Spatial Analysis with ArcGIS Pro

Welcome! The workshop will start shortly.

Download the data here:

https://uoft.me/ProAnalysis

Please mute your mic and turn off your video

Use the chat to ask questions

Slides will be shared

October 2024

Presented by: Cole White

Spatial Analysis with ArcGIS Pro

Location intelligence for real-world problems

https://uoft.me/ProAnalysis

UNIVERSITY OF TORONTO LIBRARIES
MAP AND DATA LIBRARY

How to use modern GIS to visualize, analyze, and communicate spatial solutions

October 2024

Presented by: Cole White

What We'll Cover

01	02	03	04	05
Introduction	The ArcGIS Pro Application	Map Creation & Analysis	Sharing & Collaboration	Resources

The Map and Data Library

- Data collections
- Workshops and training
- In-person and virtual support

Robarts Library

7th Floor

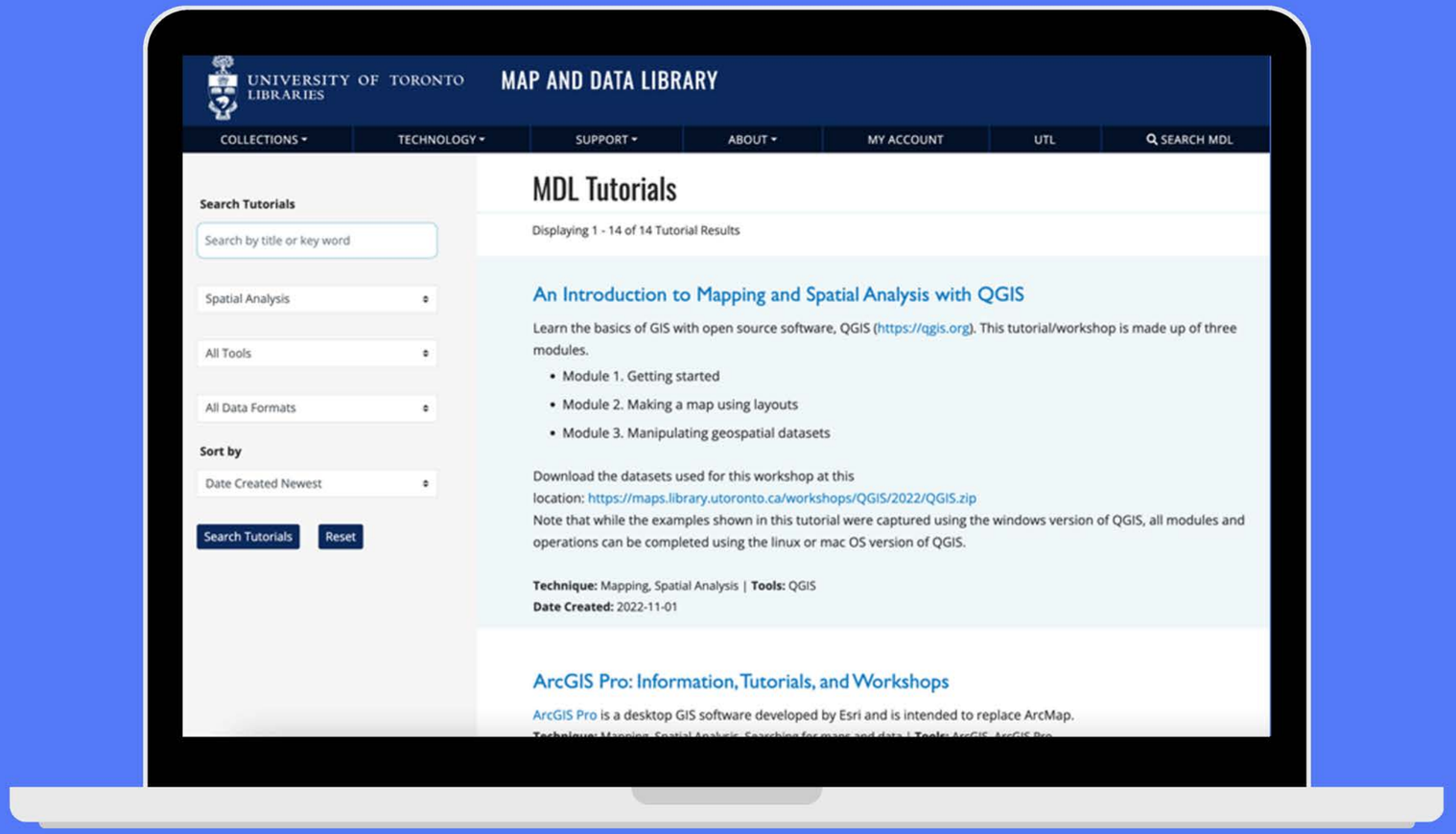
Open 11am - 5pm weekdays by appointment

https://mdl.library.utoronto.ca/

1. Introduction

MDL: Tutorials and Workshops

https://mdl.library.utoronto.ca/support/tutorials



1. Introduction

Map and Data Library: Getting Help

Virtual support:

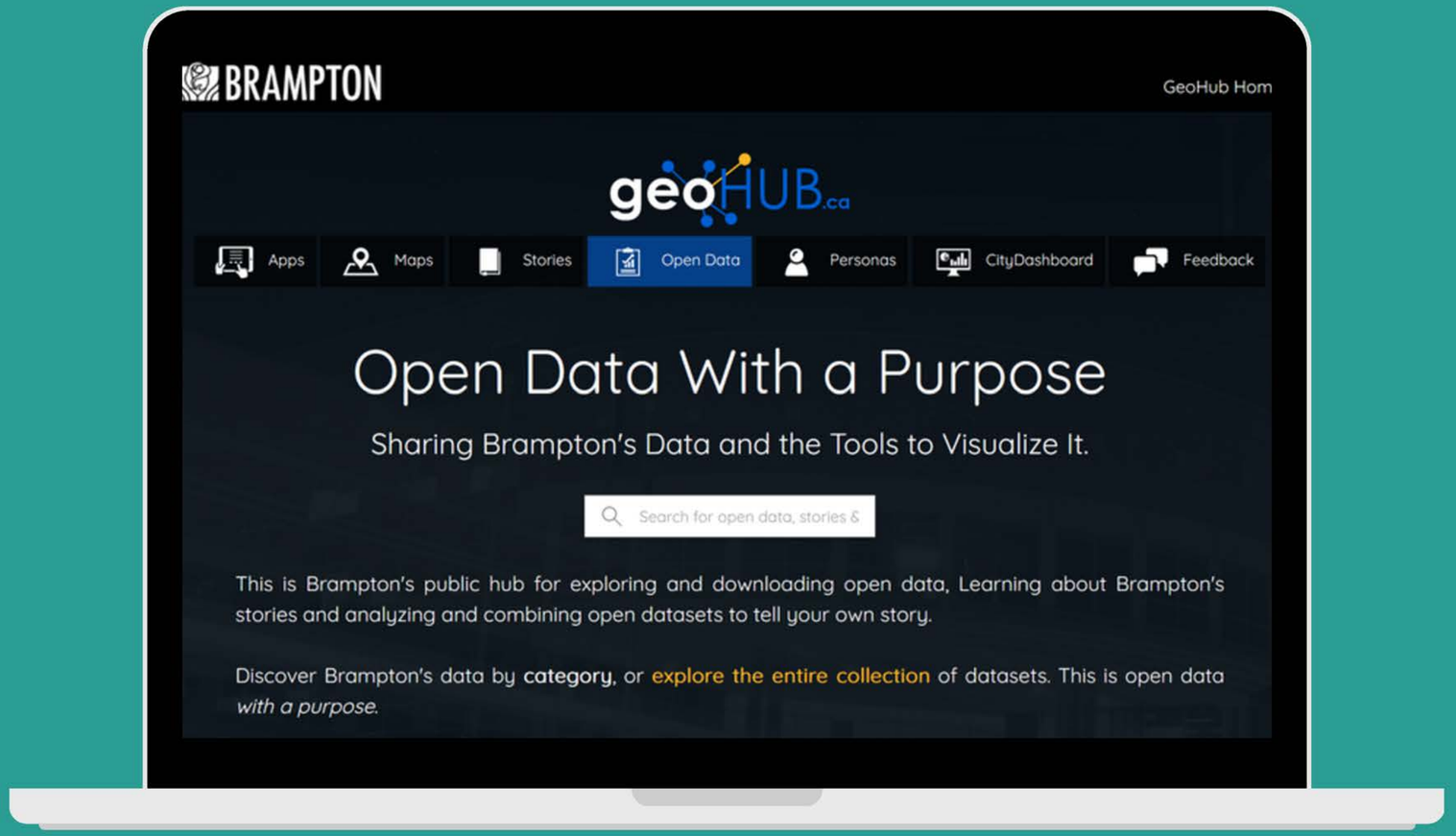
- Email us to get started
  mdl@library.utoronto.ca

In-person support:

- Reference Area:
  Robarts, 7th Floor
  Monday-Friday, 11am-5pm

1. Introduction

Open Data



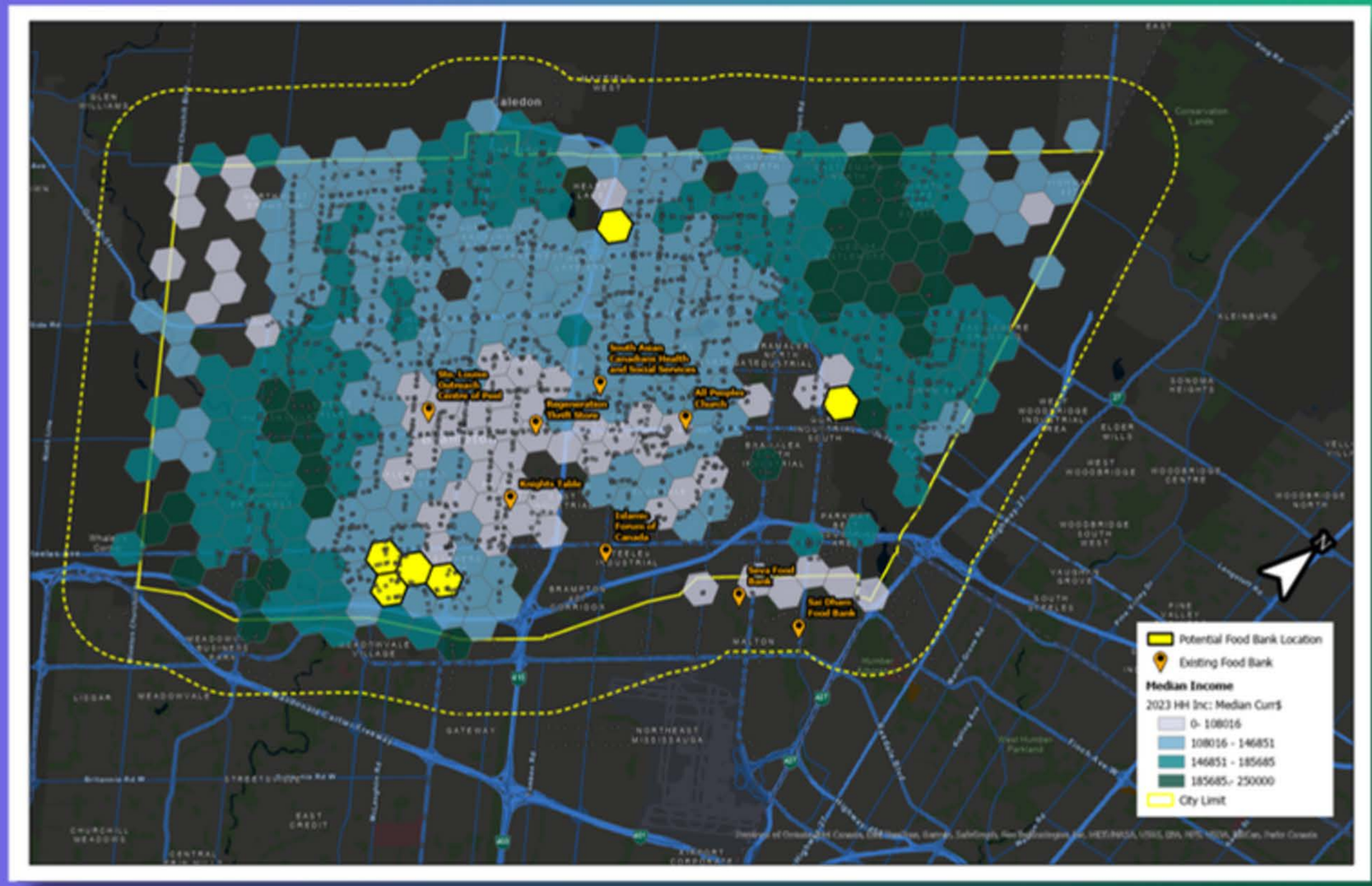
1. Introduction

Spatial Problem Solving Example: Public Health

- Identify health trends by location
- Find locations to implement new services for those at risk
- Track infectious diseases
- Study how demographic factors affect the health of communities
- Report on cases of a virus

1. Introduction

- This is the map we'll create.



1. Introduction

Case Study: Where to establish new food banks in Brampton

- What are the criteria to determine the best locations?
  - Income level?
  - Population density?
  - Existing resources?
  - Transportation network?
  - Land use?
  - Community needs?

1. Introduction

Case Study: Where to establish new food banks in Brampton

- What **spatial** and/or **statistical data** will we need to locate or create?
  - Road network?
  - Demographic data from the Canadian Census?
  - Existing services?
  - Health statistics?

1. Introduction

Case Study: Where to establish new food banks in Brampton

- What tools/software will be used?
  - ArcGIS Online?
  - ArcGIS Pro?
  - QGIS?

1. Introduction

Case Study: Where to establish new food banks in Brampton

- How will the results be shared?
  - Reports?
  - Interactive web maps?
  - Dashboards?
  - Presentations?
  - Posters?

1. Introduction

Designing a GIS project

Find and assess spatial data

- MDL Website, Open Data, ArcGIS Online/Living Atlas, etc.
- Create your own data if needed.
- Assess data quality, software compatibility, completeness, licensing.

Symbolization & analysis

- Style, Labels, Filters, etc.
- Use analysis tools to gain insights.

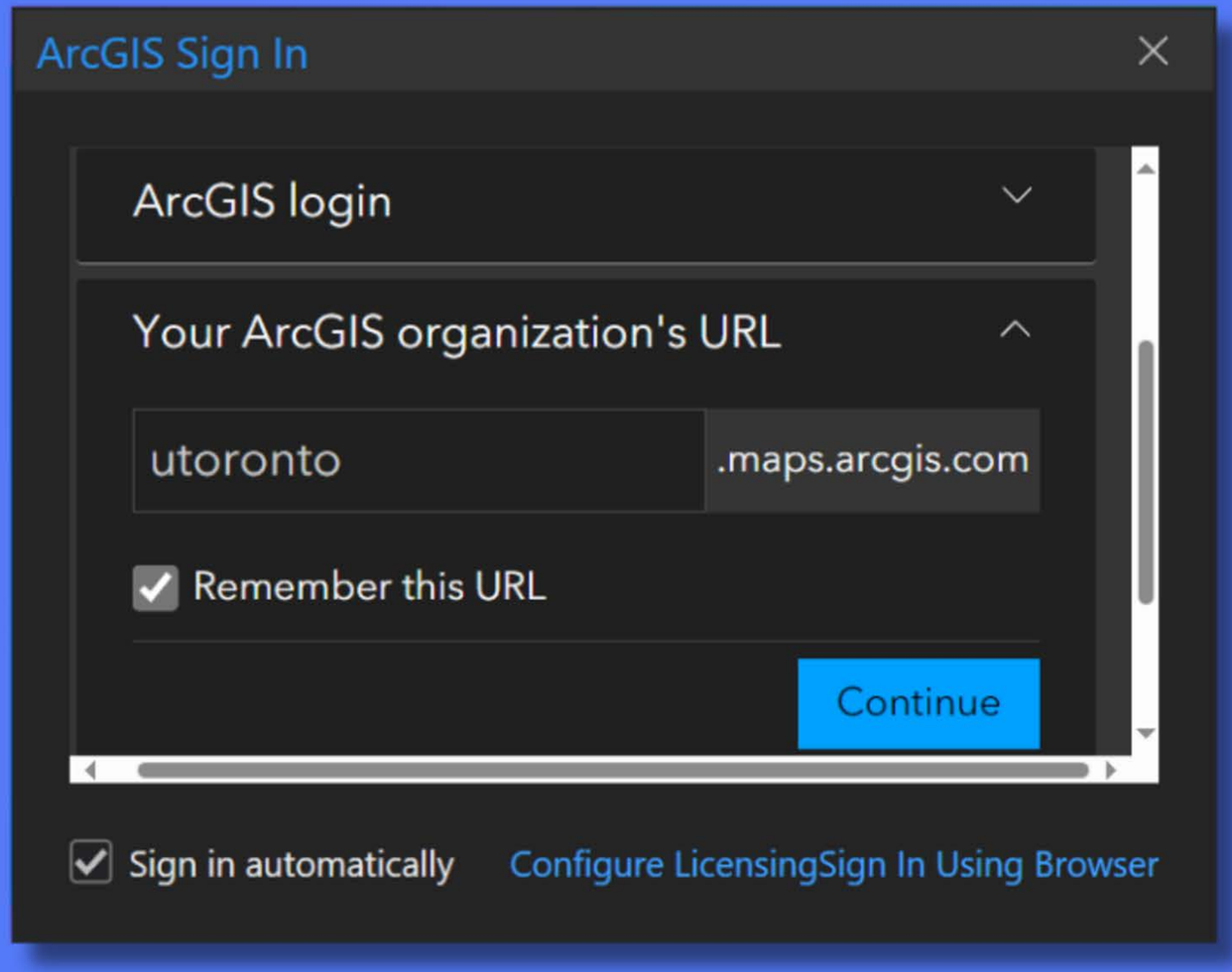
Sharing & collaboration

- Results can be shared as digital data, printed as map layouts, or uploaded to ArcGIS Online and shared as interactive web maps.

