

EXERCISE 1

Advanced Editing Tools



Introduction

ArcGIS provides many different tools that perform specific editing functions. There are many different specialized Toolbars provided by ArcMap and some have duplicate tools. We will cover all the tools on the Advanced Editing Toolbar, the Edit Vertices Toolbar, and the Feature Construction Toolbar. We will focus on tools that would be most useful for Forest Service employees and offer the rest as optional sections at the end of the lesson.

Objectives

- Learn to use the specified tools available within ArcMap to more efficiently and accurately edit GIS data
- Learn how to change editing tools between vertices

Prerequisites

- Completion of ArcMap Quick Start and ArcMap Editing Webinars or equivalent experience.
- Install Esri ArcMap on local computer or have access to and experience using Citrix.
- Download and unzip the data and exercises.



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A. Open ArcMap and Toolbar Configuration

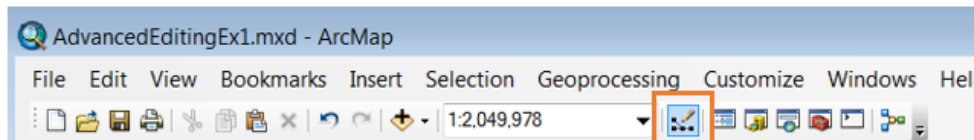
1. Launch ArcMap either locally or in Citrix.



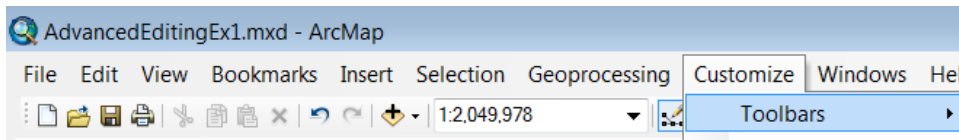
2. Click **File | Open** and select the following map document:

../AdvancedEditing/Lesson1/Data/AdvancedEditingEx1.mxd

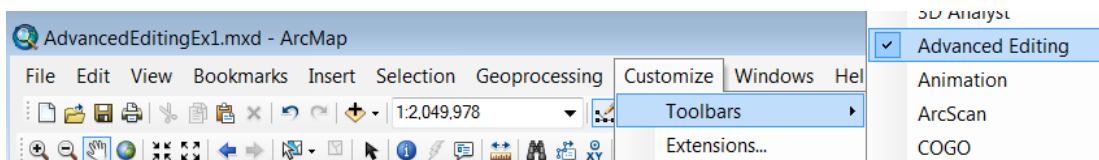
3. Click the **Editor Toolbar** button (if necessary) to open the Editor Toolbar, and dock as desired.



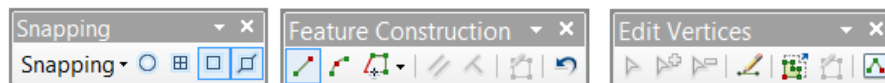
4. Click the **Customize** menu and choose **Toolbars**.

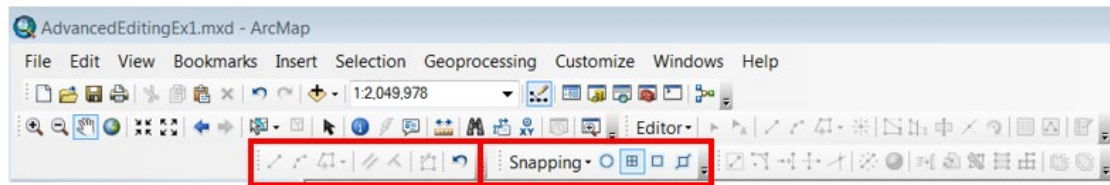



5. Select **Advanced Editing**, and dock as desired.



6. Under the **Customize | Toolbar** menu follow the instruction above to open the **Snapping** toolbar, the **Feature Construction** toolbar, and the **Edit Vertices** toolbar. Dock as desired.



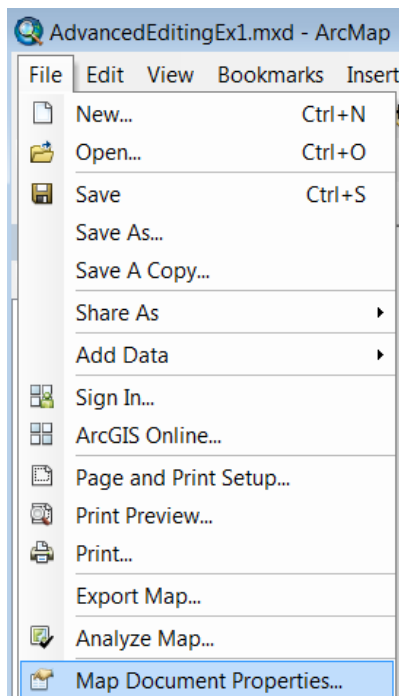


Save the map. 

When you change the configuration of the user interface of ArcMap desktop, it is saved by default in a template file called Normal.mxt that is read each time the application is started. For example, now that you have set up all the editing toolbars and saved the map, the next two Exercises will already have the toolbars set up the way you want.

B. Prepare Editing Properties

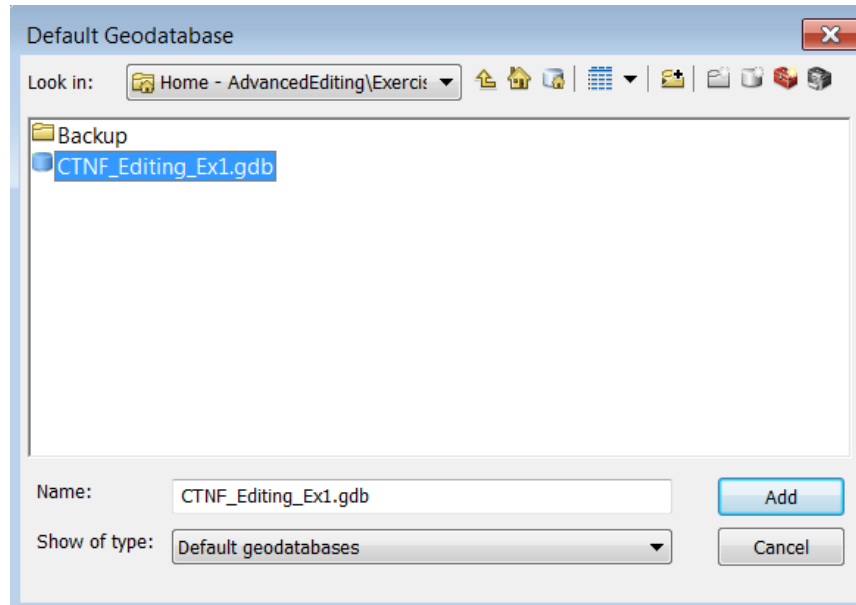
1. Set your ArcMap Properties; go to **File | Map Document Properties** to open the window.



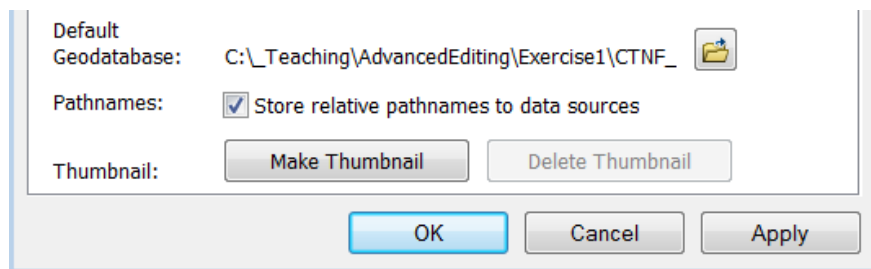
2. At the bottom of the Map Document Properties window click the yellow file folder next to **Default Geodatabase** and navigate to choose

../AdvancedEditing/Exercise1/CTNF_Editing_Ex1.gdb.

Click **Add**.



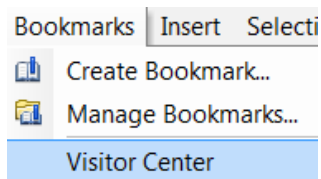
- Next it is a good habit to **check** the box for “**Store relative pathnames to data sources**” towards the bottom the window on all your map documents to protect the links to data if you should move the folder. Then click **OK**.




C. Edit Vertices Tool

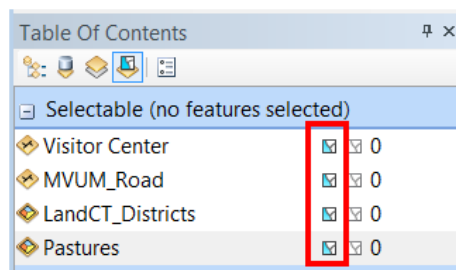
Not surprisingly, the Edit tool on the Edit Toolbar is the tool you will use most often. Here is a tip you may not have noticed. When the Edit Tool is active and you are editing the shape of a feature, the Edit tool pointer changes from a black arrow to a white arrow to show you can directly select vertices and modify segments. The black arrow pointer is shown when you are working with whole features rather than the individual vertices and segments that make up the feature.

1. Click on **Bookmarks | Visitor Center**.

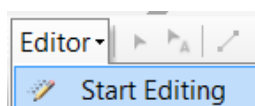


As part of setting up your editing environment for each scenario, you may have to change the selectable layers. We cover this extensively in the GTAC ArcMap Editing class.

2. Click on the **List by Selection** button  in the Table of Contents (TOC). **Make all the active layers selectable.**



3. Click **Start Editing** under the Editor dropdown on the Edit Toolbar.



4. Click the **Edit Tool**  on the Editor toolbar.



5. **Single click a feature to select it.** It will turn the feature the selection color, of which cyan is default. The pointer will be black as illustrated below.



6. **Double-click** the edge with the Edit tool. The pointer will turn white as illustrated below.



7. When you are working with the vertices of a feature, the Edit Vertices toolbar appears, providing an easy way to select vertices, add and delete them, and modify segments.

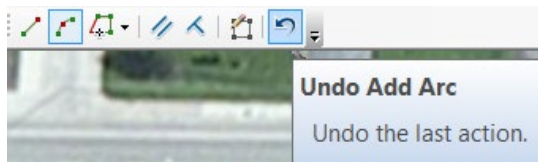


D. Undo Tool

While digitizing, there is no problem if any of your segments do not turn out as planned. As long as you haven't finished the sketch or saved the edits, you can simply click the Undo Tool on the Feature Construction Toolbar to remove the last segment or vertex.

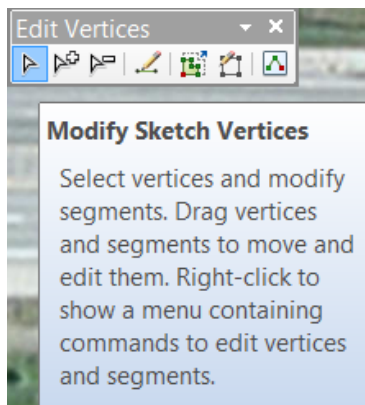
1. To remove an error on your last segment without deleting all your other segments.

Click the **Undo button on the Feature Construction Toolbar**.




E. Modify Sketch Vertices

1. Use this tool to move selected vertices.



2. **Hold down the Shift key and select multiple vertices.** They will turn white when selected. You can then grab one vertex with your mouse and all selected vertices will move. **Grab the southern vertex and move them together,** as depicted below.



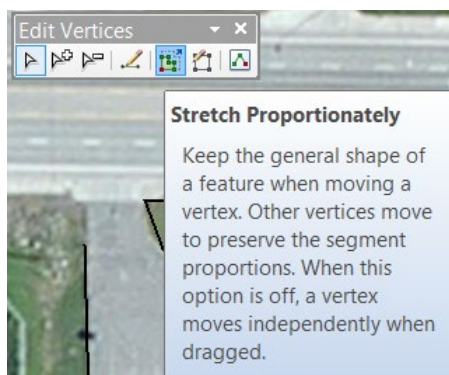
3. Since that sketch looks pretty inaccurate, hit the **Undo** button  on the Create Features toolbar.

F. Stretch Proportionally tool

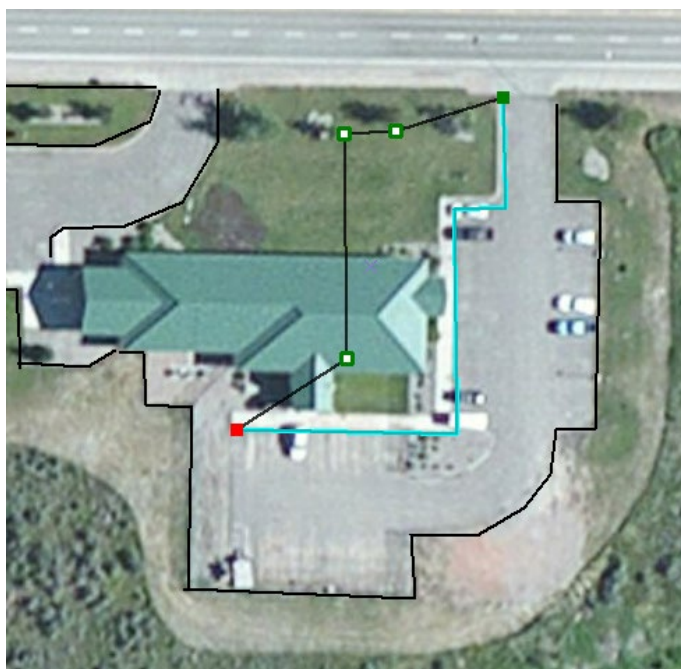
1. **Select only the middle vertex**, it will turn white.



- Click on the **Stretch Proportionally Tool**  in the Vertices Toolbar.



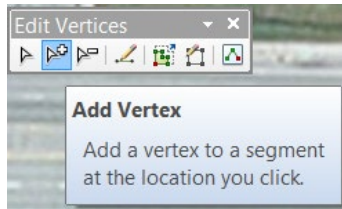
- With your mouse, grab and selected vertex and drag west.



- Click Undo .

G. Add Vertex

1. Click the **Add Vertex Tool** on the Edit Vertices Toolbar.



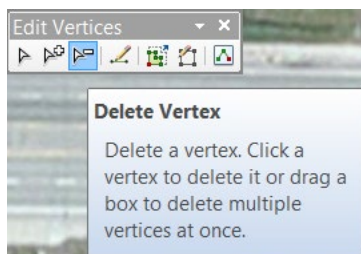
2. Click on the line to add a vertex.



3. Do not Finish Sketch, we will work through each tool in the following sections.

H. Delete Vertex Tool

1. Click the **Delete Vertex tool**  on the Edit Vertices Toolbar.




Tip: You can single click to delete one vertex at a time, or you can drag a box shape over many vertices to delete all at once.

2. Click and hold down mouse, then drag the pointer in a box shape over the two southeast vertices delete them at once.



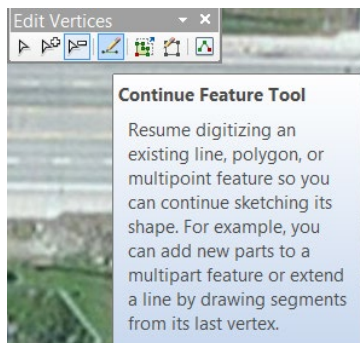
The vertices will disappear and the line will reshape itself to the remaining adjacent vertices.



