

Intermediate ArcGIS Pro

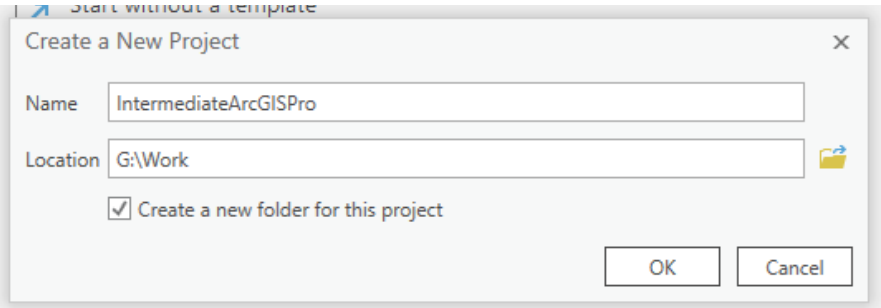
Research Question: I'm looking for a place to live in Ottawa and will be using my bicycle to get around. I want to know which Ottawa neighbourhoods have the most bike lanes and paths, and are any bike paths within 50 metres of places I need to get to?

1. Data acquisition

- a. **Data & documentation link:** <http://tinyurl.com/TrajectoriesGIS>
- b. Data is all from Open Data Ottawa and downloaded in March 2024:
 - a. ...except for CommunityGardens.csv, which is from 2020 (although [not many changes with the current dataset](#)), and we're using it due to the fact that it has XY coordinates and isn't a shapefile or other geospatial file type.
 - b. [Pedestrian Network](#)
 - c. [Cycling Network](#)
 - d. [Ottawa Neighbourhood Study \(ONS\) - Neighbourhood Boundaries Gen 3](#)

2. Getting organized and familiar with the datasets

- a. Launch ArcGIS Pro
- b. Under New templates, click Map
- c. When prompted, provide a name for your project and browse to the location where you'd like to save it. Click OK.



This will create specific folders for your project.

In Windows Explorer:

- d. We're going to change to Windows Explorer. Navigate to your new project folder in Windows Explorer. It should look something like this:

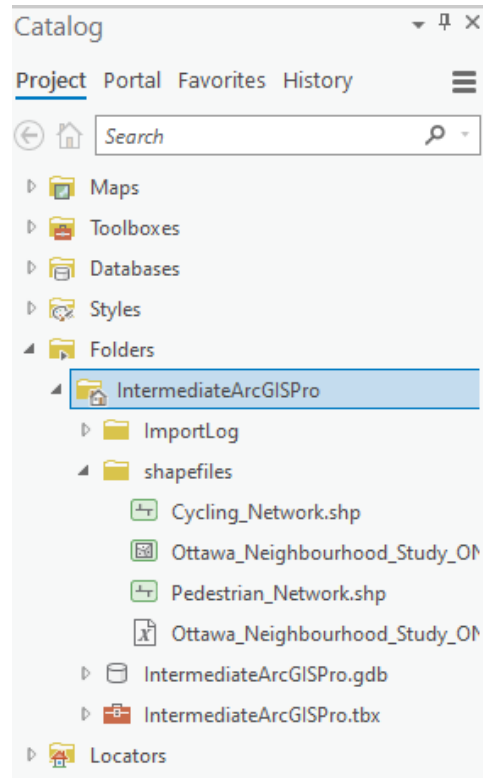
Name	Date modified	Type
ImportLog	2020-02-07 1:05 PM	File folder
Index	2020-02-07 1:05 PM	File folder
IntermediateArcGISPro.gdb	2020-02-07 1:05 PM	File folder
IntermediateArcGISPro.aprx	2020-02-07 1:05 PM	ArcGIS Project File
IntermediateArcGISPro.tbx	2020-02-07 1:05 PM	ArcGIS Toolbox

- a. The .gdb folder is the project geodatabase that ArcGIS Pro automatically creates
- b. The .aprx file is the map file
- c. The .tbx file is the project toolbox, where you could save tools you use or build
- e. Add a new folder called *shapefiles*

Name	Date modified	Type
ImportLog	2020-02-07 1:05 PM	File folder
Index	2020-02-07 1:05 PM	File folder
IntermediateArcGISPro.gdb	2020-02-07 1:05 PM	File folder
IntermediateArcGISPro.aprx	2020-02-07 1:05 PM	ArcGIS Project File
IntermediateArcGISPro.tbx	2020-02-07 1:05 PM	ArcGIS Toolbox
shapefiles	2020-02-07 1:09 PM	File folder

- f. Unzip the shapefiles you downloaded and save them in the new *shapefiles* folder

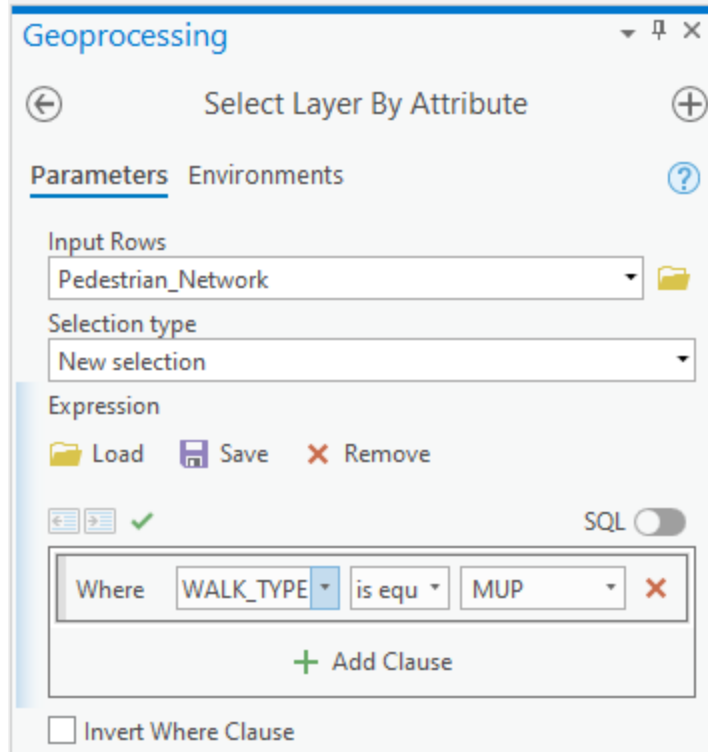
- g. Go back to ArcGIS Pro, in the right-hand pane, click on the **Catalog tab** at the bottom, then double-click on **Folders**. You should see your project folder, and if you open it you should see an ImportLog folder, plus geodatabase and toolbox.
 - a. If you don't see your new shapefiles folder, right-click on your project folder and **Refresh**



- h. Click and drag the shapefiles into the Map pane
- i. Open the attribute tables for the shapefiles and have a look at what kind of information is provided, and think about what may be helpful for us

Select by Attribute

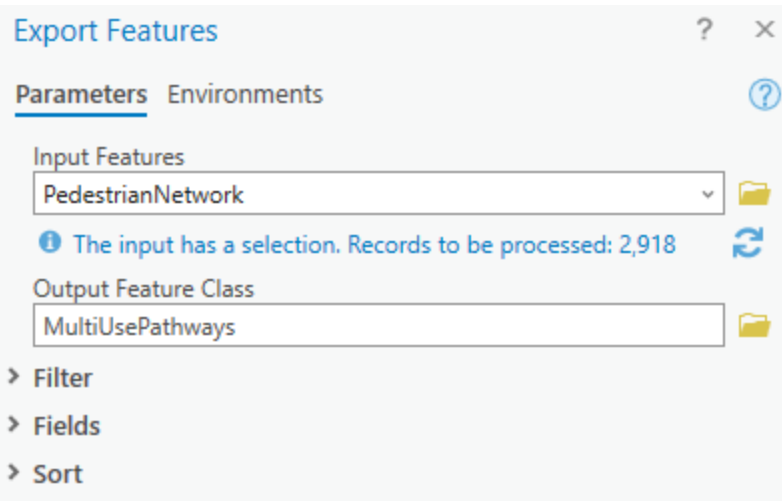
- a. **Pedestrian_Network** has some relevant data but some that isn't useful for us (since we shouldn't ride our bicycle on the sidewalk), so let's only extract the multi-use pathways.
 - a. Select the **Map ribbon > Select By Attributes**
 - b. Select features from Pedestrian_Network where WALK_TYPE is equal to MUP
 - c. Click Apply



There should be 2,918 features selected when viewing the attribute table.