2. ArcGIS Pro

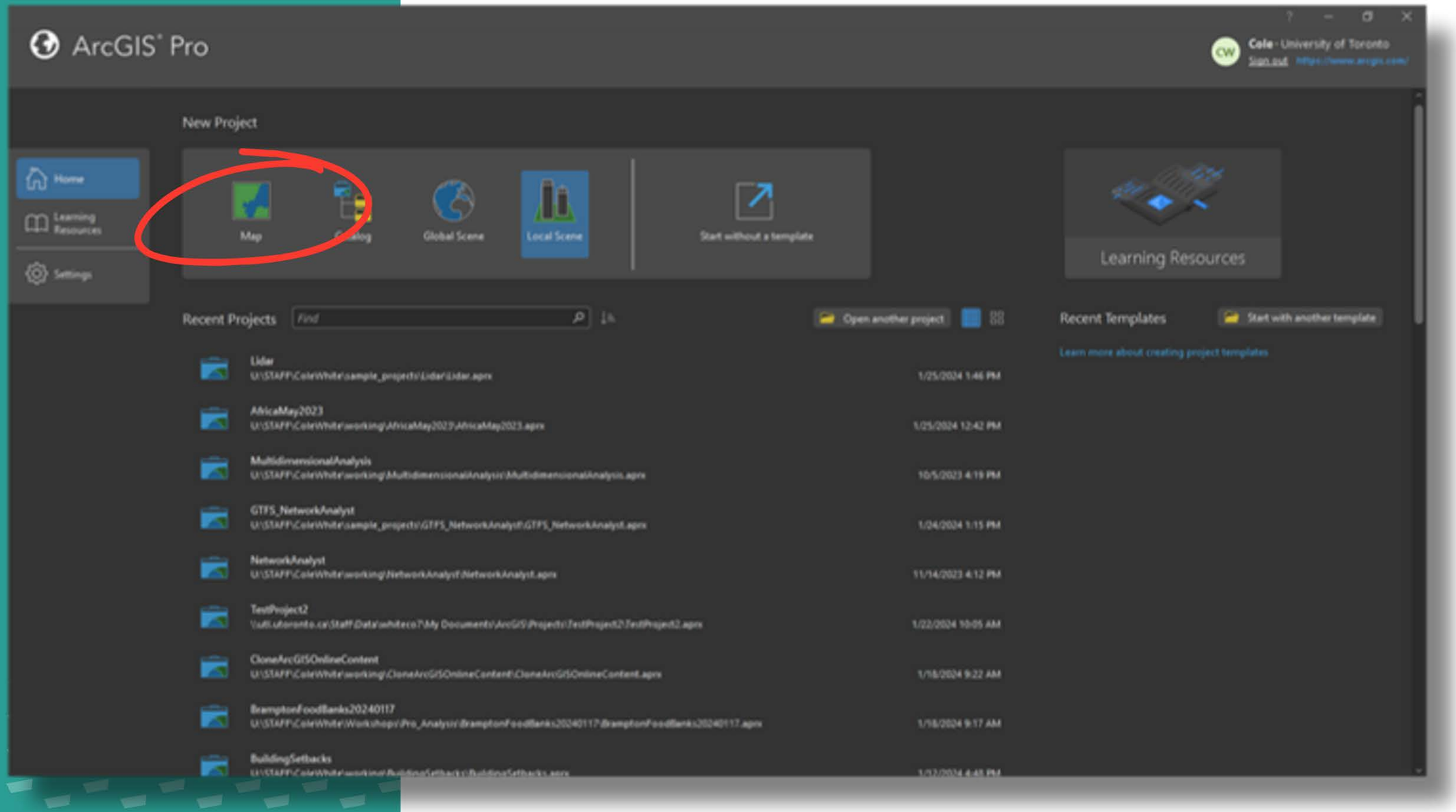
2. ArcGIS Pro

Logging In



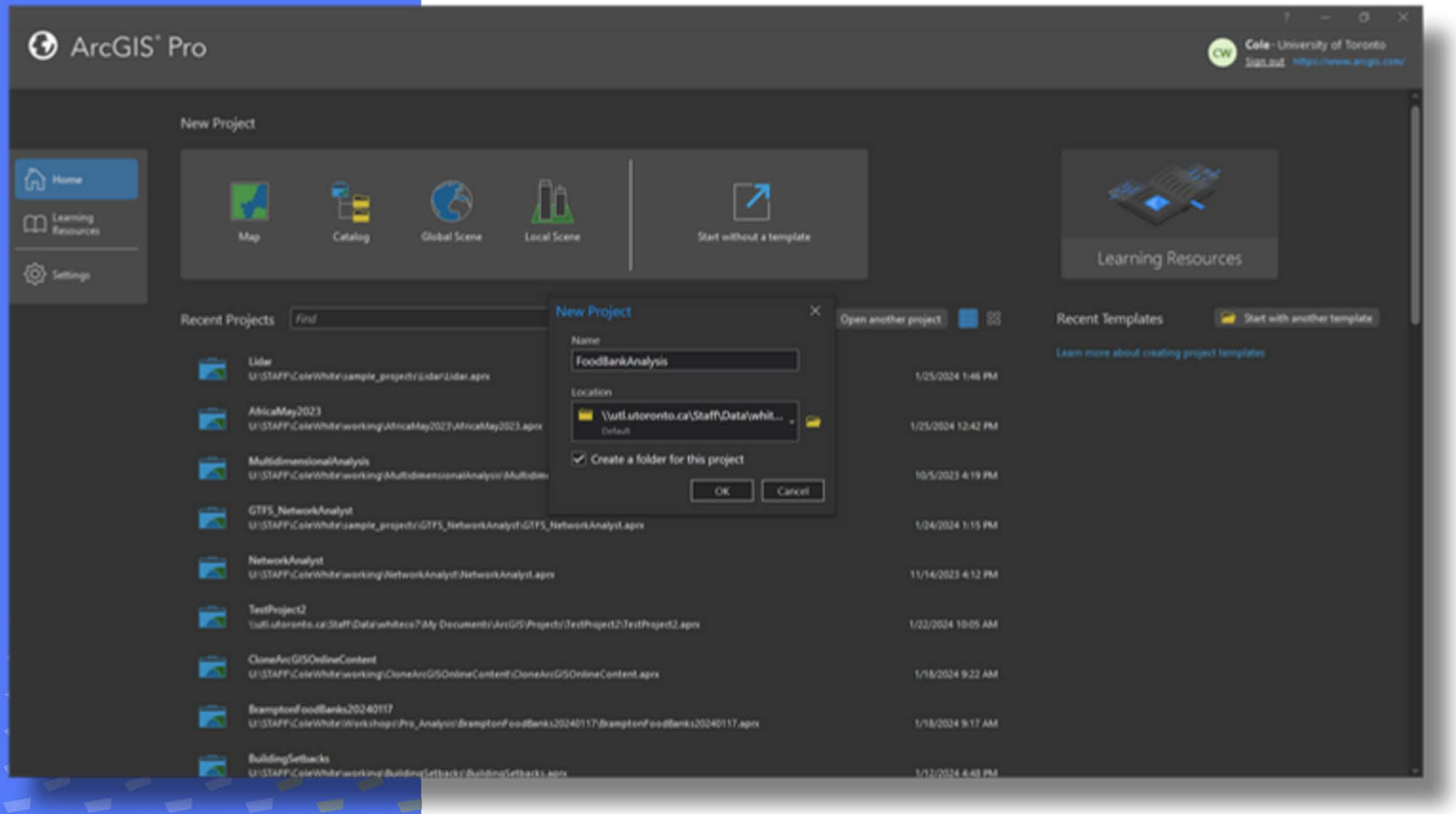
2. ArcGIS Pro

Creating a new Project

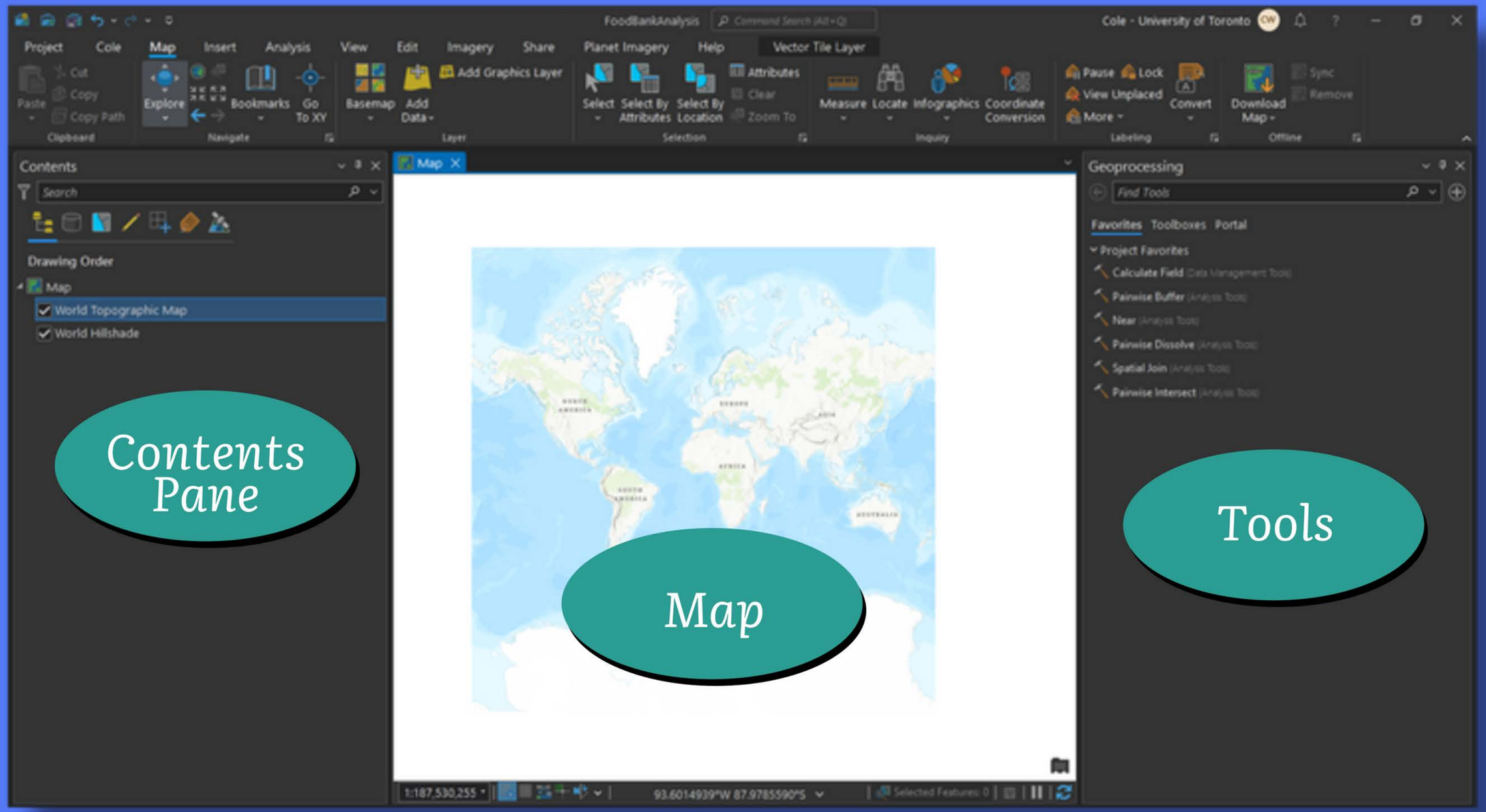


2. ArcGIS Pro

Creating a new Project

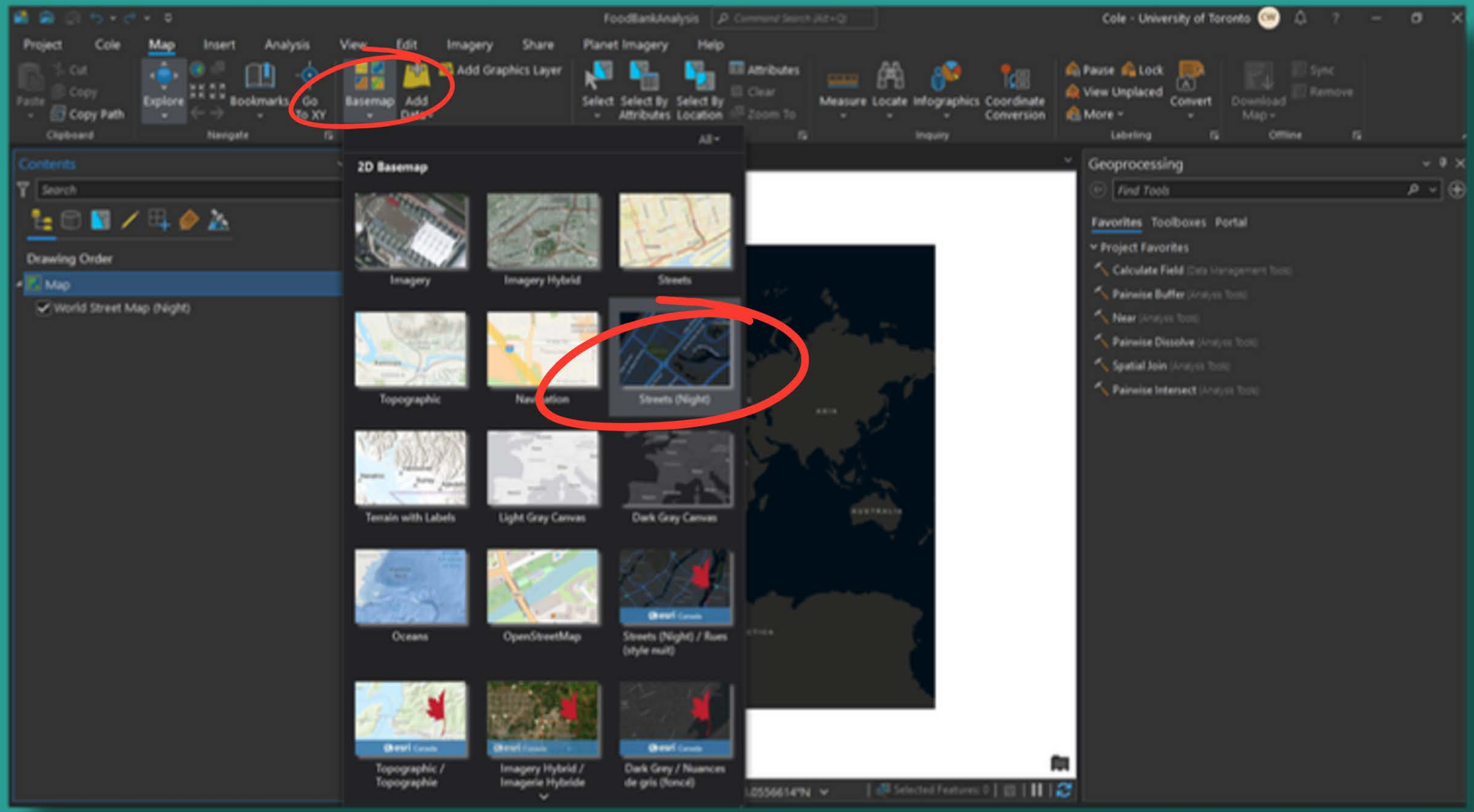


2. ArcGIS Pro



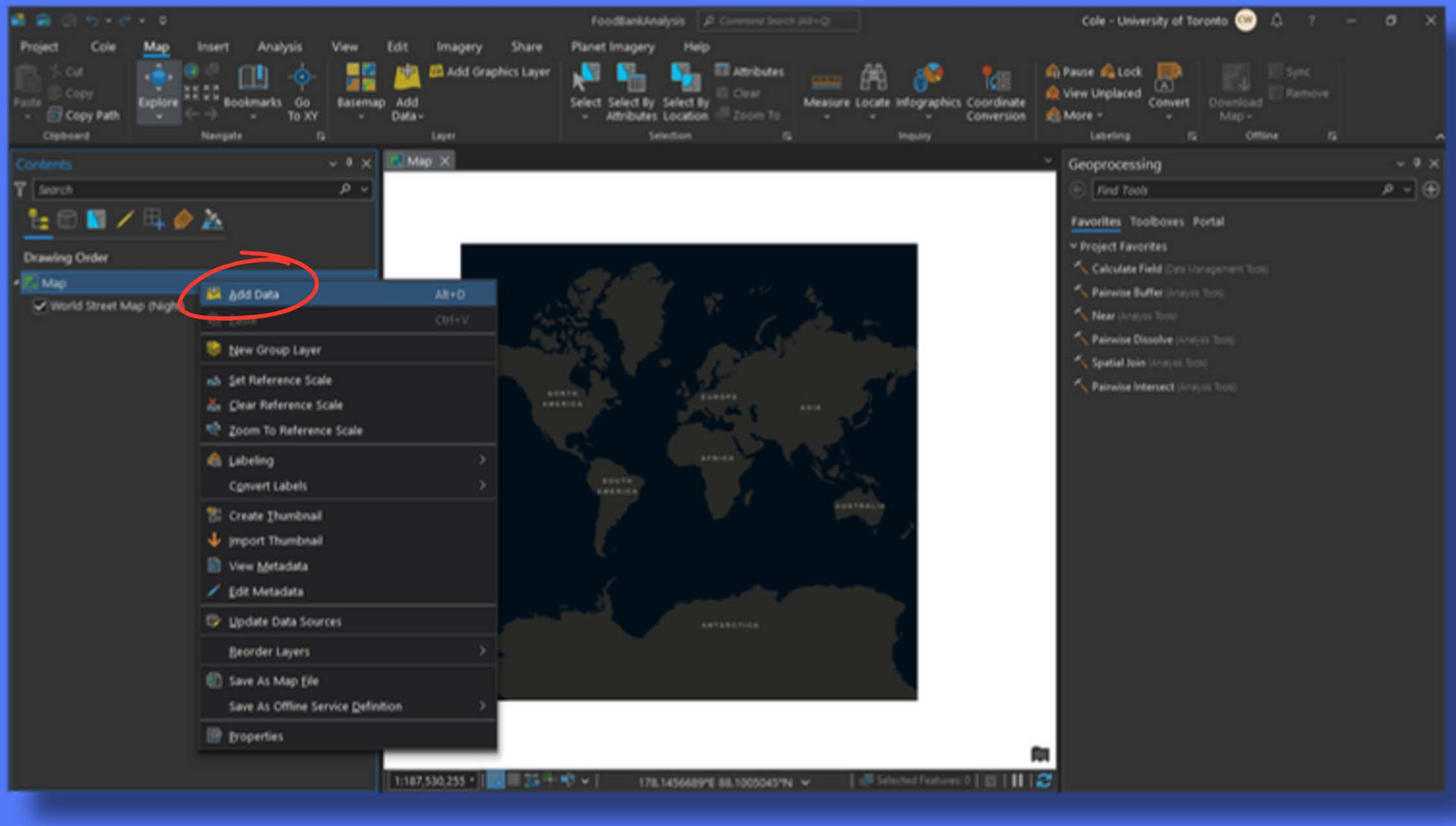
2. ArcGIS Pro

- Change the **Basemap**.



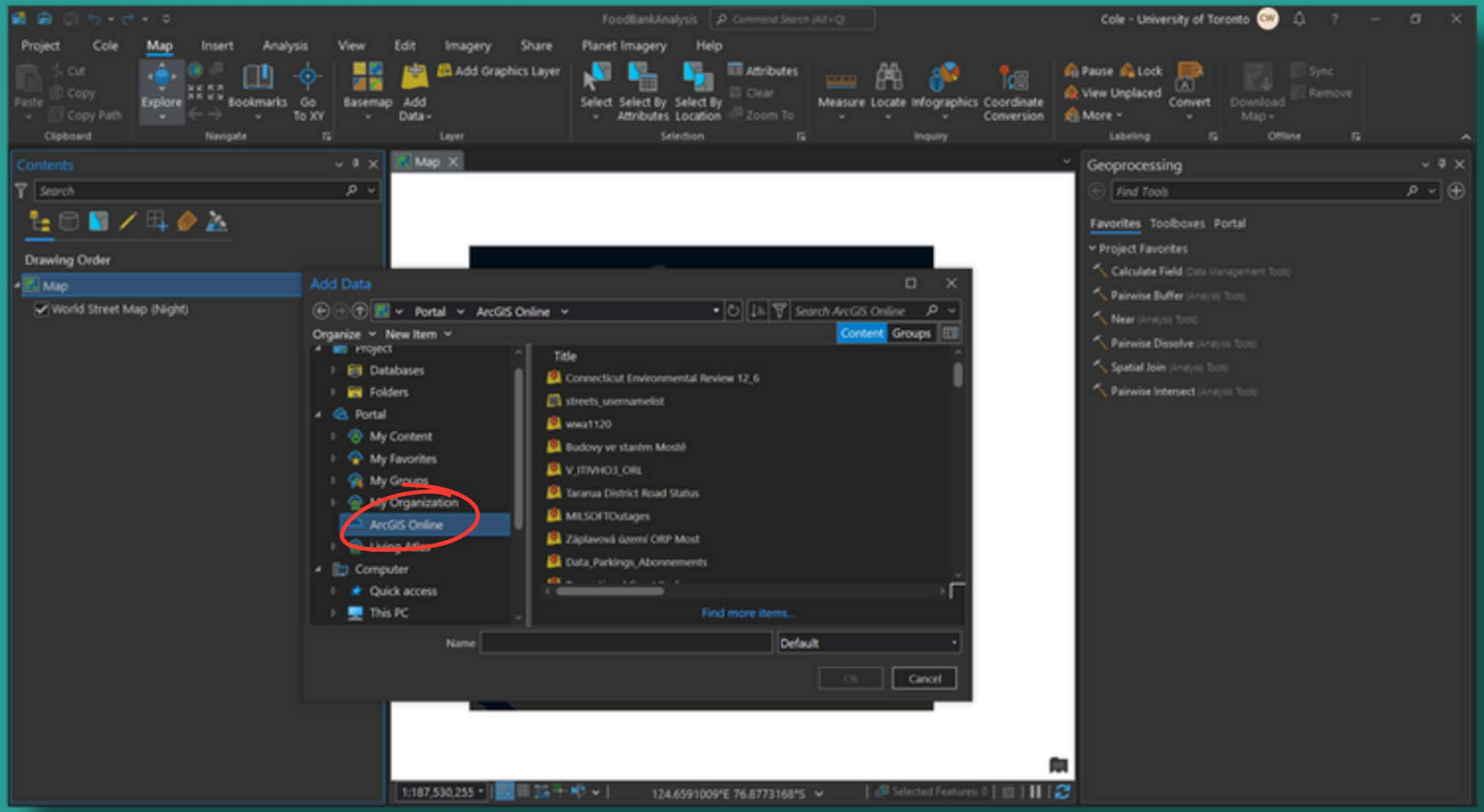
2. ArcGIS Pro

- Add Data.



2. ArcGIS Pro

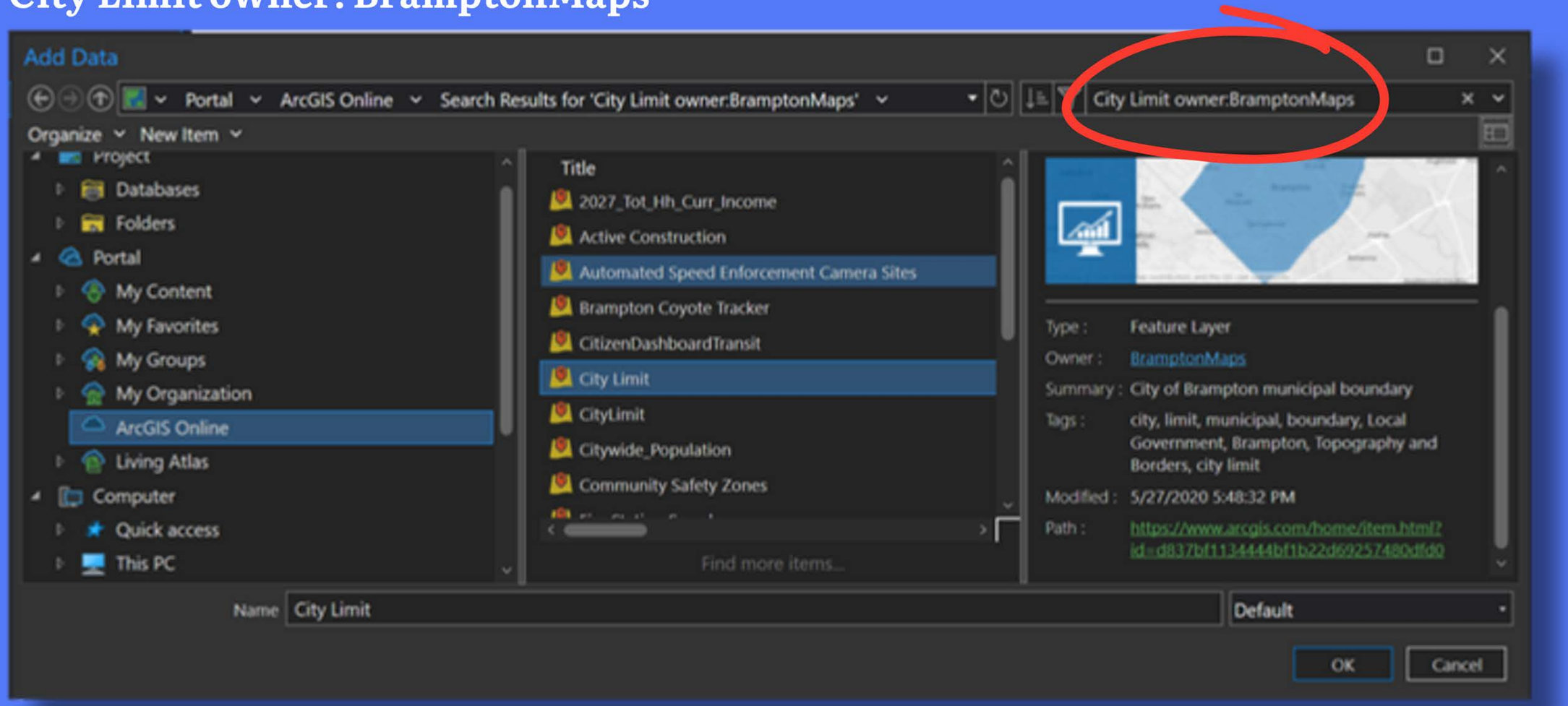
- Choose **ArcGIS Online.**



2. ArcGIS Pro

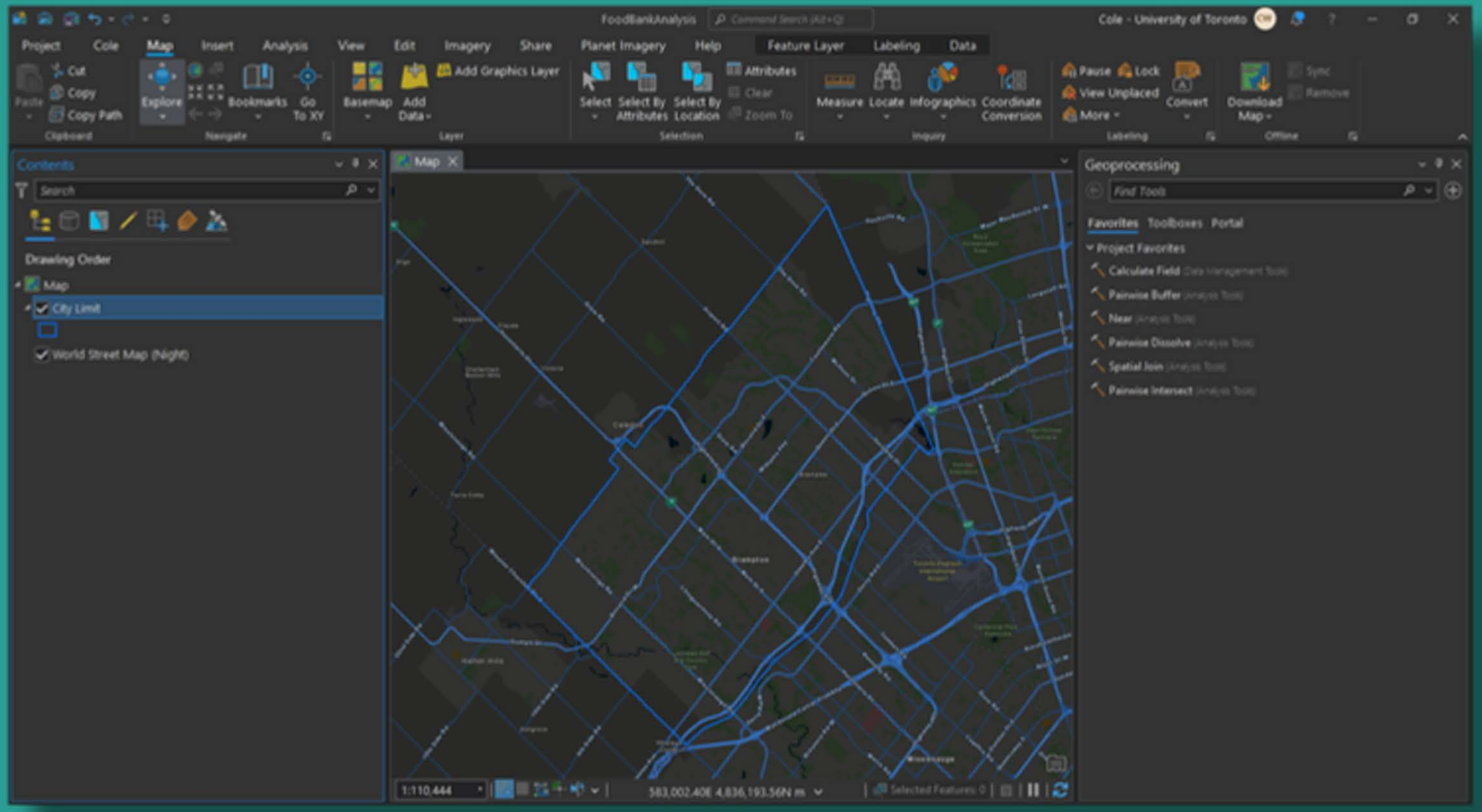
- Search for:

City Limit owner: BramptonMaps



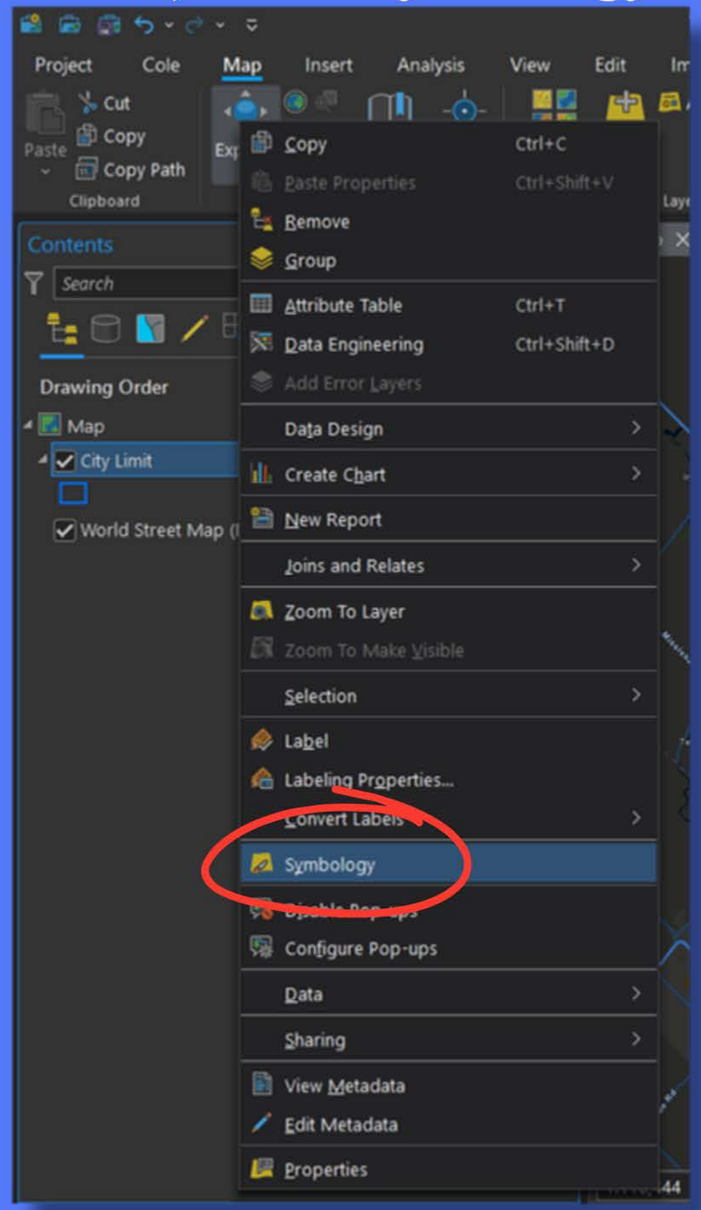
2. ArcGIS Pro

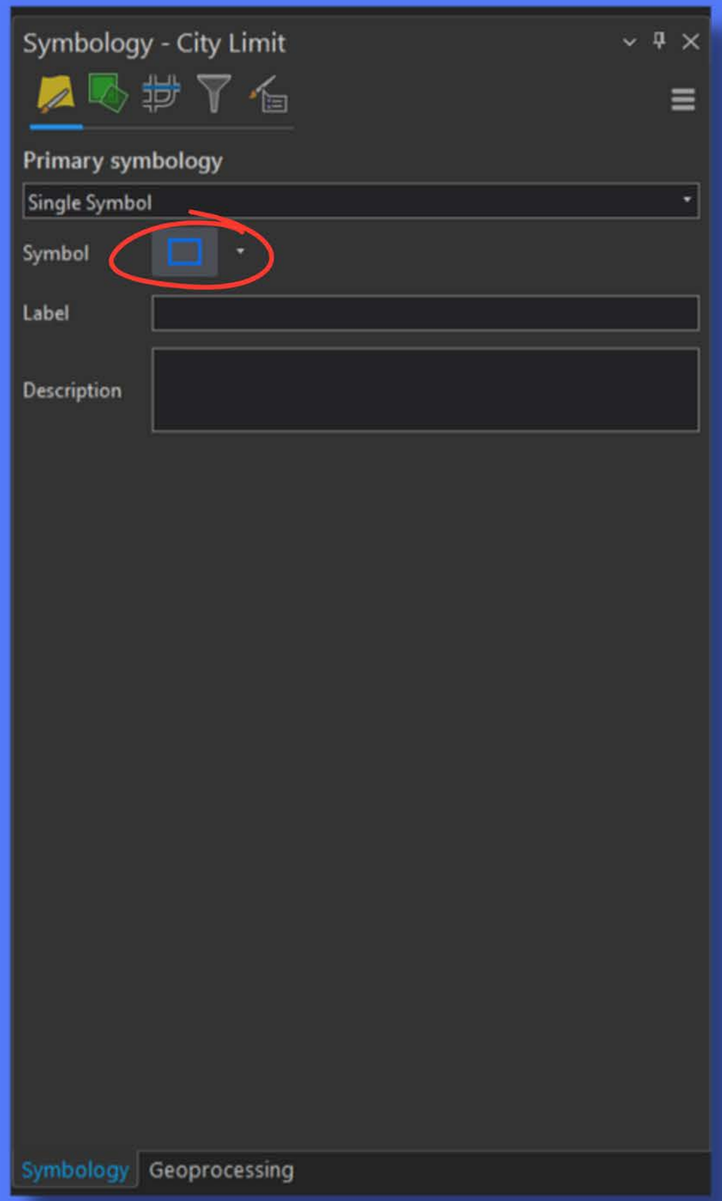
- Click **OK.** The layer is added to the map.