3. Click the **Undo** button on the Create Features Toolbar. 

I. Continue Feature Tool

4. Select the **Continue Feature Tool**  on the Edit Vertices Toolbar.



5. The **red vertex at the end** of the selected line will become active and allow you to **digitize the next vertex**.



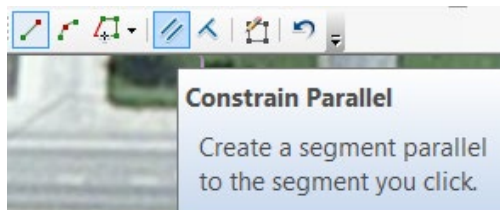
6. Click to the north of the red vertex to delineate the corner of the sidewalk.



7. Do not Finish Sketch, we will work through each tool in the following sections.

J. Constrain Parallel Tool

1. Click on the **Constrain Parallel Tool**  on the Feature Construction Toolbar.



If you finished the sketch in the previous section by accident, or hit save and started editing again, the Constrain Parallel tool may be grayed out. You may need to start the sketch again, and click on the **Continue Feature** tool button in order to see the Constrain Parallel tool.

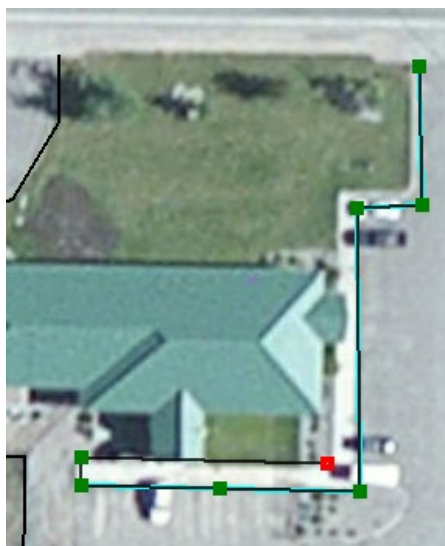
2. Click on the segment along the parking lot side of the sidewalk (shown in the screengrab below) to indicate which line you want to parallel. It will flash a thick dark green momentarily to indicate the segment you have selected. *Sorry, there is*

no way to screen capture the flash.



Click this line

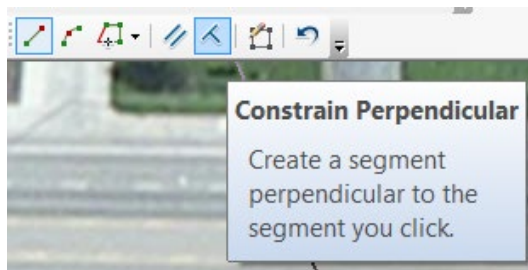
3. **Drag your mouse east and place a vertex at the corner of the sidewalk as shown below.**



4. Do not Finish Sketch, we will work through each tool in the following sections.

K. Constrain Perpendicular Tool

5. Select the **Constrain Perpendicular Tool**  on the Feature Construction Toolbar.



If you finished the sketch in the previous section by accident, or hit save and started editing again, the Constrain Parallel tool may be grayed out. You may need to start the sketch again, and click on the **Continue Feature** tool button in order to see the Constrain Parallel tool.

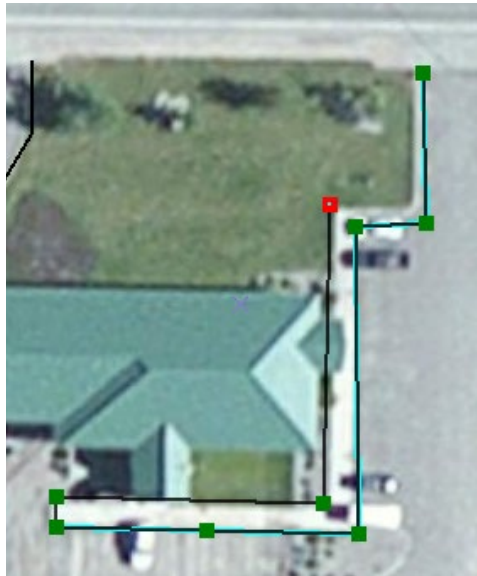
6. Click on the east/west segment below the red vertex to choose the line you want the next segment to have a perpendicular bearing. It will flash momentarily with a thick dark green line to indicate your selection.



7. Place a vertex at the sidewalk corner to the north as shown below.

If this were a real project, some other adjustments may need to be made to make the


north/south sidewalk more parallel.

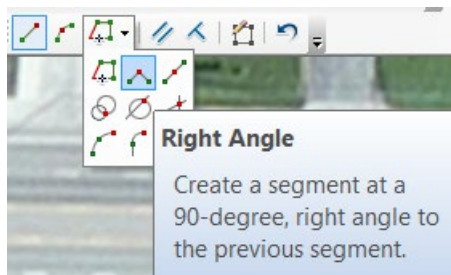


8. Do not Finish Sketch, we will work through each tool in the following sections.

L. Right Angle Tool

Be aware: The tools on the Feature Construction toolbar may turn gray and require that you open the Create Features window and choose a template to edit in order to activate them again.

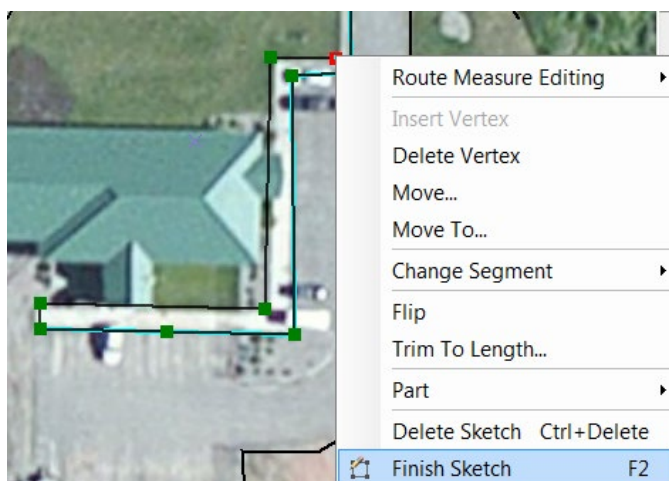
1. Select the **Right Angle Tool**  under the Trace Tool dropdown on the Feature Construction Toolbar.



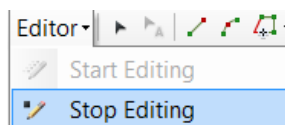
2. **Drag your mouse east and click** to place a vertex at the next corner.



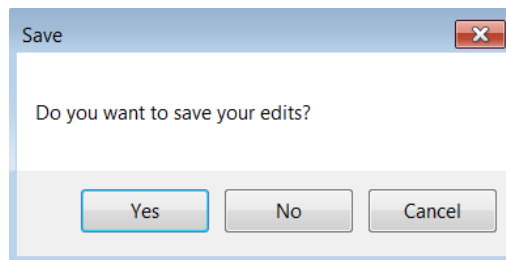
3. **Right Click** and choose **Finish Sketch**.



4. Click on the Editor dropdown on the Edit Toolbar, and select **Stop Editing**.



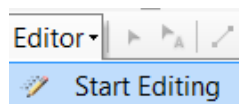
5. Click **Yes** when asked if you want to save your edits.




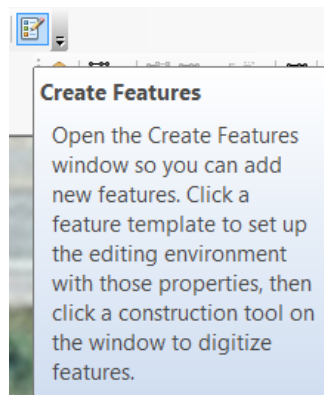
M. Fillet Tool

The Fillet tool creates a circular arc that is tangential to two line segments to produce a smooth, curved connection between lines. One example is to create a rounded curb in a parking lot.

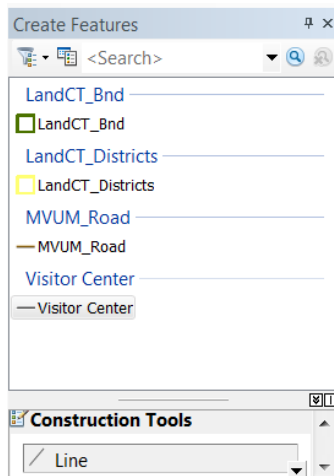
1. In the Editor toolbar, click the Editor dropdown and select **Start Editing**.



2. Click on the **Create Features icon**  in the Editor toolbar to open the Create Features window. If necessary dock and pin the window to the side.




3. Select **Visitor Center** as the feature to edit, and **Line** as the **Construction Tools**.

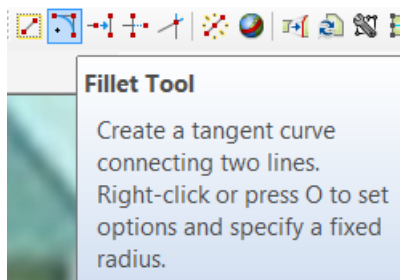


4. Click on the **Bookmarks menu**, then **Fillet Tool**.

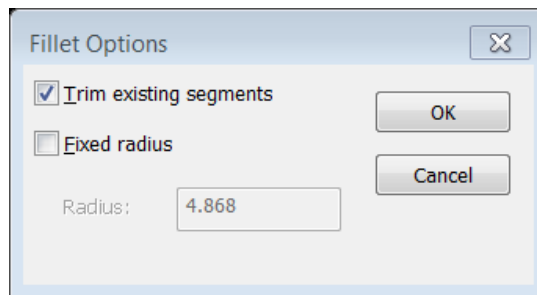


5. Select the **Fillet Tool**  on the Advanced Editing toolbar.

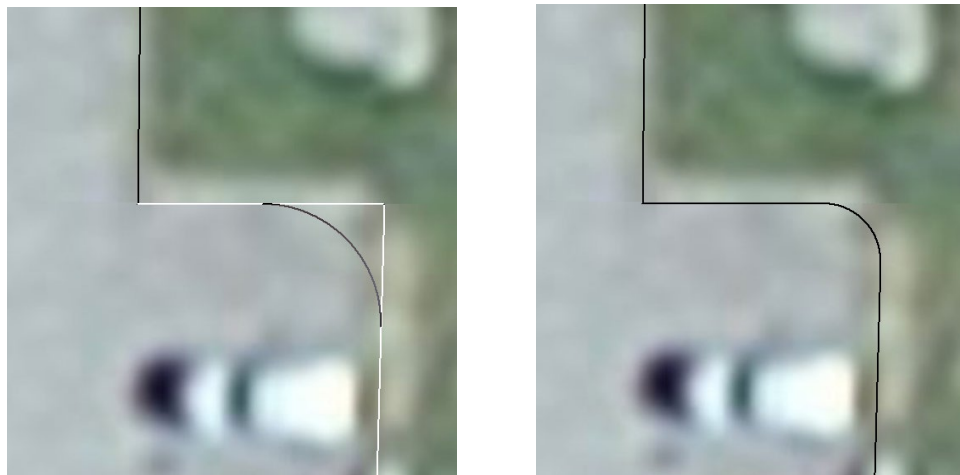
We want the corners of the parking lot to be rounded instead of square.



6. To set options you can right click or press the “O” on the keyboard (for options).
Check Trim existing segments to remove the existing segments that extend beyond the tangent points. **Uncheck Fixed radius** so we can create the curve manually. Click **OK** when you are finished.



7. We want the line to smoothly follow the curve of the Parking lot instead of having corners. **Click on one line then the other that you want the curve to be created between,** they will change color. **Then float your cursor in between the lines by dragging the mouse to manually move the curve** where you want to place it. **Click to finish.**

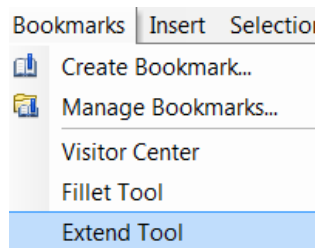


A new fillet curve joins the two selected lines. The extra line segments outside the curve are trimmed off since we checked Trim existing segments.

N. Extend Tool

The Extend Tool on the Advanced Editing toolbar lets you click a line feature and extend it to another selected line feature. To use the Extend tool, select the feature that you want to extend lines to, then start clicking the lines you want to extend.

1. Click **Bookmarks | Extend Tool**.




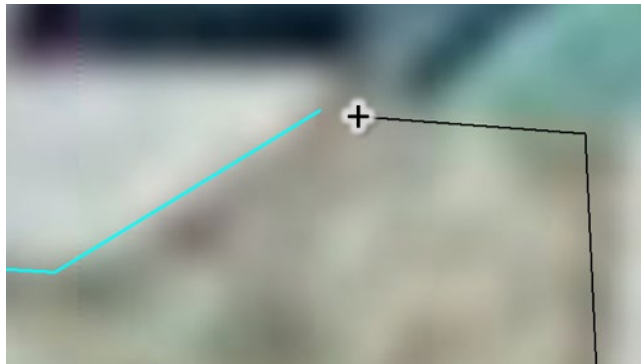
2. Click the **Edit Tool**  on the Editor toolbar.



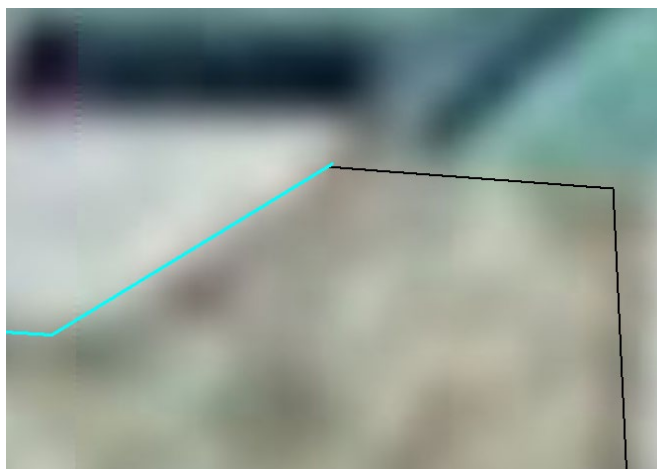
3. **First select the line segment to which you want to extend a line.**



4. Click the **Extend tool**  on the Advanced Editing toolbar and **click the endpoint of the feature you want to extend.**



5. The line you clicked is extended to the selected line.

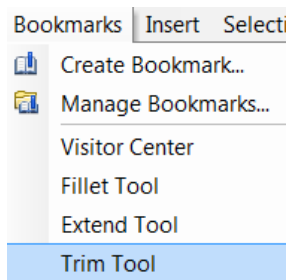



The Extend Tool above extended the line on the same direction until it intersected with the chosen line. It does not necessarily go to the end point. In this example we want them to intersect at the endpoints so we will fix that with the next tool.