- d. Click OK to close the Select By Attributes window

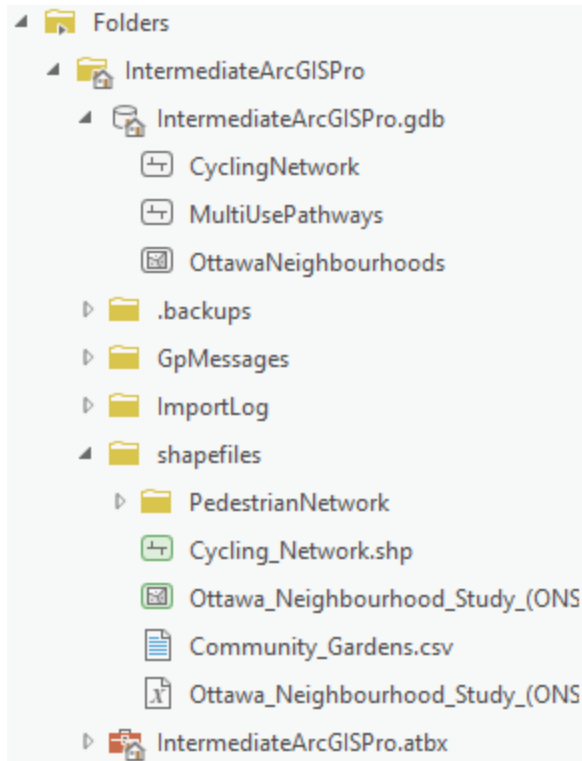
- b. Right-click on Pedestrian_Network in Contents and select **Data > Export Features** (could also click on the name of the shapefile in the Contents pane, then the **Export Features** button in the **Feature Layer > Data ribbon**)
 - a. Input Features: PedestrianNetwork
 - i. There's a note that "The input has a selection. Records to be processed: 2,918" which is exactly what we want.
 - b. Output Feature Class: MultiUsePathways
 - i. When you click on the text box to change the output name, note that the file will save to the project geodatabase.
 - ii.



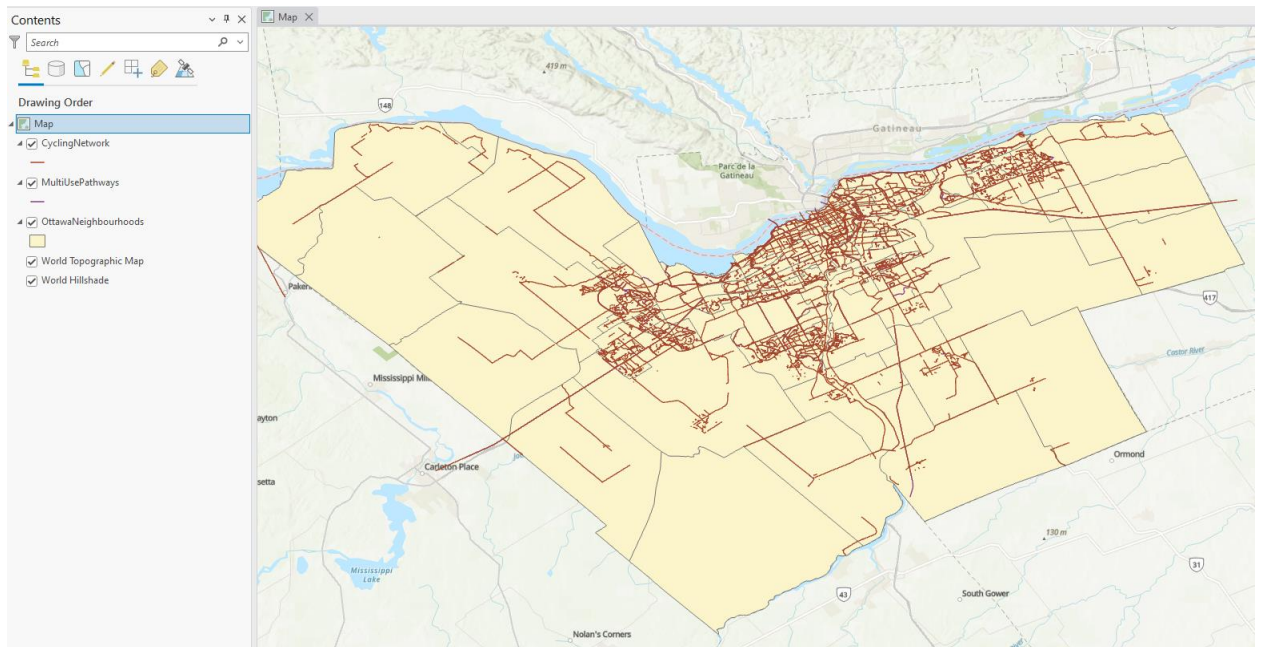
- c. Click OK
- d. In the table of contents, right-click on the new MultiUsePathways feature layer and select **Properties > Source**
 - a. In the Data Source section, note that the Data Type is File Geodatabase Feature Class and it indicates the file path for the geodatabase
 - i. For shapefiles, the Data Type is Shapefile Feature Class
- e. Right-click on Pedestrian_Network shapefile and select **Remove**

Copy shapefiles into the geodatabase

- a. Since we have our MultiUsePathways feature layer in the geodatabase, let's copy the other two shapefiles into the geodatabase as well so they're all in one location
 - a. In the Map ribbon in the Selection section, click the Clear button  **Clear** to ensure no features are selected
 - i. If they are, only those features will be exported
 - ii. if the button is greyed-out, there are no features selected and you're good to go
 - b. In the table of contents, right-click a shapefile and select **Data > Export Features**
 - c. Ensure that the Output Location is the project geodatabase
 - d. Give the Output Feature Class a name (e.g.: CyclingNetwork or OttawaNeighbourhoods)
 - e. Click OK
 - f. Repeat for the other shapefile
- b. If you click on the Catalog pane, your file structure should look something like this:



- c. In the table of contents, right-click and remove the cycling network and neighbourhood shapefiles, keeping only the geodatabase feature classes. Your map should look something like this:

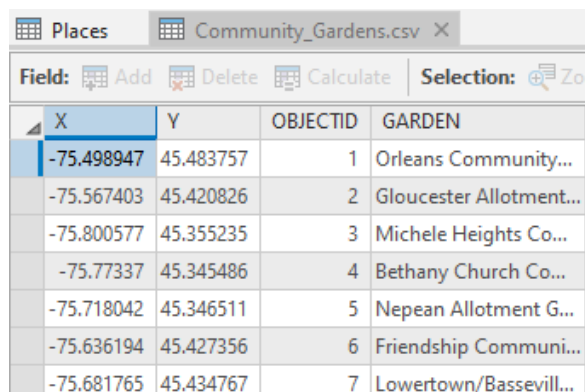


3. Using a CSV file with latitude & longitude coordinates

Sometimes geospatial files (shapefiles, KMZ, geodatabases, etc.) aren't available, but it's possible to use any dataset that has latitude & longitude coordinates.

How can I tell if data has latitude and longitude?

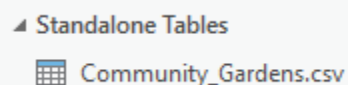
Have a look at the CSV or Excel file! The coordinates may be called X and Y, latitude and longitude, or some combination of those but the numbers should look like these (-75 and 45):



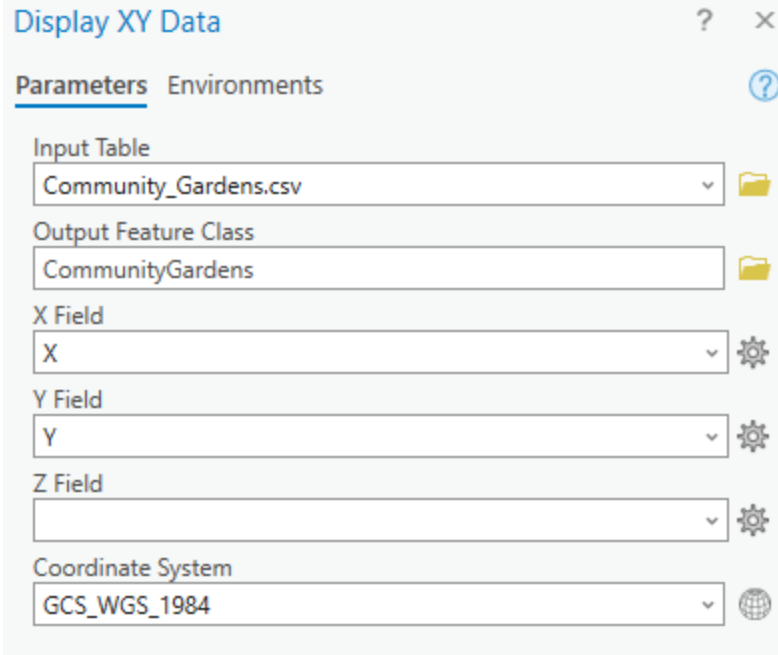
X	Y	OBJECTID	GARDEN
-75.498947	45.483757	1	Orleans Community...
-75.567403	45.420826	2	Gloucester Allotment...
-75.800577	45.355235	3	Michele Heights Co...
-75.77337	45.345486	4	Bethany Church Co...
-75.718042	45.346511	5	Nepean Allotment G...
-75.636194	45.427356	6	Friendship Communi...
-75.681765	45.434767	7	Lowertown/Bassevill...

