?



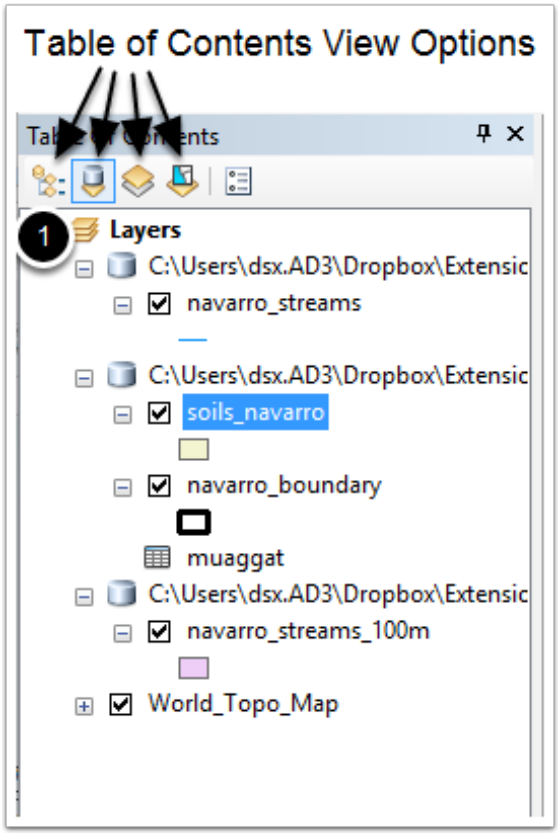
4.3 More geoprocessing

We're going to analyze the soils drainage of that stream corridor we just created. Add in a new data layer named *soils_navarro* from your source geodatabase. What could be done better in the naming of this feature class?