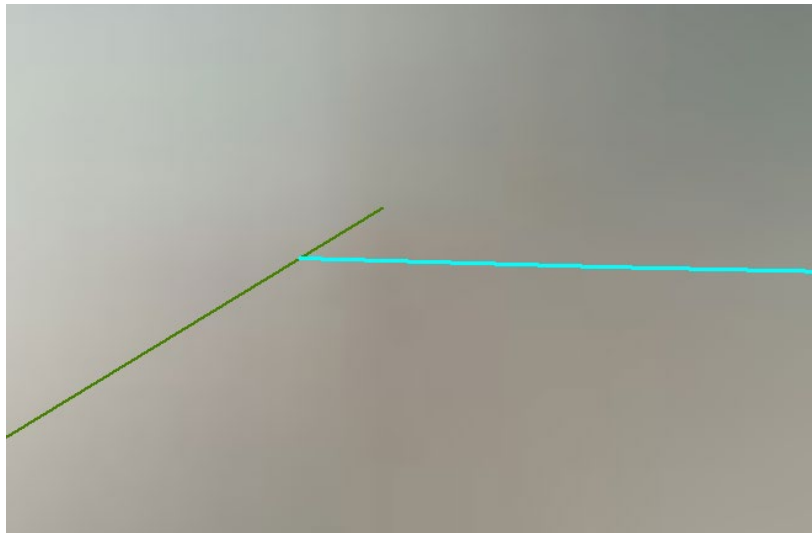
O. Trim Tool


The Trim tool Trim Tool on the Advanced Editing toolbar lets you click a line feature and trim it based on its intersection with a selected line feature. To use the Trim tool, select the feature that you want to use as a cutting line, then start clicking the intersecting line segments that you want to trim. The part of the line that you click will be removed.

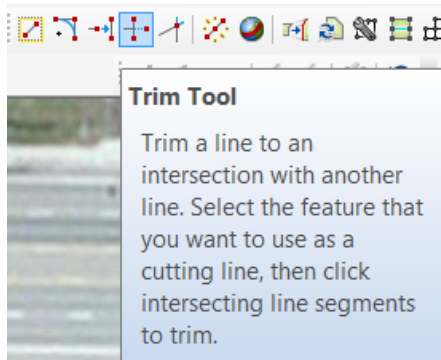
1. Click on **Bookmarks | Trim Tool**.



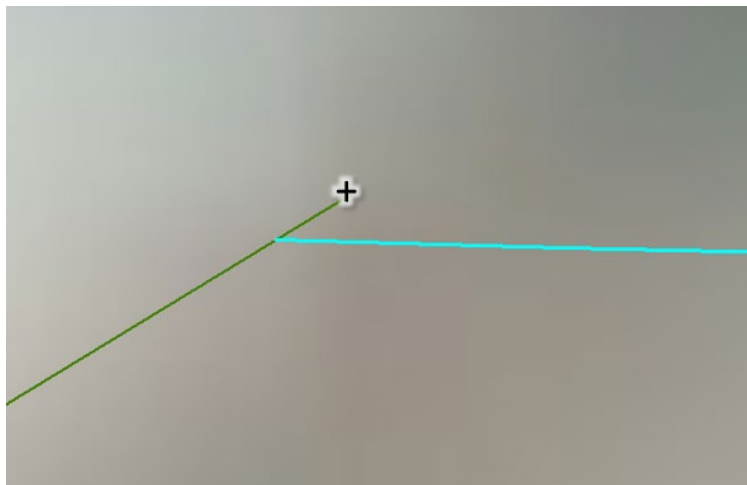
2. If necessary, **select the line segment you want to use as a cutting line** with the Edit tool  on the Editor toolbar.



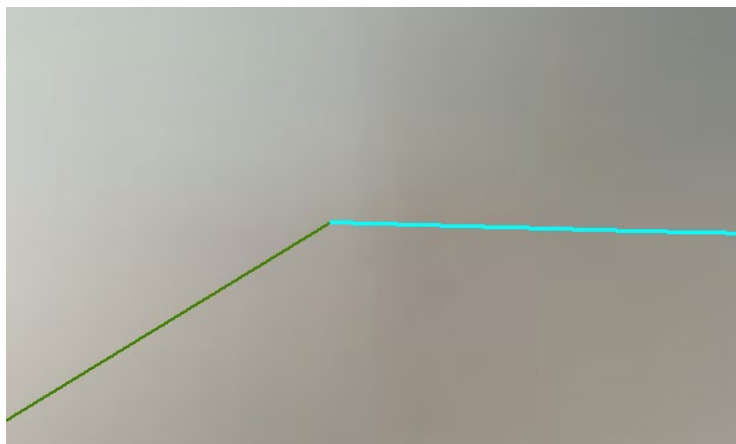
3. Click the **Trim tool**  on the Advanced Editing toolbar.



4. Click the end of the feature that you want to trim.



5. The line you clicked is trimmed to the selected line.



P. Line Intersection Tool

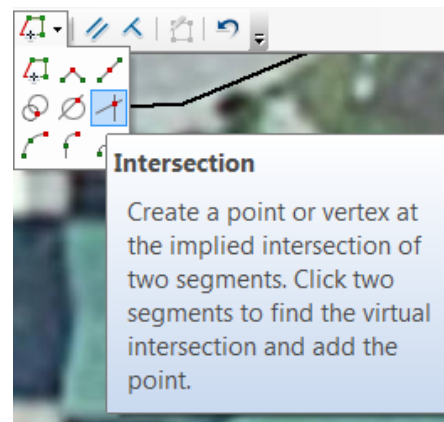
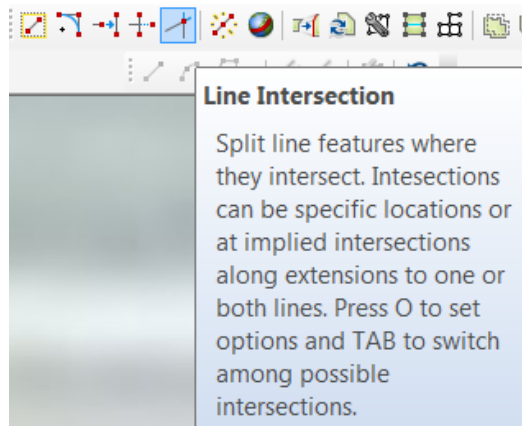
The Line Intersection tool allows you to split line features at their intersections. The lines are split at the location where you click the mouse. The split operation updates the shape of the existing feature and creates a new feature using the default attribute values for the feature class.

There can be many potential intersections between the lines' features, and the intersection points can be either at specific locations in the middle of both lines or at implied

intersections along extensions to one or both lines. When a feature needs to be extended to a point of intersection, you can either extend the existing feature or add a new feature.

1. Click the **Line Intersection tool**  on the Advanced Editing toolbar.

Alternatively, this tool can be accessed two other ways: under the Trace Tool dropdown on the Editor Toolbar; and under the Trace tool on the Construct Features Toolbar.



2. Click on **Bookmarks | Line Intersection Tool**.



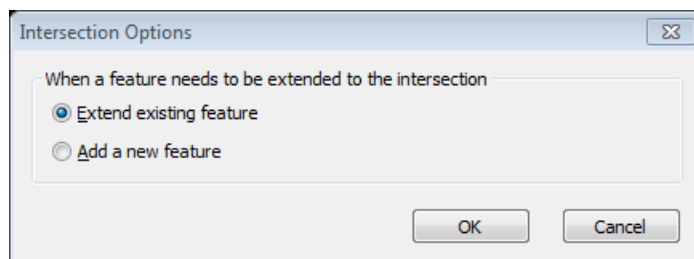
3. Click the first feature you want to intersect (it will turn a light color).



4. **Click the second feature** you want to intersect, indicated in the screengrab below.
The tool will give you a preview of where the lines would intersect. Click on that intersection if you want to extend those lines so that they intersect there or Tab to see other possible intersections.



5. Optionally, press the letter “O” on your keyboard to set the intersection options. You can choose whether a feature is extended to the point of intersection or a new feature is added. Alternatively, **press TAB to cycle through all the intersection possibilities.**

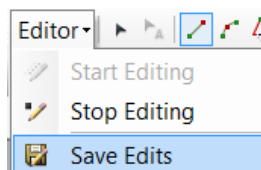


6. **Move the pointer to the intersection you want and click.** We will choose the southwest intersection option indicated with the red box. The final click chooses which intersection is correct and splits or extends the features at the intersection.





7. Save edits.



Q. Straight Segment

While we are working with editing lines around a Visitor Center parking lot, let's look at how the tools on the Feature Construction toolbar can help us improve our digitizing accuracy and efficiency.

You can switch between the Feature Construction Tools in the middle of digitizing a feature. This is when the default "Straight Segment" tool is used, when you want to switch back from say an Arc Segment.

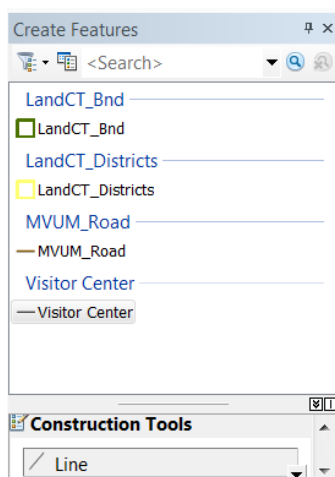
These steps can be used to create features in either lines or polygons. This tool creates a vertex each time you click your mouse and the segments between vertices are straight lines. Right click or use keyboard shortcuts to place vertices using exact measurements.

1. Click **Bookmarks | Feature Construction tools.**

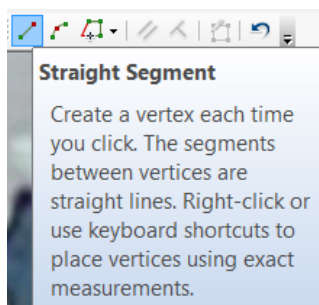


You have to be editing a Layer before the Straight Segment construction tool on the Feature Construction Toolbar will be activated.

2. To start editing a layer, **open the Create Features window, click the Visitor Center template and Line as the Construction Tool.**



- Click the activated (by default) **Straight Segment Tool** .



- Click on the map in the northeast corner to digitize the first vertex of the feature as shown below in green, then move your mouse east and click to create another vertex. We will be switching digitizing tools between vertices, starting on the northeast side if the extent. The last vertex you digitized will be red by default.




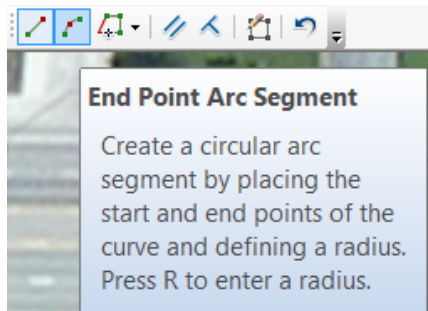
- Do not finish sketch, we will continue this line using the next tool.

R. End Point Arc Segment Tool

Endpoint Arc Segment allows you to specify the start and endpoints of the curve, then define a radius for the curve. This is particularly useful in sketching culs-de-sac, where the beginning and ending points of the arc, as well as the radius of the cul-de-sac, are known.

To use Endpoint Arc, click to place the start point, click again to construct the endpoint, then drag the curve or press the letter "R" on the keyboard to set the radius value, and click again to finalize the location of the curve. These steps can be used to digitize segments in either lines or polygons.

1. Even though you are in the middle of digitizing a feature you can go up and **click the Endpoint Arc Segment Tool**  on the Feature Construction Toolbar.



2. **Click the endpoint of the arc as your next vertex.** *It is hard to see, but the arc preview is in gray.* You can play with the size of the arc interactively and then click when it is the desired shape/size.



3. **Move the pointer to get the approximate radius for the curve and click to finish the segment.** *Alternatively you could press "R" on your keyboard to type the radius for the curve.*



4. Click on the **Straight Segment Tool** again and digitize a small segment as shown.




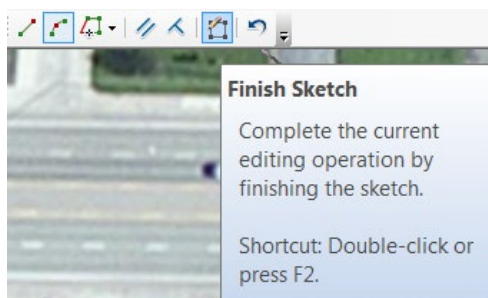
5. Click on **Endpoint Arc Segment Tool** again to draw a curve around the next landform.



S. Finish Sketch Tool

There are multiple ways to complete a sketch. There are Finish Sketch Tools on the Feature Construction Toolbar and on the Vertex Toolbar, alternately you can double click or hit F2 to stop digitizing.

1. To complete this sketch click on the **Finish Sketch Tool**  on the Feature Construction Toolbar.



2. The sketch will turn into a completed feature that is selected.

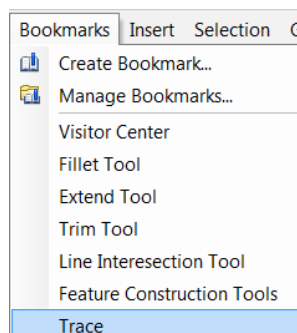



T. Trace Tool

Tracing is a quick and accurate way of creating new segments that follow the shapes of other features. You can trace directly on top of a feature or apply an offset value. To trace, use either the Line or Polygon tool in conjunction with the Trace construction method on the Feature Construction mini toolbar.

Tracing is particularly useful when the features you want to follow have curves or intricate shapes, since snapping is more difficult in those cases. For example, when digitizing a forest boundary that is adjacent to a river, tracing the river is an easy way to create the forest segments shared with the river.

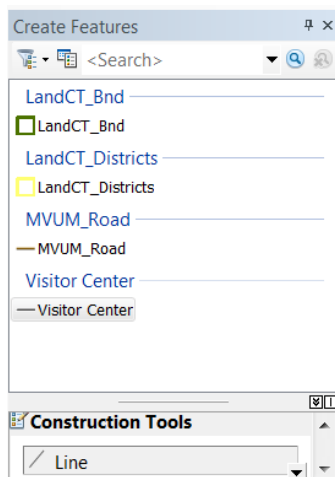
1. Click on **Bookmarks | Trace**.



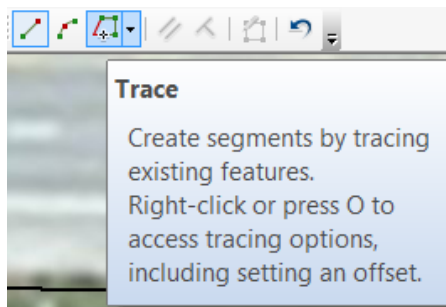
2. Click the **Select Features Tool**  and select the feature as shown below. We will want to use the trace tool to digitize the sidewalk.



3. You have to be editing a Layer in order for some tools to be activated. If the tools are grayed out, in the **Create Features window**, click the **Visitor Center** template, and **Line** for the Construction Tool.

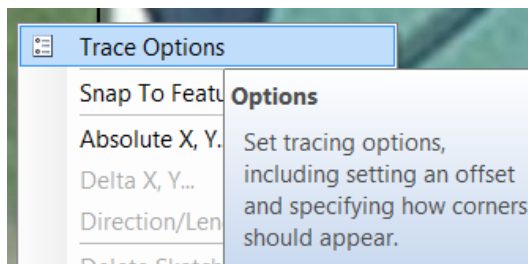


- Click the Trace tool  on the Feature Construction Toolbar.