Displaying X,Y Data

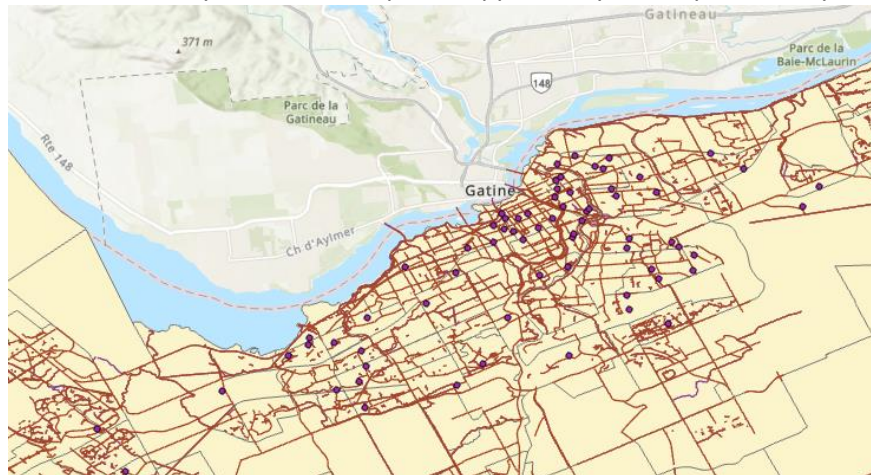
- In ArcGIS Pro, go to the Catalog and your project folder. The CSV file may be in the shapefiles folder.
- Click and drag the CSV into the map window. In the Contents, you should now have a Standalone Table that is your CSV file:



- - Right-click on your CSV and select Open** to view the attribute table. Review the attributes and particularly make note of the latitude and longitude (or X and Y) fields.
- Once you know which fields are your latitude and longitude, right-click on the CSV and select **Display XY Data**
 - The XY Table To Point geoprocessing tool should appear on the right and may already have fields filled in.
 - X Field: either X or longitude
 - Y Field: either Y or latitude
 - Give it a helpful name (e.g. CommunityGardens)
 - Coordinate system: GCS_WGS_1984 (this is not a projection but a coordinate system, and its unit is degrees)



- v.
- e. Click OK
- f. After a moment or two, you should see points appear on your map in the city of Ottawa



- i. Common error: if you zoomed to the new layer and the points show up in Antarctica, the X/longitude and Y/latitude got mixed up so just run it again after correcting that error.
- g. You can remove the CSV standalone table from your map.
- h. Your map should now have the following datasets:
 - i. Your new points feature class (e.g.: community gardens)
 - ii. Multi-use pathways line feature class
 - iii. Cycling network line feature class
 - iv. Ottawa neighbourhoods polygon feature class

4. Some final data preparation

Lots of work to prepare the data!

For the sake of this analysis, we're going to consider both the multi-use pathways and cycling network to be bike-friendly and we don't want to distort our analysis if the two layers overlap or fall within a few metres of one another. In other words, if the cycling network and multi-use pathways overlap or run parallel, we want to ensure we don't count them twice. A good example of this is in the Experimental Farm west of Carleton, where the same paths are included in both datasets.

There are many ways of de-duplicating data and we will use two methods in this workshop.

Select by Location

- We're going to start by selecting features that are identical. Go to the Map ribbon and **Select By Location**
- We're going to select features that are identical in both the MUP and Cycling Network datasets. Fill in the Select Layer By Location form as follows (MultiUsePathways features are the ones that will be selected based on their relationship to CyclingNetwork):

The screenshot shows the 'Select By Location' dialog box with the following configuration:

- Input Features:** MultiUsePathways
- Relationship:** Are identical to
- Selecting Features:** CyclingNetwork
- Search Distance:** Meters
- Selection Type:** New selection
- Invert Spatial Relationship

- Click Apply to ensure that some features are selected. If so, click OK.
 - Open the MultiUsePathways attribute table and there should be **246 features** selected.

	OBJECTID_1 *	Shape *	OBJECTID	WALK_TYPE
1	105	Polyline	28219	MUP
2	106	Polyline	28220	MUP
3	148	Polyline	28262	MUP
4	152	Polyline	28266	MUP
5	261	Polyline	29763	MUP
6	262	Polyline	29764	MUP
7	263	Polyline	29765	MUP
8	265	Polyline	29767	MUP
9	266	Polyline	29768	MUP
10	289	Polyline	30284	MUP
11	290	Polyline	30285	MUP
12	292	Polyline	30287	MUP

- i.
- e. Because we want to ensure we don't eliminate any data, we're going to export only the MultiUsePathways that *don't* match perfectly with the cycling network. To do so, we're going to start by clicking the **Switch Selection** button in the attribute table.

	OBJECTID_1 *	Shape *	OBJECTID	WALK_TYPE	GLOBALID
1	105	Polyline	28219	MUP	{92709252-128C-454F-...
2	106	Polyline	28220	MUP	{642BEA15-297F-4CAF-...
3	148	Polyline	28262	MUP	{8A935FD1-8316-4D48-...
4	152	Polyline	28266	MUP	{F5373EC5-BD25-4915-...

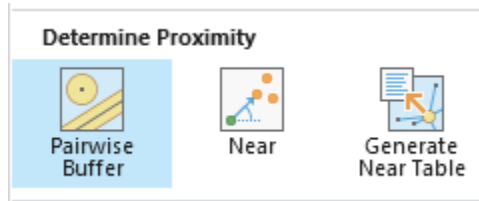
- i.
- f. There should now be **2672 features** selected. Right-click on the MultiUsePathways feature class and **Data > Export Features**
- g. Name the Output Feature Class something helpful, like MUP_noSameCyclePath (that's a bit awkward but at least I know what it means). Click OK.
 - i. Reminder in addition to the blue text, that ArcGIS Pro automatically saves **ONLY** the selected features if there are any selected

- ii.

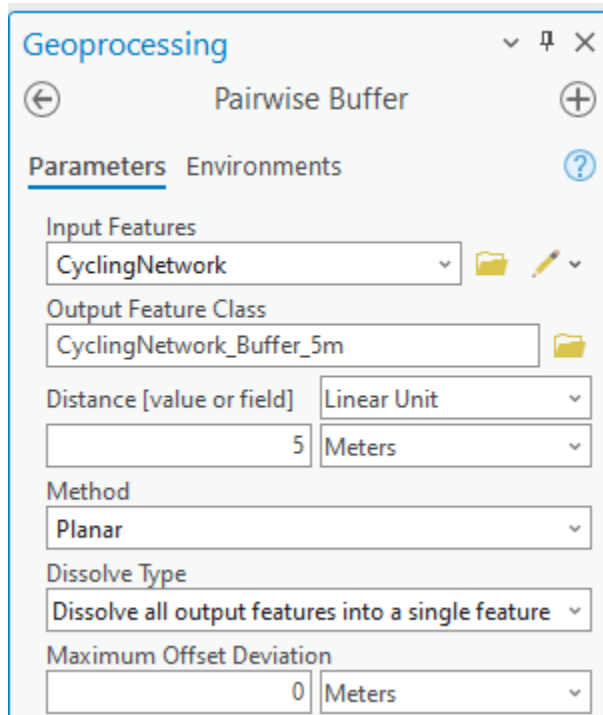
Creating a Buffer

Since there are still cycling paths that run parallel to (or are mostly the same as) the multi-use pathways, we're going to create a buffer around the cycling paths and clip (remove) the MUPs that fall within those buffers. An example of this is on the side of Dows Lake along Queen Elizabeth Driveway.

- a. In the table of contents, click on the CyclingNetwork feature class, then go to the **Analysis ribbon** and in the tools portion, find the **Pairwise Buffer** tool

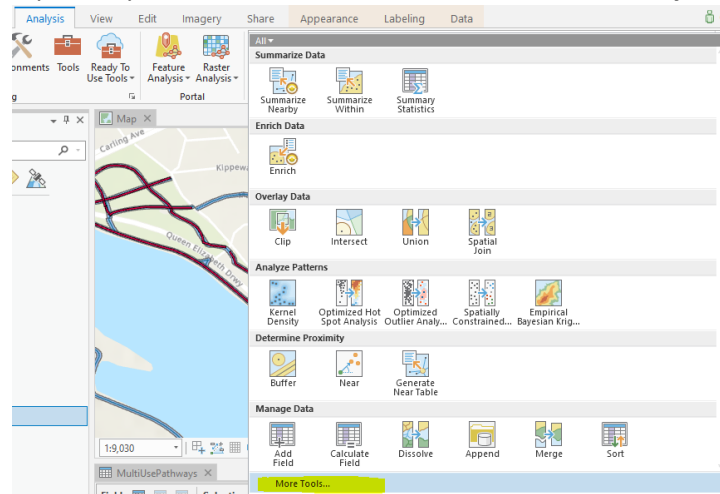


- b. Fill it in as follows and Run.
 - i. We're selecting to "Dissolve all output features into a single feature" as it eliminates overlap between the resulting buffer polygons, so there's only one layer of buffer polygons.