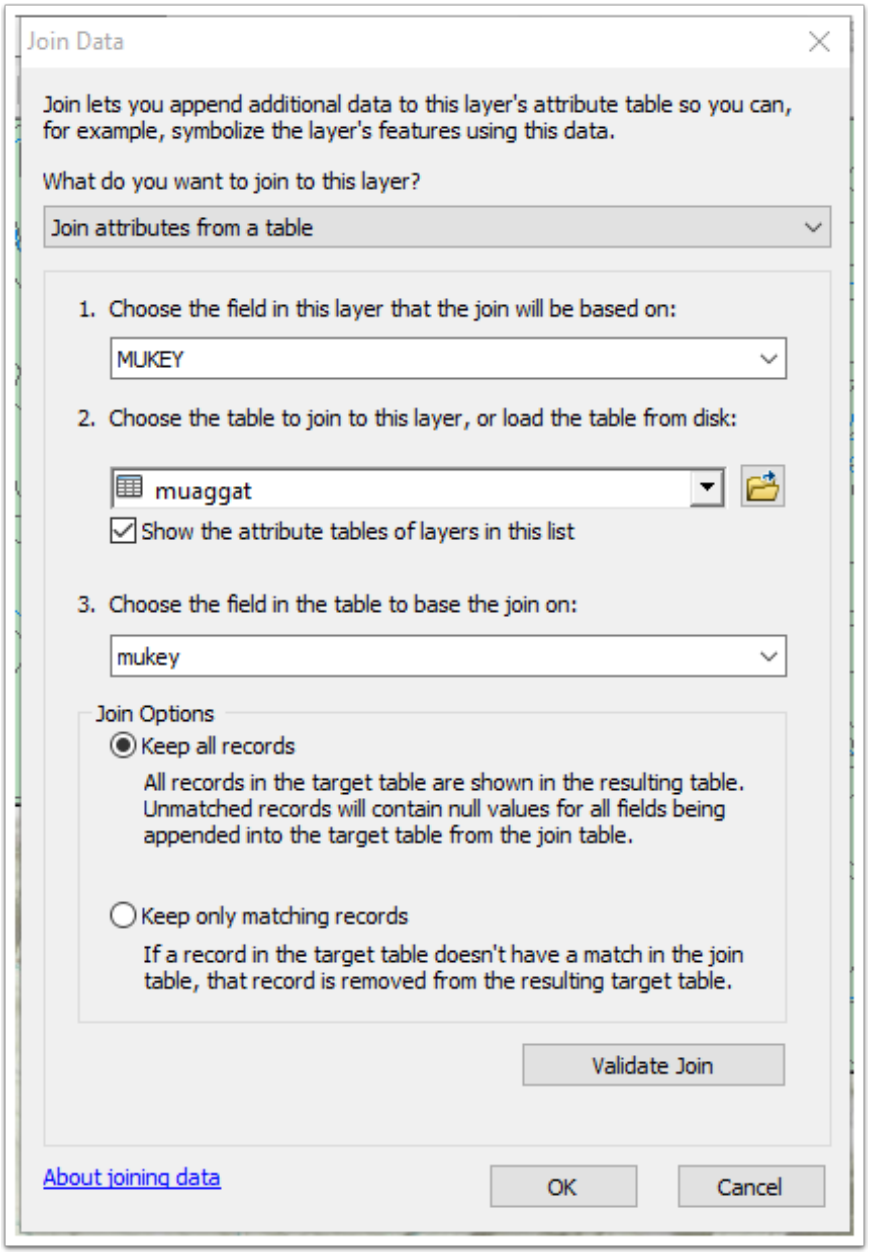
4.4 Add in another data table

Now we're going to add in a data table to associate with the soils layer. Use the add data button, but this time add the table named *muaggat* from the source geodatabase. Notice what happens to your table of contents when you add that data table. It's now split up by data source. This happens whenever you add a table - why might this be? The normal table of contents displays layers in their *drawing order* on the map. Since tables aren't drawn, they can't be shown in that view, and ArcGIS switches us to the next view, which can accommodate tables. For now, we can switch back to the normal view. Do so by clicking the first button to the left in the Table of Contents view options area and you'll be taken back to your familiar view (1).



4.5 Add a join

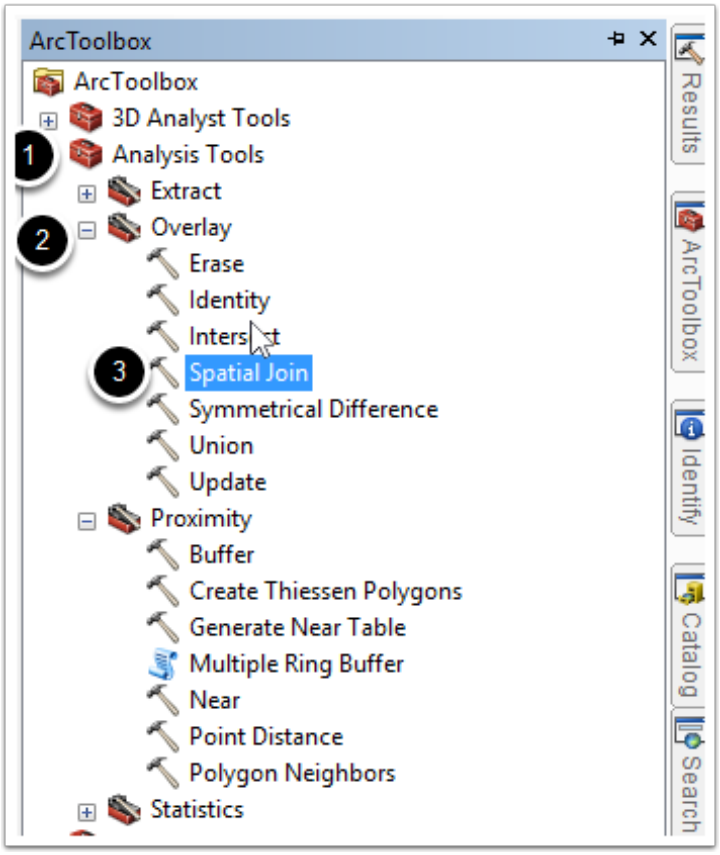
Now, we want to join our soils layer with the muaggat table we just added. Create a join for the features to the table based on the common field *mukey* (map unit key).



4.6 Spatial Join!

Now we want to attach soils information to our buffered streams. To do this, we'll use the *Spatial Join* tool - it operates on the same basis as *Select By Location* where it determines a spatial relationship between sets of features, but it then attaches attributes from one set of features to another. Also, notice the word *join* in the name - it is the same concept as the table joins we've been doing, but instead of using a common table field to attach attributes, it uses a common location.