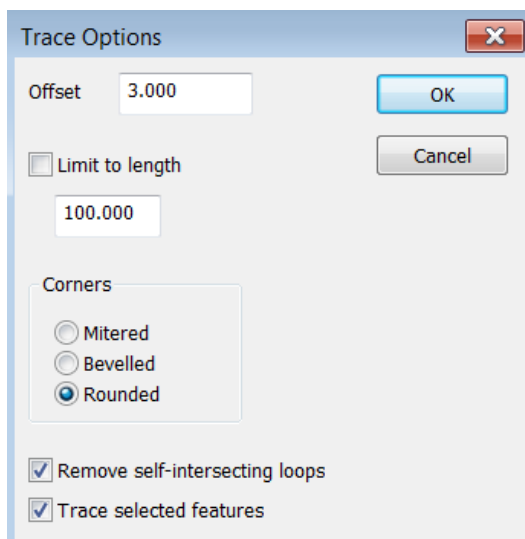


- Right click in the Data View and select Trace Options.

Alternately, you can press the letter "O" on the keyboard.



- For this scenario we will **set an offset of 3 map units**, we will make the **corners Rounded** and **check Trace selected features**, as shown below.



When tracing at an offset, you can press the TAB key to trace on the opposite side of the edge. This simply makes the offset value negative on the Trace Options dialog box. Or you could set the offset to -3 manually. However you have to start tracing to see which side it will start on.

7. Click on the segment you want to trace, where you want to start tracing, to create the first vertex. **Start the Trace in the location indicated below with a red dot.**



8. **Drag your mouse along the selected feature to trace**, you will see the line turn darker as your mouse moves along it. Follow around the corner and to the edge of the parking lot as shown below.

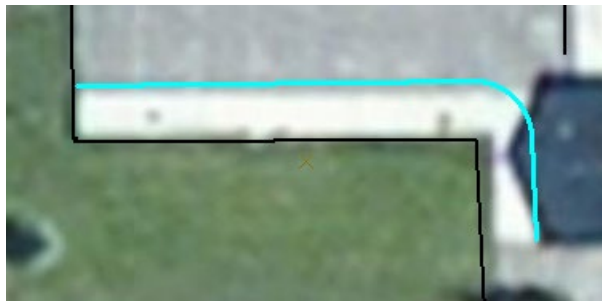


If you trace too far or trace in the wrong direction, you can move the pointer backward over what you have traced. Press ESC if you need to cancel the trace.

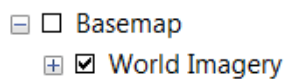
To pan the map while tracing, press either the C key or the middle mouse button. You can also use continuous map panning if you are using basemap layers.

Alternatively, you can switch between tracing and other segment construction methods using the Feature Construction toolbar. For example, this allows you to trace, create a straight or curved segment, then return to tracing.

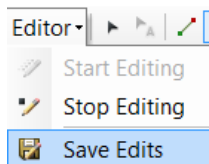
9. Double click to **Finish Sketch**.



10. Turn off the **Basemap** to allow for faster drawing.



11. **Save your edits.**



12. **Save your map document.** 

Remember that saving your document does not automatically save your edits; and saving edits does not save your map document.

U. Align to Shape Tool

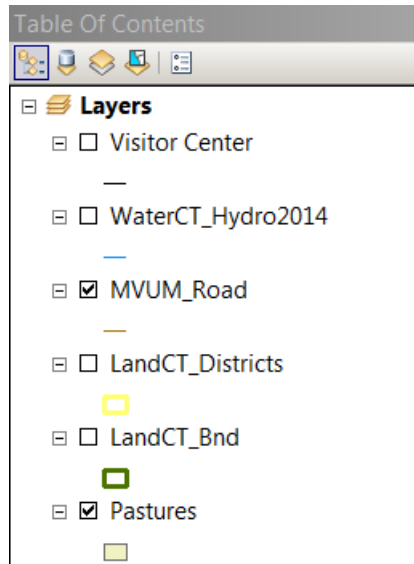
You can use Align To Shape to adjust layers to a shape you trace. This is useful when you want to align features to the edges of other features. Alignment errors with and between datasets commonly happens when layers were captured at different resolutions, scales, or time periods—causing edges to be braided, have overlaps, or have gaps between them.

To use Align To Shape, you need to trace a path to which you want to align other features. This path is created by tracing the edges of one or more adjacent, existing features. You then choose which layers will be adjusted to match this path; other layers will not be updated. For a layer to be listed, it must be either a point, line, or polygon; be editable and visible (turned

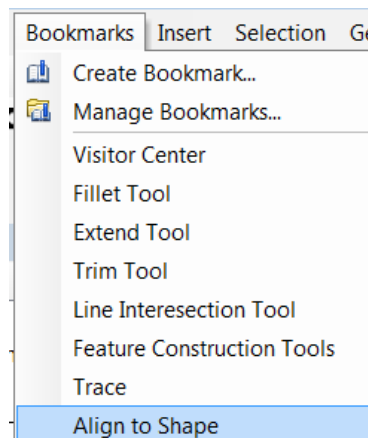
on and not hidden at the current scale because of a visible scale range).

Since Align To Shape is an interactive tool that requires that you manually trace the shape to align to, it works best for cases where just portions of features need to be adjusted.

1. In the TOC, make the **Pastures, and MVUM Roads** the only active layers.

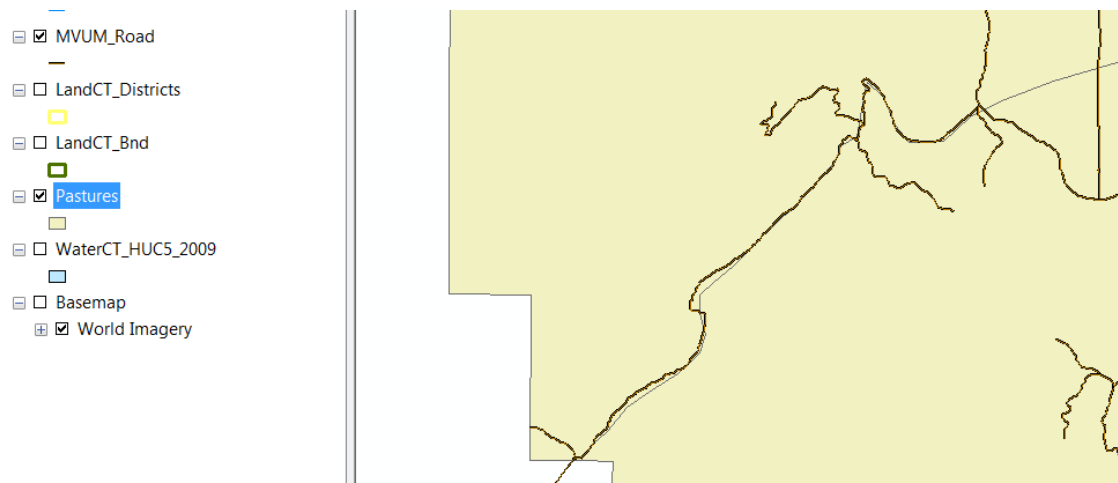


2. Click on **Bookmarks | Align to Shape**.

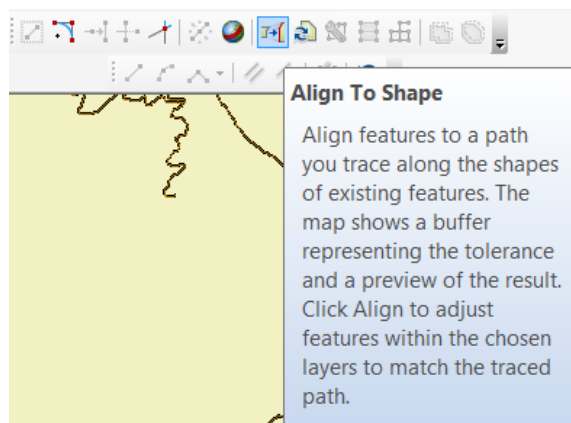


3. **Turn the MVUM_Roads layer off and on and notice the area where the Pastures boundary should align with the roads to be more accurate. The MVUM_Roads layer is considered more reliable than the Pastures data so we will align the Pastures**

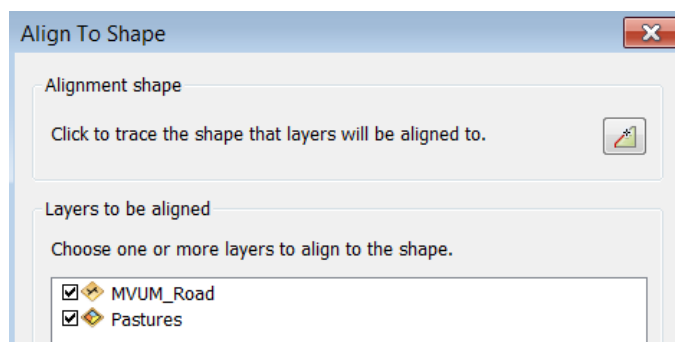
boundary with the roads.




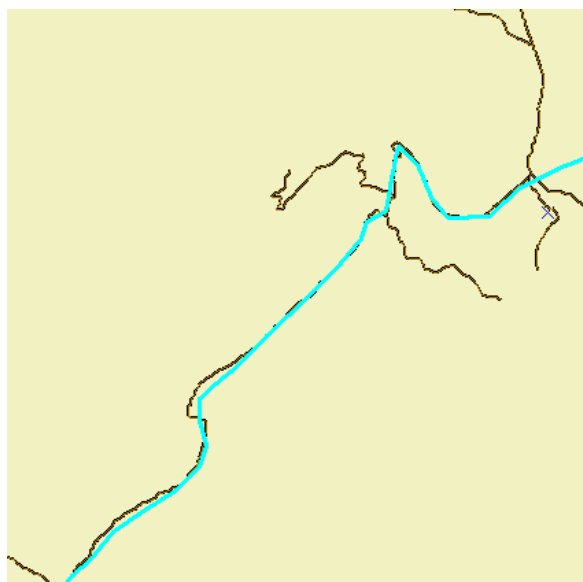
4. Click the **Align To Shape** tool  on the Advanced Editing toolbar.



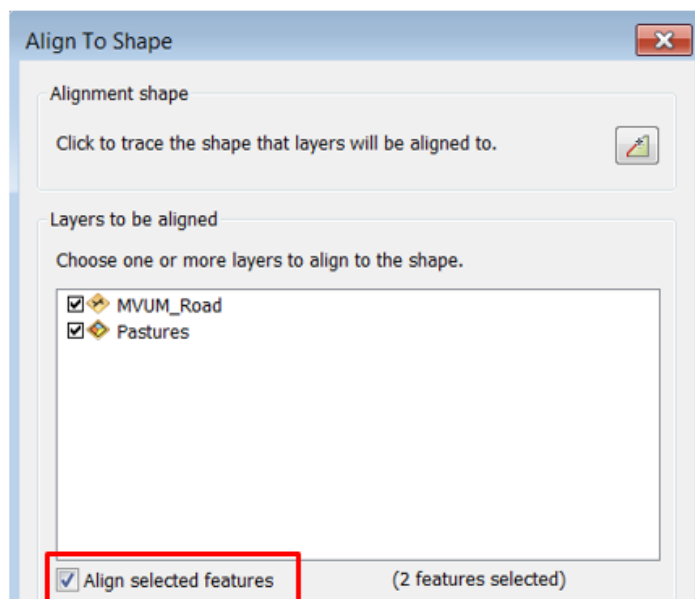
5. Notice only the layers that are turned on in the TOC will show up in the Align to Shape window. **Keep both layers checked.**



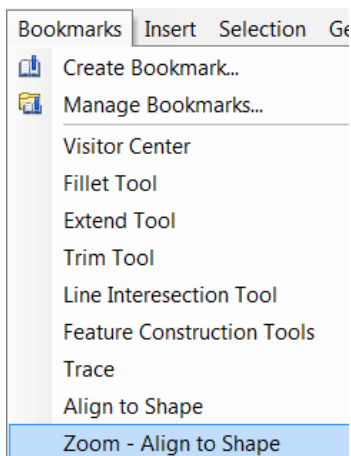
6. Use the **Select Features Tool**  on the Tools toolbar to **select the Pasture boundary** that should be align with the road.




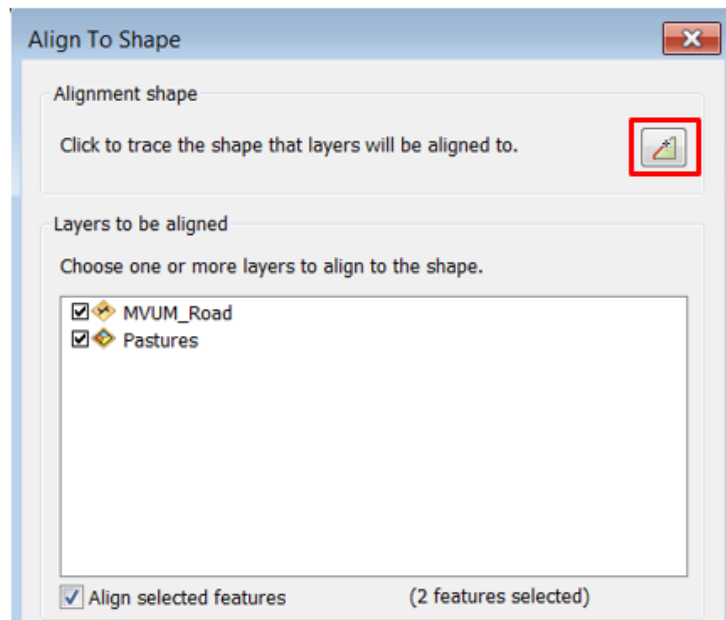
7. Check the **Align selected features** option and leave the default Tolerance.