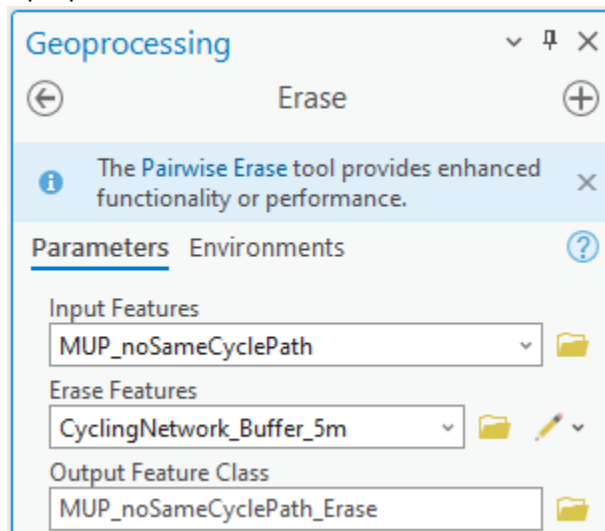


Erase Features within the Buffer

- Now that we have the 5-metre buffers around the cycle network, we're going to erase all the multi-use pathways that fall within that buffer area. In the **Analysis ribbon**, click on More tools...



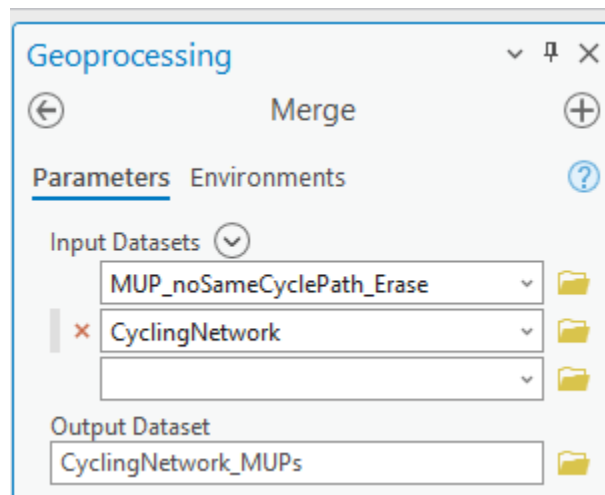
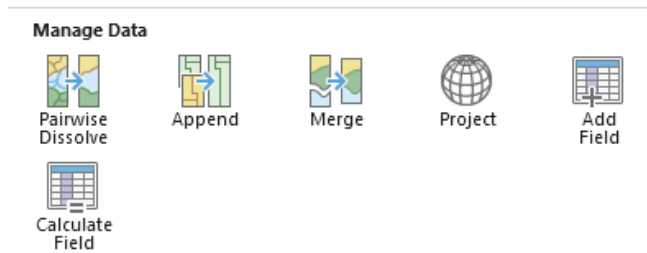
- Type 'erase' into the search box
- Click on the **Erase (Analysis Tools)** option. When the Geoprocessing pane loads with the Erase options, hover over the question mark to see a visualization of what this tool will do.
- Fill in the properties as follows and click Run:



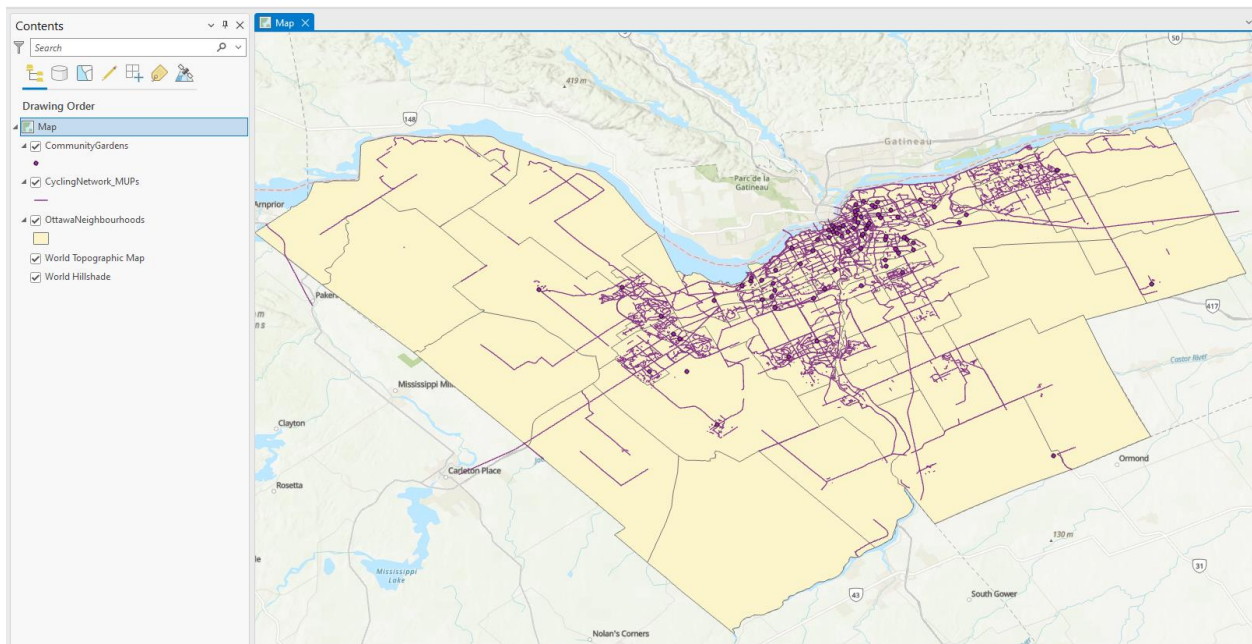
- While the results of this workflow aren't perfect, it reduces the overlap sufficiently to proceed with a more accurate analysis of the cycling infrastructure than where we started. It also reduces the overlap sufficiently to manually remove multi-use pathways that you may consider too close, duplicating, or overlapping the cycling network.

Merge GIS Data

Now – finally – we’re going to merge both the MUPs and cycling network into one dataset to perform the analysis. Go to the **Analysis ribbon** and select **Merge**.



- i.
- f. SHAZAM! Now remove all the extra feature classes from the table of contents that we don't need anymore, keeping only your community gardens points feature class, the CyclingNetwork_MUPs feature class, and the neighbourhoods.



5. Analysis time!

If you're thinking we spent a whole lot of time getting and preparing the data to do the analysis, you're right! This is a realistic reflection of geospatial work and the next step is figuring out which tool to use for your analysis. Most analysis can be done with using a variety of tools and methods. The trick is correctly identifying the tool(s) to use by exploring the documentation.

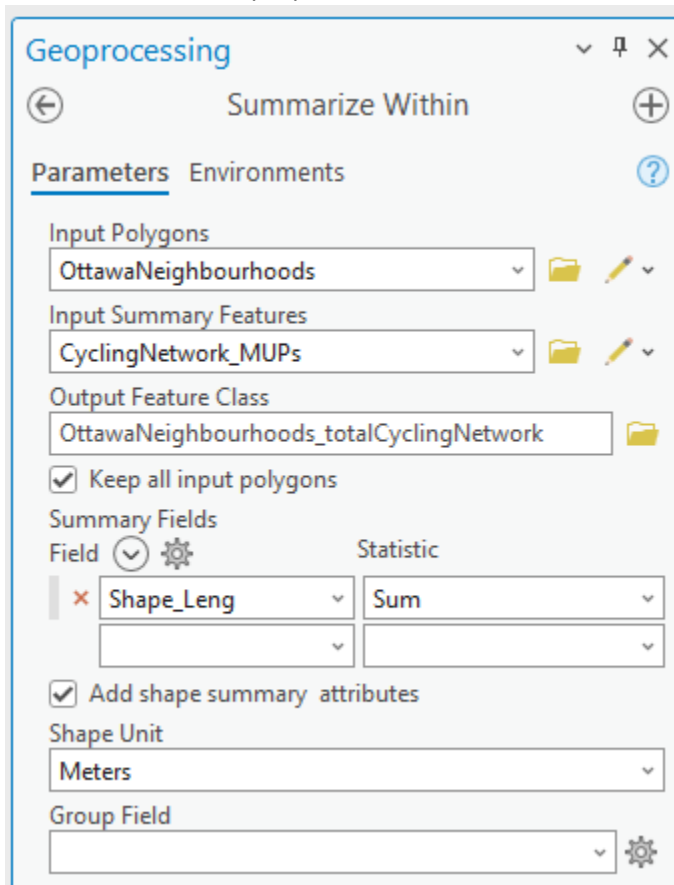
Our question is: I'm looking for a place to live in Ottawa and will be using my bicycle to get around. I want to know which Ottawa neighbourhoods have the most bike lanes and paths, and are any bike paths within 50 metres of places I need to get to?