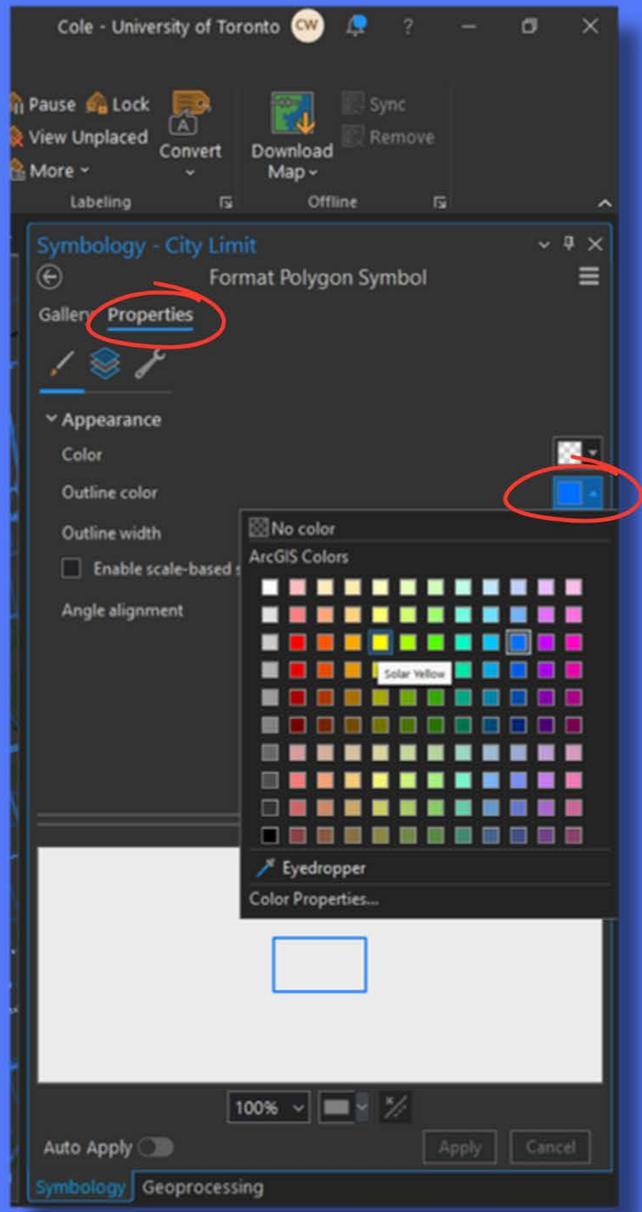


2. ArcGIS Pro

- Adjust the symbology.

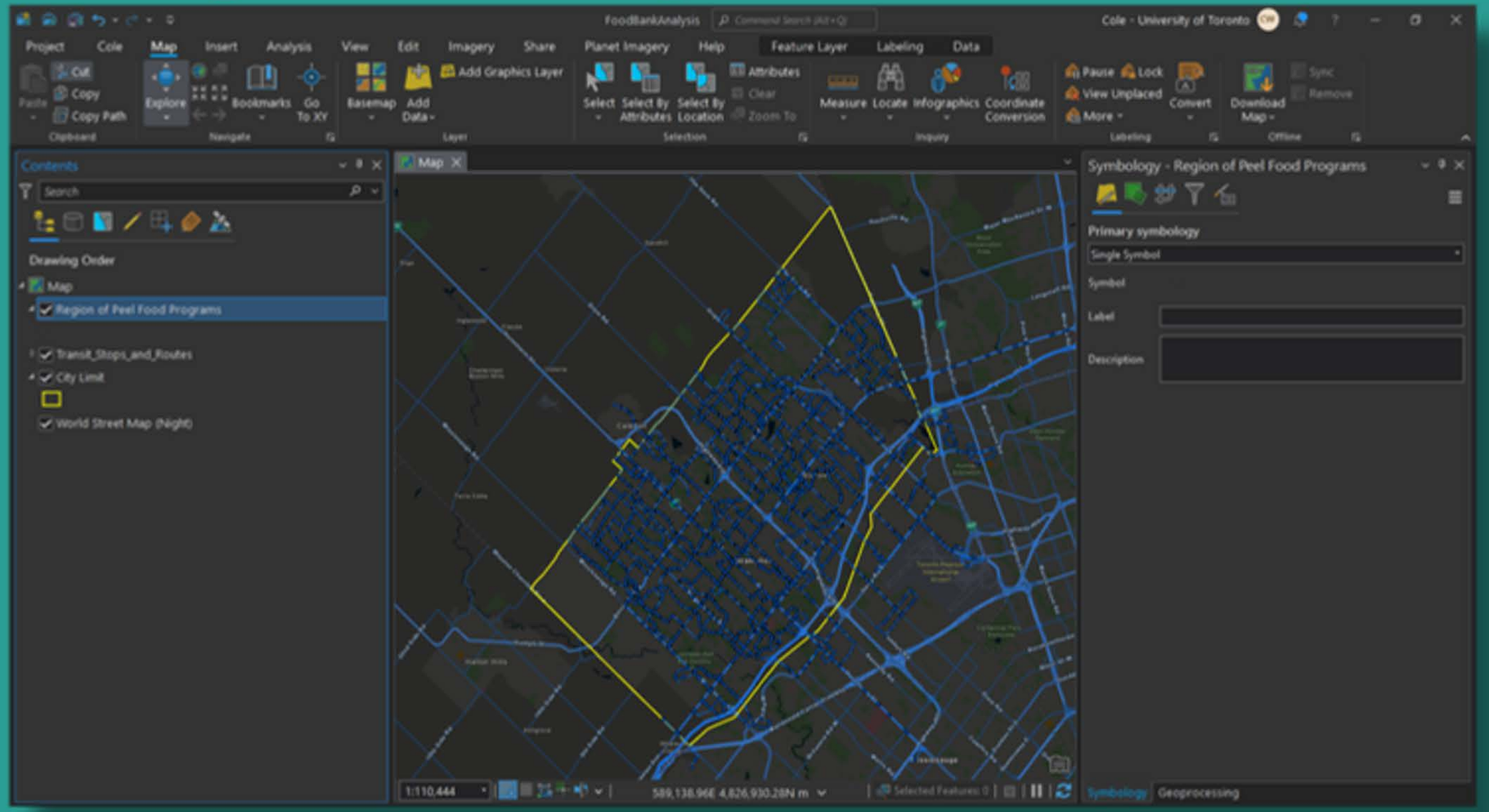






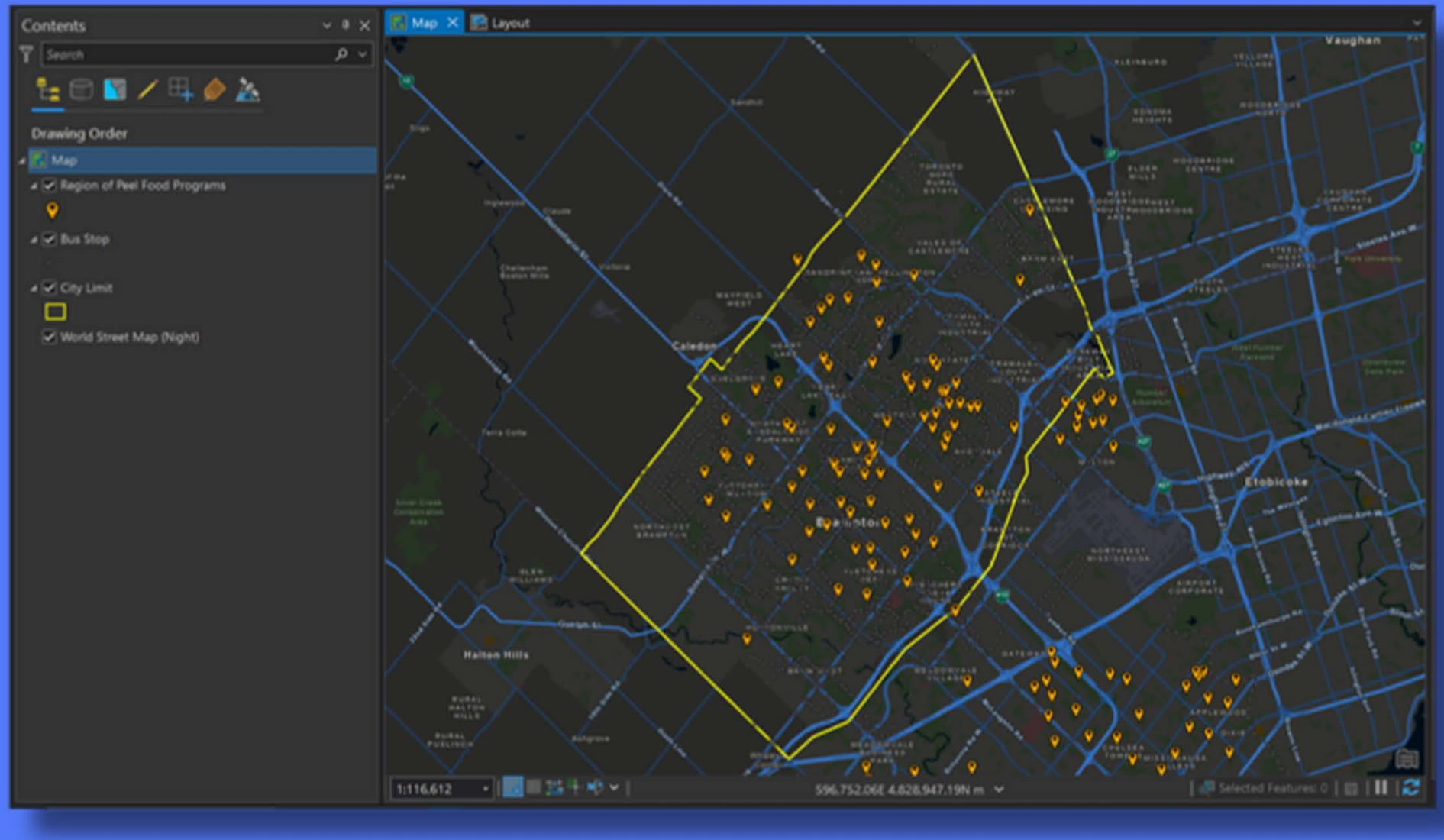
2. ArcGIS Pro

- Add the following layers (also by searching and using the owner: BramptonMaps flag):
  - **Transit_Stops_and_Routes**
  - **Region of Peel Food Programs**



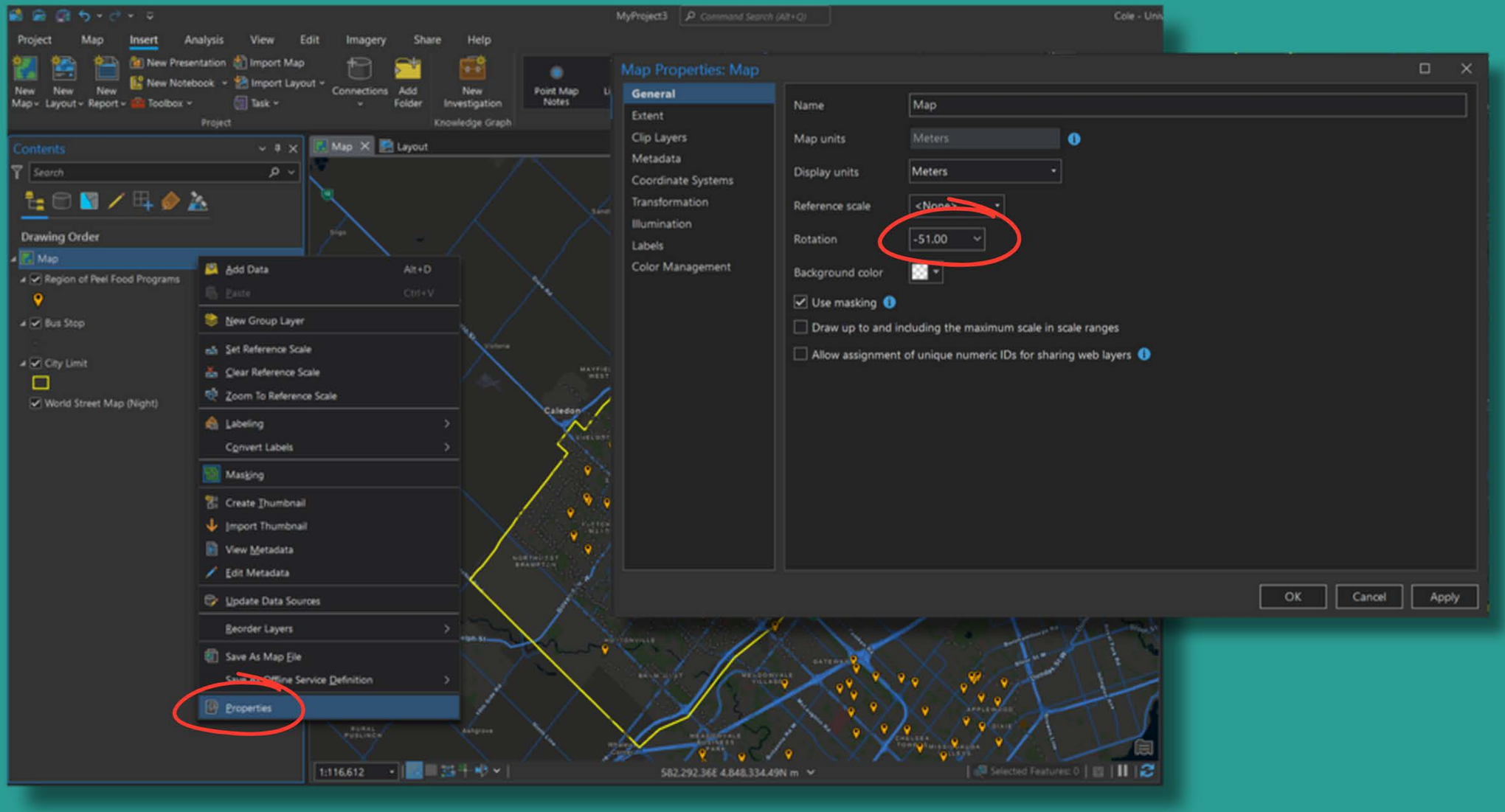
2. ArcGIS Pro

- Customize the **symbology** for each layer.



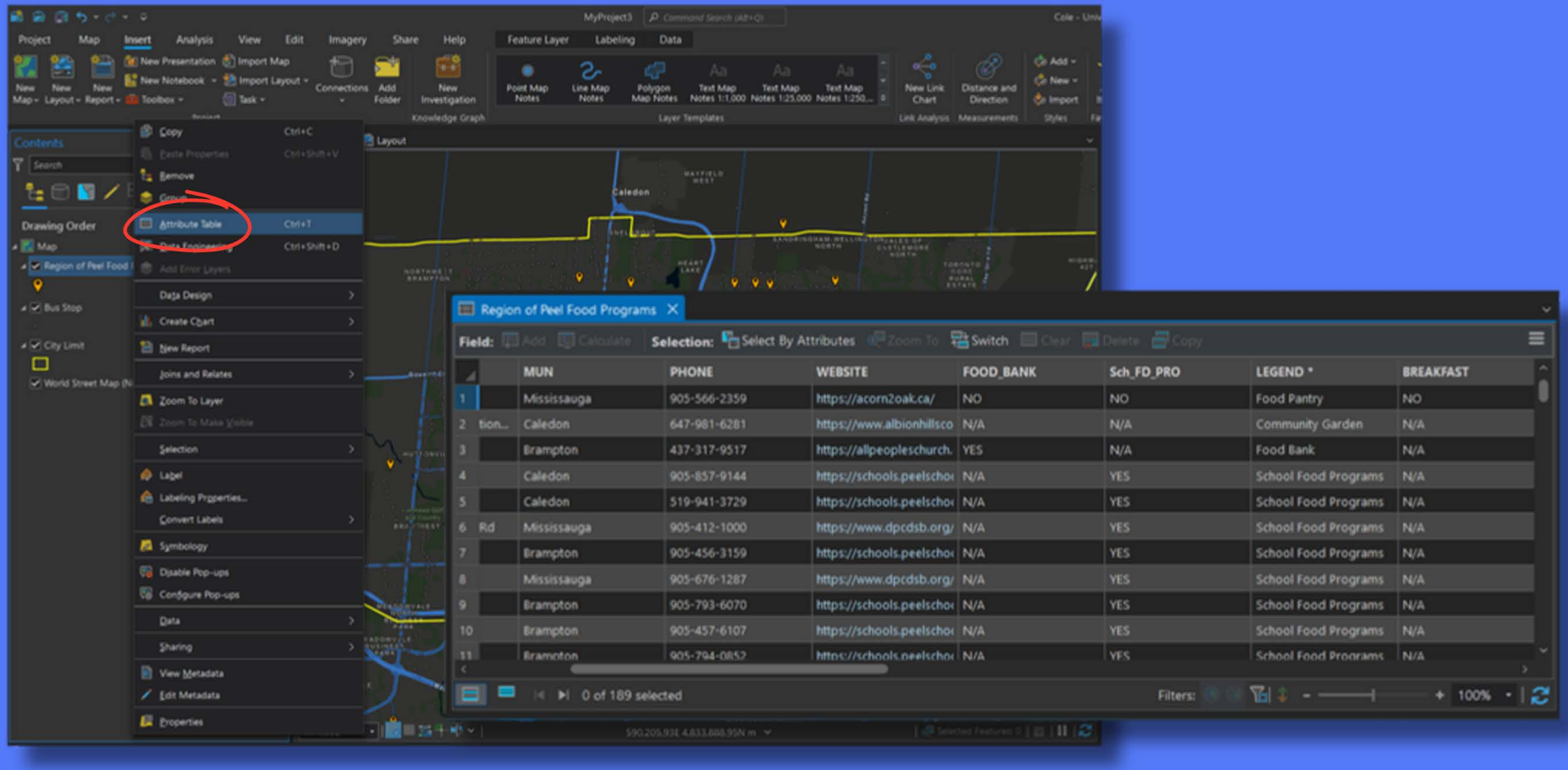
2. ArcGIS Pro

- Open the **Map Properties**
- Set the map rotation to **-51**



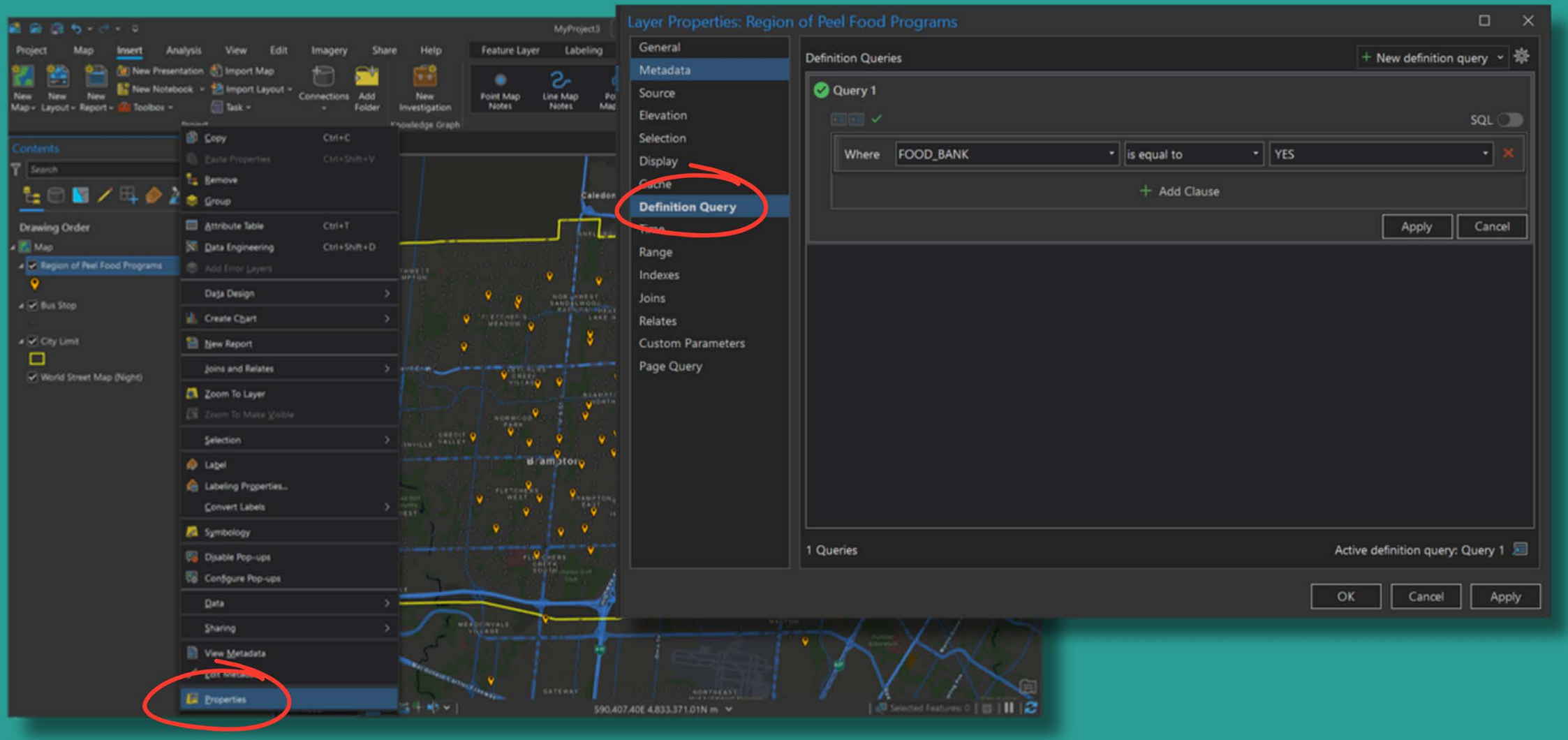
2. ArcGIS Pro

- Review the **Attribute Table** of the Region of Peel Food Programs layer.