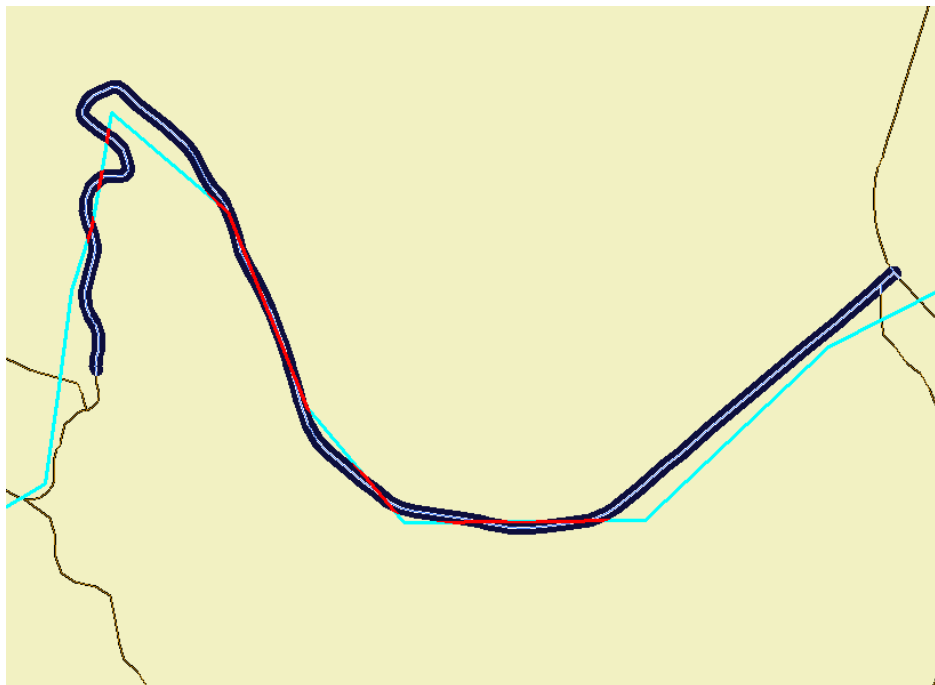
8. You will want to zoom in more and only align one section at a time in order to see better, and to more accurately trace the desired line. **Click Bookmarks | Zoom – Align to Shape.**



9. Click the **Alignment shape** button  to define the shape to which features will be aligned.

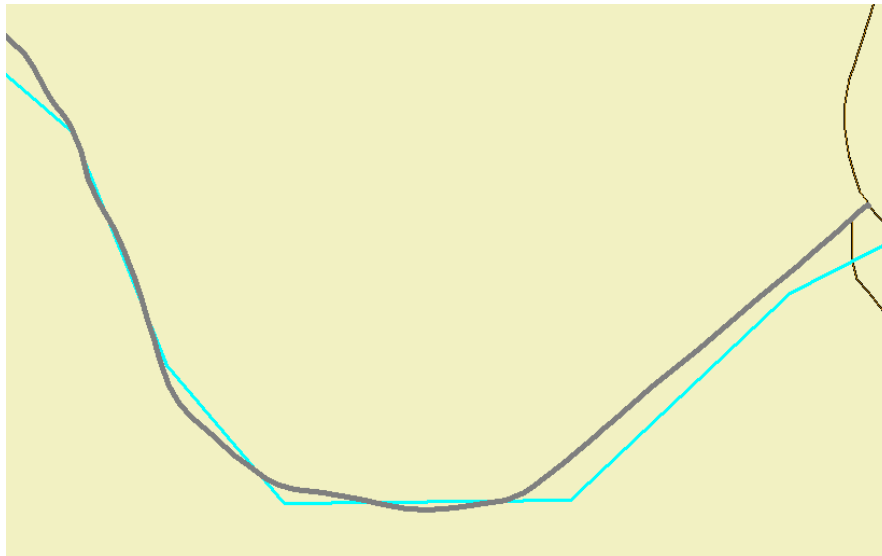


10. On the map, **click the MVUM, drag mouse along edge to trace, and click again to end the trace.** Trace only to the point shown below and click to end the trace. Features will be aligned to this line, which is displayed transparently. Press the ESC key to cancel the trace if you make a mistake, then you can start over.



It is easy to lose control of the Align to Shape shape tool (it is similar to Trace tool). If you are not careful enough, or you are not zoomed in enough, or there are lines close together in the view, you can select the wrong line. It takes practice to switch your mouse to the desired side in time.

11. What happens next is that **the buffer around the line will show the tolerance** and what will be aligned. At this tolerance, not much will be aligned so **we will have to increase the Tolerance number** until all of the selected feature is within the buffer. *We have zoomed in further to demonstrate.*



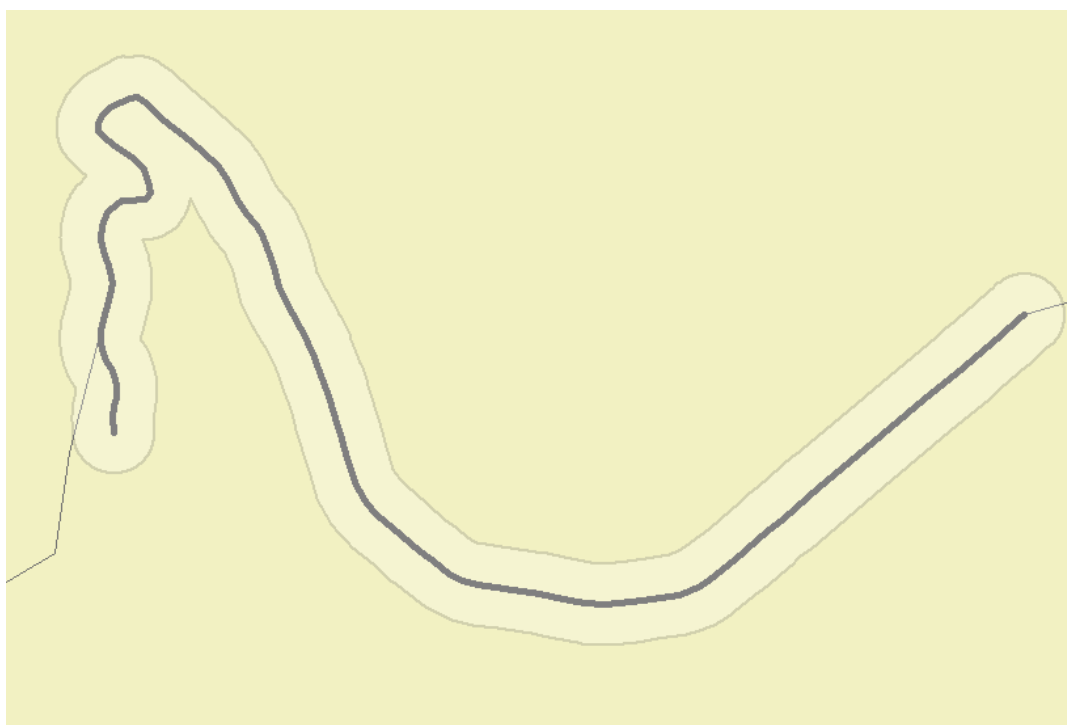
12. **Type 20 meters in the Tolerance window** of the Align to Shape tool to see in the preview if that covers the line to be aligned.



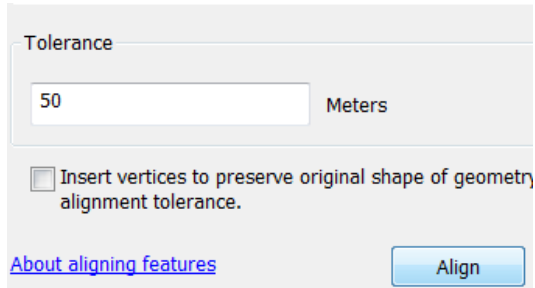
It appears to cover most of the line but not all.

13. **Type 50 meters in the Tolerance window** and see if that will fix most of the line.

The screengrab below is zoomed out to show the whole line.



14. We are satisfied with the preview, so **click the Align button at the bottom of the window** to perform the alignment.

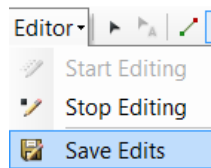


15. The roads and the Pastures boundary will now be aligned.



16. If desired, you may align the rest of the Pastures boundary to the MVUM_Road by selecting additional features, changing a parameter such as redrawing the trace path, or updating the tolerance. Then you can click Align again.
17. **Click Close** to close the Align to Shape dialog box.

18. Click **Save Edits**.



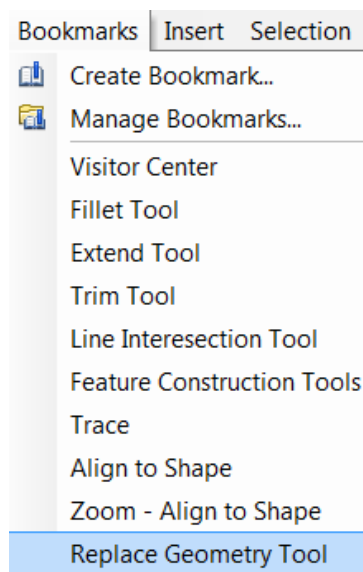
V. Replace Geometry Tool

The Replace Geometry Tool replaces all geometry for a polyline or polygon feature with new geometry you create in the map. This workflow preserves the attribute values of the original feature.


You can also create geometry for features with null geometry, for example, when a geocoded feature contains null geometry as a result of an unmatched record. For steps to replace specific segments with new segments you create in the map, see Reshape feature segments.

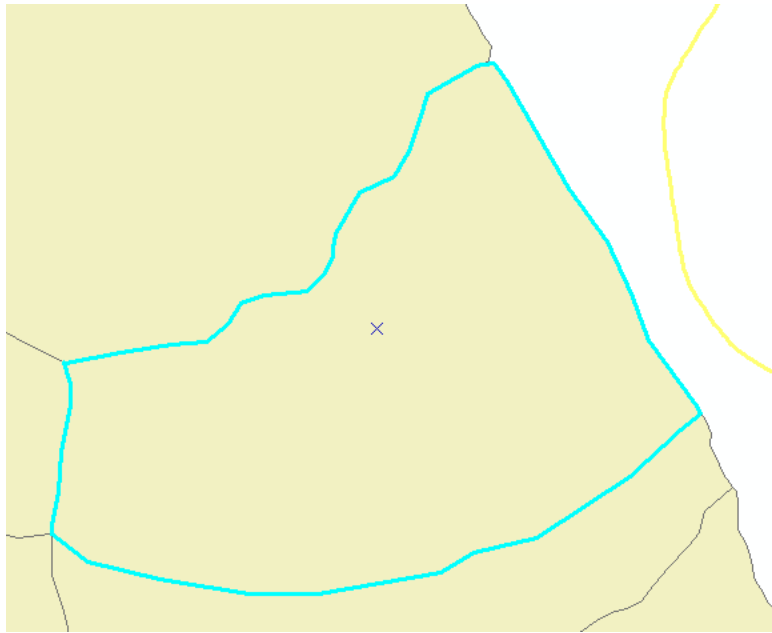
In this scenario, we will replace a polygon's geometry because it will be easier than adding vertices one at a time and extending the boundary of a pasture out to the Forest Boundary. This tool will replace the geometry but keep the original attributes in the new polygon.

1. Click **Bookmarks | Replace Geometry**.

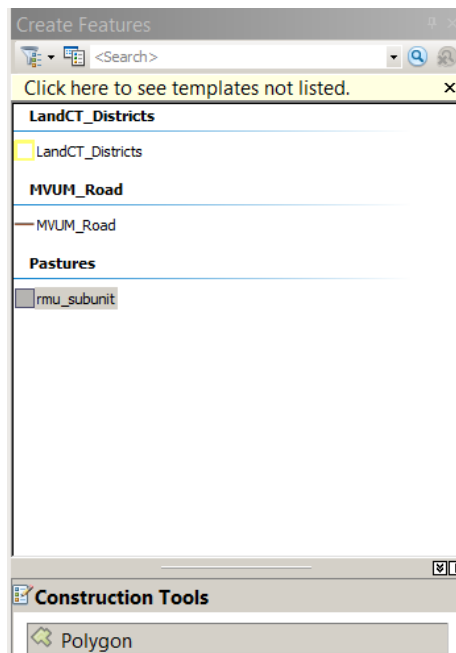


2. Turn on the **LandCT_Districts** layer in the TOC.

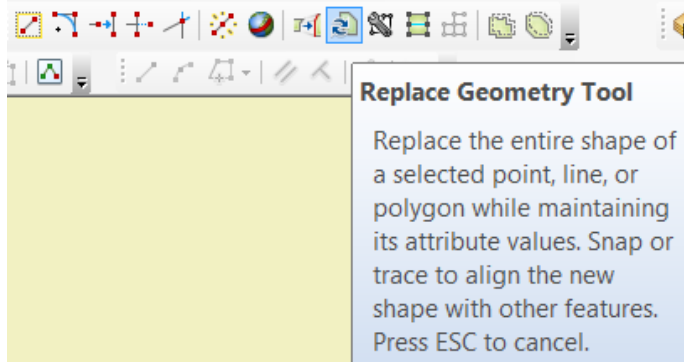
3. Click the **Edit Tool**  on the Editor toolbar and **click the feature** with the geometry you want to replace to select it.



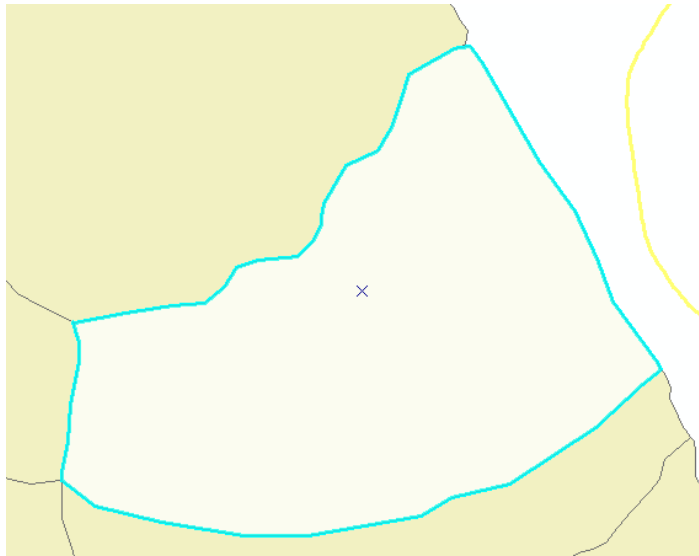
4. **You have to be editing a Layer** before the Trace construction tool on the Feature Construction Toolbar will be activated. To start editing a layer, open the Create Features window, **click the rmu_subunit template and polygon** as the Construction Tool.




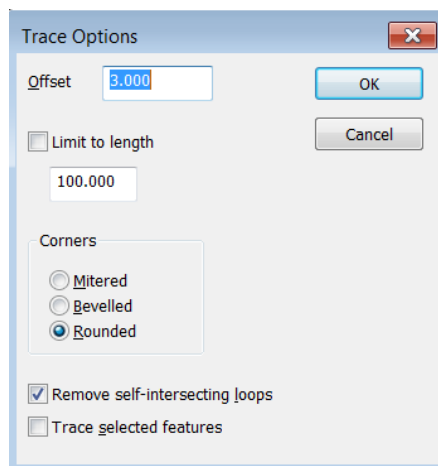
5. Click the Replace Geometry tool  on the Advanced Editing toolbar.



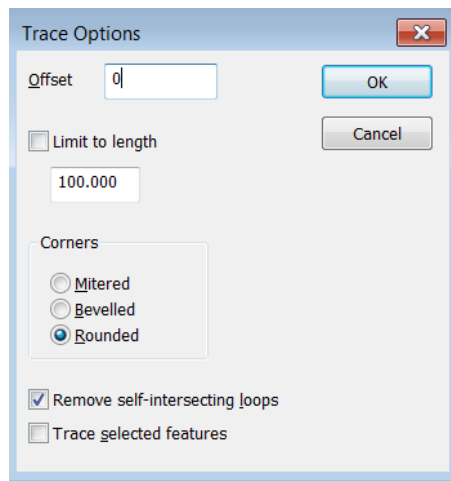
6. **The selected feature is drawn transparently** to distinguish it from the new feature shape you are capturing.