In the Geoprocessing window, click on **Toolboxes > Analysis Tools** and explore some tools by clicking on them and reading the documentation. You can also get an overview of the Analysis toolbox from ArcGIS Pro Help: <https://pro.arcgis.com/en/pro-app/3.1/tool-reference/analysis/an-overview-of-the-analysis-toolbox.htm>. Which tool(s) do you think might help?

Which Ottawa neighbourhoods have the most bike lanes and paths?

After reading the documentation, the **Summarize Within** tool sounds promising. This tool will allow us to extract the summarized length of lines within each neighbourhood, or find the total length of the cycling network & MUPs in each neighbourhood, which is what we want.

- a. Fill in the Summarize Within properties and click run:

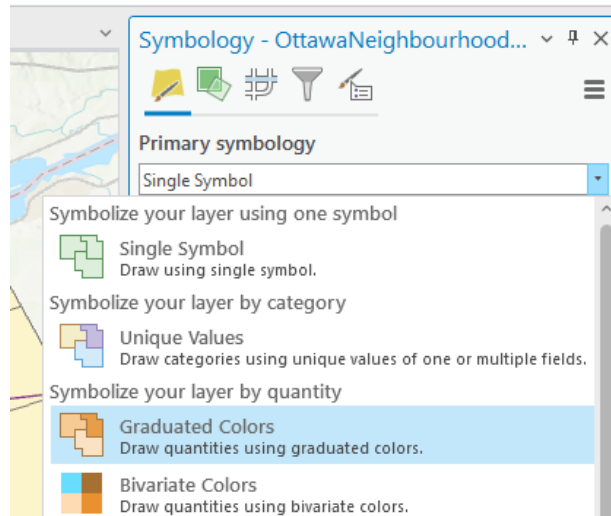


i.

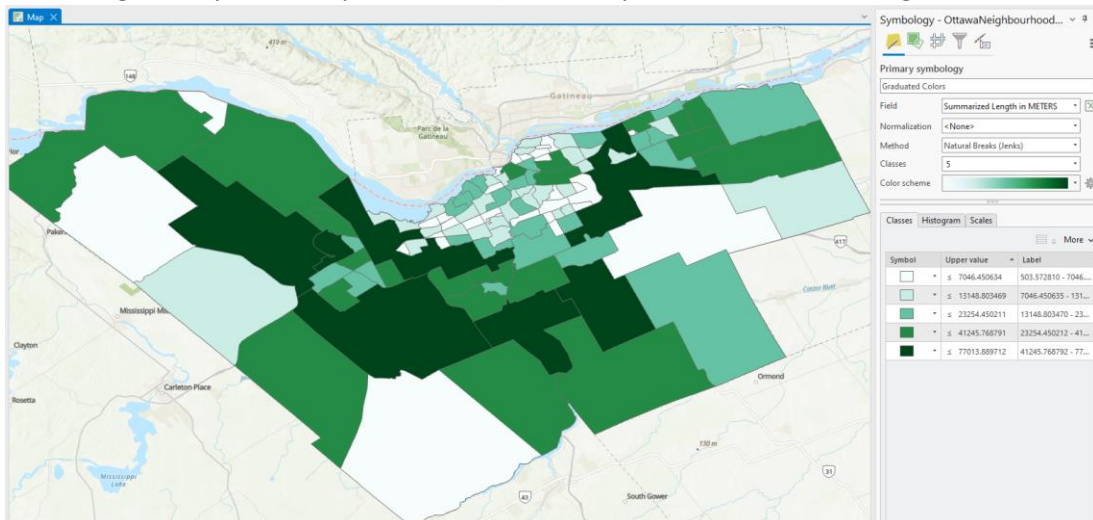
- b. Open the attribute table for the OttawaNeighbourhoods_totalCyclingNetwork feature class. Note the differences between the two length sum fields, and that the Summarized Length in METERS field is always smaller.

OBJECTID*	Shape *	FID_1	ONS_ID	ONS_Name	ONS_Region	Shape_Leng	Shape_Are	Shape_Len	Shape_Length	Shape_Area	Sum Shape_Leng	Summarized Length in METERS	Count of Lines
1	Polygon	1	3110	TREND-ARLINGTON	OTTAWA	7702.210228	3547391.808594	7702.210228	7702.210228	3547391.801338	10884.55339	6603.574448	49
2	Polygon	2	3076	NAVAN - SANSFIELD	OTTAWA	58734.090873	154732041.542969	58734.090873	58734.090873	154732041.548129	47791.303368	30545.472966	44
3	Polygon	3	3075	MUNSTER - ASHTON	OTTAWA	77575.55674	300179620.054688	77575.55674	77575.55674	300179619.99892	52479.061035	27958.418836	38
4	Polygon	4	3048	GLEN CAIRN	OTTAWA	15162.94755	9600679.683594	15162.94755	15162.94755	9600679.674439	41253.047827	22973.21055	227
5	Polygon	5	3091	PORTOBELLO SOUTH	OTTAWA	24969.709978	34260276.550781	24969.709978	24969.709978	34260276.559924	53966.555535	37149.886913	216
6	Polygon	6	3039	EDWARDS - CARLSBAD...	OTTAWA	82565.183976	274502052.261719	82565.183976	82565.183976	274502052.247399	5596.047663	3930.869249	8
7	Polygon	7	3041	EMERALD WOODS - S...	OTTAWA	8535.573238	3843689.65625	8535.573238	8535.573238	3843689.654446	7209.981673	4828.112446	62
8	Polygon	8	3040	ELMVALE - CANTERBURY	OTTAWA	9352.862576	5426031.550781	9352.862576	9352.862576	5426031.542352	11734.961734	8168.619638	39
9	Polygon	9	3065	LEDBURY-HERON GATE...	OTTAWA	13088.474311	8180413.039063	13088.474311	13088.474311	8180413.036386	9055.977691	5995.734541	67
10	Polygon	10	3053	GREENBORO WEST	OTTAWA	7153.081299	2560947.472656	7153.081299	7153.081299	2560947.482744	18355.843565	11003.583731	122
11	Polygon	11	3030	COLONNADE BUSINES...	OTTAWA	14554.53163	9304080.03125	14554.53163	14554.53163	9304080.052248	15233.361694	9562.564813	44
12	Polygon	12	3071	MARLBOROUGH	OTTAWA	97720.787092	522814451.15625	97720.787092	97720.787092	522814451.160512	3678.505666	2598.27679	6

- i.
- c. Let's visualize it! Right-click on the layer in Contents and select **Symbology**.
- d. For Primary Symbology, select **Graduated Colours**.



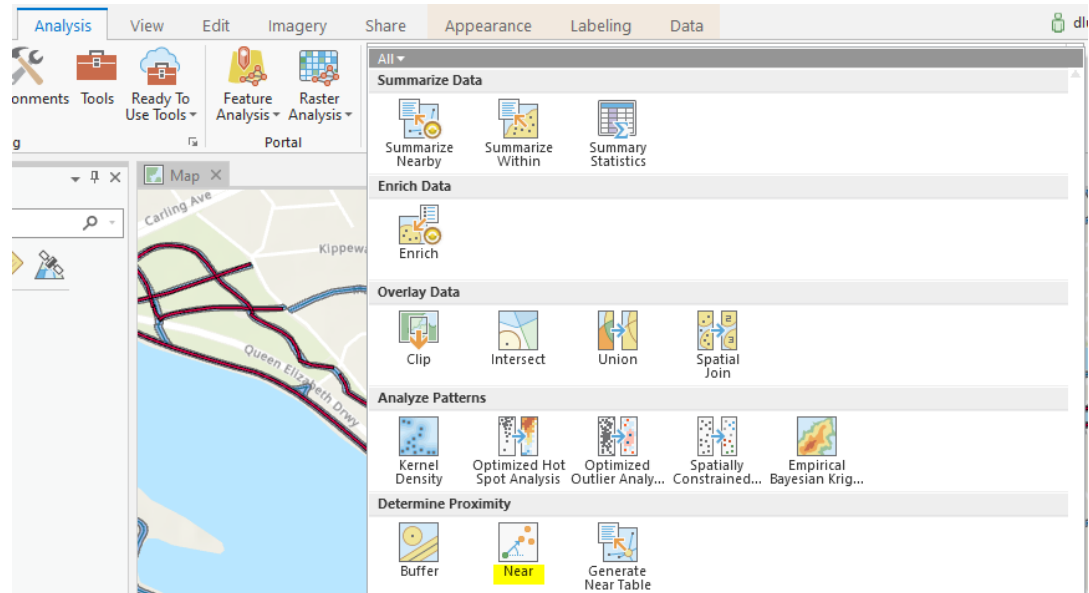
- i.
- e. Make sure you select "Summarized Length in METERS" as the Field
- f. Choose a colour scale and a method for dividing the data into classes (5 classes and Natural Breaks is generally a decent place to start). Your map should look something like this:



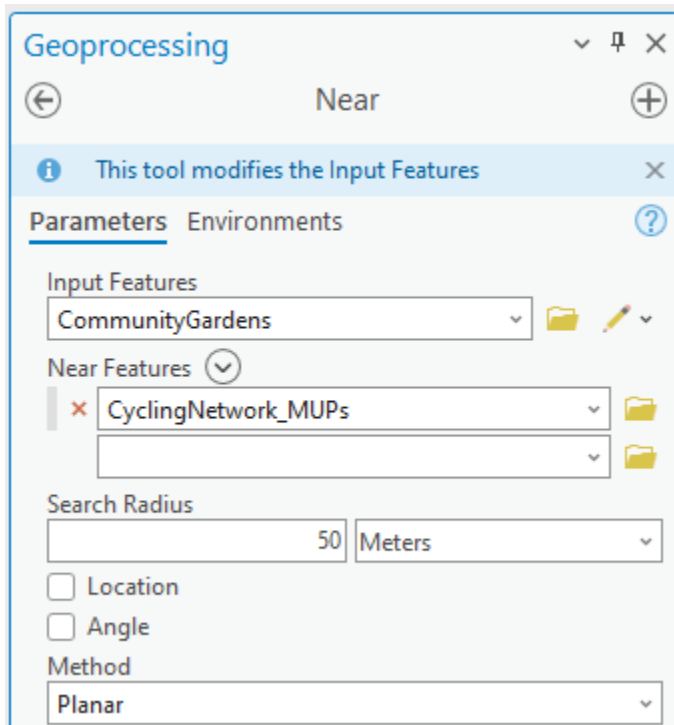
- g. Consider using this tool with just the cycling Network feature class.

Are any bike paths within 50 metres of places I need to get to?

- a. Now that we know the length of the cycling network within each neighbourhood, let's find out how many community gardens are within 50 metres of the cycling network.
- b. In the Analysis ribbon, find the **Near** tool

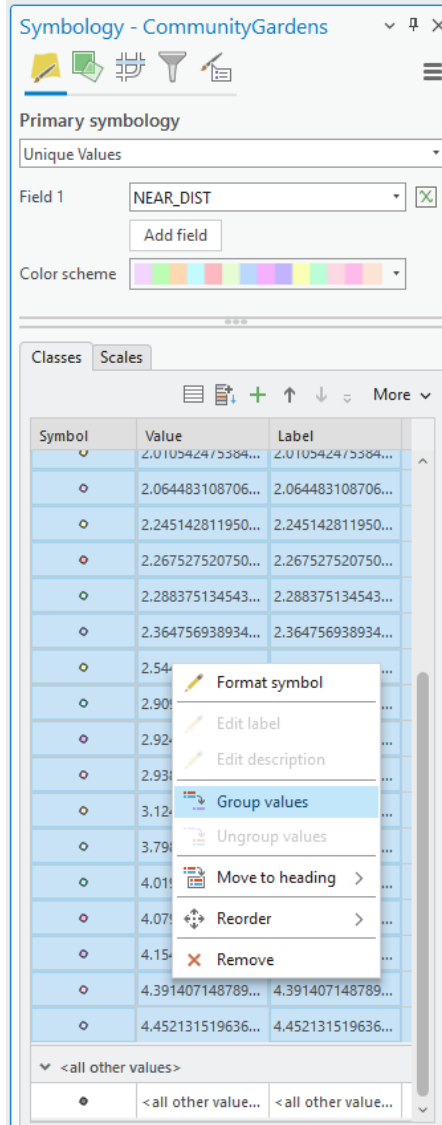


- i.
- c. Fill out the properties as below and click Run:



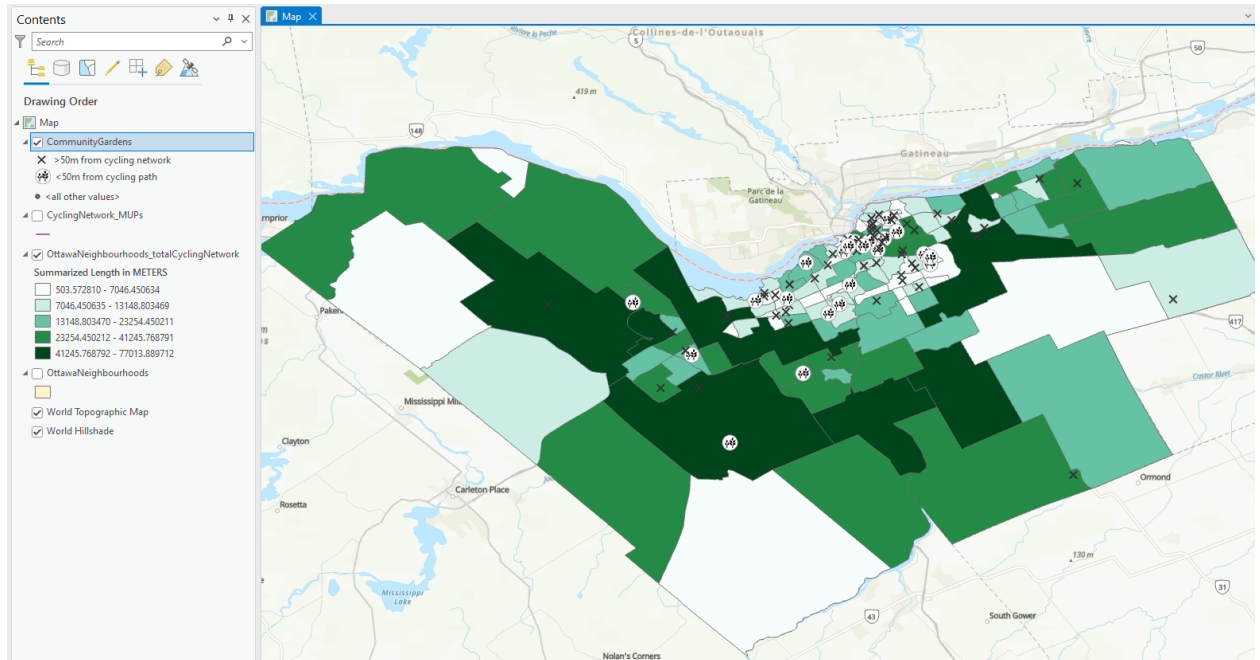
- i.
- d. Once the process is complete, open the attribute table for Community Gardens. At the far right of the table, there should be two fields called NEAR_FID and NEAR_DIST.
 - i. The NEAR_FID is the closest bike path, and the distance is how far away the nearest bike path is.
 - ii. Gardens that had no bike paths within 50 metres have -1 in both fields

- e. Let's symbolize the community gardens based on if the locations are within 50m of the cycling network.
 - i. Primary Symbology: **Unique Values**
 - ii. Field 1: NEAR_DIST or NEAR_FID (doesn't matter at this point)
 - iii. Click on the first value that is not -1, hold down the Shift key, and scroll down to click on the last item in that list
 - iv. Right-click one of the highlighted rows and select **Group Values**



- a.
 - v. Click on the symbol for the -1 row, then select a symbol
 - a. You can search the Gallery, for example 'x' or 'plant'
 - b. Click the Properties tab at the top to change the size, colour, style, etc. of the symbol you choose
 - c. Click Apply to see your changes
 - vi. Once you're happy, click the back arrow to select a symbol for the grouped values
- f. Once you've selected symbols, in the Primary Symbology pane we can change the label for each class.

- g. You should now have a map that looks something approximately like the map below. In this case, the red stars represent community gardens within 50 metres of a bike path, and the black Xs are community gardens farther than 50 metres of a bike path:



Congratulations! You've answered a spatial question!

6. Creating a map layout

Creating a map layout includes some critical components: north arrow, scale, legend, and title. Legibility and understandability of the map are highly important; the map is a communication tool and its layout contributes significantly to its usefulness.

That said, it can be very tedious and quite irritating. There are many buried options, from font sizes to text wrapping, so it can be a lot of work to get things looking how you'd like.