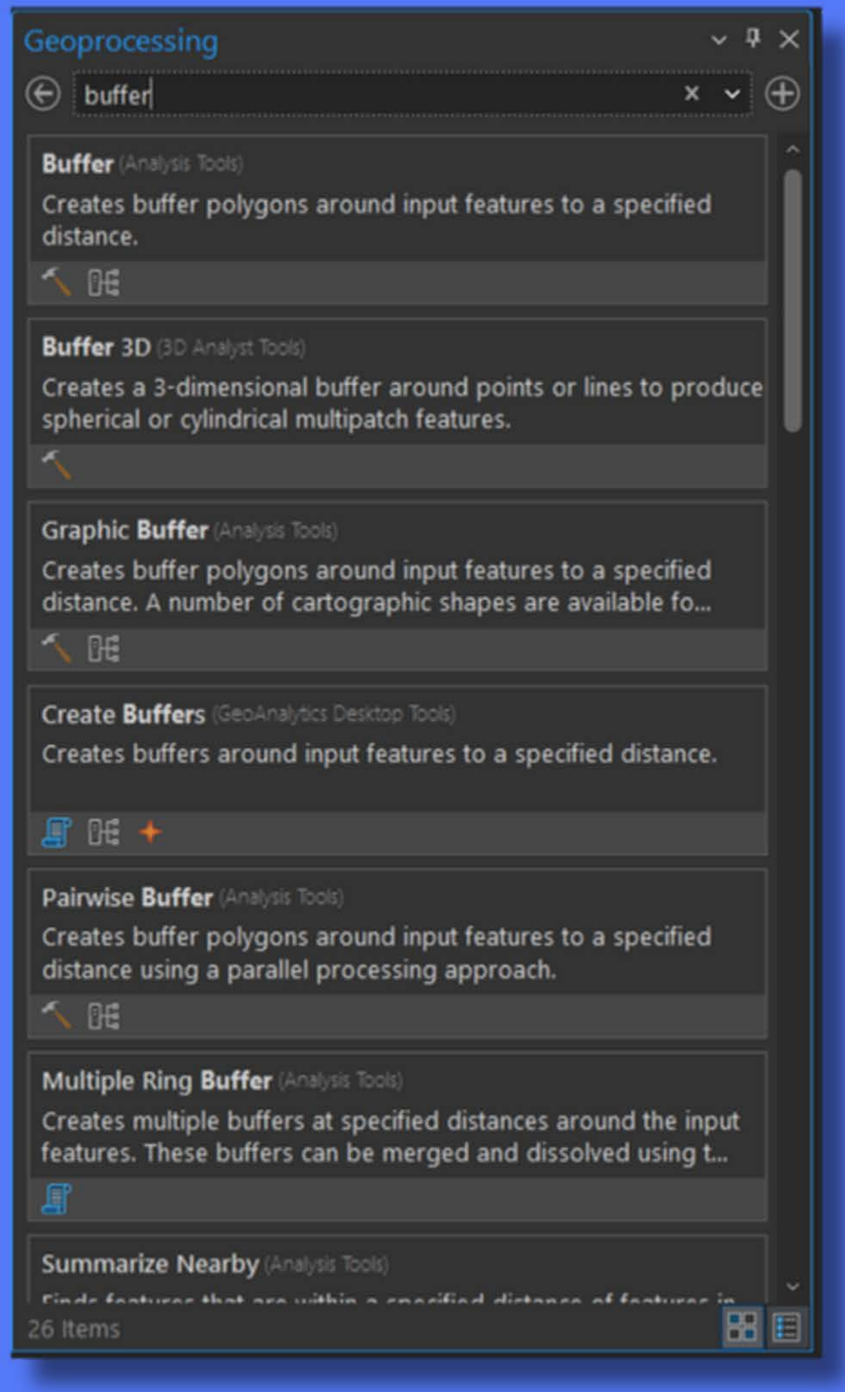
2. ArcGIS Pro

- **Filter** the Food Programs layer using a Definition Query.
- Build the expression: **FOOD_BANK is equal to YES.**



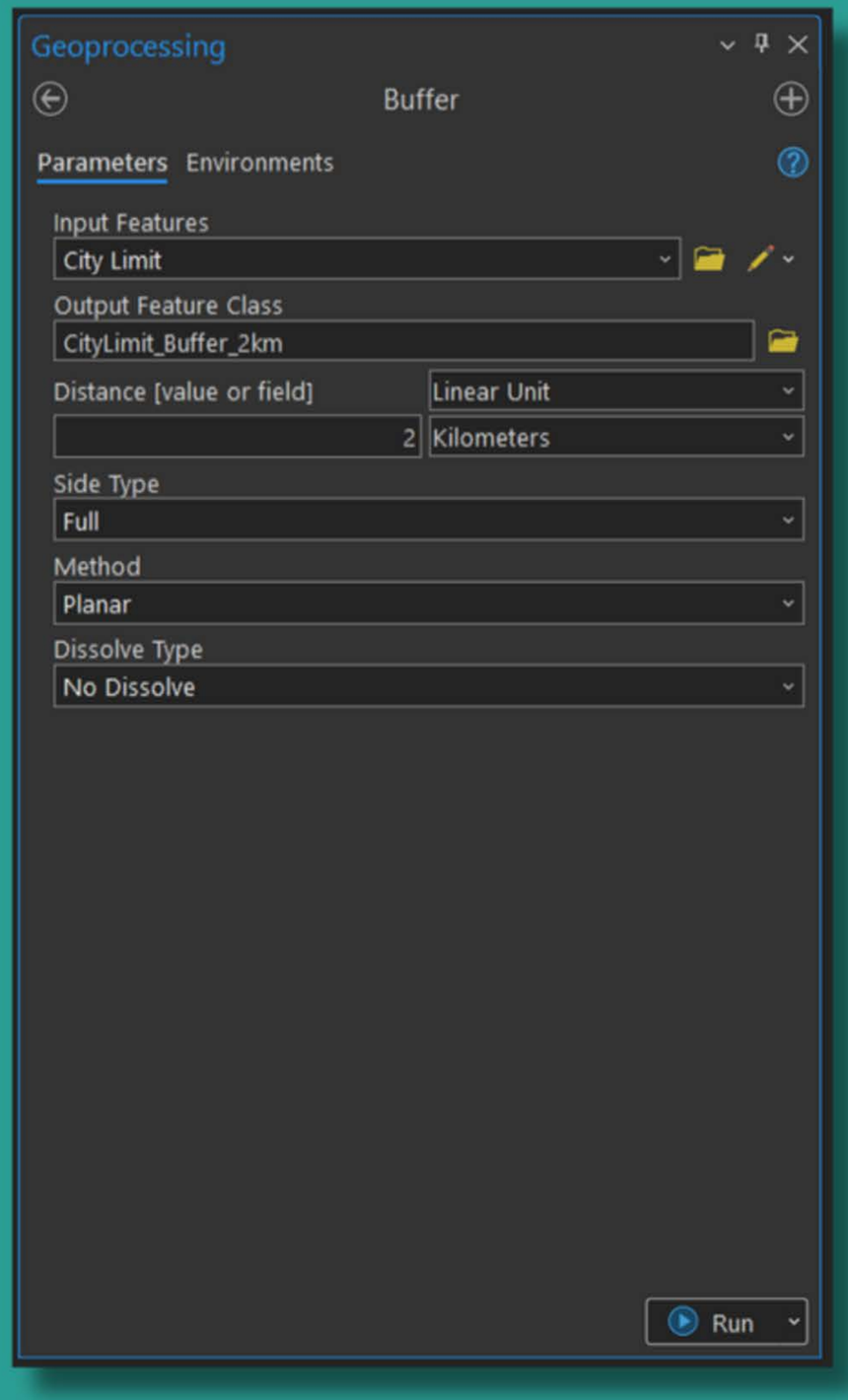
2. ArcGIS Pro

- Create a 2km buffer around the City Limit (this will be our study area).
- From the **Geoprocessing** pane, search for and open the **Buffer** tool.



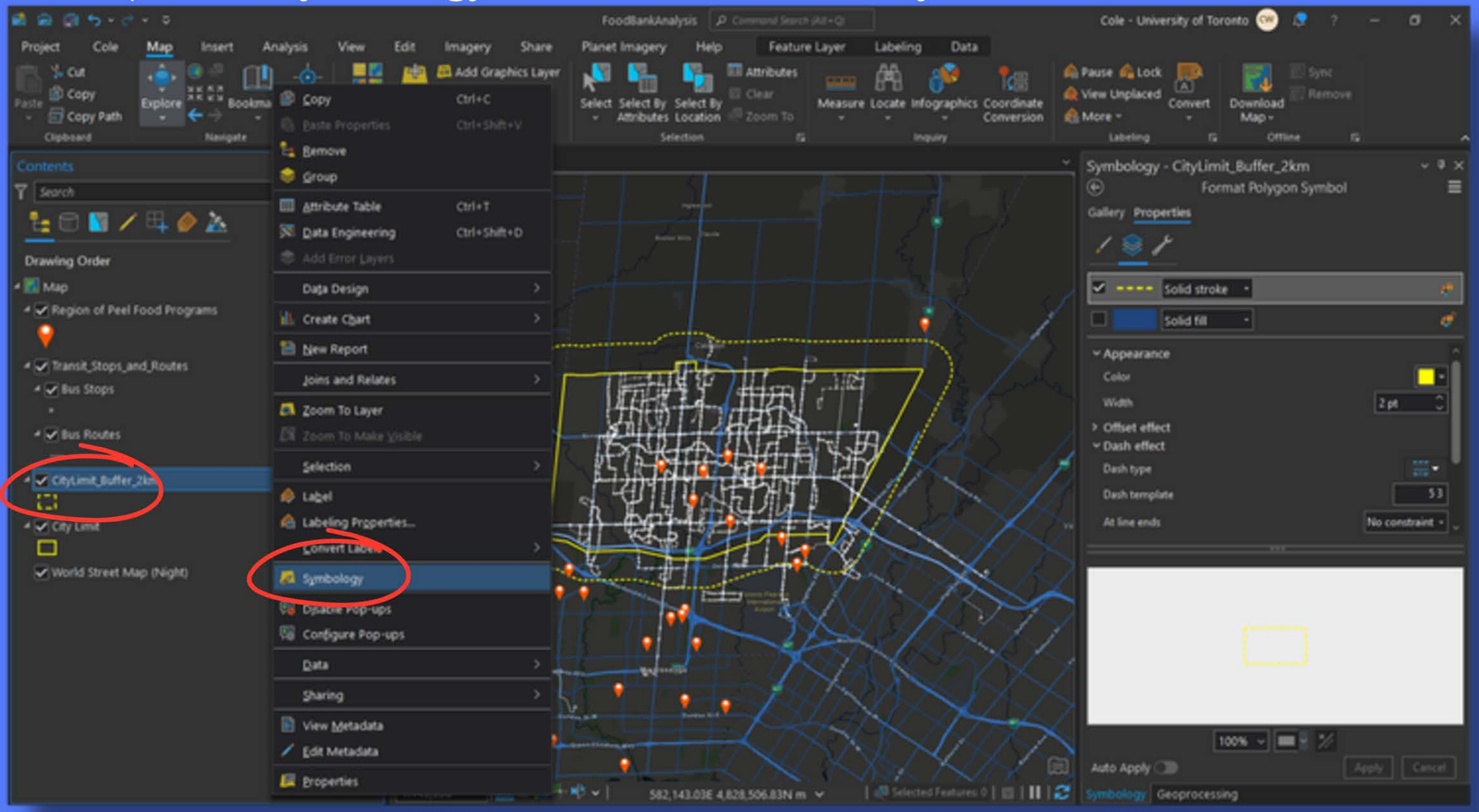
2. ArcGIS Pro

- Select the **City Limit** layer for the **Input Features** parameter.
- Give the output feature class a descriptive name.
- Specify **2** for the **Distance** value and **Kilometers** for the **Unit.**
- The other parameters can be left at the default values.
- Click **Run.**



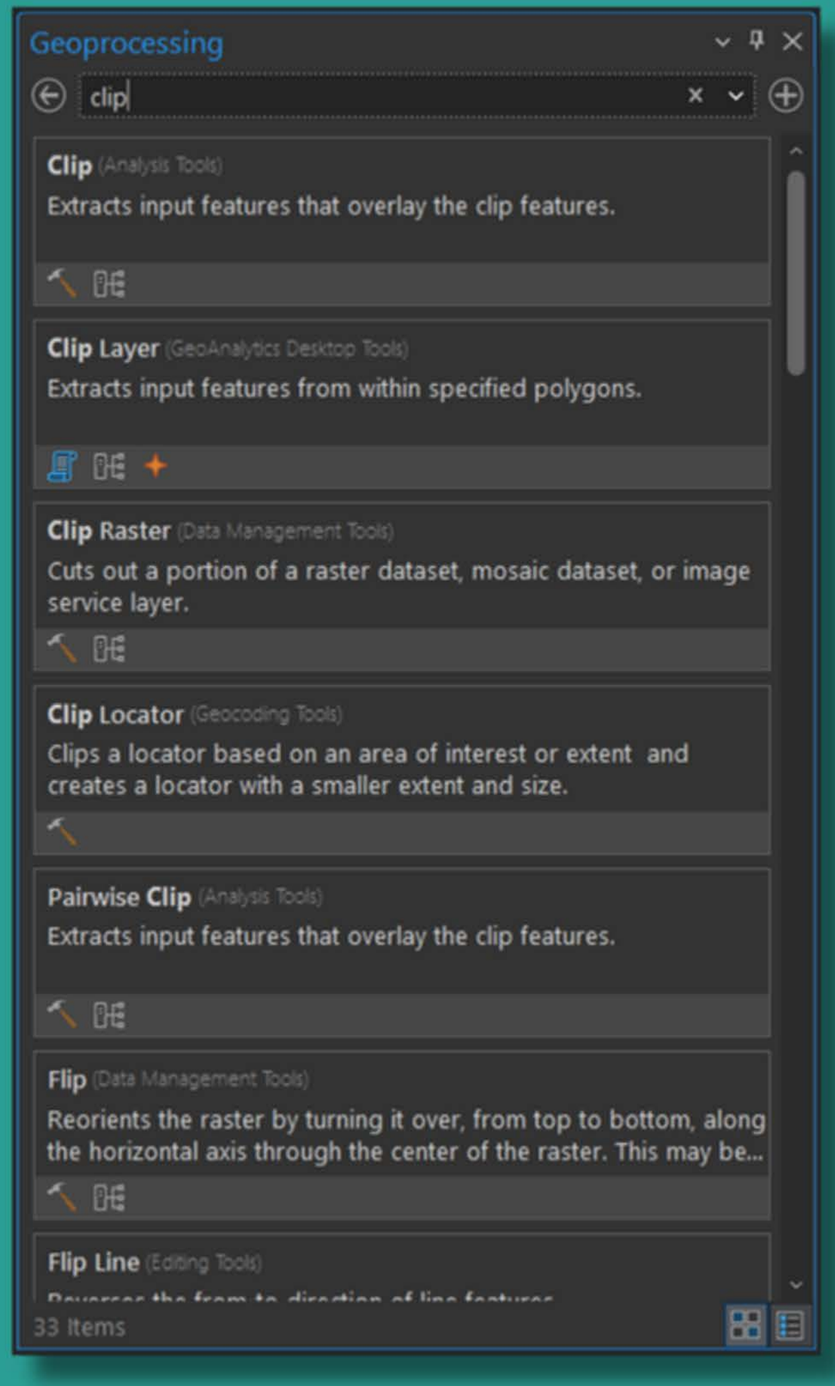
2. ArcGIS Pro

- Adjust the symbology of the new buffered layer.



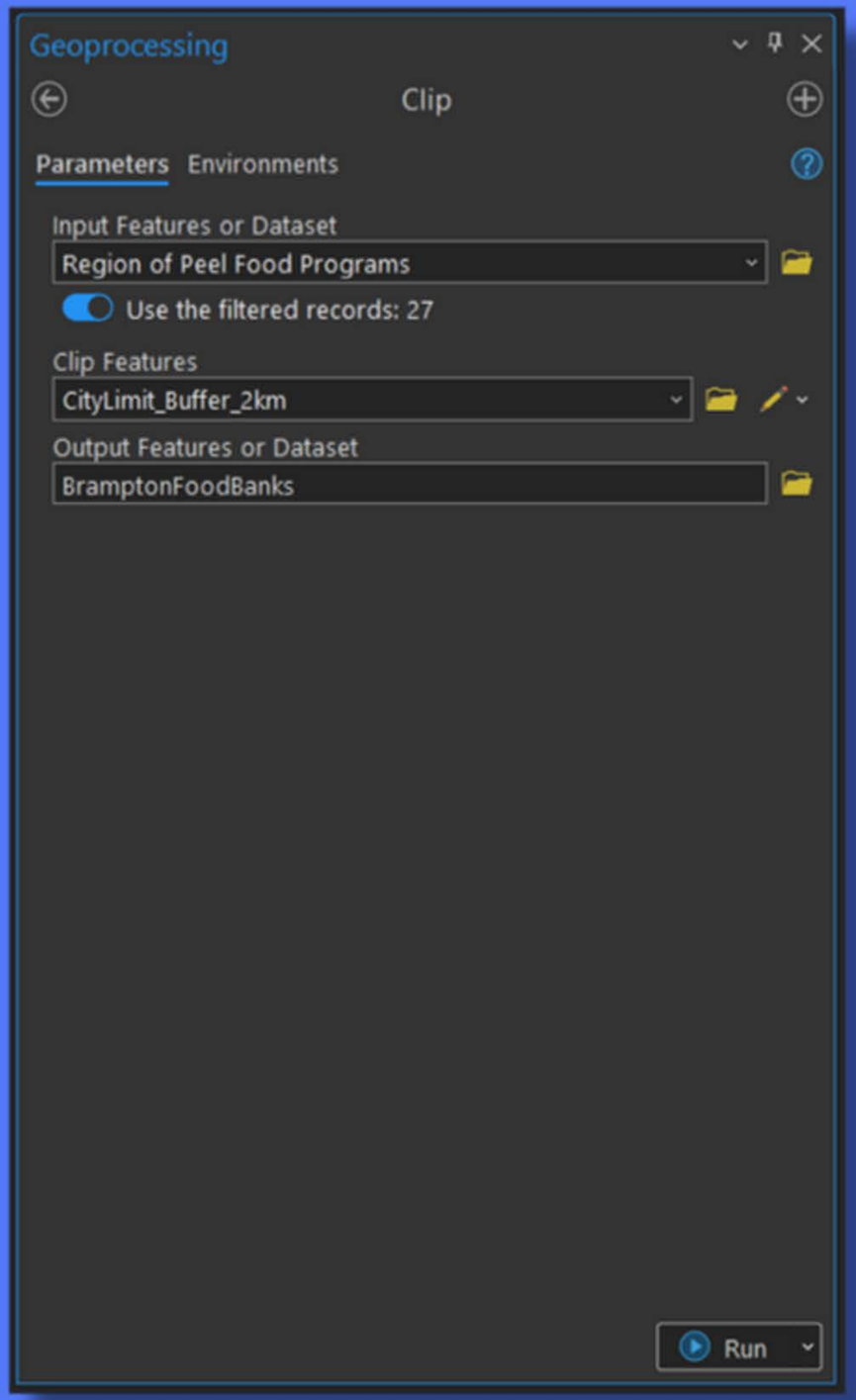
2. ArcGIS Pro

- Create a layer containing only food banks within the study area.
- In the **Geoprocessing** pane, search for and open the **Clip** tool.



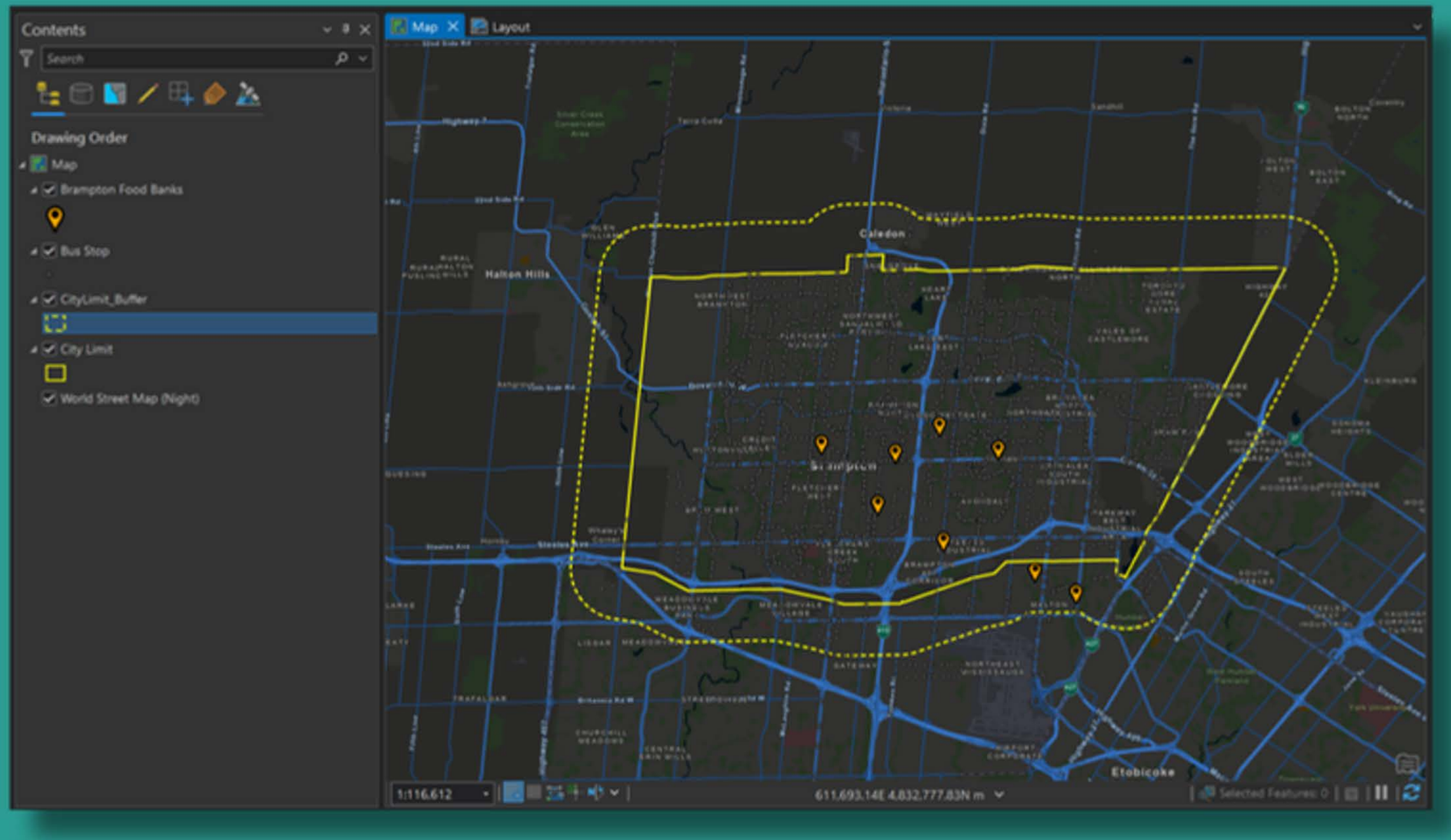
2. ArcGIS Pro

- Specify the **Region of Peel Food Programs** as the **Input Features or Dataset**.
- Leave ‘Use the filtered records’ toggled **on**.
- Select the buffer layer as the **Clip Features**.
- Give the output a descriptive name.
- Click Run.



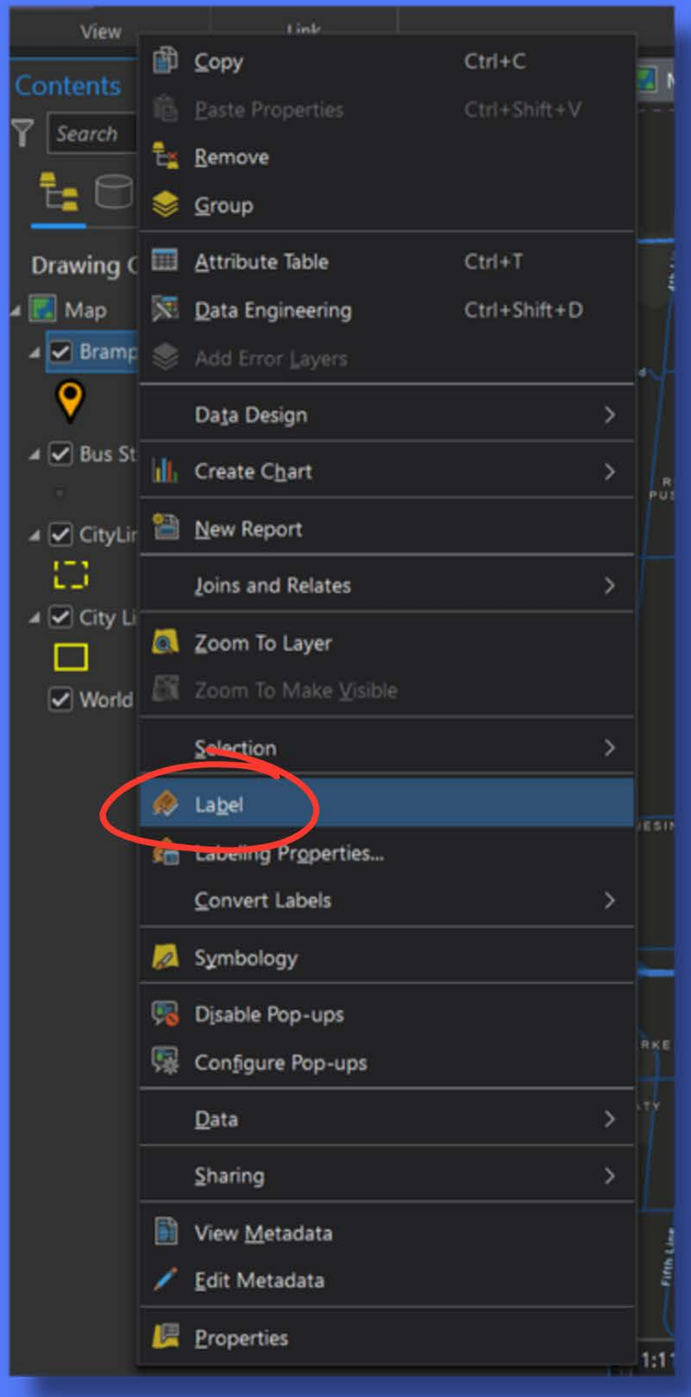
2. ArcGIS Pro

- Remove the original Region of Peel Food Programs layer.



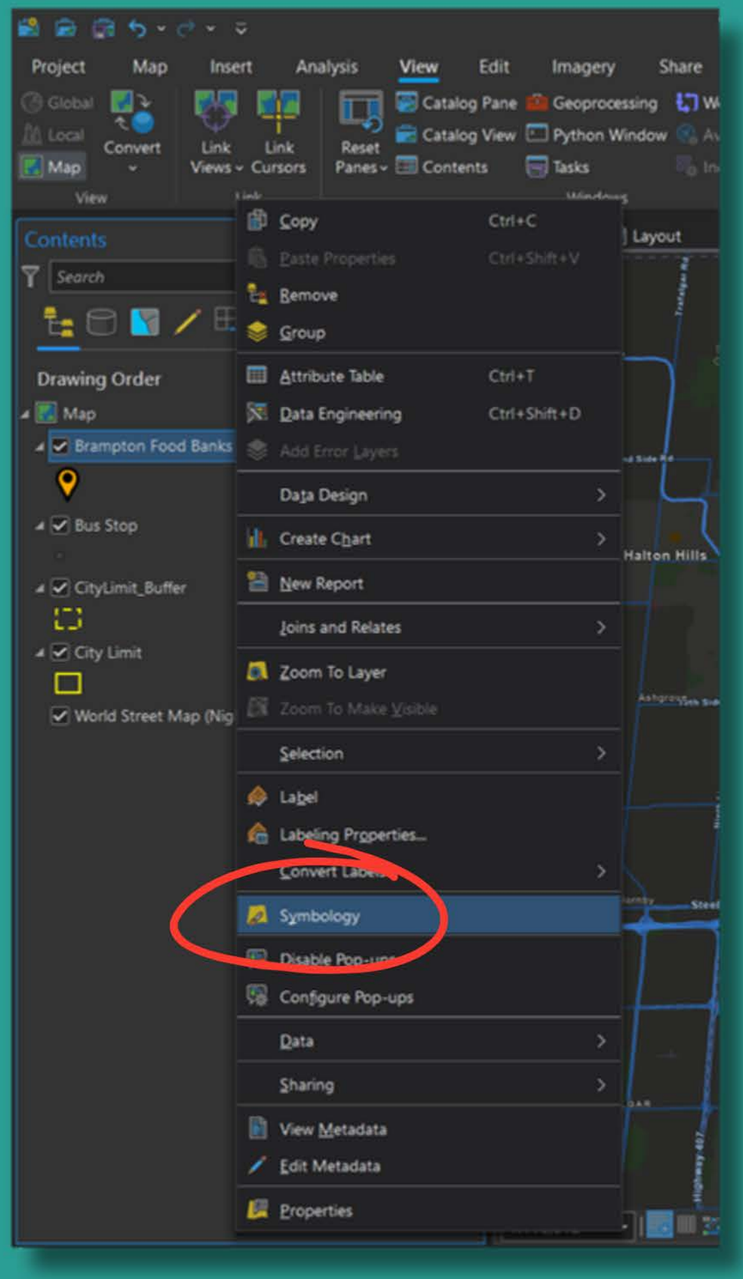
2. ArcGIS Pro

- Create labels for the existing food bank locations
- Right-click the BramptonFoodBanks layer and click the **Label** menu item to enable labels.