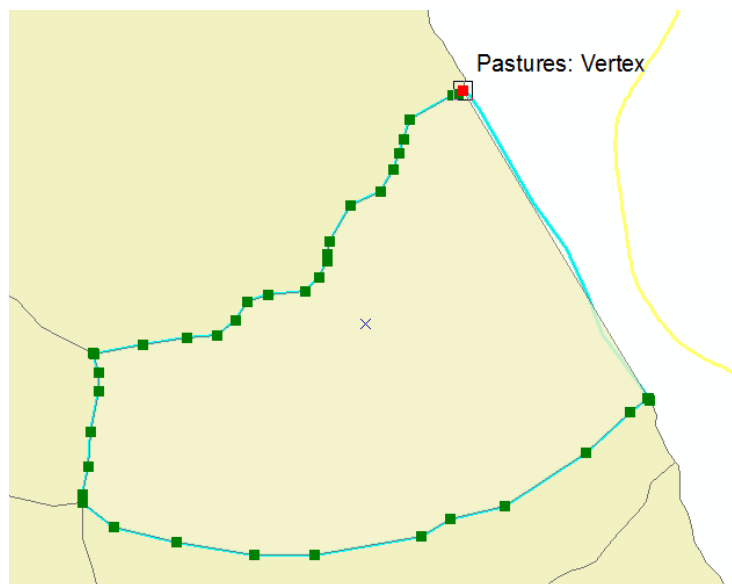
7. Click the **Trace Tool**  in the Feature Construction Toolbar to trace the coincident boundaries. *Before you start digitizing be sure to set the trace options as they are bound to be different from the last time you used it.*
8. Click **"O"** on your keyboard to open the Trace Options window.



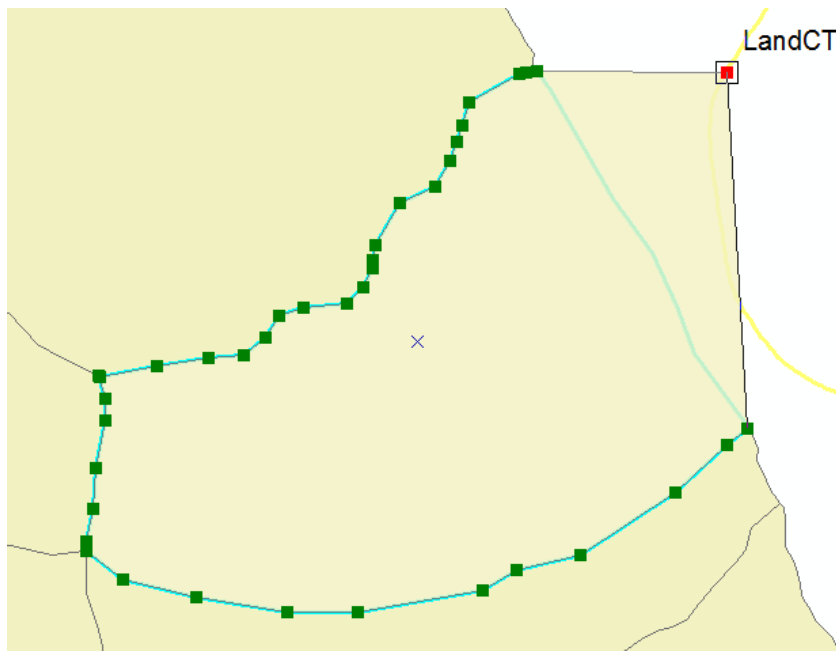
9. **Change the Offset to 0, and uncheck the Trace selected features option. Click OK.**



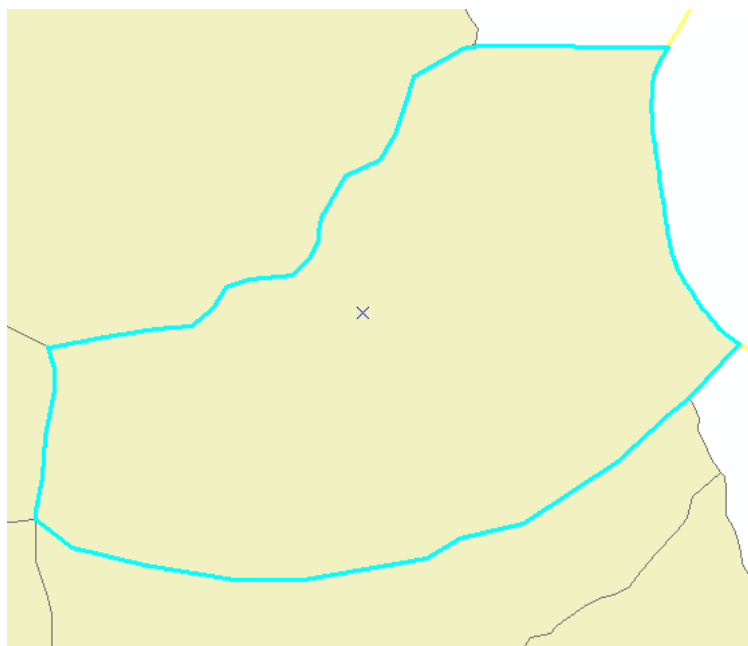
10. **Trace the coincident pasture boundaries as show below, and click your mouse to stop tracing (but not finish sketch).** *Your sketch should look like the screengrab below.*




11. Next **click the straight segment on the Feature Construction Toolbar** and draw a straight line east and snap to the LandCT_Districts.



12. Click on the **Trace tool** again to trace along the **Forest boundary** and **double click to end the trace and finish the sketch at the same time**. Your new polygon should look like the screengrab below.



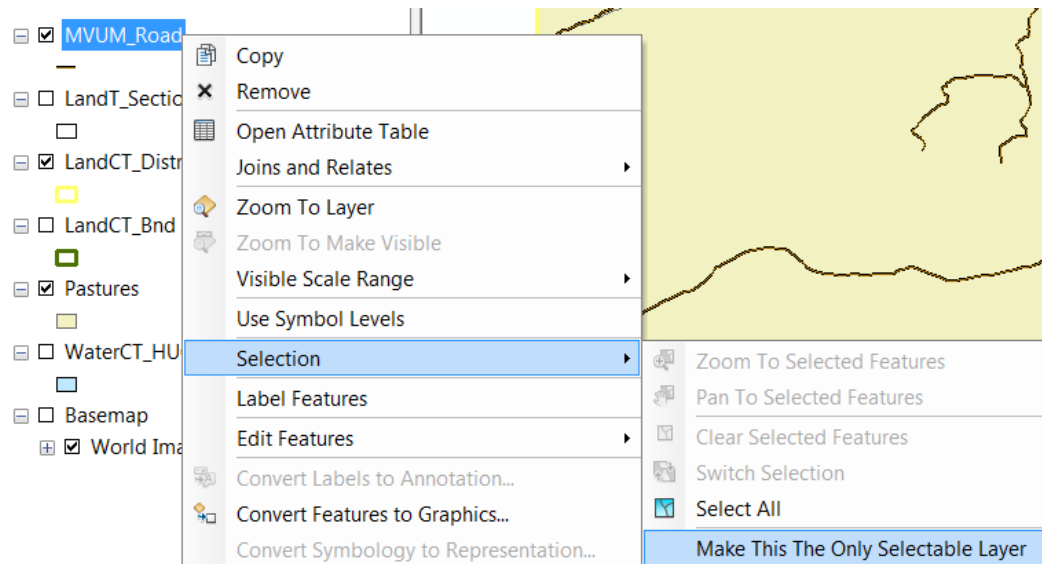
13. Click on the ID button  and select the new polygon. *If the attributes for another collocated layer pops up, simply click the Pastures layer in the “Identify from:” dropdown. Then click the ID Tool and new polygon again. You will see that the new polygon has the attributes of the replaced polygon.*


Identify	
Identify from:	Pastures
Pastures	F
Location:	486,337.089 4,790,048.518 Meters
Field	Value
OBJECTID	397
SHAPE	Polygon
OBJECTID_1	273
CN	12898.010495
UNIT_NO	40263
SUB_NO	006
SUB_NAME	F
SUB_TYPE	1
REV_DATE	4/4/2017
DATA_SOURC	07
ACCURACY	20
ALLOT_NAME	Poker Peak
ALLOT_TYPE	Active Allotment
ALLOT_KIND	S&G
SHORT_NUMB	263
FULL NAME	Poker Peak S&G

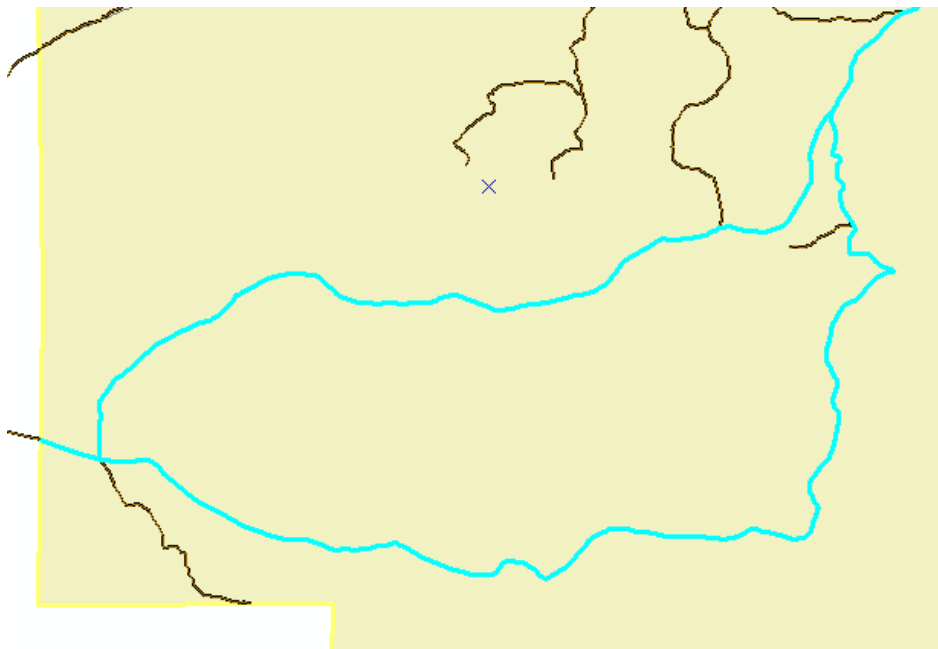
W. Construct Polygons Tool

You can use Construct Polygons to create new polygons from the shapes of existing lines or polygons. For example, in this scenario we are going to create a new pasture based on features in the Roads layer.

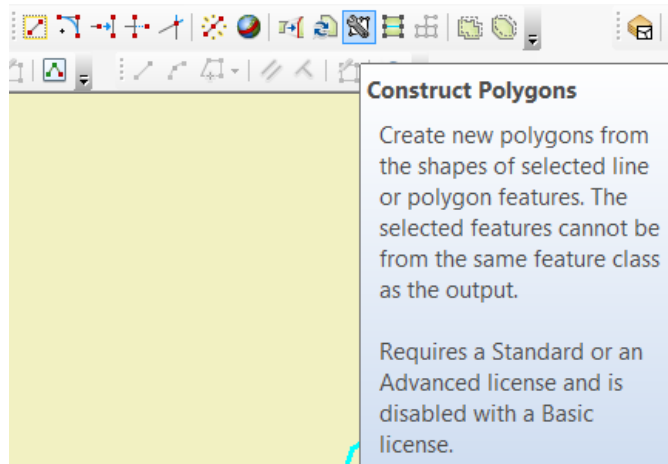
1. Click **Bookmarks | Construct Polygons Tool**.
2. **Right click the MVUM_Roads layer in the TOC and choose Selection | Make this the only selectable layer.**



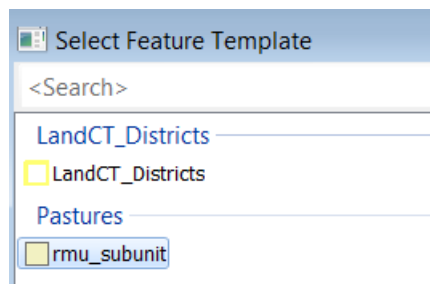
3. Click the **Edit Tool**  on the Editor toolbar, **hold down the Shift key, and select all three of the road segments** that make an enclosed area, as shown in the screengrab below.



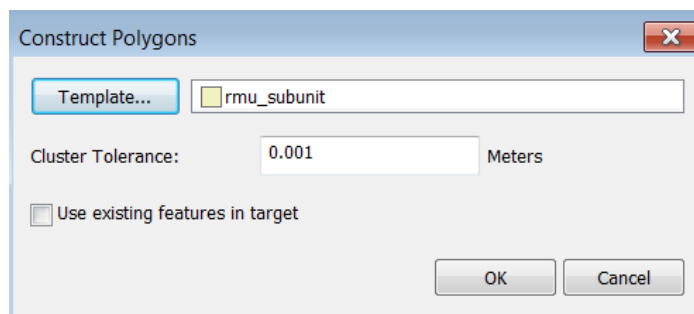
- Click **Construct Polygons**  on the Advanced Editing toolbar.



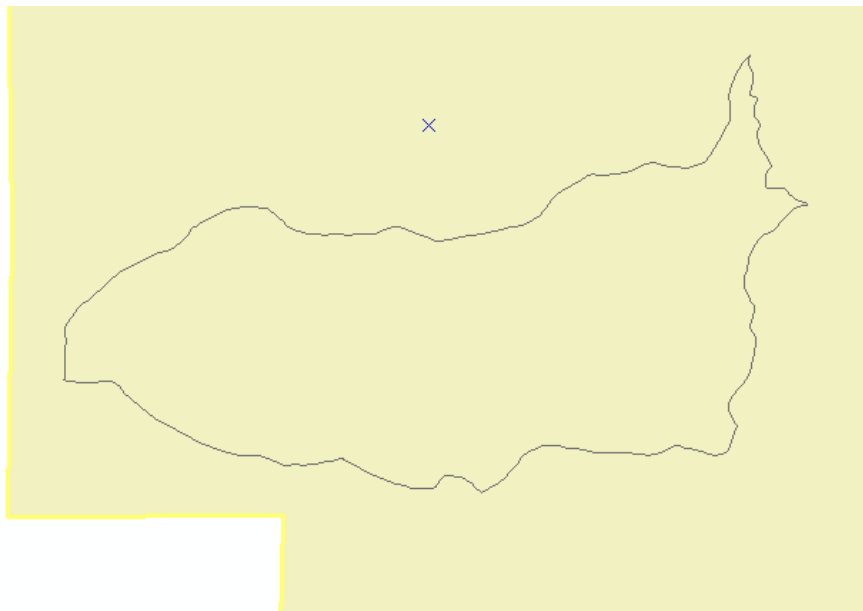
- Click **Template** and choose the **rmu_subunit** layer as the Target for the new feature. Click **OK**.



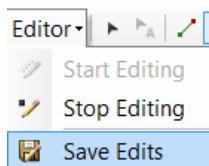
- Leave the default **Cluster Tolerance**, and do not check the checkbox. Click **OK**.



- The new features are created in the target feature class. **Turn off the MVUM_Roads** layer to see the new polygon created in the Pastures layer.