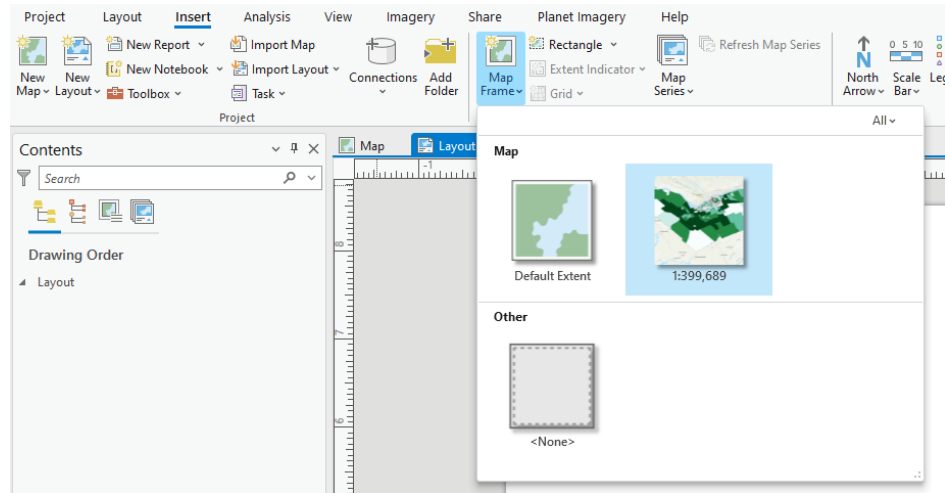
Layouts in ArcGIS Pro: <https://pro.arcgis.com/en/pro-app/latest/help/layouts/layouts-in-arcgis-pro.htm>

Make a layout from ArcGIS Pro tutorials: <https://pro.arcgis.com/en/pro-app/latest/get-started/add-maps-to-a-layout.htm>

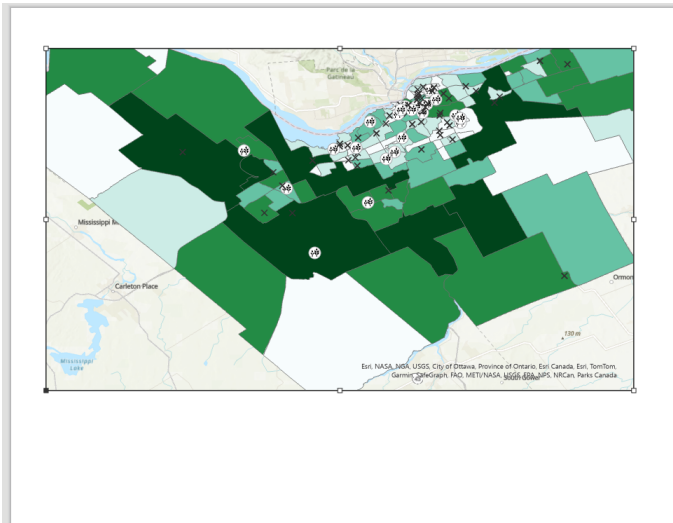
Create the layout and add your map frame

- Save your project!
- Right-click on the `OttawaNeighbourhoods_totalCyclingNetwork` layer and click **Zoom To**
- In the **Insert** ribbon, click **New Layout**
- Since the shape of Ottawa is wider than it is long, choose **ANSI Landscape - Letter 8.5" x 11"** may be a good fit.
- You should now have a blank Layout pane should now appear
- On the **Insert** ribbon, click **Map Frame**, then the image where you can see the Ottawa neighbourhoods

- a. If that isn't an option, click the Map tab beside the Layout tab, do the previous steps, then return to the Layout pane.



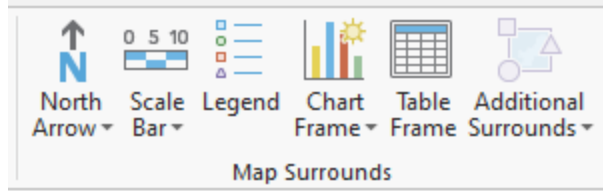
- b.
- g. Click and drag to draw a rectangle on the blank sheet



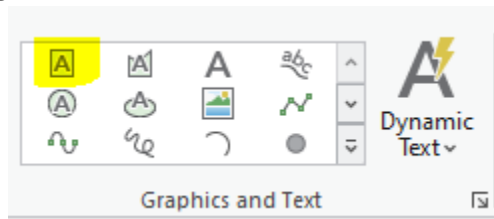
- a.
- b. If you need to change the zoom level or where the data appears in the map frame (e.g. if the Bronson buffer area is too small in the map frame or you can't see all the data), this is how you can do that:
- Right-click on the map frame and select **Activate**
 - Use the tools in the Navigate section of the Map ribbon to zoom in or drag the map
 - When it looks the way you want it to, there's a **Layout ribbon**
 - Select **Close Activation**

Add a title, north arrow, and scale bar

- h. In the Insert ribbon, there's a Map Surrounds section that includes some important map components



- a.
 - i. Add the following map surrounds and place them on or near the map frame, somewhere that they're easy to read. Select a style of each and draw it on the layout.
 - a. North Arrow
 - b. Scale Bar
 - i. Once the scale bar is drawn in, click on the scale bar to view the Format Scale Bar properties, where you can change the units to kilometers, meters, etc.
 - j. To add a title, go to the Insert ribbon then go to the Graphics and Text section and select Rectangle Text from the box

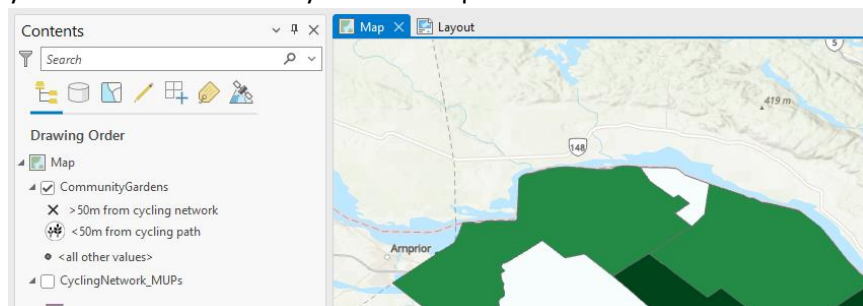


- a.
 - k. Draw a box where you want your title, probably near the top. Move your map frame if you need/want to.
 - l. Over on the right, where the Symbology pane is, click the Element tab at the bottom to view the Text options
 - m. In the Text textbox, give your map an informative title. For ease of reading, the tile can be optionally split into multiple lines.
 - n. To change the font size, click Text Symbol at the top of the Element pane, then **Appearance**
 - a. Select different sizes/fonts and Apply to make sure the entire title fits!
 - o. Save!

Add a legend and tweak it

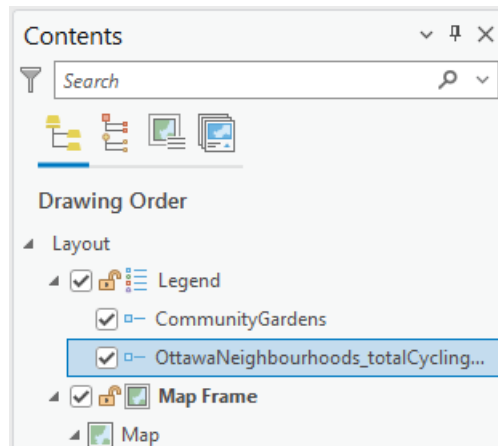
Legends are finicky and can be time-consuming. A couple of things to remember before we start:

- Every layer that is “on” (visible) in the Map tab and Layout will appear in the legend
 - It can be helpful to go to the map tab (beside the layout tab) and remove all the layers you don't want to see in your final map

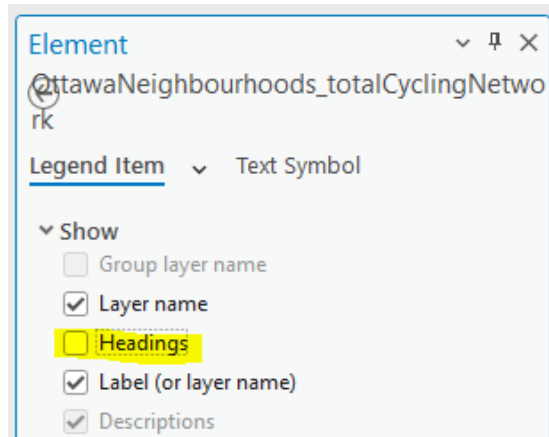


- Even so, the automatically-generated legend will probably be a mess to start

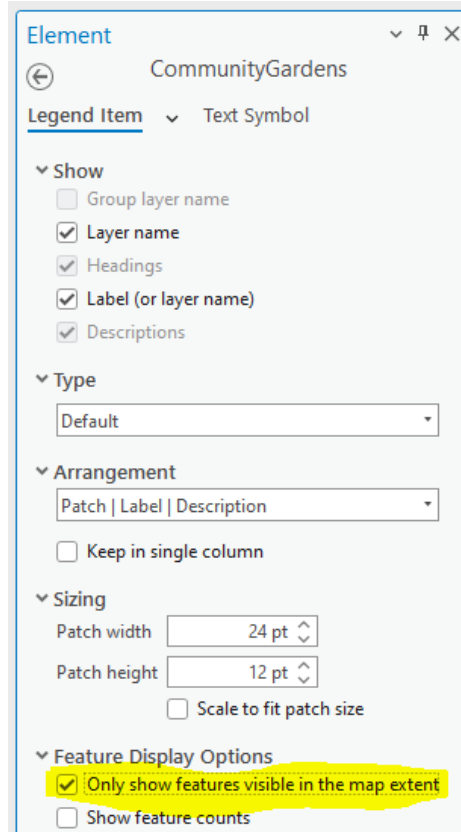
- p. Adding a legend to the map layout:
 - a. Make sure you're in the Layout tab so you see your piece of paper
 - b. Click on the Legend button, select a legend style (you can always delete and add another one later), and outline a fairly large area (it's always changeable)
- q. Configuring the legend:
 - a. There's a lot going on and you can spend a lot of time on the legend, right-click on the legend and select **Properties**
 - b. Over in the Drawing Order pane, under Legend, click on OttawaNeighbourhoods so it's outlined in blue