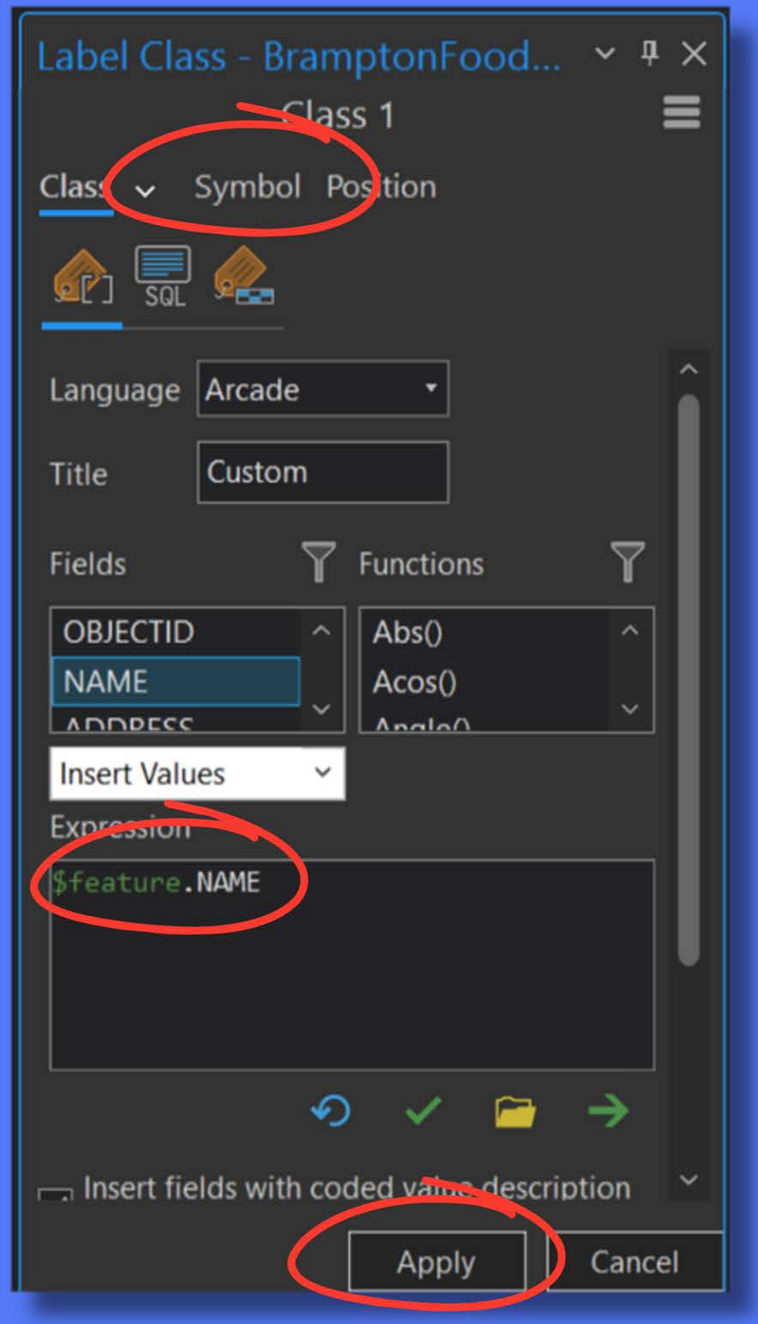
2. ArcGIS Pro

- Right-click the BramptonFoodBanks layer again.
- Click the **Labeling Properties** item in the contextual menu.



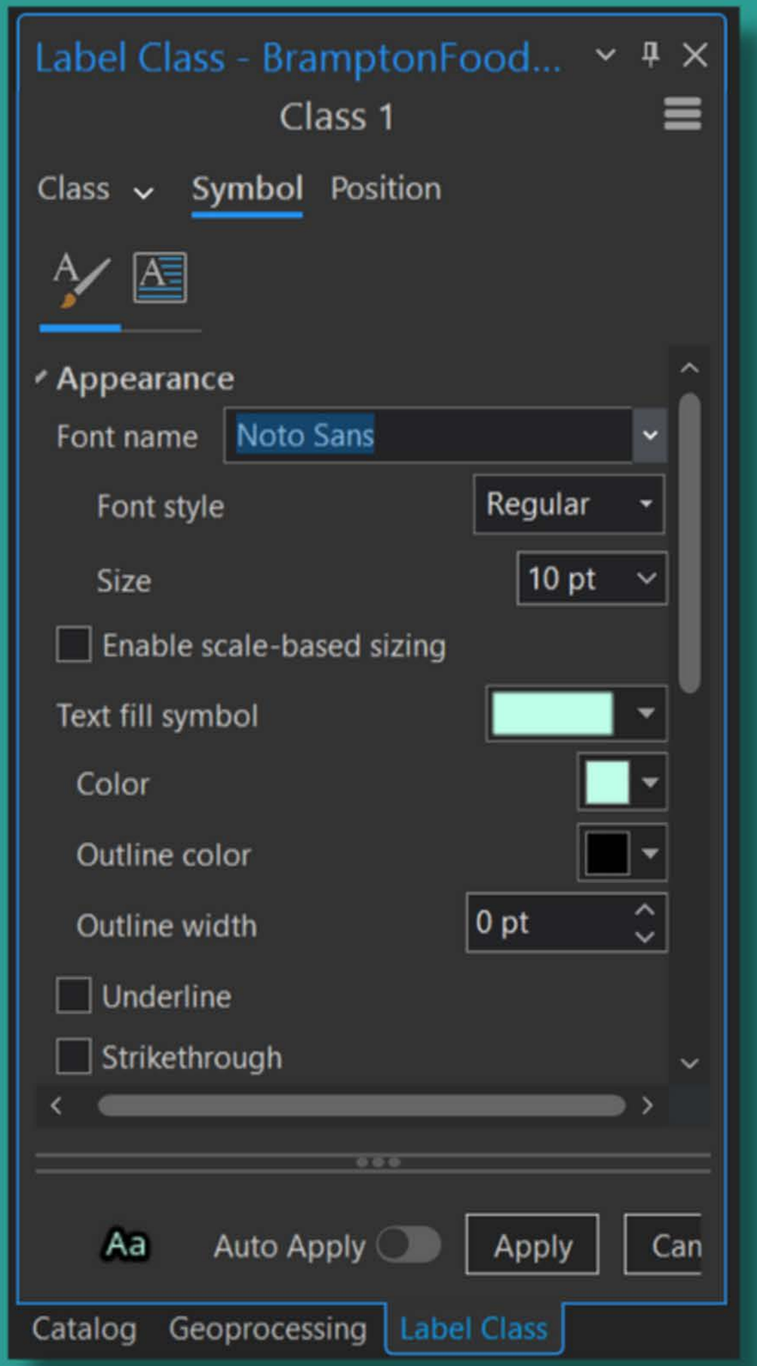
2. ArcGIS Pro

- Select **NAME** as the label field if it isn't already
- The Expression box should contain text reading **$feature.NAME**
- Click **Apply**.
- Next, click the **Symbol** tab to customize the label's appearance.



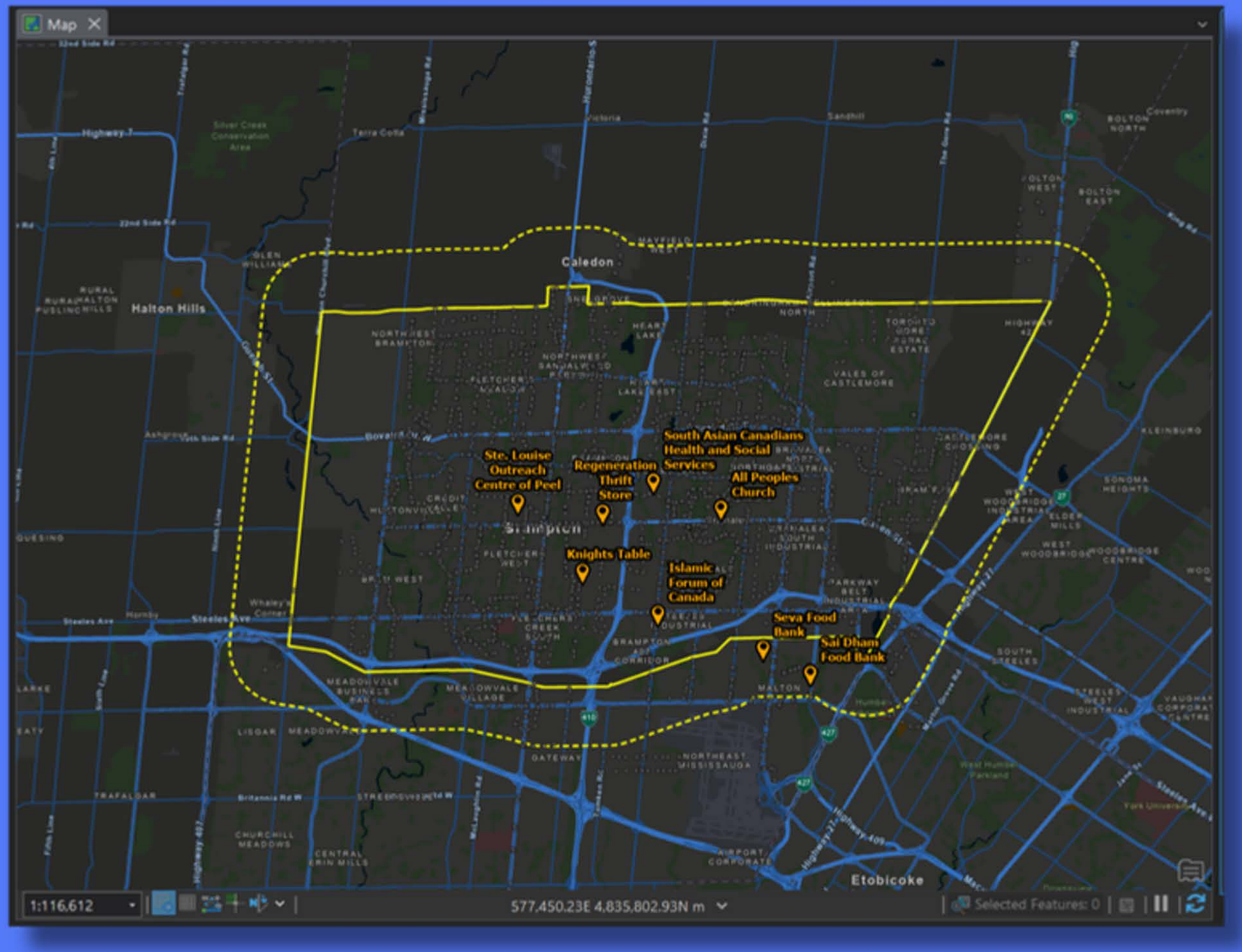
2. ArcGIS Pro

- Adjust the label font, size, and colour.
- Click Apply.



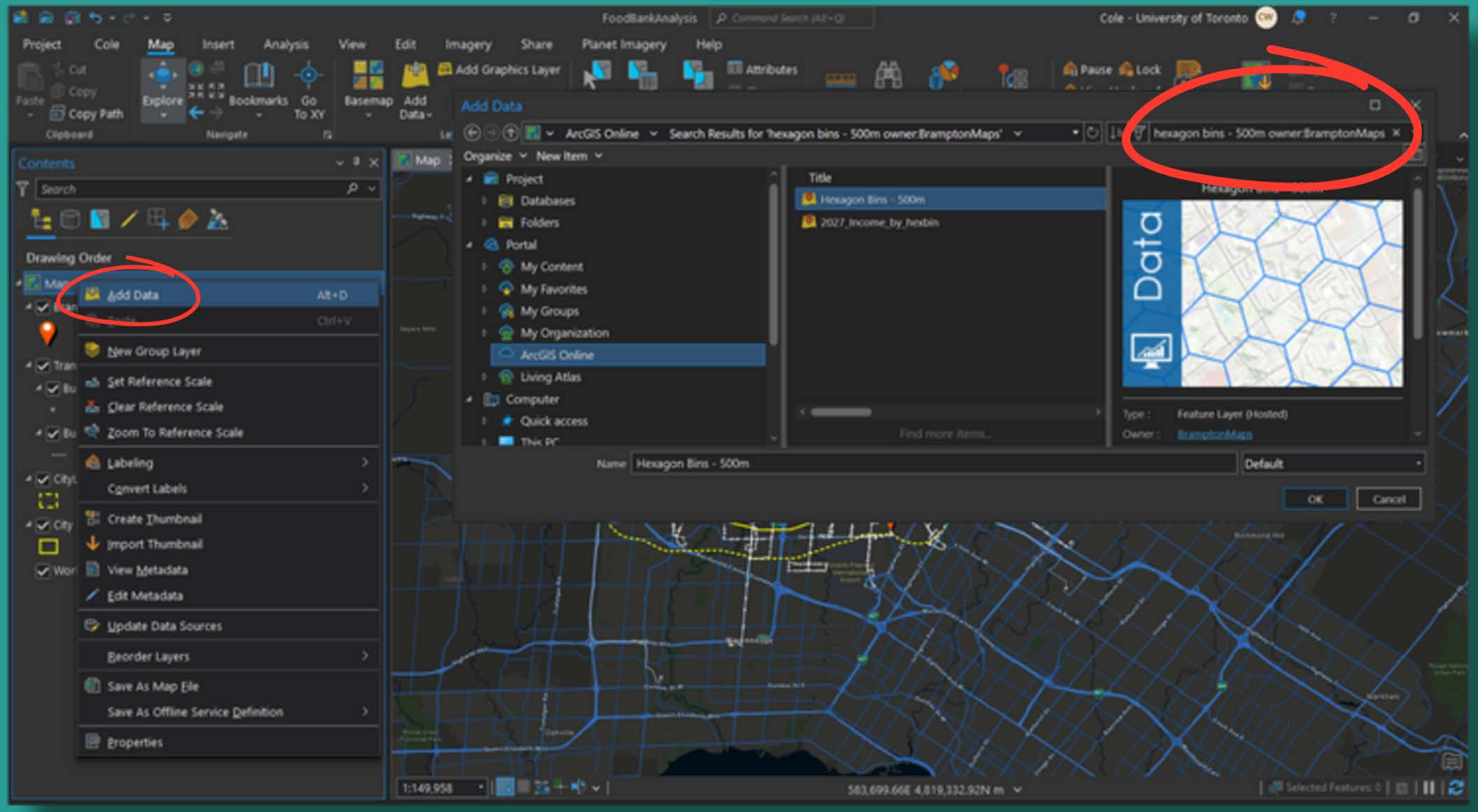
2. ArcGIS Pro

- Labels will now appear for each point.



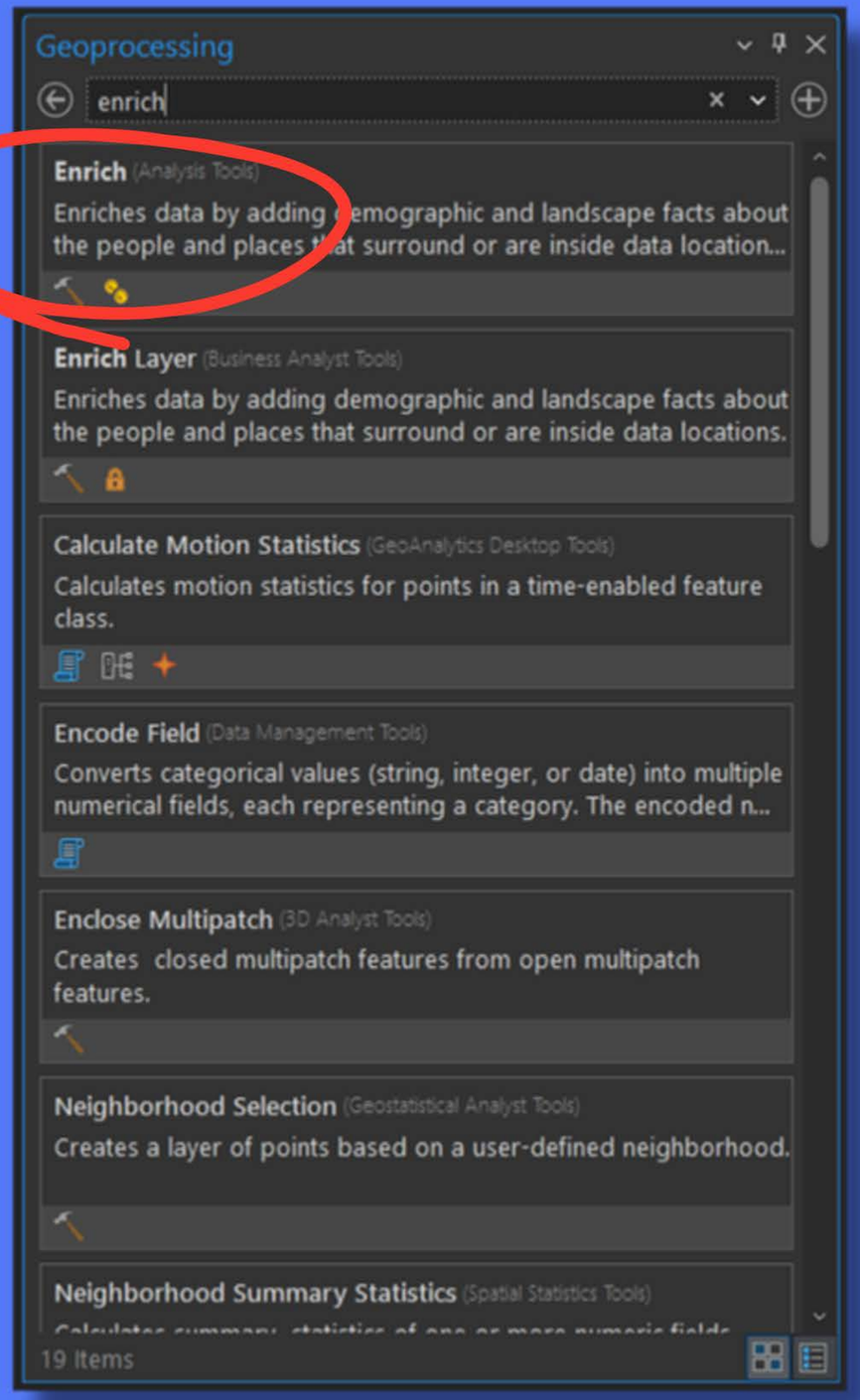
2. ArcGIS Online

- Analyze income within the study area.
- Add Data
- Search for and select **Hexagon Bins - 500m owner:BramptonMaps** within ArcGIS Online. Click OK.



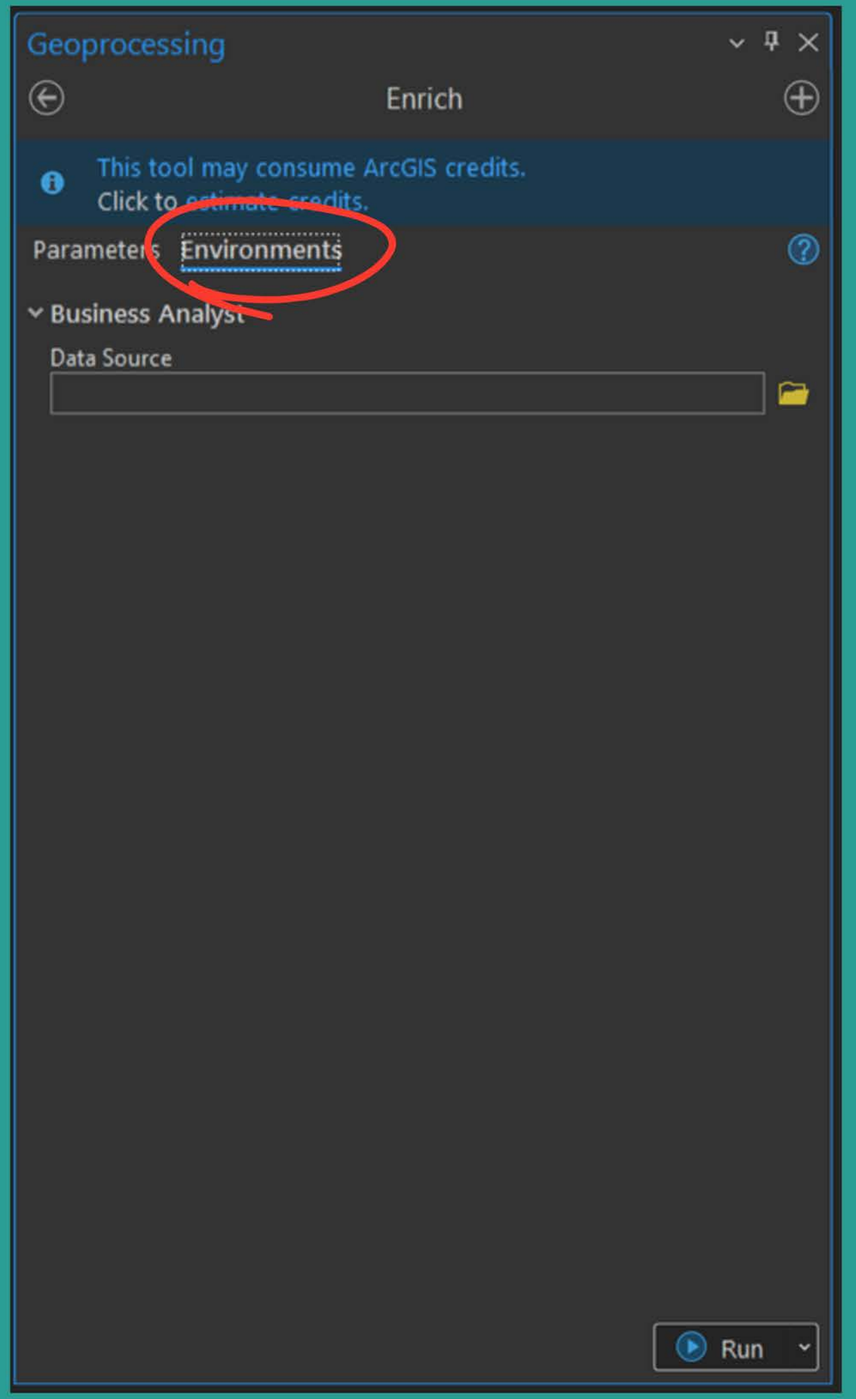
2. ArcGIS Pro

- In the **Geoprocessing** pane, search for and open the **Enrich** tool.



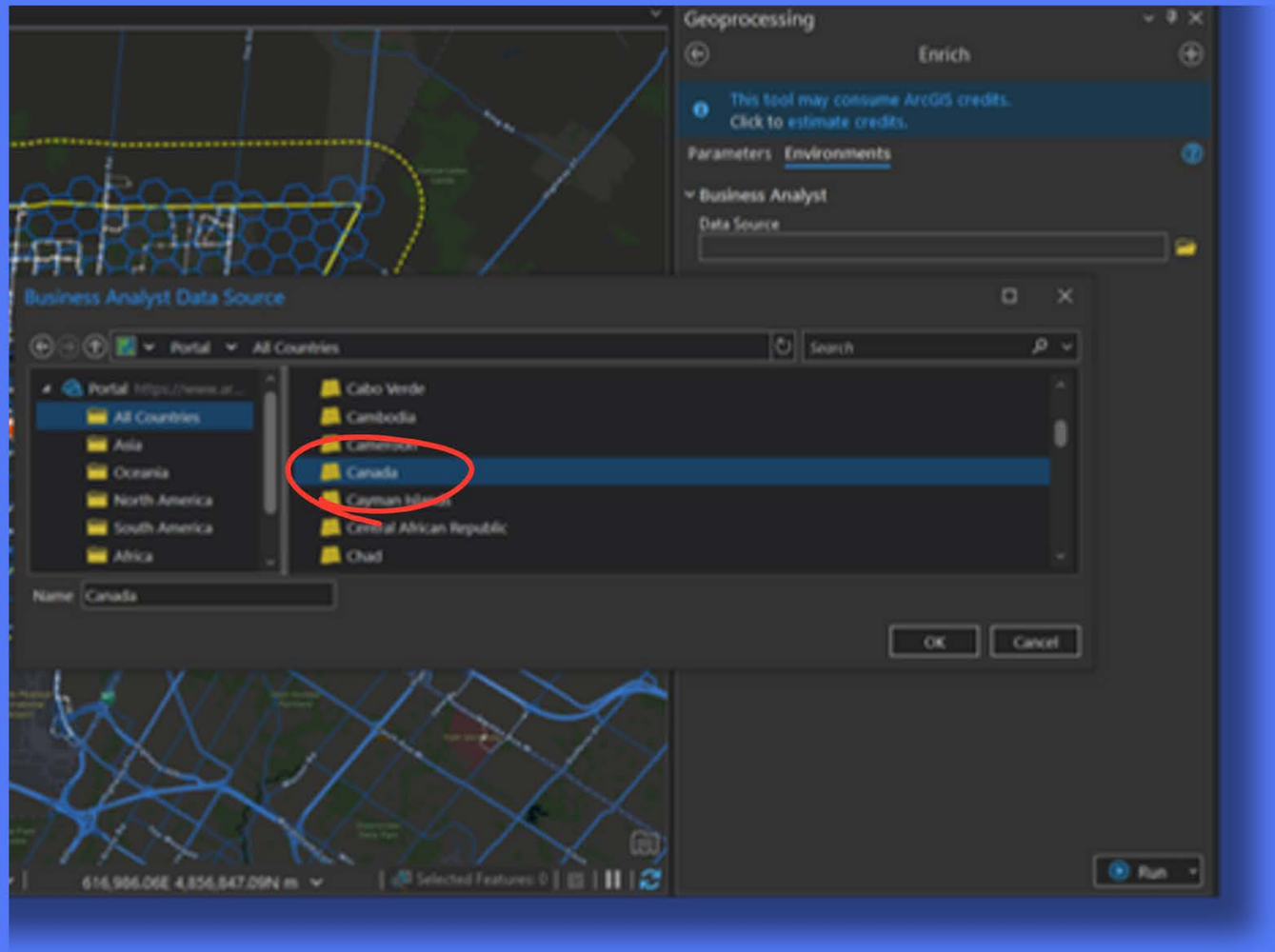
2. ArcGIS Pro

- The Enrich tool defaults to United States locations. Change this by clicking on the **Environments** tab.
- Click the **folder icon** to the left of the Data Source box.