1. Expand *Analysis Tools* in ArcToolbox
2. Expand the *Overlay* toolset
3. Double click on *Spatial Join* to run it.

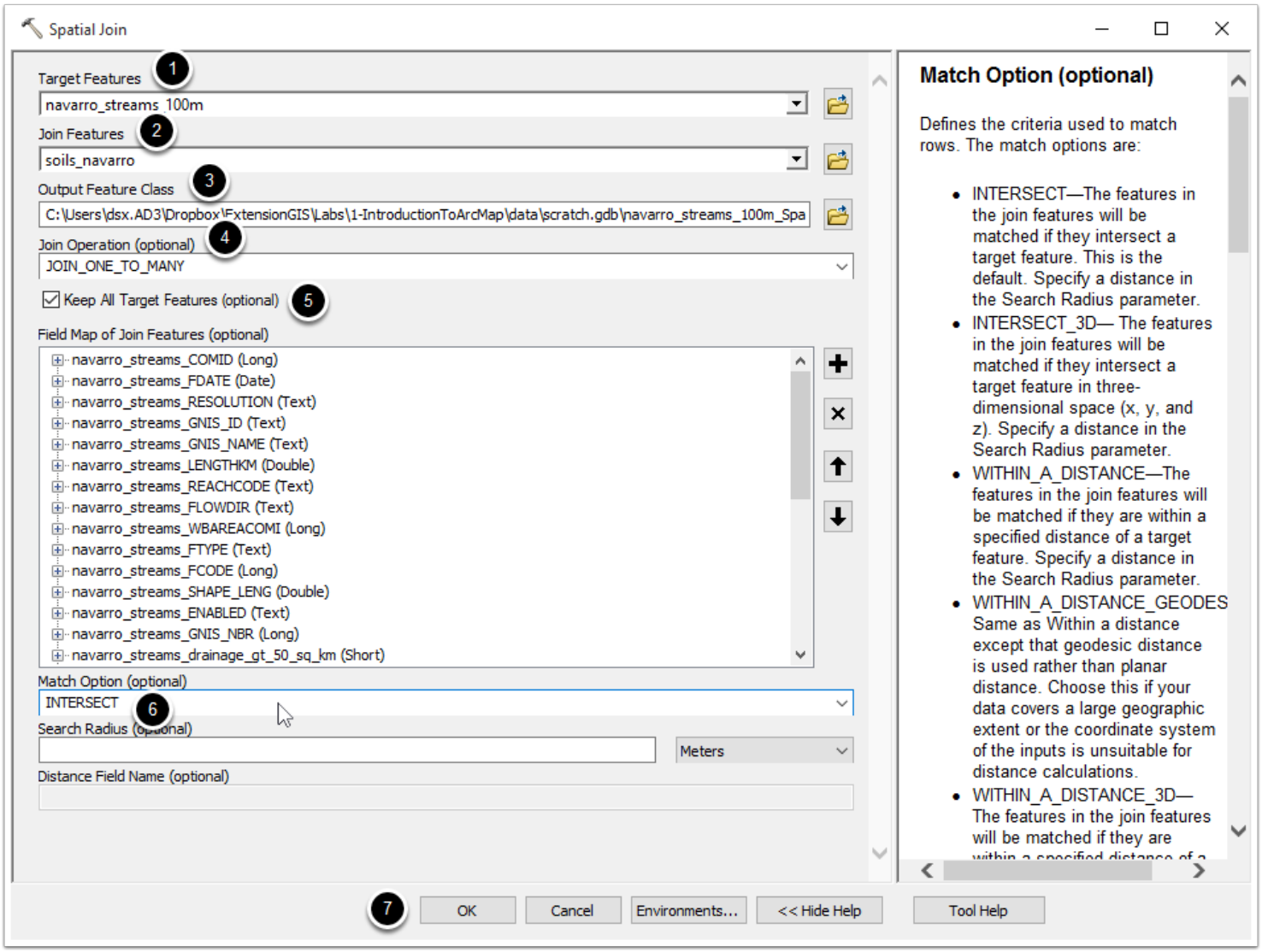


4.7 The best tool in the toolbox

Spatial Join has some slightly confusing terminology for newcomers, but it will make sense when you get used to it. We first need to understand which features are our target features and which are our join features. If you remember from table joins, the *join features* get attached to the *target features* - so that we keep the structure of the target features table and append the join features table to the end. It works

the same here, but with an even more important distinction that the actual spatial information that is retained is that of the target features. The end result is a layer that looks like the target features, but has attributes of both for a given location.