- i.
- c. Over on the Element pane (right side), uncheck Headings
 - i. This will get rid of "Summarized Length in METERS" in the legend



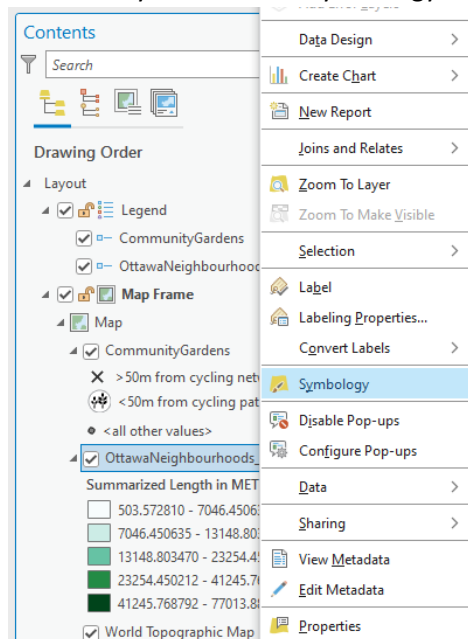
- ii.
- d. Now click on CommunityGardens in the Drawing Order pane
 - i. Because the <all other values> designation shows up, but actually doesn't have any points in the group, we'll check off "Only show features visible in the map extent"



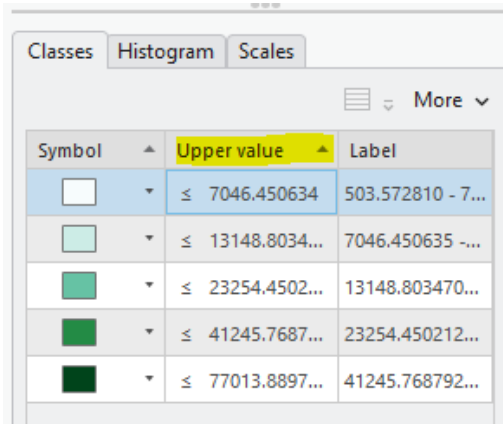
ii.

- r. The numbers that show up in the Ottawa Neighbourhoods dataset are...a bit unwieldy. We can change that *but* be aware that method of splitting the values will become Manual (not Natural Breaks) and the symbology may change a bit.
 - a. In the Drawing Order pane, under the Map Frame section, right-click on the Ottawa neighbourhoods layer and select Symbology

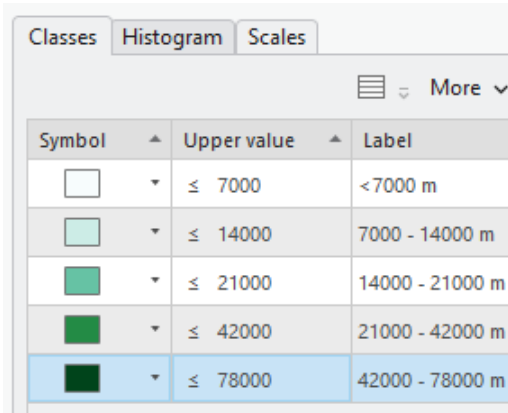
i.



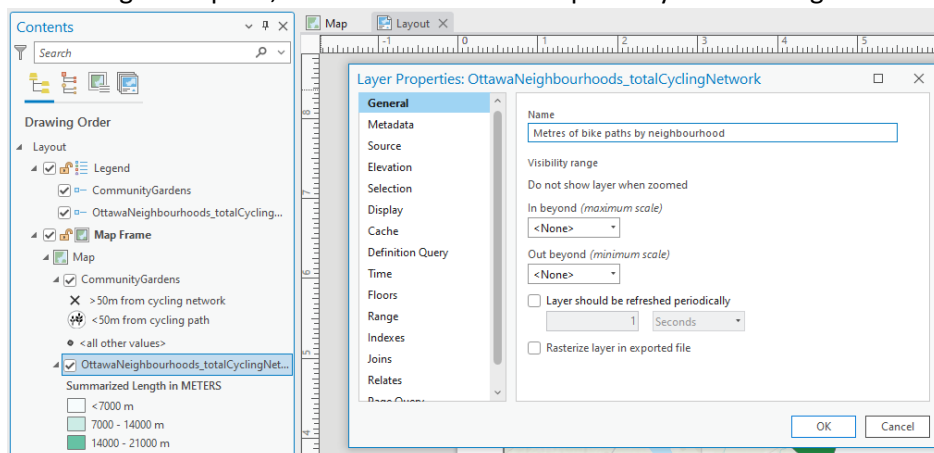
- b. In the Symbology pane, in the Upper Value column, take a look at the intervals to see if there's a pattern **or** just pick some equal-interval-ish gaps, like 10s or 15s.
 - i. Because I have 5 classes and the intervals are around 7000, I'll go with that to start



- 1.
 - ii. Double-click in the Upper Value cell and type in a number you want to go with, and so on with the rest of the classes.
 - iii. Adjust the labels as well, and maybe add a unit to the end (e.g. m for metres)



- 1.
 - s. To change the names of the layers, right-click on a layer and select Properties
 - a. In General, the Name text box is an “alias”, or the name of the layer as it appears in the Drawing Order and legend. It doesn't effect the filename so you can change it to something descriptive, such as “Metres of bike paths by Ottawa neighbourhood”

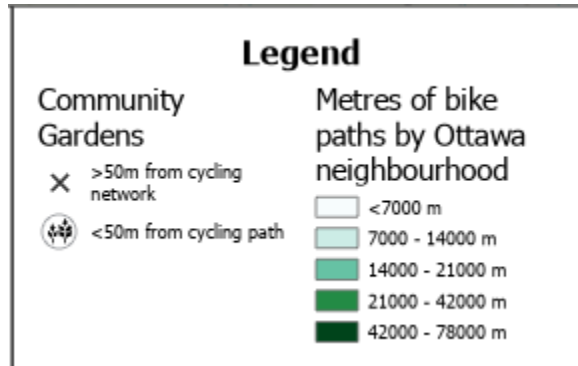


b.

t. The legend isn't AMAZING but it's certainly better:



a. Before:

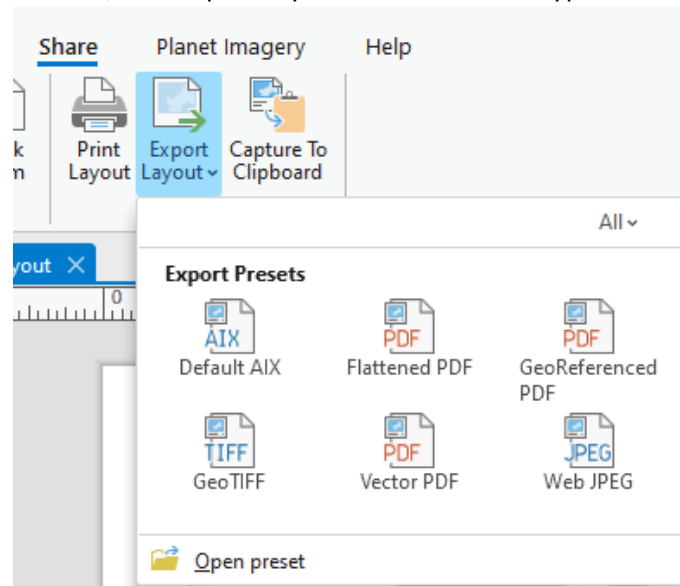


b. After:

u. Save all your hard work!!

Export your layout

v. In the Share tab, click Export Layout and select a file type



a.

b. In the Layout properties, there will be options like Compression, Resolution, etc. Click Export when you're happy with the settings.

Fini! 😊