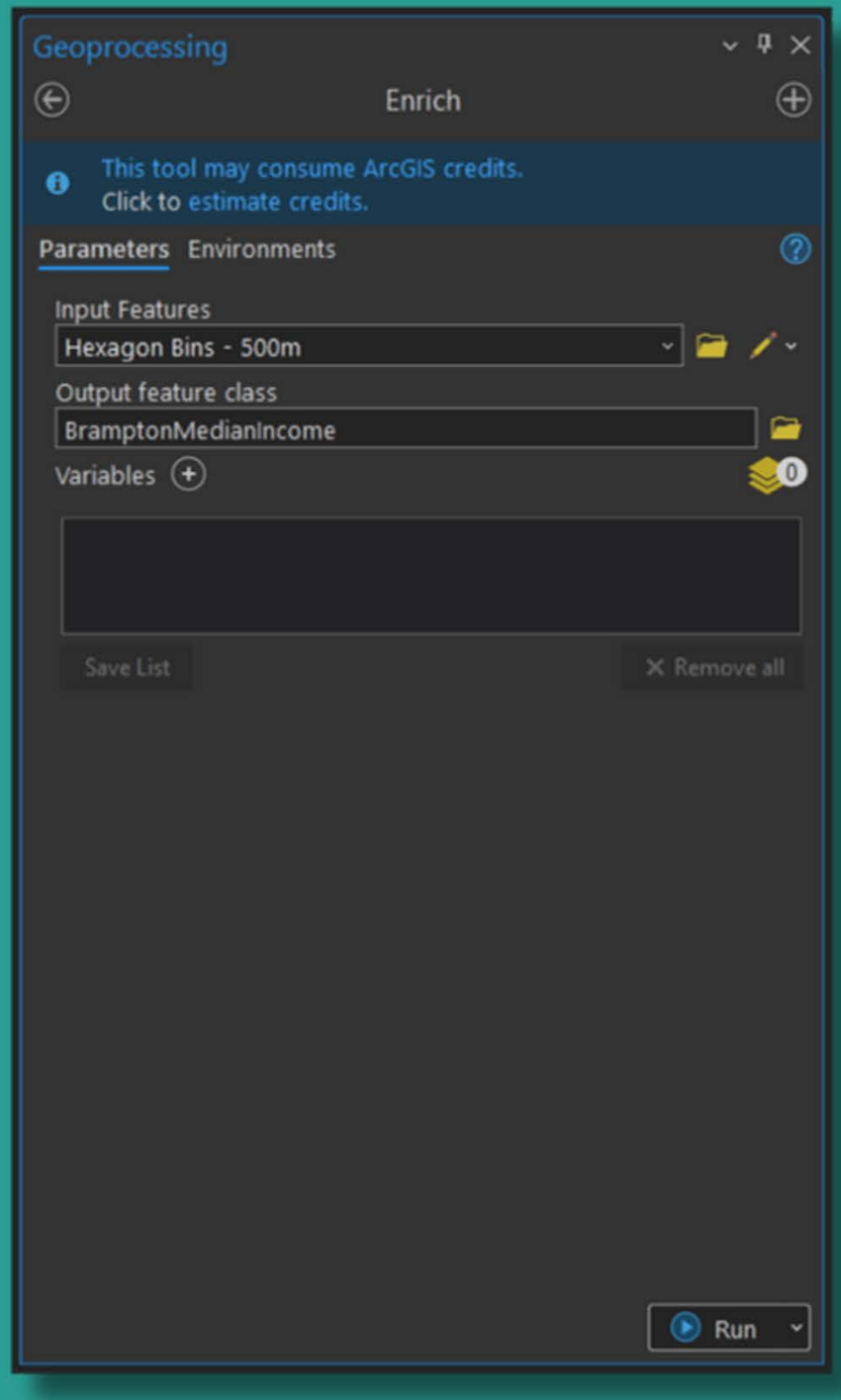
2. ArcGIS Pro

- Find and select Canada. Click OK.



2. ArcGIS Pro

- In the **Parameters** tab of the **Enrich** tool, specify the following:
- **Input Features:** Select the **Hexagon Bins - 500m** layer
- **Output feature class**: Enter **BramptonMedianIncome** or another descriptive name.

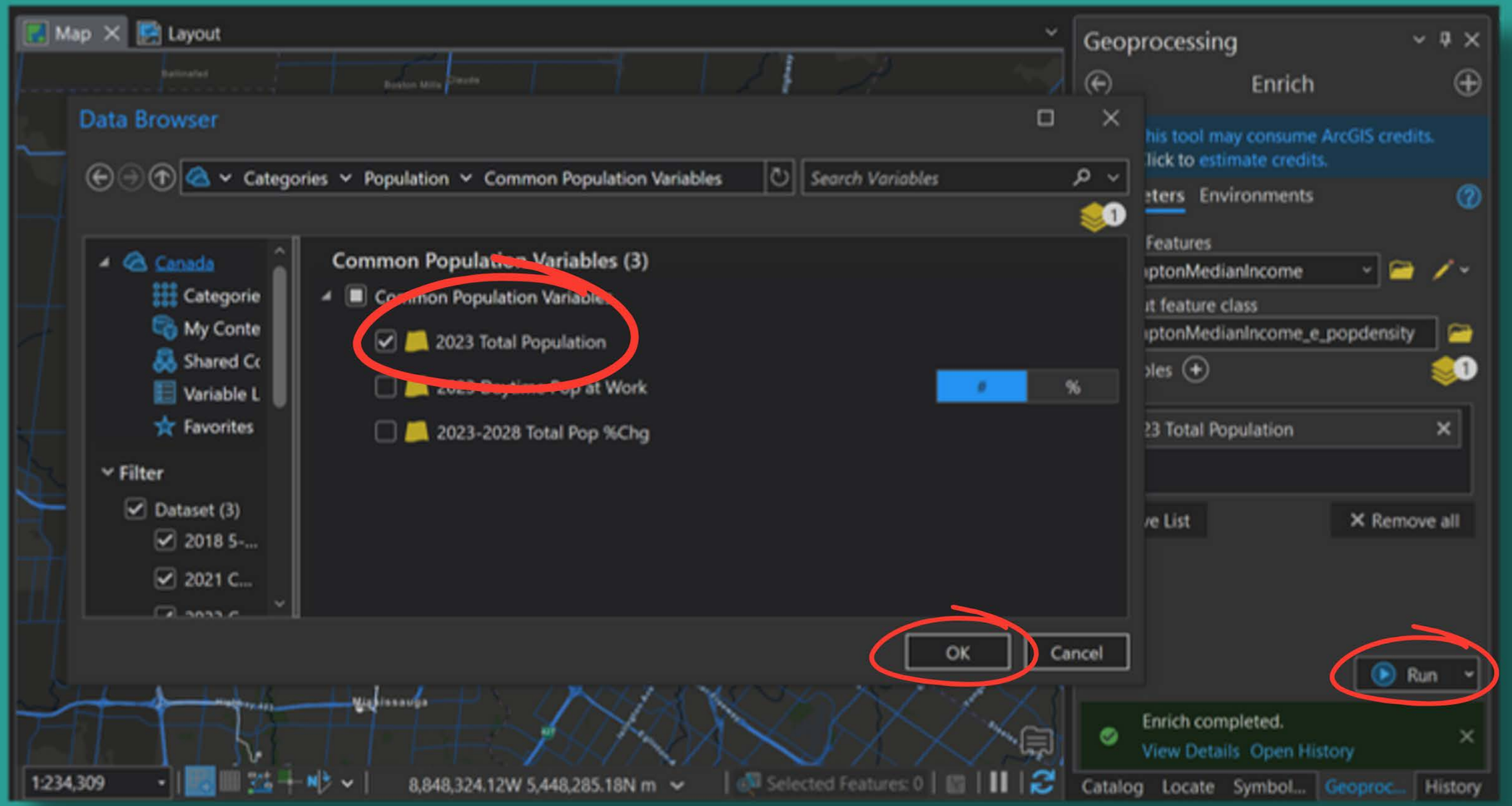


2. ArcGIS Pro

- Click the **+** button next to the word Variables.
- Navigate to Income > **Common Income Variables.**
- Check the box next to **2023 HH Inc. Median Curr$.**

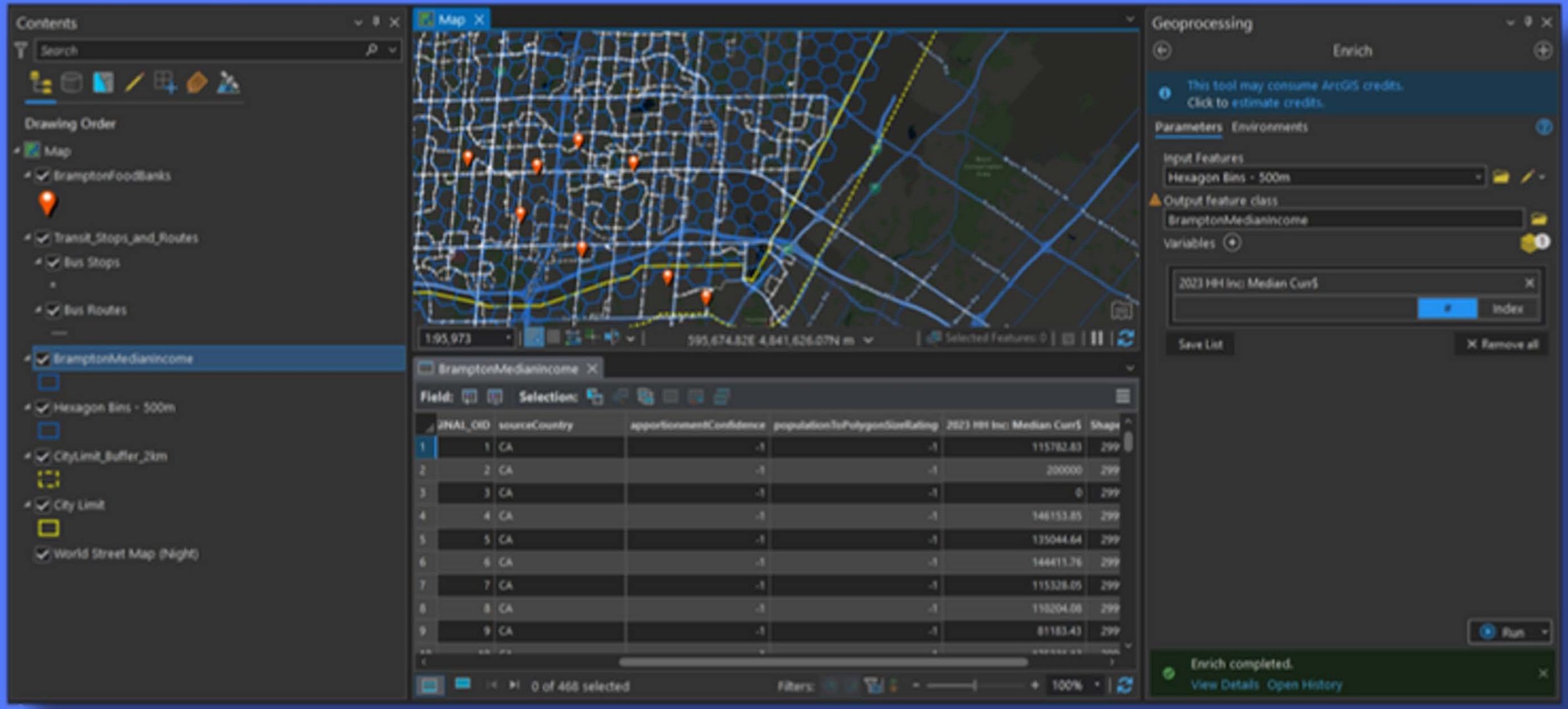
2. ArcGIS Pro

- Navigate to **Population** > **Common Population Variables.**
- Check the box next to **2023 Total Population.**
- Click **OK.** Click **Run.**



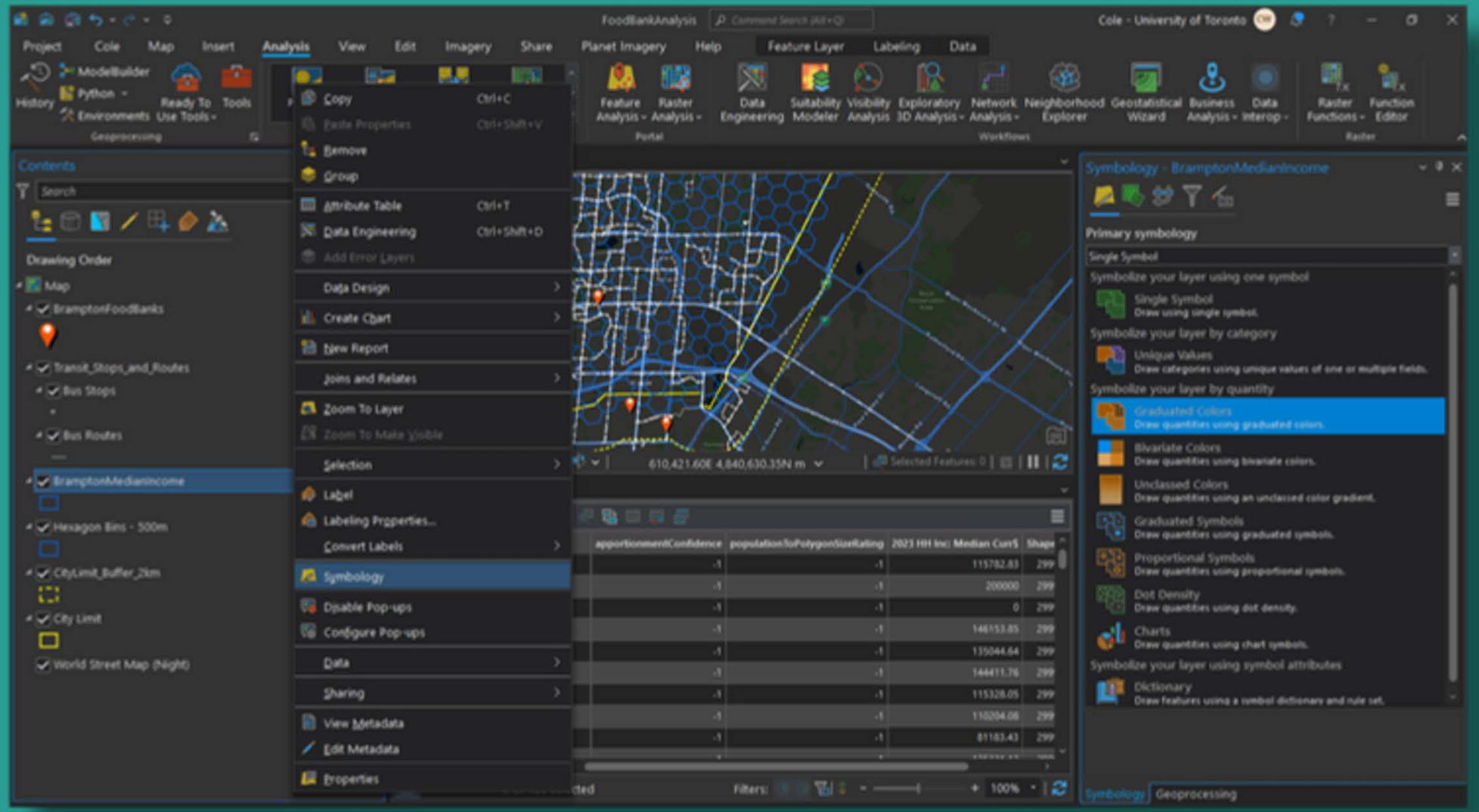
2. ArcGIS Pro

- Review the **Attribute Table** of the new layer created by the **Enrich** tool.
- The layer now includes median household income values and population counts for each feature.



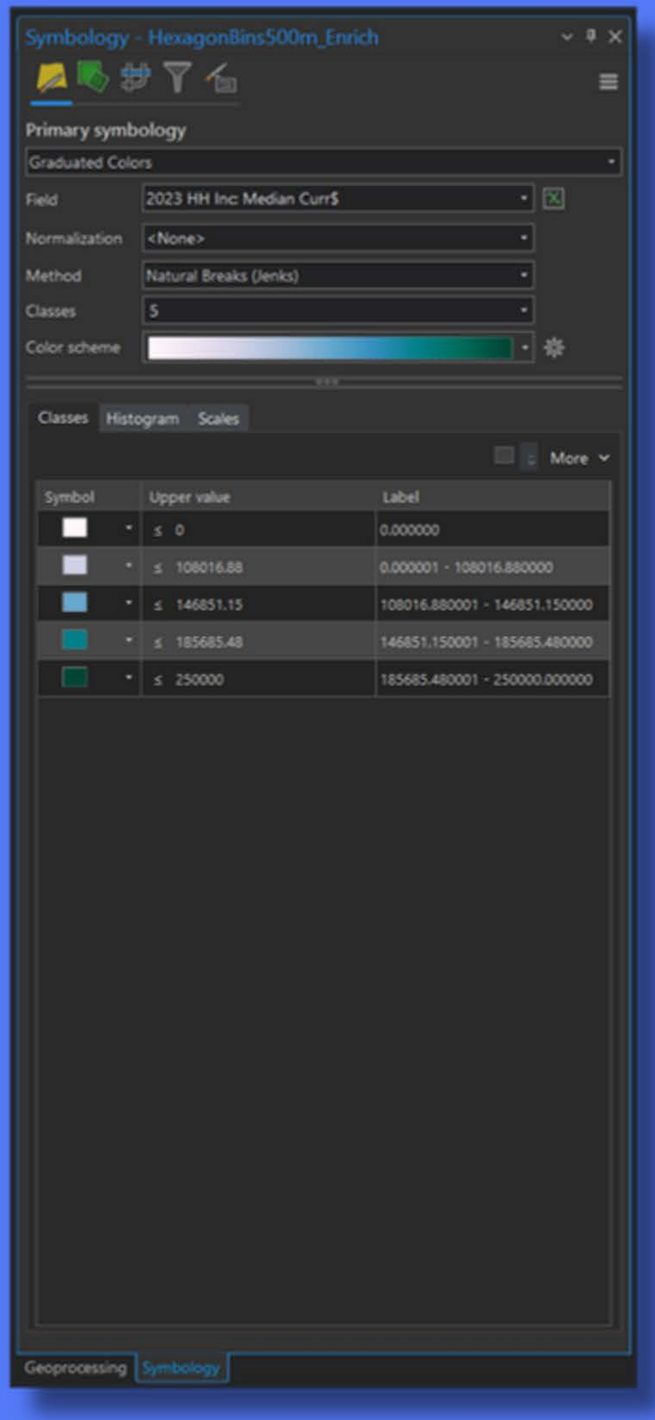
2. ArcGIS Pro

- Open the **Symbology** pane for the BramptonMedianIncome layer
- From the Primary Symbology dropdown, choose **Graduated Colors.**



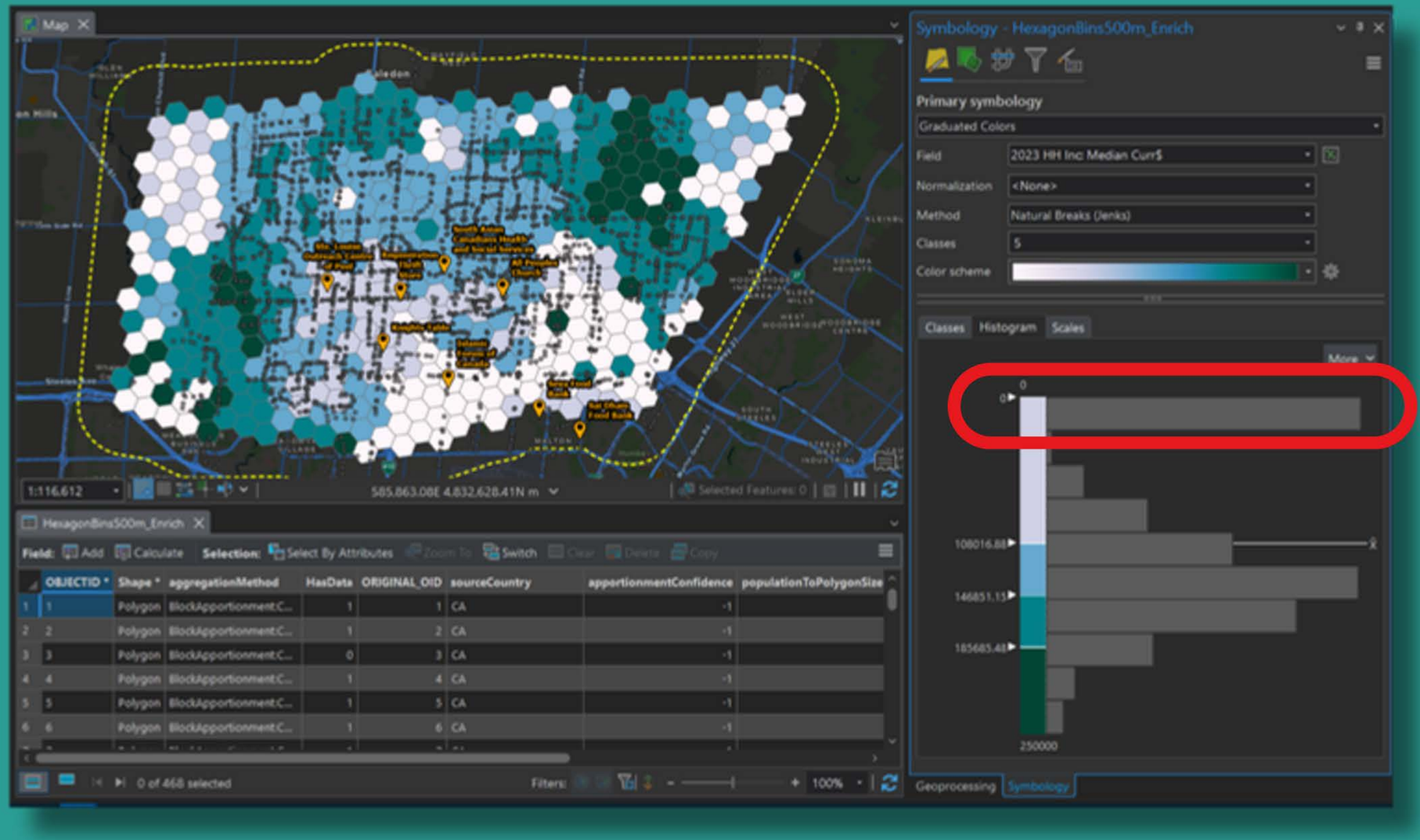
2. ArcGIS Pro

- Select **2023 HH Inc: Median Curr$** for the Field
- Input 5 for the number of classes
- Choose a colour ramp
- *Note: you may wish to experiment with the classification method, number of classes, and color scheme to see how the same data may be visualized in different ways.*



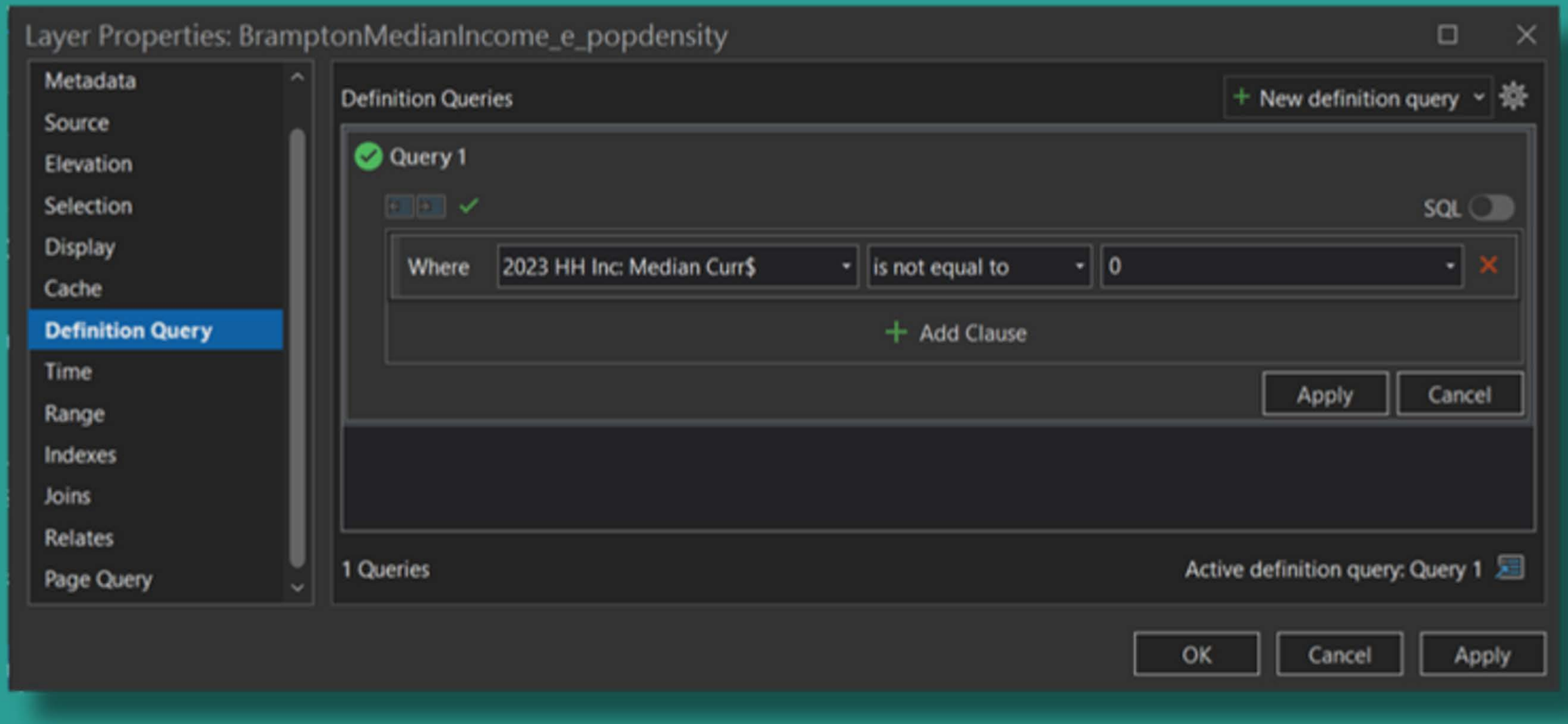
2. ArcGIS Pro

- Click on the **Histogram** tab of the Symbology pane.
- Note the high number of zeros for the Median Income field.
- This is because some features had no data returned by the Enrich Layer function.



2. ArcGIS Pro

- Add a **Definition Query** to the Median Income layer to filter out the zeros.
- Build the expression: **2023 HH Inc: Median Curr$ is not equal to 0**
- Click **Apply**. Click **OK**.