1. Select navarro_streams_100m for the *Target Features* - we want to attach features to this layer and keep the stream segment representations.
2. Select *soils_navarro* as the *Join Features.*
3. Use the default name for the *Output Feature Class*
4. Select *JOIN_ONE_TO_MANY* as the *Join Operation*. This option will keep duplicate records in the stream buffer layer whenever multiple soils polygons intersect it - this will let us see the complete set of soils features in the buffer zone.
5. Make sure *Keep all Target Features* is checked so that even features without a match are retained.
6. Make sure that *Intersect* is the *Match Option* - this setting is similar to the same setting in *Select By Location.*
7. Click *OK* to run the tool.



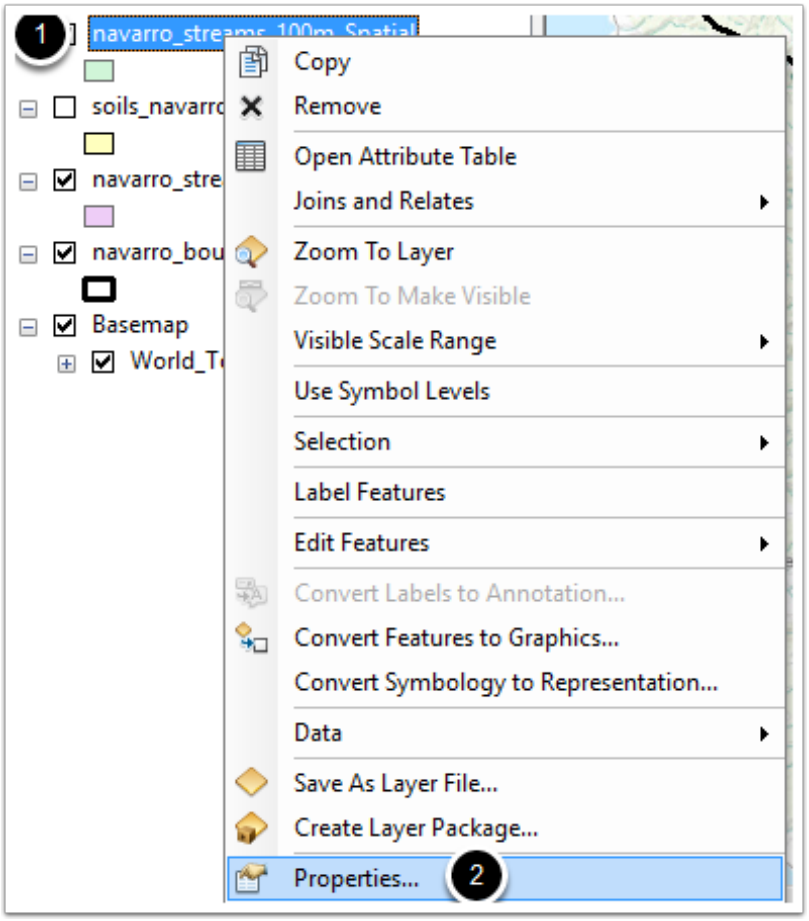
5. Joined attributes

We'll get a new layer back in the Table of Contents with the attribute information from:

- Our buffered streams,
- The soils feature data
- the data that was joined to the soils features at the time we ran the spatial join