8. Save your edits.

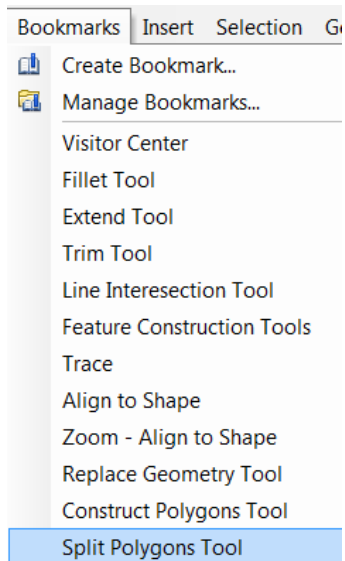



X. Split Polygons Tool

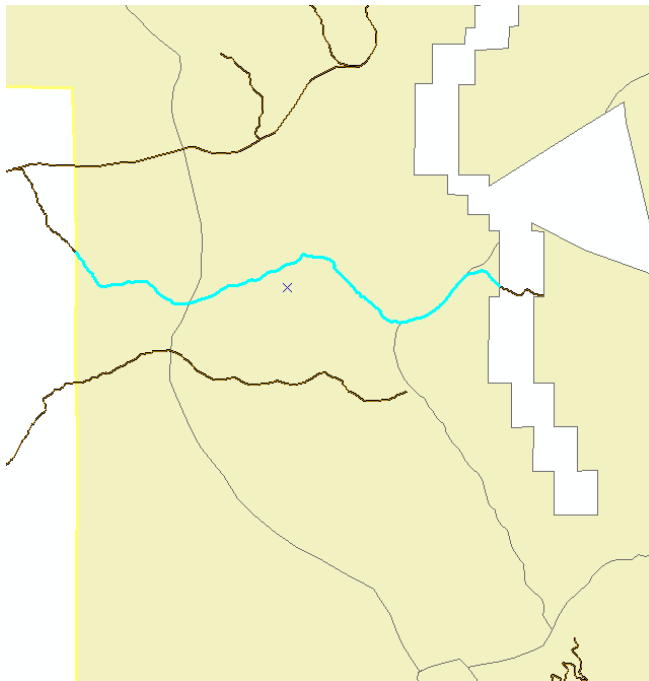
You can use the Split Polygons command to split polygons by overlapping features. Split Polygons allows you to split many polygons simultaneously. For example, this may be useful if you are creating new parcels from a larger tract polygon.

In this scenario we will divide some pastures using a road segment to split them into smaller pastures.

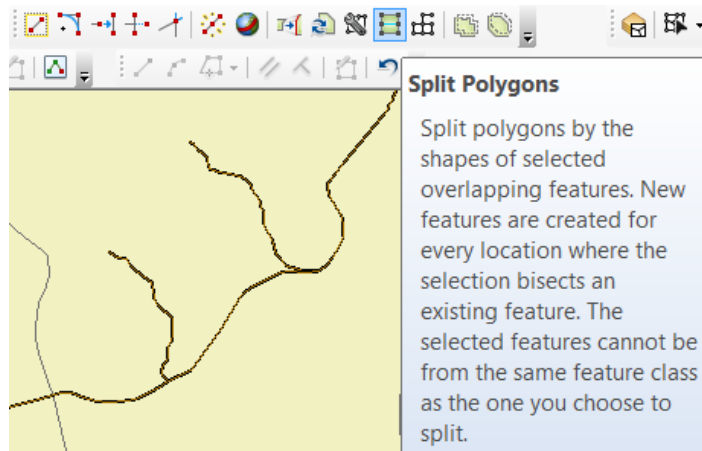
1. Select **Bookmarks | Split Polygons Tool**.



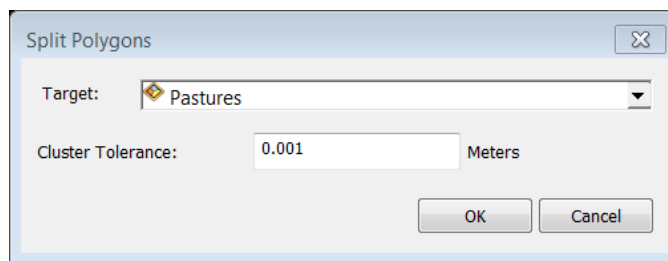
2. Use the **Select Features tool**  to select the road segment that will be used to **split the existing polygons**, as shown in the screengrab below. *Only features that overlap the polygons are used in the split.*



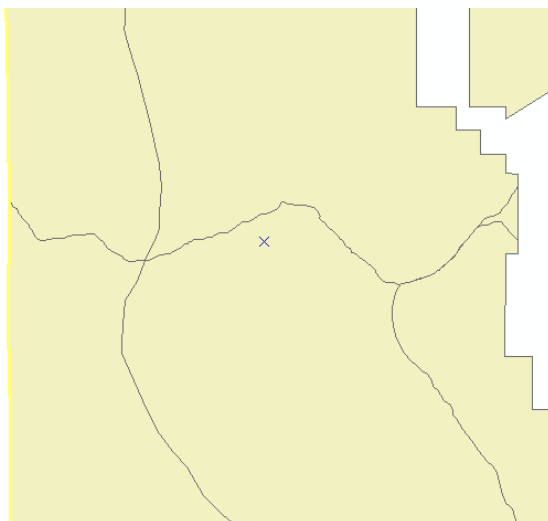
3. Click **Split Polygons Tool**  on the Advanced Editing toolbar.



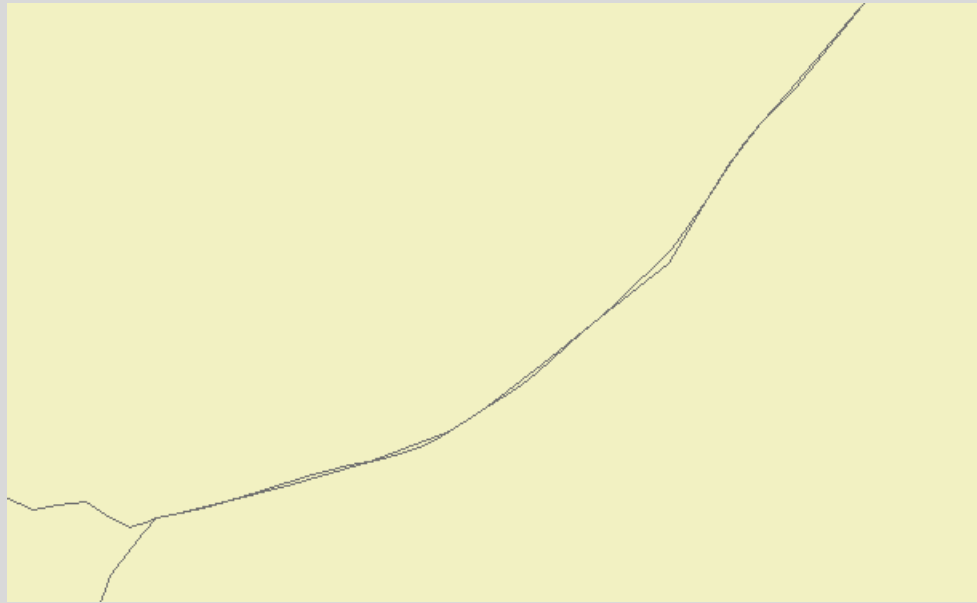
4. Click the **Pastures** layer as the Target, leave the default cluster tolerance. Click **OK**.



5. Turn off the **MVUM_Roads** layer to see the result.




Notice in the screengrab below, on the east allotment, we may have inadvertently created some sliver polygons. The boundary already approximated the road boundary, but was not aligned. In the next lesson we will use Map Topology tools to find and fix errors of this nature. In Lesson 3 we will use a Python tool to help find the sliver errors, and fix them automatically.

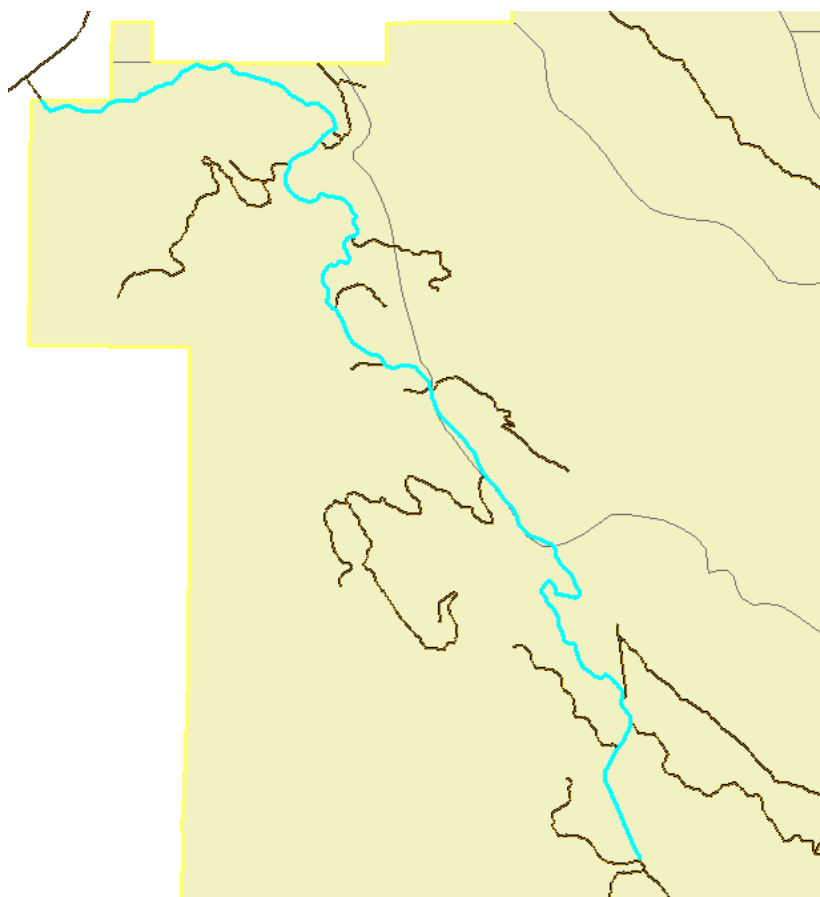


Y. Planarize Lines Tool

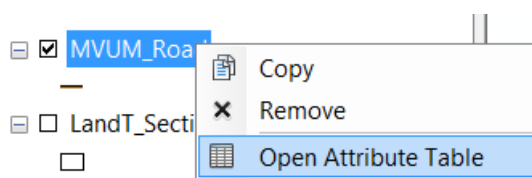
You can split selected lines where they intersect by using the Planarize Lines Tool on the Advanced Editing toolbar. When Planarize is used on a multipart line feature, it is split at the point of intersection into a new feature.

In this scenario, we want to split all the road segments wherever they intersect. This will help determine where we may need road signs installed.

1. Click **Bookmarks | Planarize Lines Tool**.
2. Click the **Select Tool**  and select the road segment shown in the following screengrab. It should only take one click because that is all one road segment. Notice that several other road segments intersect this road and there is not a split.



3. **Right click the MVUM_Roads layer in the TOC and open the Attribute Table.**



4. At the bottom of the Attribute table **notice how many records** there are.

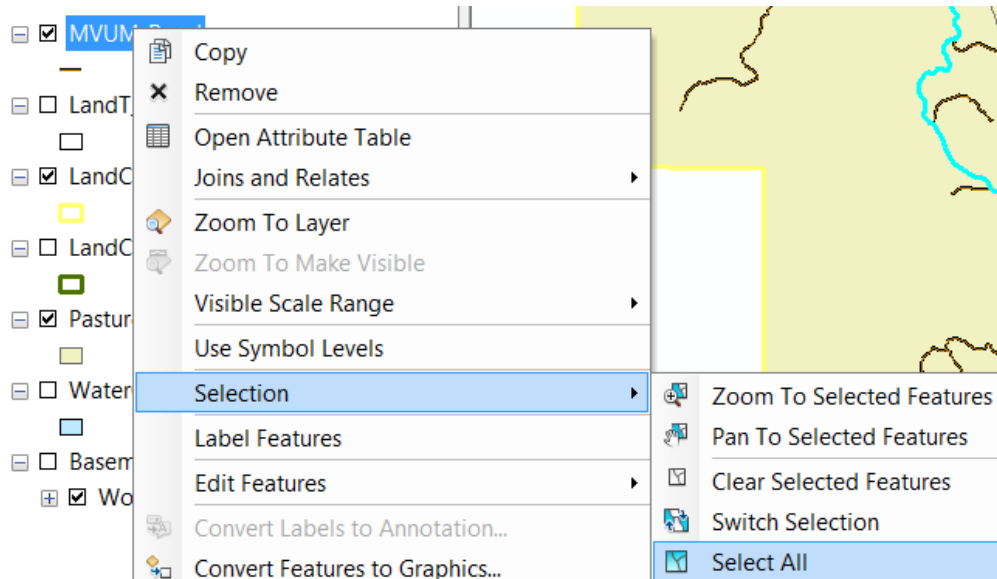
Table

MVUM_Road

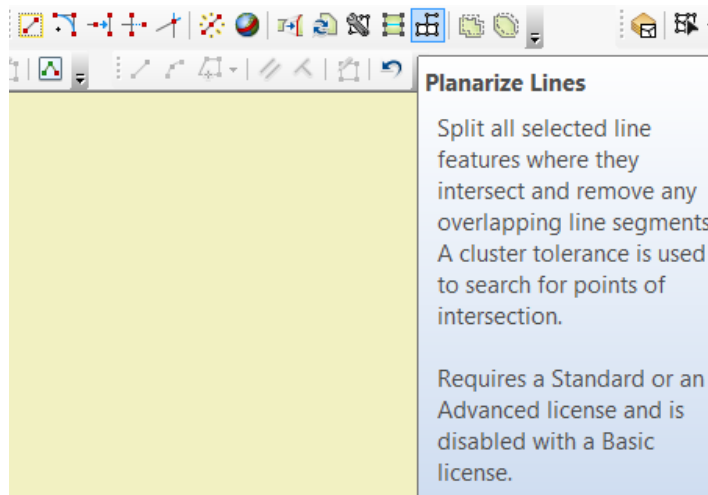
	OBJECTID *	RTE_CN	BMP	EMP	ID	Name
	1	416010515	0	0.46	29015	CURLEW C G
	2	214526010602	0	0.22	20136F	TIMOTHY LANE
	3	477010515	0	0.47	50083	UPPER BARNES CREEK
	4	25180010602	0	0.04	70207	TOPONCE CORRAL
	5	172494010602	0	0.19	40320B	BPA POWER LINE
	6	675255010602	0	0.03	50886B	AUBURN FISH HATCHERY B

(1 out of 4016 Selected)

5. Right click the **MVUM_Roads** layer in the TOC, click **Selection** and **Select All**.

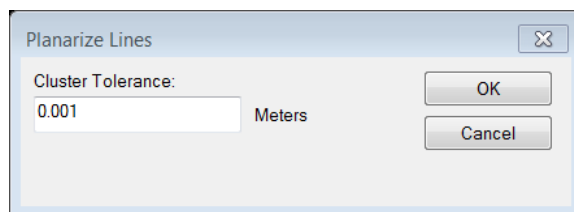


6. Click the **Planarize Lines** tool  on the Advanced Editing toolbar.



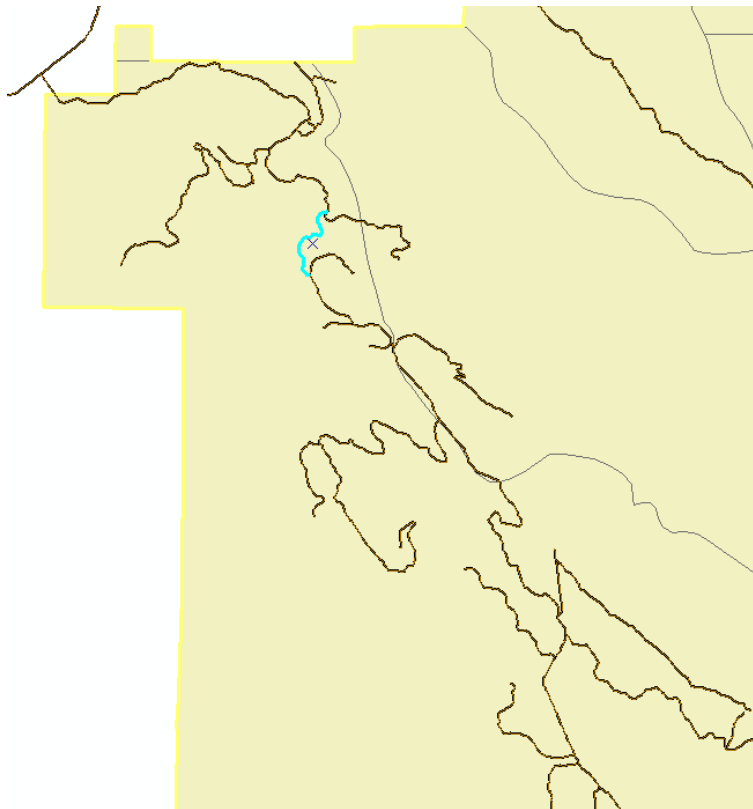
7. Accept the default cluster tolerance. **Click OK.**

The process may take a few seconds since there are so many roads.