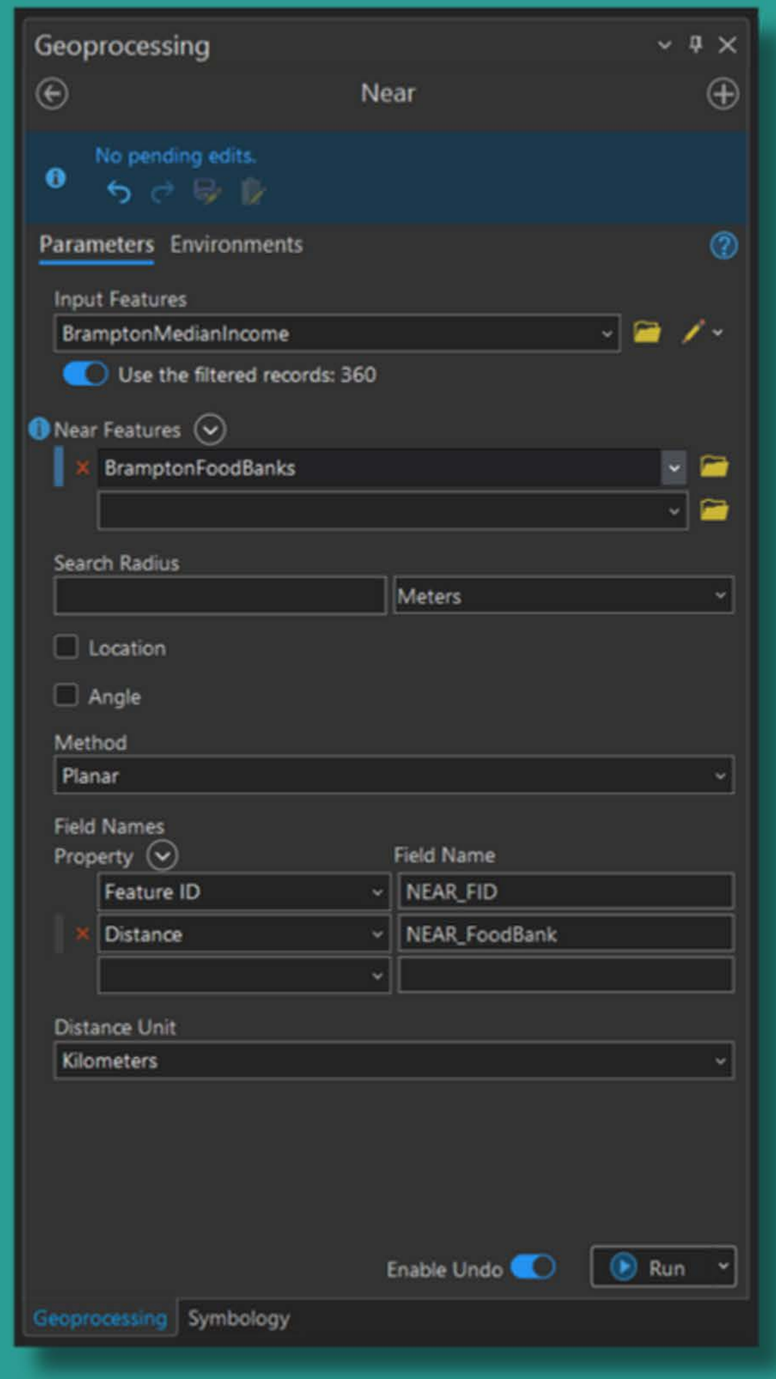


2. ArcGIS Pro

- Remove the original Hexagon grid layer. The map should look something like this.

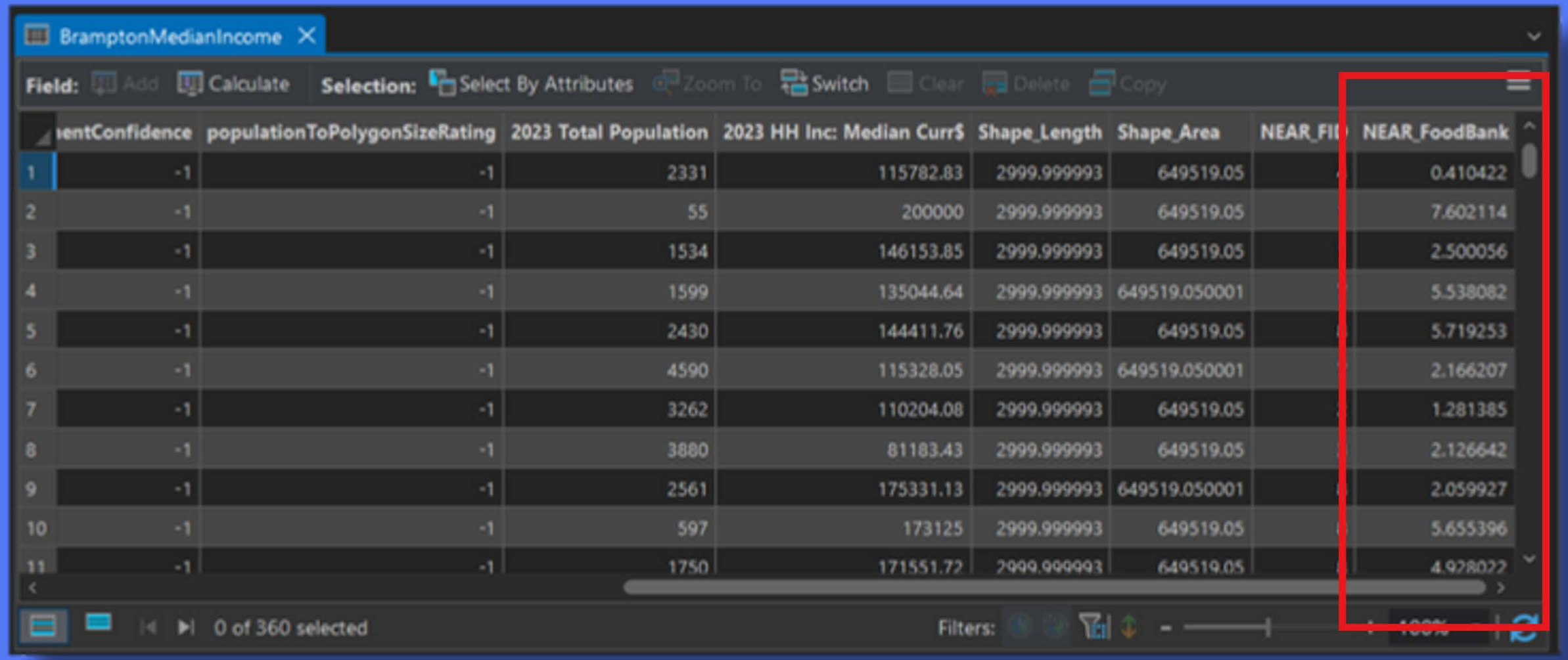
2. ArcGIS Pro

- How far is each area from a food bank?
- Open the **Near** geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Food Banks layer for the **Near Features**.
- Distance Unit = **Kilometres**.
- Distance Field Name = **NEAR_FoodBank**
- Click **Run**.



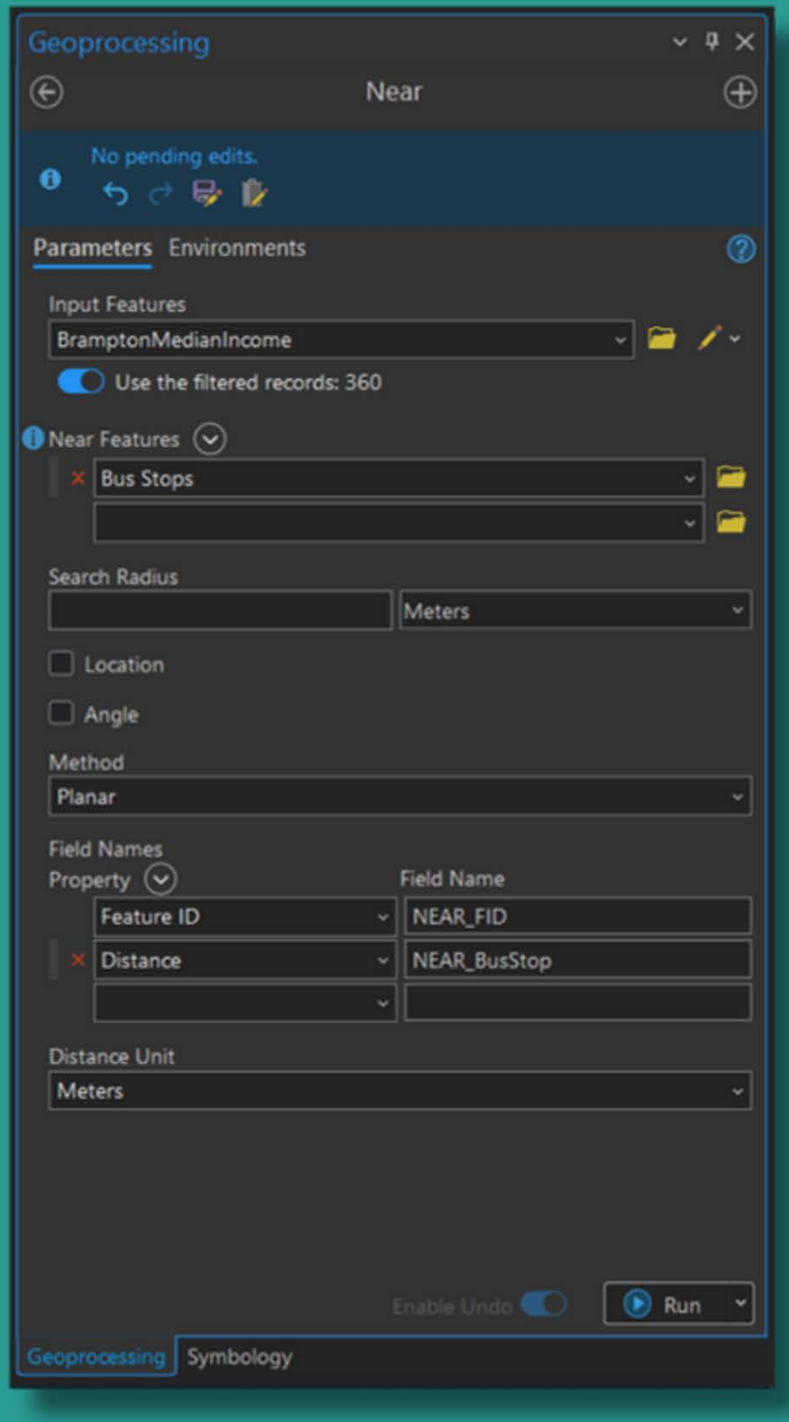
2. ArcGIS Pro

- The layer's Attribute Table now contains a field called **NEAR_FoodBank.**
- The attribute values in the NEAR_FoodBank field represent how far each area is from a food bank, in kilometres.



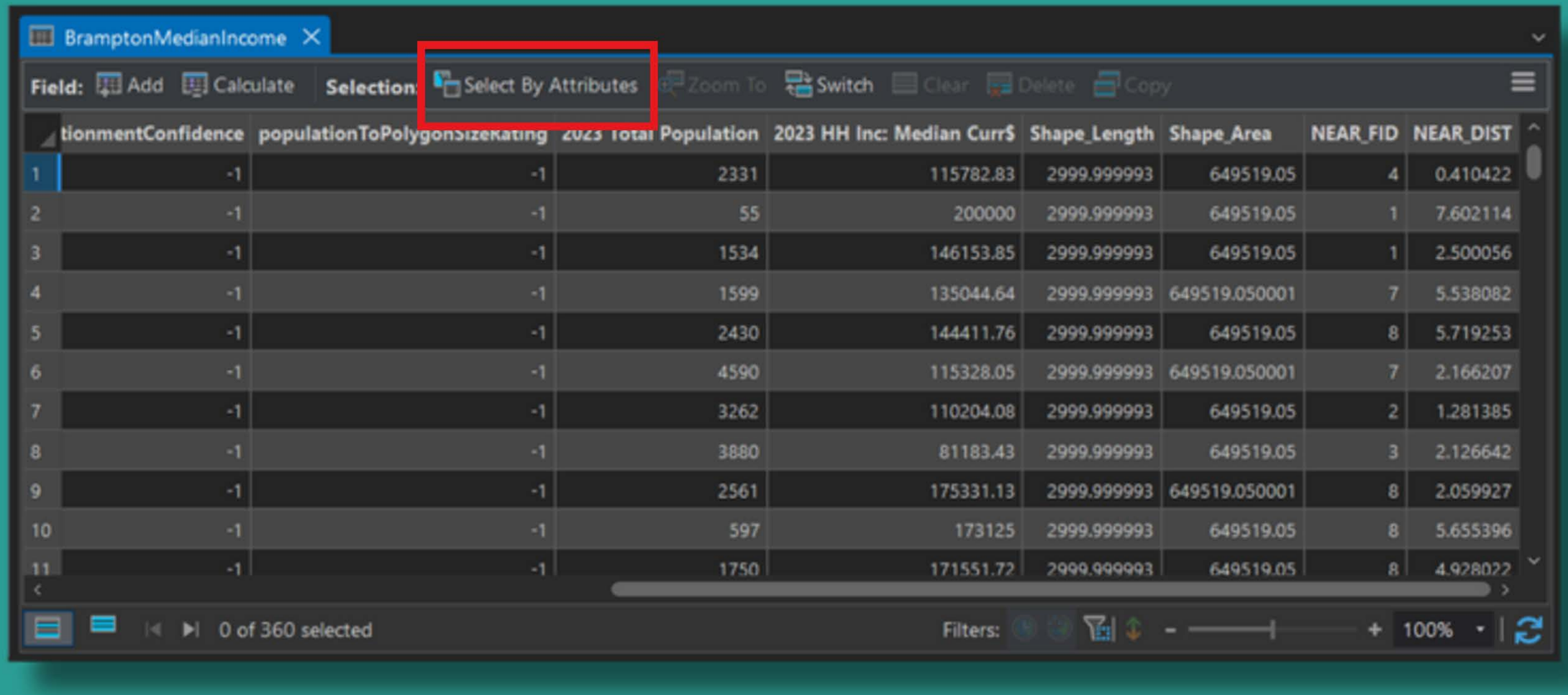
2. ArcGIS Pro

- How far is each area from a bus stop?
- Open the **Near** geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Bus Stops layer for the **Near Features**.
- Distance Unit = **Metres**.
- Distance Field Name = **NEAR_BusStop**
- Click **Run**.



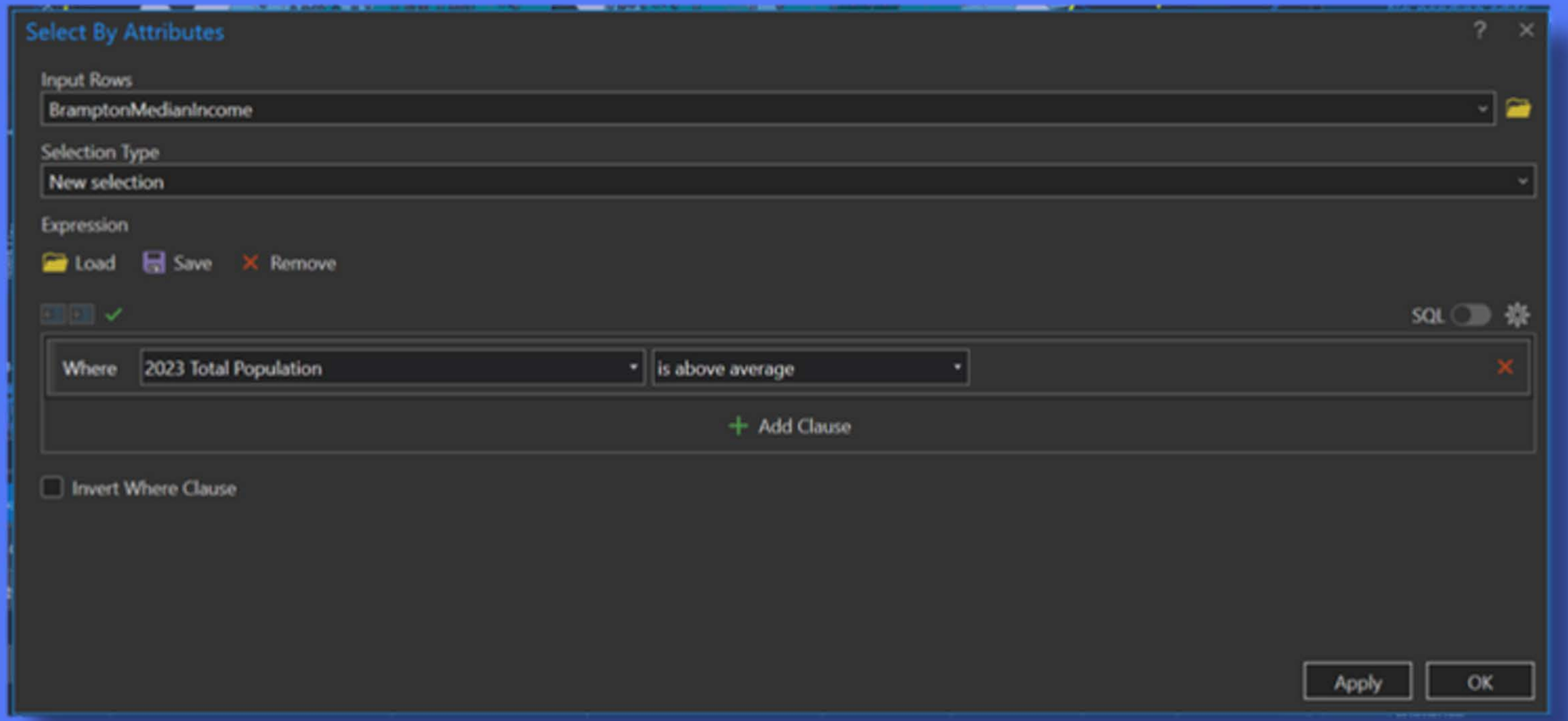
2. ArcGIS Pro

- Use the information in the attribute table to select some potential locations.
- Click the **Select by Attributes** button.



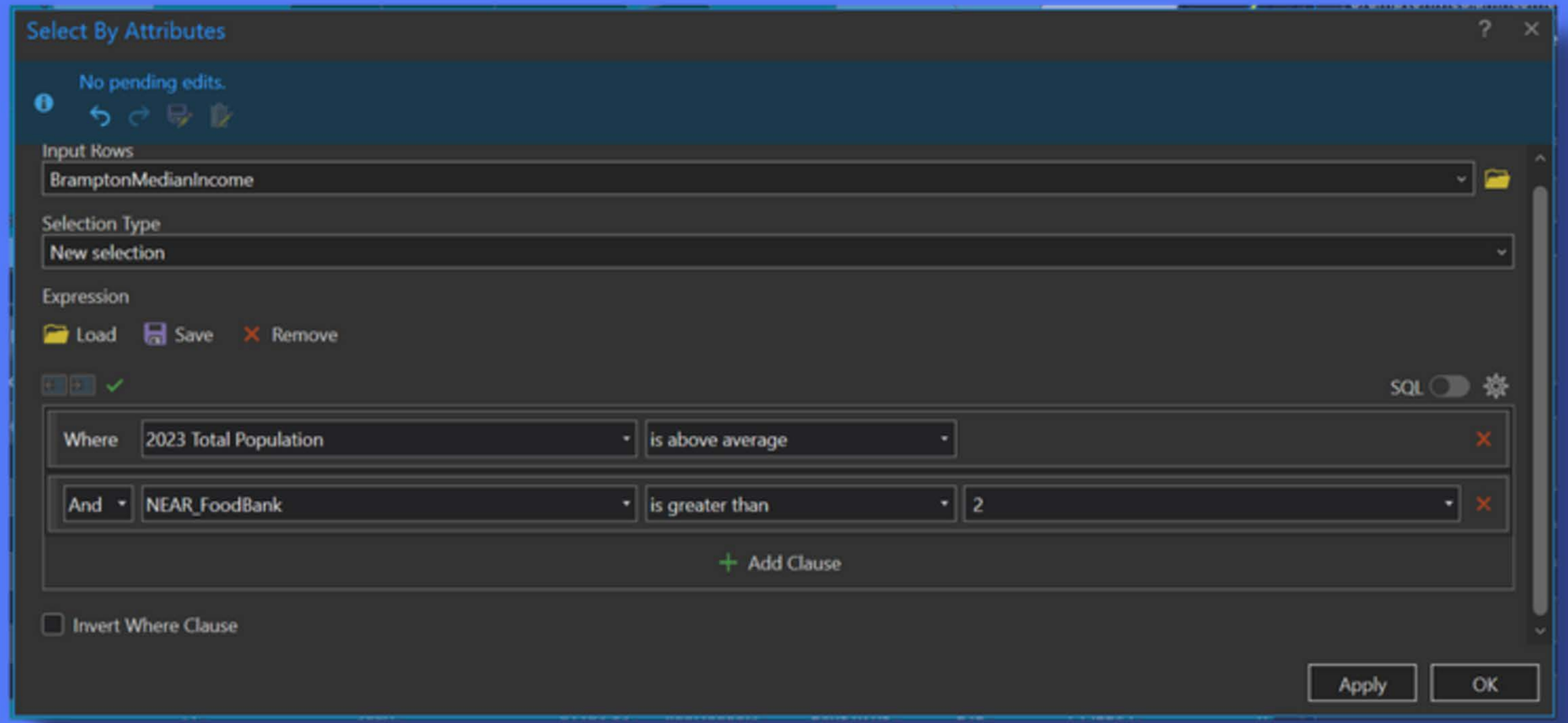
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - **Densely populated**



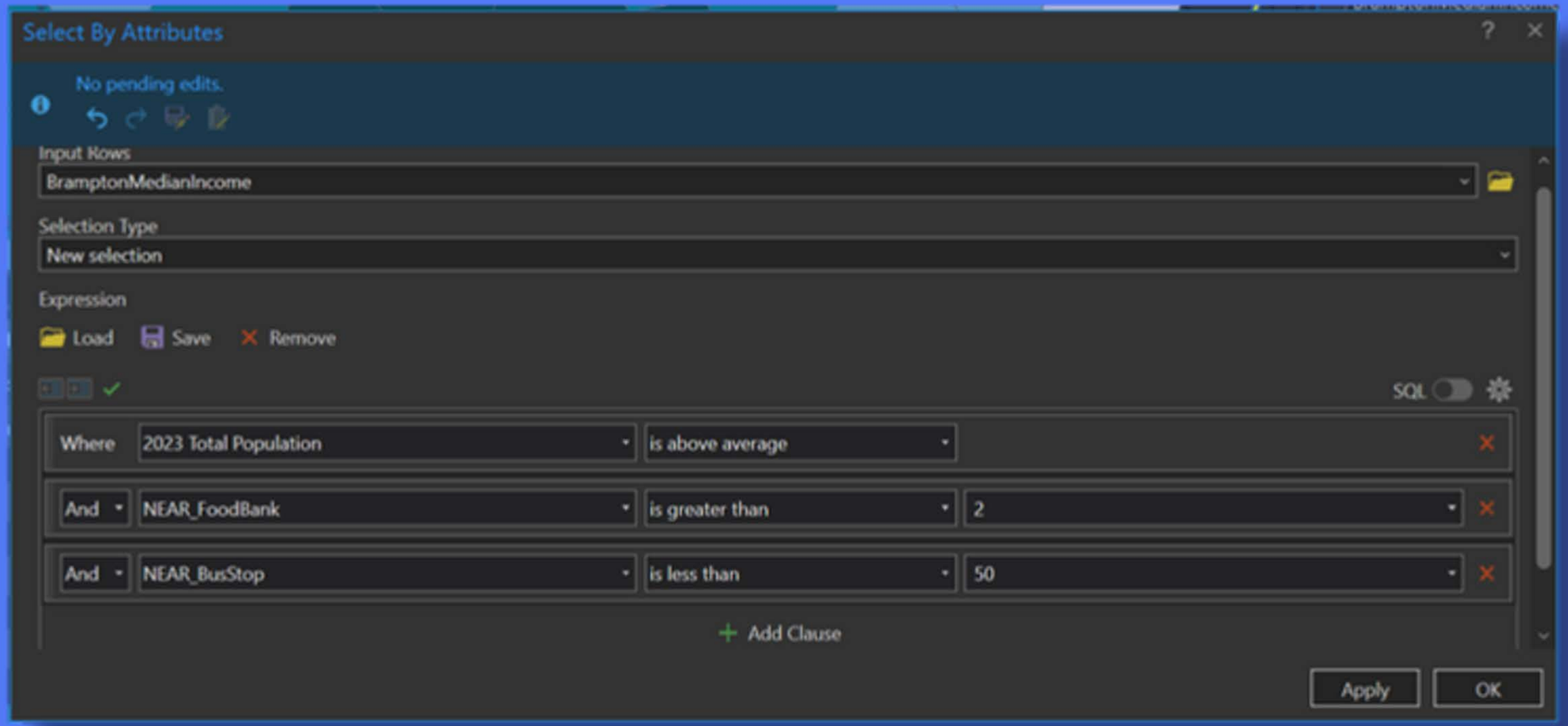
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - **More than 2km from an existing food bank**