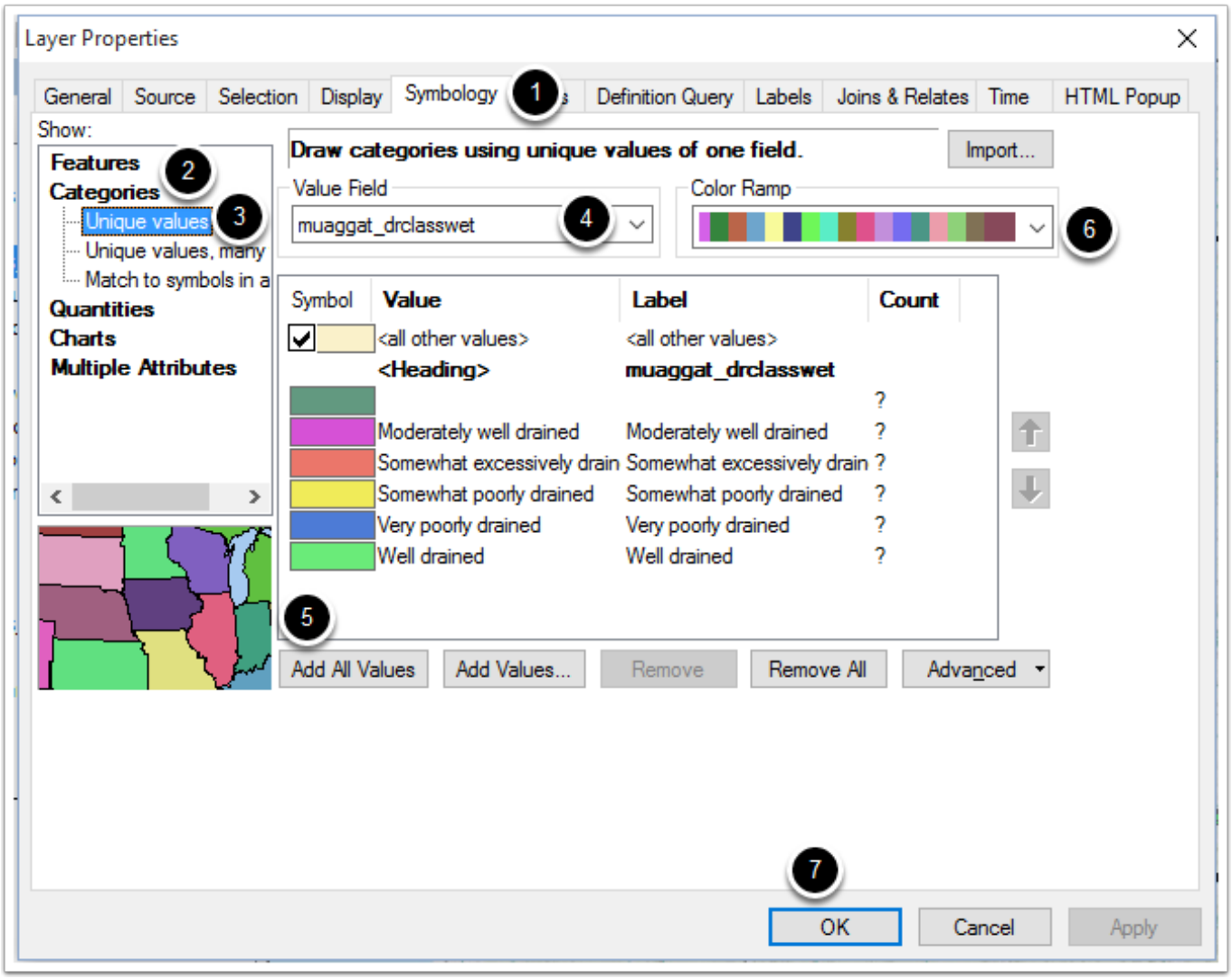
Let's now symbolize that data based on the newly attached drainage class information:

1. Right click on *navarro_streams_100m_Spatial*
2. Click *Properties* to bring up the layer properties dialog



5.1 Symbology!

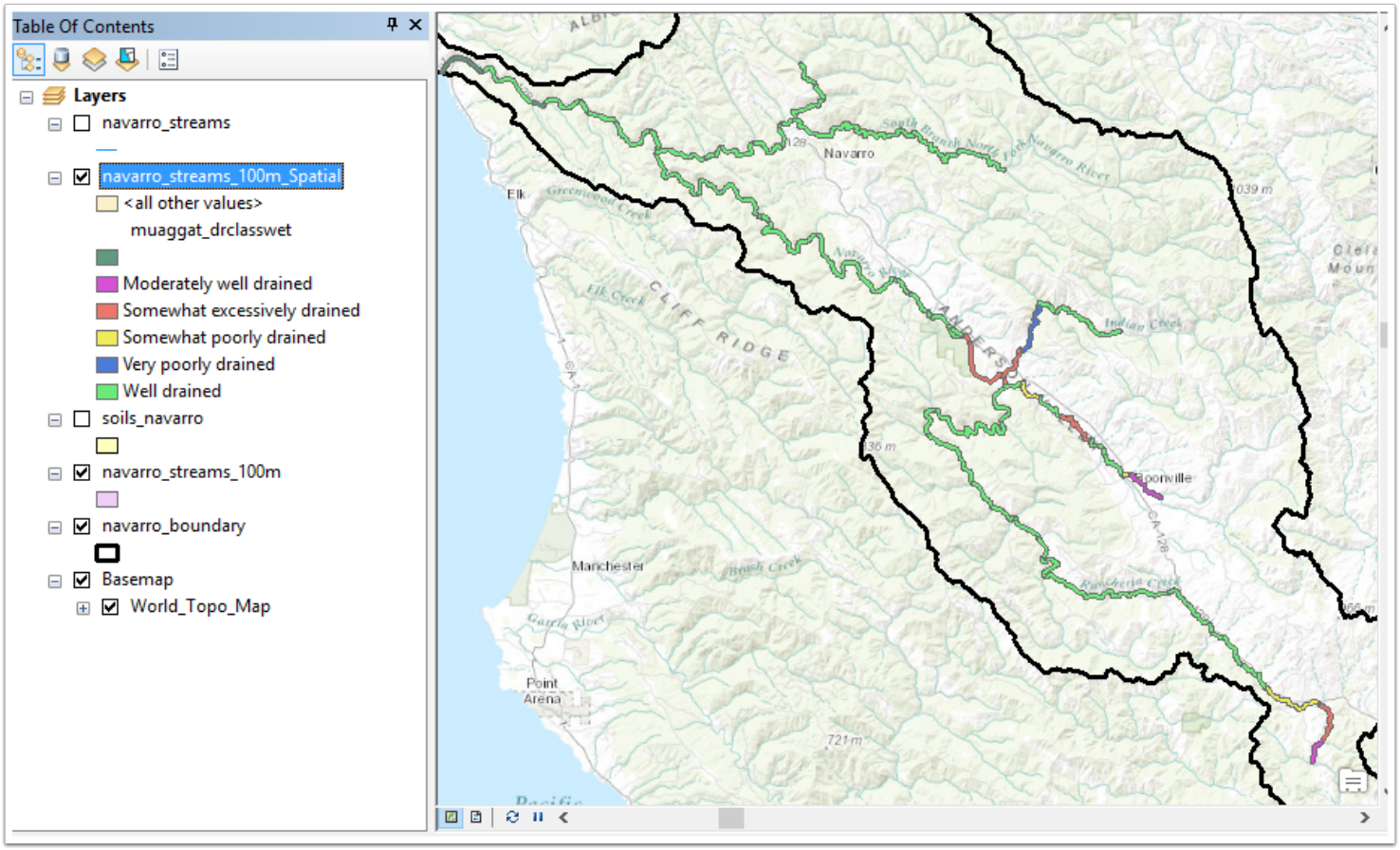
1. Switch to the symbology tab. Until now, we've just used some prebuilt symbology options, but here is where you can dig in and make custom map displays based on attributes.
2. To start with, we want to switch it to *Categories* - we have a set of categories we want to use as the basis for our symbols, so we'll start there
3. Then select *Unique values*. We have a set of values and we'll choose symbols for each
4. Now, we need to select the field that contains those values. Select *muaggat_drclasswet* - the drainage class field - from the *Value Field* dropdown.
5. Click the *Add All Values* button to add the unique values from the field to the symbol set.
6. You can change the colors used for each one either manually or by selecting a new color ramp. Feel free to do either one. To change it manually, click on each color patch and select a new color.
7. Click OK to save your changes and see the results.



5.2 Visualizing the data

Turn off the navarro_streams layer and zoom to the extent of *navarro_streams_100m_Spatial.* Zoom around the map and inspect the results and the attribute tables. Normally, we'd continue our analysis from here now that we have the drainage class infromation, but that's the end of the analysis for this lab. Instead, we'll now begin making a map with this data.

First, if you haven't already, change the symbol colors to be more appropriate for drainage class (maybe light to dark blue depending on drainage - something that has a continuous feel).