8. When the Planarize process is completed, **click the Select Features tool and select the road segment** to verify that it has been divided into segments based on the intersections.

Planarize also removes overlapping line segments—such as those created by constructing lines from polygons that have shared boundaries.



- Look at the Attribute table and **see how many records there are after the Planarize process.**

There are about 2,000 more road segments now.

Table						
MVUM_Road						
	OBJECTID *	RTE_CN	BMP	EMP	ID	Name
	4017	386010515	0.78	1.36	71201	ELGROVE CANYON
	4018	386010515	0	0.78	71201	ELGROVE CANYON
	4019	135010515	4	5.75	30414	SWAN FLAT
	4020	1063010515	2.89	3.19	70055	STEEL CANYON
	4021	861010515	0	0.27	31114	BOSS CANYON
	4022	861010515	0.27	2.37	31114	BOSS CANYON

10. **Click Save Edits.** Unless you plan to complete the optional sections, click **Stop Edits** on the Editor Toolbar.

OPTIONAL: Most of the following tools do not apply for the majority of work in the Forest Service, so in an effort to shorten the exercise, they were made optional. However, we wanted to provide an opportunity for students to gain experience with all the tools on the Advanced Toolbar and other editing toolbars. The directions to use each tool are below, and you are welcome to use the training data to practice the steps.

Z. Copy Features Tool (Optional)

The copy Features tool is different than Copy and Paste on the Standard toolbar. Instead of the Standard toolbar where the features are pasted directly on top of the features you copied, with the Copy Features tool, you click where you want to paste the features or drag a box to scale the features when they are pasted.

The Copy Features tool allows you to copy features from non-editable layers that are outside the extent of your editable layers into your spatial data. The tool allows you to click where you want to place the features, or draw a box to scale the selected features to fit inside the extent of the features you are editing.

For example, you have some roads features drawn in a CAD layer that need to be added to surface disturbance layer, but the CAD features are too big to fit properly. Use the Copy Features tool to drag a box to scale the selected features and paste into your Surface Disturbance data.

The attributes will be only be copied and pasted along with the geometry if the source and target layers are the same. If they have different schemas, a copy of the geometry (but not the attributes) of the selected feature is created.

1. Click the Edit tool Edit Tool  on the Editor toolbar.



2. Click the feature you want to copy. Hold down the SHIFT key while clicking features to select additional features.

3. Click the Copy Features Tool  on the Advanced Editing toolbar.



4. Click the place where you want a copy of the feature to be pasted, or drag a box into which the features will be scaled and pasted.
5. Select the layer in the dropdown where you wish store the pasted feature.
6. Click OK.
7. You may need to do further editing to the pasted data to align it perfectly into the target data.

AA. Explode Multipart Feature Tool (Optional)

You can use Explode Multipart Feature on the Advanced Editing toolbar to separate a selected multipart feature into its individual, component features. This would be useful if you needed to alter the attributes of one of the elements in a multipart feature.

There are also geoprocessing tools available to merge and separate features. The Merge and Multipart To Singlepart geoprocessing tools work on all features in a layer rather than just the selected features.

1. Click the Edit Tool  on the Editor toolbar.



2. **Select the multipart feature you want to separate** into individual features.
3. **Click Explode Multipart Feature** on the Advanced Editing toolbar.



The parts of the multipart feature become independent features, with each one being assigned identical attribute values.

BB. Construct Geodetic Tool (Optional)

You can create geodetic features—lines, circles, and ellipses—that are spatially accurate and geodetically correct in any projection. For example, if you are creating a feature that spans a

large distance, such as an airplane's flight path across an ocean or the effective range of a weapon, you should use a geodetic feature. For an overview of geodetic features and more information on the distortion they account for, see [About geodetic features](#).

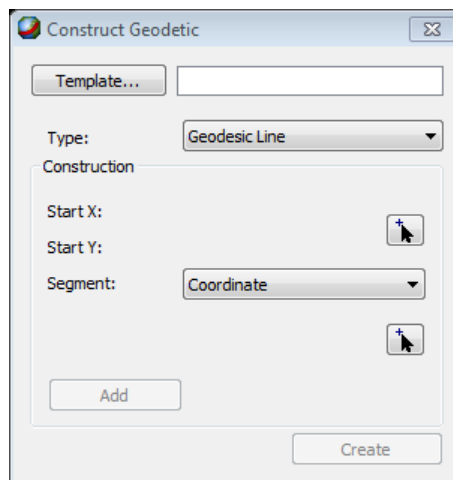
You can enter coordinates for whole features or feature segments by clicking the map or by typing the values. You can specify the location as a longitude-latitude coordinate pair, a Military Grid Reference System (MGRS) grid location, a U.S. National Grid (USNG) location, or a Universal Transverse Mercator (UTM) coordinate. Click the Units button Units button to choose the units you want. For guidelines on specifying coordinates, see [About distance units and editing](#).

Direction is specified in the angular units specified on the Editing Options > Units tab. Distances, such as the radius or axis length, are specified in map units of the data frame by default. You can enter values using different units by clicking the Units button Units button next to the text box. For example, when the map units are decimal degrees, clicking the Units button allows you to enter values in distance units, such as kilometers.

1. In ArcMap, start an edit session with either line or polygon layers.
2. Click Construct Geodetic Construct Geodetic on the Advanced Editing toolbar.



- a. The Construct Geodetic dialog box appears.



3. Choose the target in which the new feature will be created.

- a. If you have feature templates for the layers in your map, click the Template button and click the template to use to create the new feature. You can also double-click the preview of the template to choose a different template.
 - b. If you do not have feature templates, click the layer in which to create the feature.
4. Click the Type drop-down arrow and click the type of geodetic feature you want to create. For a description of each type, see About geodetic features. The Construction area of the dialog box changes to reflect the type you selected.
5. If you are creating a geodesic line, great elliptic, or loxodrome:
 - a. Type the starting x- and y- coordinate values. You can also click the Interactive Start Point Selection tool Interactive Start Point Selection tool, then click the map display to set the start point.
 - b. Click the Segment arrow to set whether you want to create the segment by entering a coordinate for the end point or by a distance and bearing direction.
 - c. Enter the end coordinate or the distance and direction.
 - d. If you want to create a multi-segment line, click Add so the current end coordinate will become the start coordinate for the next segment. The Add button becomes enabled when you have entered two valid coordinates for points, directions, distances, and lengths.
6. If you are creating a geodesic circle:
 - a. Type the center x- and y- coordinate values. You can also click the Interactive Start Point Selection tool Interactive Start Point Selection tool, then click the map display to set the center point.
 - b. Type the radius value.
7. If you are creating a geodesic ellipse:

- a. Type the center x- and y- coordinate values. You can also click the Interactive Start Point Selection tool Interactive Start Point Selection tool, then click the map display to set the center point.
 - b. Type the major axis, minor axis, and direction values.
8. As you enter locations, you see a preview of the feature on the map. Once you are ready to create the feature, click the Create button.
9. Repeat these steps to create additional features. Close the Construct Geodetic dialog box when you are finished creating features.

CC. Midpoint Tool (Optional)

Midpoint allows you to place a point or vertex by clicking two points; the new point or vertex is placed at the midpoint of the line between these points. If you were creating street centerlines from parcel data, you might use Midpoint to create the vertices directly between the parcels on opposing sides of the road.

1. These steps can be used to create either point features or vertices in lines and polygons:
 - a. To create a point feature - Click a point feature template in the Create Features window and click the Point tool Point.
 - b. To create a vertex in a line - Click a line feature template in the Create Features window and click the Line tool Line.
 - c. To create a vertex in a polygon - Click a polygon feature template in the Create Features window and click the Polygon tool Polygon.
2. Click Midpoint on the Editor toolbar construction method palette.
3. Click once to establish the first of two points. The new vertex is created between this point and the next point you click.
4. Click the second point to place the vertex or point at the midpoint of the line between the two points you clicked.

DD. Distance – Distance Tool (Optional)

Distance-Distance allows you to create a point or vertex at the intersection of two distances from two other points. For example, the Distance-Distance method could be used to place a new electrical pole based on field measurements. The next point is known to be 50 feet from one building corner and 75 feet from another. Distance-Distance creates two circles based on these distances and finds two possible intersection points where the pole can be placed.

1. These steps can be used to create either point features or vertices in lines and polygons:
 - a. To create a point feature - Click a point feature template in the Create Features window and click the Point tool Point.
 - b. To create a vertex in a line - Click a line feature template in the Create Features window and click the Line tool Line.
 - c. To create a vertex in a polygon - Click a polygon feature template in the Create Features window and click the Polygon tool Polygon.
2. Click Distance—Distance Distance-Distance on the Editor toolbar construction method palette.
3. Click once to establish the centerpoint of the first circle, and press D on the keyboard.
4. Type the radius length for the first circle and press ENTER.
 - a. A circle is created with the specified radius.
5. Click once to establish the centerpoint of the second circle, and press D.
6. Type the radius length for the second circle and press ENTER.
 - a. A second circle is created with the specified radius. The two locations where the radii of the circles intersect are highlighted when you move the pointer over them.
7. Position the pointer over the location where you want to add the vertex, or point and click. You can also press TAB to alternate between the two points of intersection and press ENTER to create the point.

EE. Direction – Distance (Optional)

Direction-Distance allows you to create a point or vertex using a distance from a known point plus a direction from a known point to define a bearing line. For example, a pole might be located at a specified distance from the corner of one building and at a defined angle from the corner of another building.

1. These steps can be used to create either point features or vertices in lines and polygons:
 - a. To create a point feature - Click a point feature template in the Create Features window and click the Point tool.
 - b. To create a vertex in a line - Click a line feature template in the Create Features window and click the Line tool.
 - c. To create a vertex in a polygon - Click a polygon feature template in the Create Features window and click the Polygon tool
2. Click Direction–Distance on the Editor toolbar construction method palette.
3. Click a point to specify the location from which the direction to the next vertex is measured.
4. Move the pointer to get the approximate direction toward the next vertex. As you move the pointer in the direction from the point you clicked, the direction is displayed in the lower left corner of the ArcMap window.
5. Press D and type the direction to the vertex from the point you clicked, then press ENTER.
6. Optionally, click again on the map to set the direction.
7. Click a point to specify the location from which the distance to the next vertex is measured.
8. Move the pointer to get the approximate distance from the point you clicked to the next vertex.
 - a. As the pointer is moved, a circle, centered at the second point you clicked, is dragged out to intersect the direction line you just defined. The radius of the circle is displayed in the lowerleft corner.

- b. Optionally, press D and type a distance in map units to the next vertex from the point you specified. Pressing ENTER sets the size of the circle.
 - c. The new vertex is placed at one of the intersection points of this circle and the direction line.
9. Click the intersection of the circle and the direction line that corresponds to the position of the new vertex. The intersection point nearest the cursor is selected, and once clicked, the new vertex is placed. Optionally, you can press TAB to switch between the two intersection points and ENTER to select one of them.

FF. Tangent Curve Segment Tool (Optional)

Tangent Curve Segment adds a segment that is tangential to the previously sketched segment. This method is practical when sketching rail lines in which the curves are nearly always tangential to the previous segment. To create a tangent curve, you need to have already sketched a segment using one of the other sketch construction methods.

1. These steps can be used to create vertices in either lines or polygons:
 - a. To create a vertex in a line - Click a line feature template in the Create Features window and click the Line tool Line.
 - b. To create a vertex in a polygon - Click a polygon feature template in the Create Features window and click the Polygon tool Polygon.
2. Create a segment using any construction method.
3. Click Tangent Curve Segment on the Editor toolbar construction method palette.
4. As the pointer is moved, the arc bends and changes in length to remain tangent to the previous segment. Press R to set the radius value, then press TAB to cycle through the possible curve solutions.
5. Click again to place the endpoint of the arc.

GG. Bezier Curve Segment Tool (Optional)

Bézier Curve Segment constructs smoothed curves. You can use the handles to change the angle, height, and shape of the curve. If you rotate the handles, you can create an S-shaped curve.

1. These steps can be used to create vertices in either lines or polygons:
 - a. To create a vertex in a line - Click a line feature template in the Create Features window and click the Line tool Line.
 - b. To create a vertex in a polygon - Click a polygon feature template in the Create Features window and click the Polygon tool Polygon.
2. Click Bézier Curve Segment on the Editor toolbar construction method palette.
3. Click where you want the curve to begin.
4. Drag the handle to set the distance and angle of the curve.
5. Click where you want that curve to end.
6. Drag that handle to complete the curve's shape.
 - a. Pressing the M key allows you to hold down the mouse button while dragging the Bézier control arm handle to shape the curve.
7. If you want to reshape the curve, you can edit the curve later by moving the handles with the Edit tool.

HH. Generalize Tool (Optional)

The Generalize command Generalize simplifies the shape of the selected features using the published algorithm (Douglas and Peucker, 1973). The degree to which the geometry is simplified depends on the maximum allowable offset, which limits how far the output geometry can be from the input geometry. For features composed of linear segments, the output vertices are a subset of the original feature vertices.

1. Type the maximum allowable offset.
 - a. The maximum allowable offset is the maximum distance in map units that any part of the output geometry can be from the input geometry. You can also give the value in other units by specifying a distance units abbreviation



with the value that you enter. To learn more, see [About distance units and editing](#).

2. Click OK.

II. Smooth Tool (Optional)

The Smooth command is used to smooth the straight edges and angular corners of a feature. The feature geometry is replaced by a series of smoothed line segments.

1. Click Smooth on the Advanced Editing toolbar.
2. Type the maximum allowable offset.
 - a. The maximum allowable offset is used to derive an intermediate, simplified line from the input line. From this intermediate line, a final smoothed line is then produced. The offset is in map units. You can also give the value in other units by specifying a distance units abbreviation with the value that you enter.
3. Click OK.

Congratulations, you have completed this Exercise!