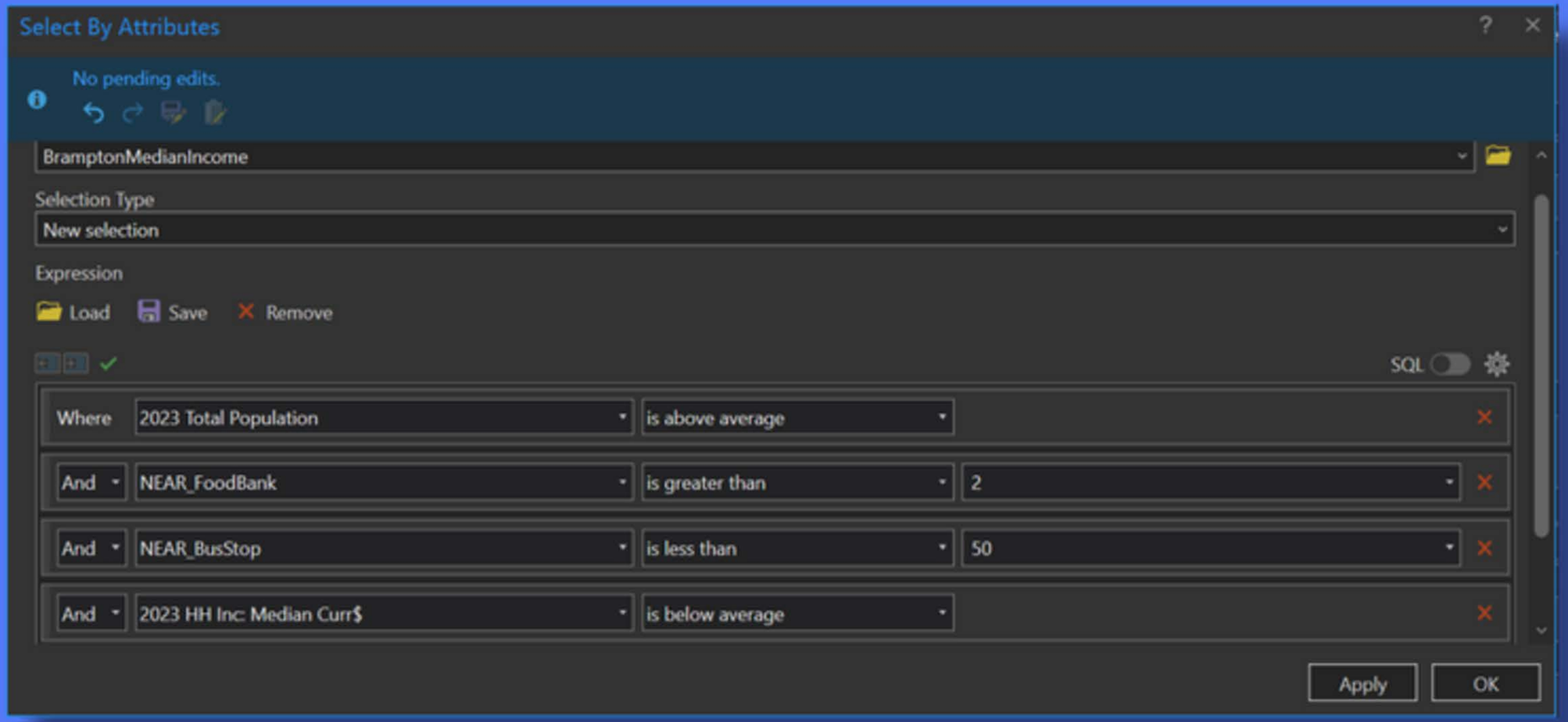
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - More than 3km from an existing food bank
  - **Within 50 metres of a bus stop**



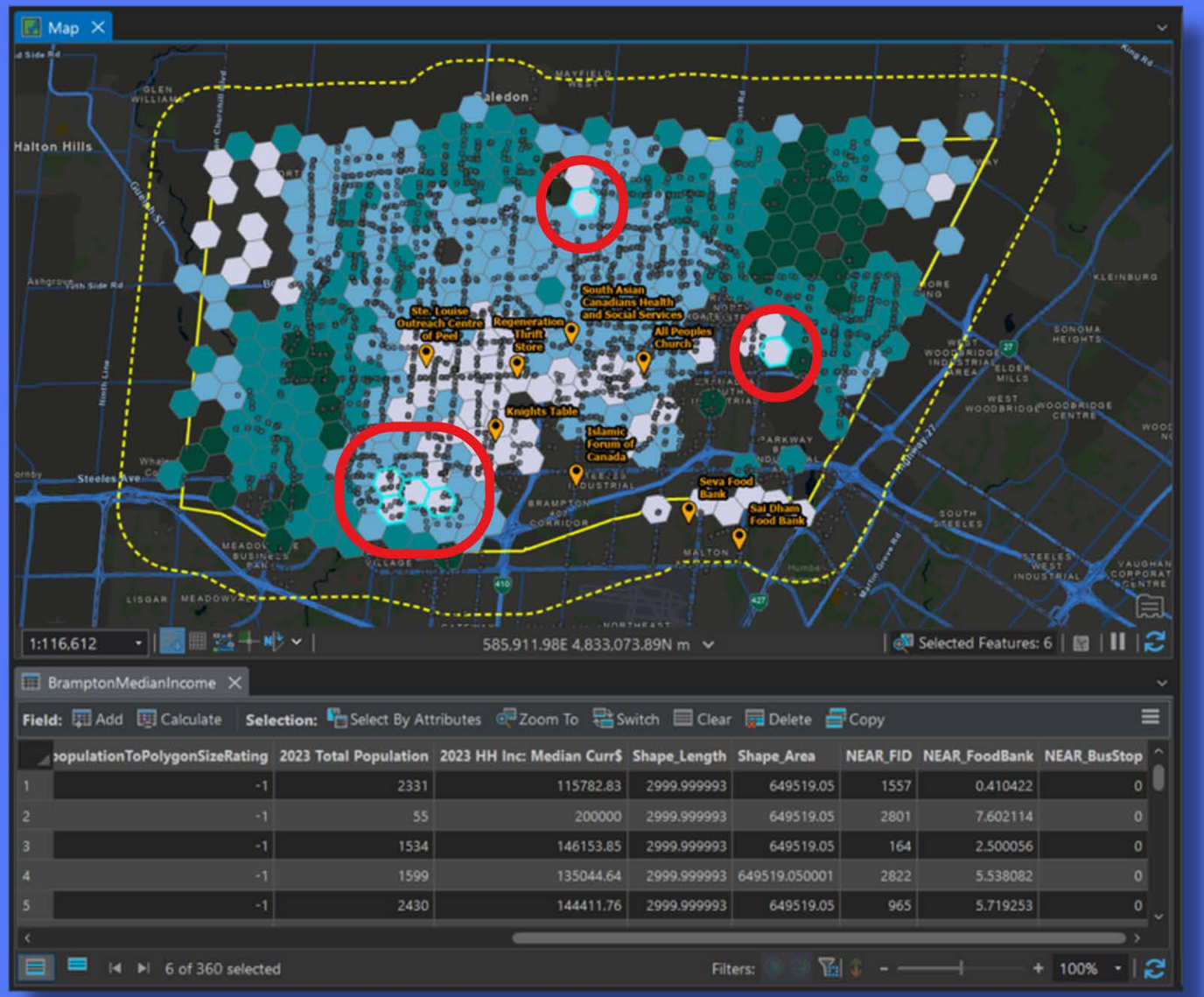
2. ArcGIS Pro

- We will build an expression to find areas that are:
  - Densely populated
  - More than 3km from an existing food bank
  - Within 50 metres of a bus stop
  - **Relatively low-income**

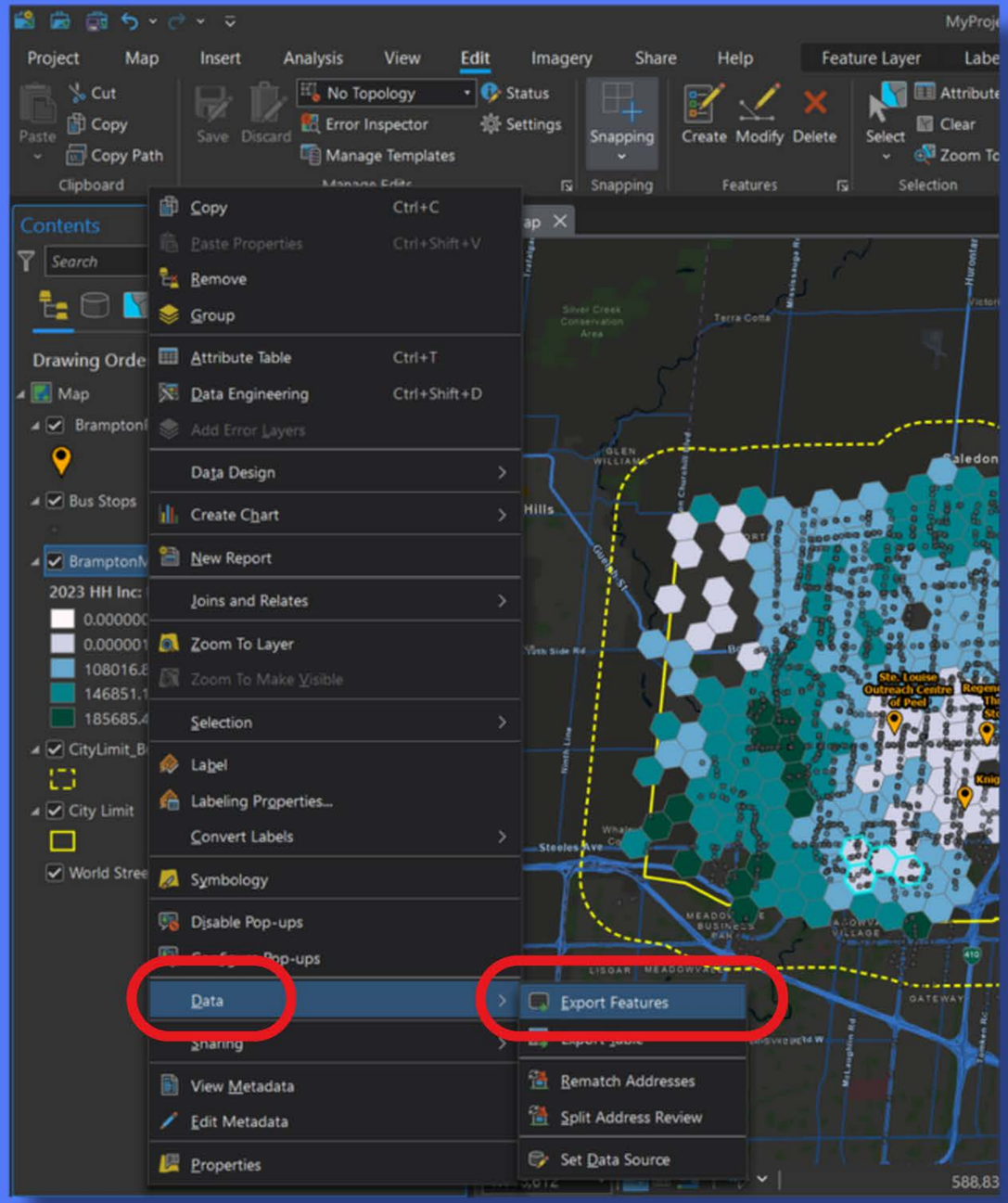


2. ArcGIS Pro

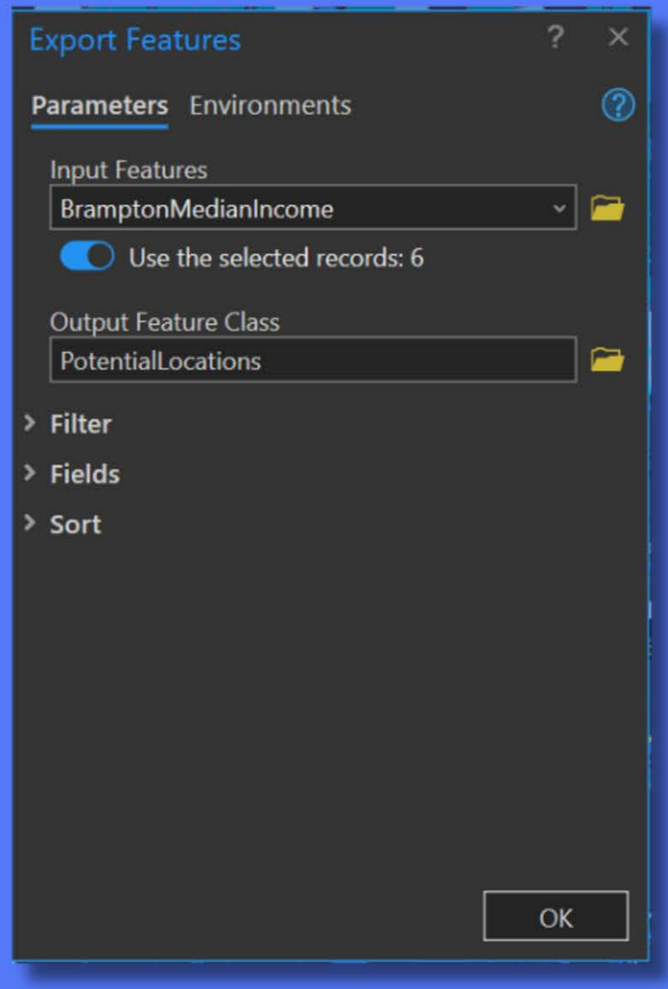
- Click OK.
- Results will be something like this:



2. ArcGIS Pro



- Export the selection to create a new layer.



2. ArcGIS Pro

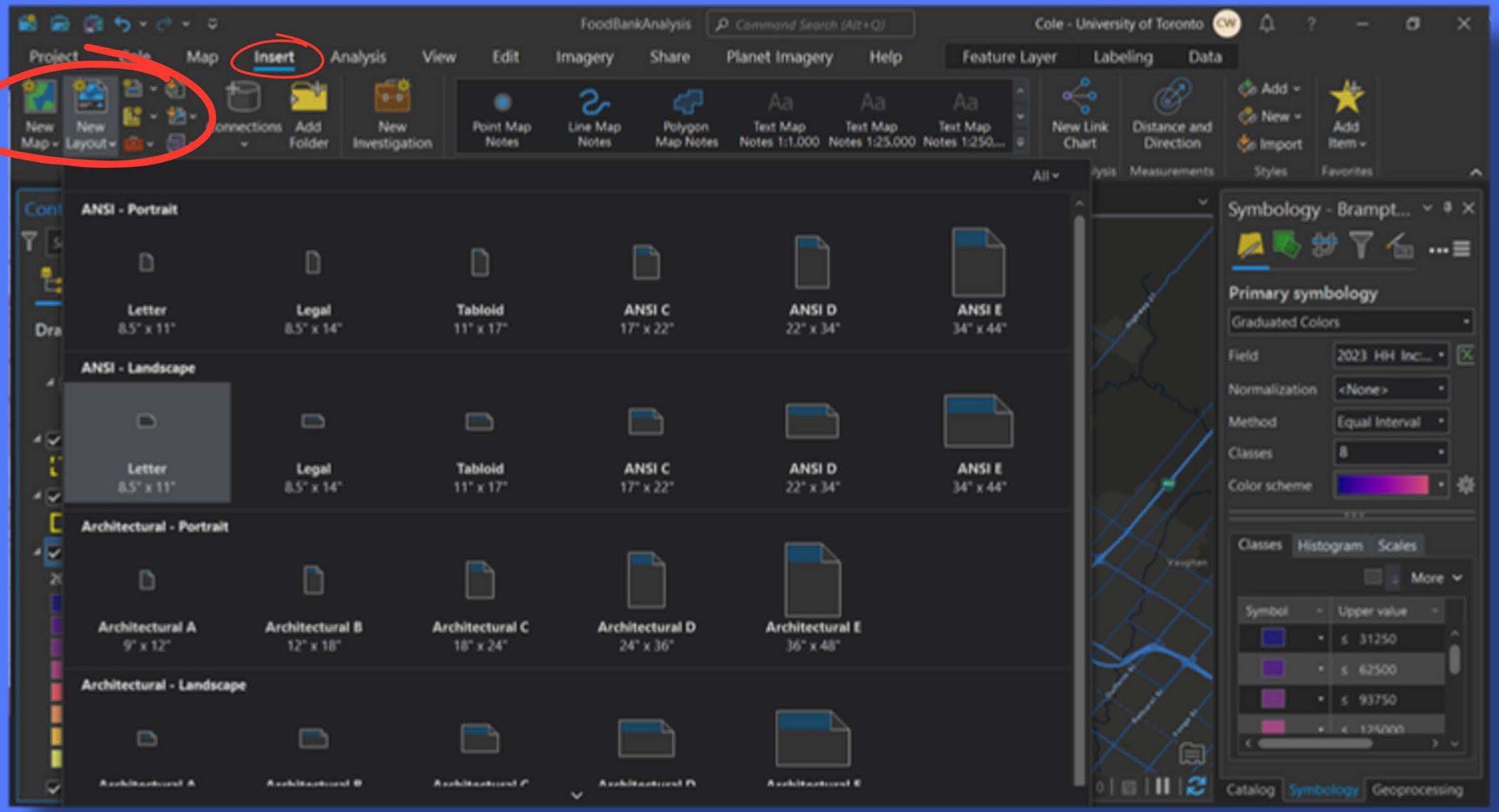
- Result:

- Based on the result, where would the best locations be to establish new food banks in Brampton, Ontario?

- What could be done to make this analysis better?

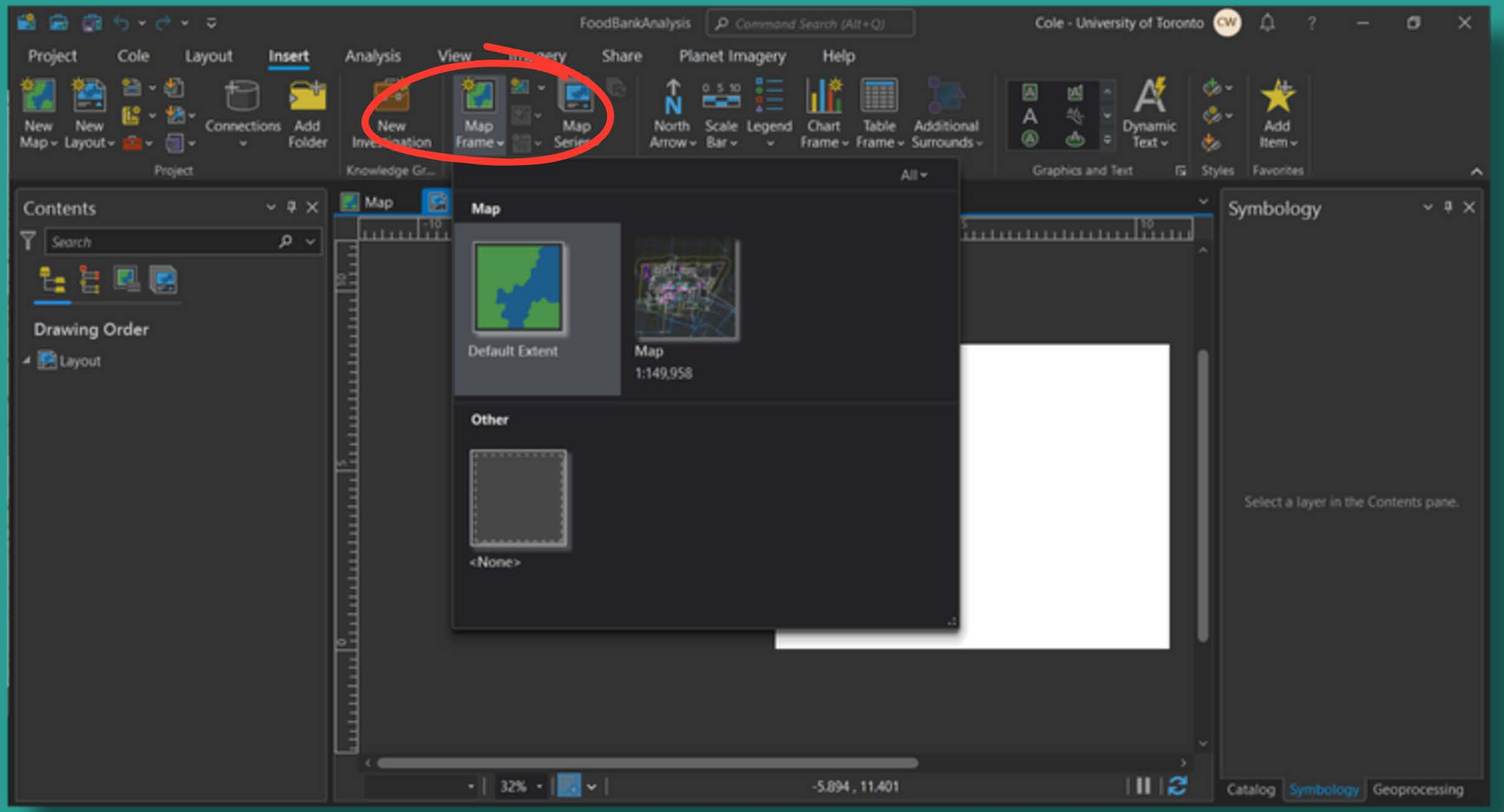
2. ArcGIS Pro - Next Steps - Layouts

- Next steps: Create a map **Layout** by choosing New Layout from the Insert tab



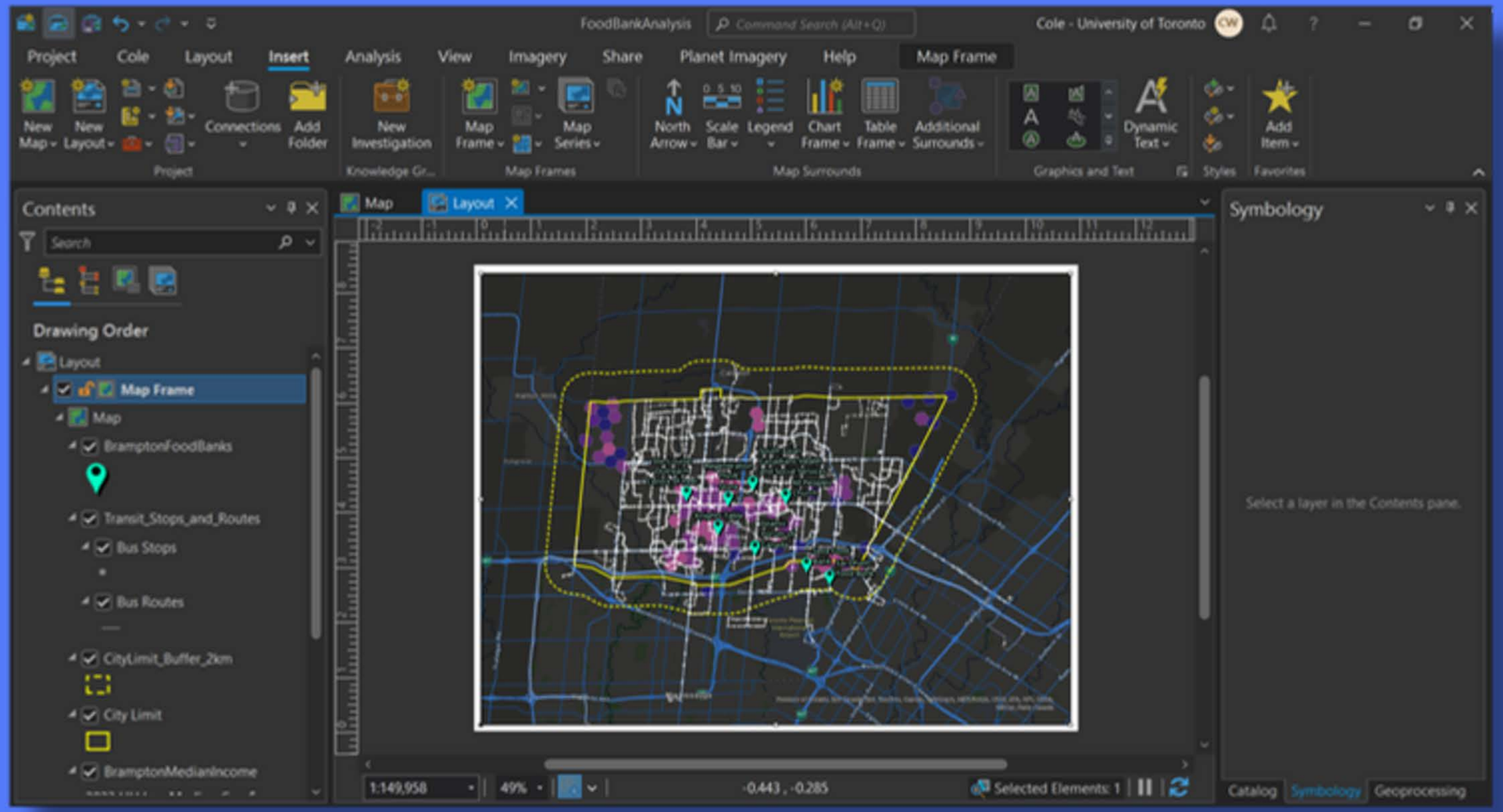
2. ArcGIS Pro - Next Steps - Layouts

- Click the **Map Frame** button and click the **Map** button



2. ArcGIS Pro - Next Steps - Layouts

- Hold down the left mouse button and drag to place the Map Frame within the Layout.
- **Title text, north arrows, scale bars**, and **legends** can be added at this point.



Resources: Further Reading

Learn ArcGIS Pro

- Map and Data Library Tutorials
  https://mdl.library.utoronto.ca/taxonomy/term/70

- Esri Training: Getting Started With Spatial Analysis
  https://www.esri.com/training/catalog/5bca58f8f77b99238f845e1c/getting-started-with-spatial-analysis/

- Esri Training: Exploring Spatial Relationships
  https://www.esri.com/training/catalog/60d1fa75b588b75ae084c42c/exploring-spatial-relationships/

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

Other Resources

- Esri Education Blog: How to find, evaluate, and use geospatial data in a GIS
  https://community.esri.com/t5/education-blog/how-to-find-evaluate-and-use-geospatial-data-in-a/ba-p/1366056

- GIS for Urban Planning (Official Esri website)
  https://www.esri.com/en-us/industries/urban-community-planning/overview

Resources: Finding Data

Spatial Data

MDL Geospatial Data Collection
https://mdl.library.utoronto.ca/collections/geospatial-data

Scholars GeoPortal
https://geo1.scholarsportal.info

Natural Earth Data
https://www.naturalearthdata.com/

Open Street Map
https://www.openstreetmap.org

City of Toronto Open Data
https://open.toronto.ca/

Ontario GeoHub
https://geohub.lio.gov.on.ca/

Toronto and Region Conservation Authority Open Data
https://data.trca.ca/

GIS at NASA
https://www.earthdata.nasa.gov/learn/gis

ArcGIS Hub
https://hub.arcgis.com/search

Other Data and Media

MDL Numeric Data Collection
https://mdl.library.utoronto.ca/collections/numeric-data

Wikimedia Commons
https://commons.wikimedia.org/wiki/Main_Page

Creative Commons Search Portal
https://search.creativecommons.org/

Freesound
https://freesound.org/

Open Culture
(see the Free Art & Images and Free Music sections)
https://www.openculture.com/

Burst by Shopify
https://www.shopify.com/stock-photos

GitHub: Awesome Public Datasets
https://github.com/awesomedata/awesome-public-datasets

Internet Archive (Archive.Org)
https://archive.org/

Resources: Troubleshooting

Esri community discussion boards
https://community.esri.com/

GIS StackExchange
https://gis.stackexchange.com/

Contact the Map and Data Library
https://mdl.library.utoronto.ca/about/contact-form

Thank you!