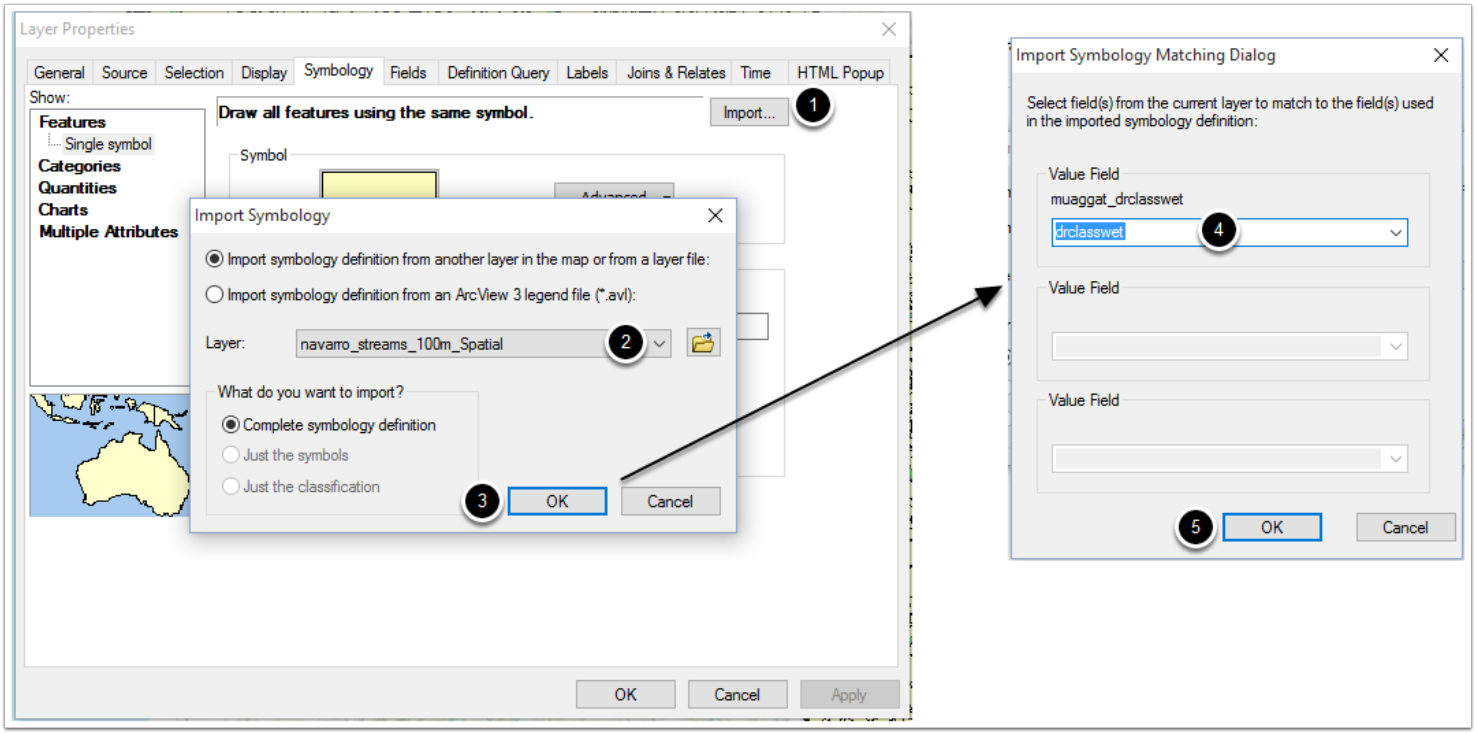


5.3 Importing Symbology

Now, for our map, we want to draw the drainage class for all of the soils - not just the soils near the rivers. Let's copy our symbology over from our stream buffered soils layer. Open the *symbology tab* in the *layer properties* dialog for the *soils_navarro* layer.

1. Click the *Import* button in the top right of the palette.

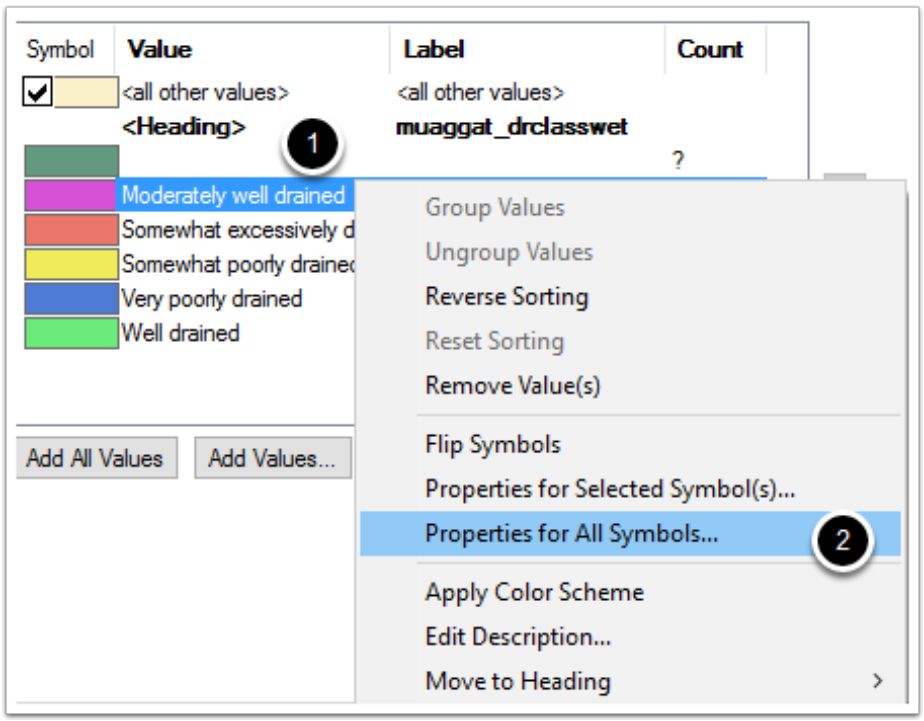
2. Select our stream buffered soils layer, *navarro_streams_100m_Spatial,* from the *Layer* dropdown. This is the layer to import the symbology from
3. Click OK to import the symbol definition.
4. It will ask you to tell it what field matches muaggat_drclasswet - find the one you think is appropriate from the dropdown menu (or see screenshot).
5. Click OK



5.4 Changing all the symbols at once

Often, having outlines on soils layers can be a distraction when viewing a large area, so let's remove the outlines. Before we do this, feel free to click apply in the symbology palette to see how it looks beforehand.

1. Right click on any symbol listing.
2. Select *Properties for All Symbols.*

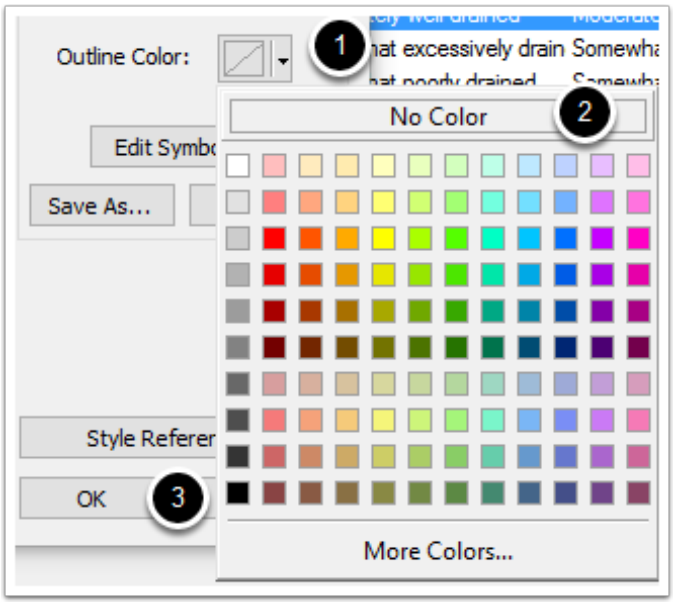


5.5

A familiar picker will come up.

1. Click the arrow next to *Outline Color*
2. Then select *No Color* to remove the outline from the patches
3. Click OK to save these symbols,

Then, click OK to save the symbology and close the Layer Properties dialog (not shown).



5.6 Making a map from here

That's it for this lab. In this lab, you learned how to work with data frames, basic projections, attribute records, symbology, and basic geoprocessing. In the next lab, you'll use this same map document again to make a fully laid out, ready to publish version of the map (like below).