

# **SD2005 - From Sustainable Development to Human Security**

**Technical Practices required for the Quantitative Data Report**

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# About this site

This book has been developed as part of the module **SD2005 – From Sustainable Development to Human Security** at the School of Geography and Sustainable Development, University of St Andrews. It includes a set of five practical labs designed to introduce students to essential skills in geographic information systems (GIS), using **ArcGIS Online**—one of the most widely adopted Cloud-based GIS platforms in both academia and industry.

The SD2005 module includes a variety of lectures from different types of topics, but also includes two weeks and six lectures related to the use of spatial data to the study and monitoring of the SDGs. The labs included here have been tailored to complement the module’s lecture content on spatial data, sustainable development, and the Sustainable Development Goals (SDGs).

The material and instructions here are an adapted version of several tutorials from Esri’s *Learn ArcGIS* resources. Through these hands-on exercises, you will gain practical experience working with spatial data—learning how to create interactive web maps, manage geospatial datasets, conduct spatial analysis, and build simple web applications to communicate geographic insights.

As part of your coursework, you have to complete the labs included here, in pairs and submit a **technical report in PDF** ([get all the instructions to create this data report in the module handbook available in Moodle](#)). This report must demonstrate your understanding and application of GIS concepts, including screenshots and descriptions of the maps or apps you create. You are encouraged to begin working on the labs from the very first week, as the technical components may require time and independent effort outside of scheduled lectures.

All students enrolled in SD2005 have access to the University’s ArcGIS Online **Organisational Account** using their University credentials. To get started, please log in at:  
<https://uostandrews.maps.arcgis.com>

# Introduction

## Why Spatial Data Matters for the SDGs

Spatial data is **essential for advancing the Sustainable Development Goals (SDGs)** because it provides a crucial geographic lens through which global challenges can be better understood, monitored, and addressed. From poverty and food insecurity to urban resilience and climate change, the spatial dimension of sustainable development helps identify **where** interventions are most urgently needed, **how** different indicators interrelate across space and time, and **what** progress is being made at various scales—local, national, and global.

**Geospatial** information allows us to move beyond abstract statistics and instead interact with real-world patterns—**making data visible, tangible, and actionable**. For instance, **web dashboards** powered by geospatial data enable stakeholders to track SDG indicators in near real-time, providing dynamic visualizations that combine charts, maps, and open datasets. These tools support data-driven decision-making by offering interactive interfaces for understanding spatial disparities and highlighting areas that require targeted policy or humanitarian response.

**Geospatial** data is not just a complement to SDG monitoring—it is key. Access to **open data sources**, such as those published by national governments, the United Nations, and development agencies, has democratised the availability of high-quality spatial information. Students, researchers, NGOs, and policymakers alike can now explore and analyse global issues from a geospatial perspective. This access empowers users not only to consume information but also to **create spatial narratives**, develop **analytical tools**, and contribute meaningfully to SDG implementation.

At the centre of this framework lies **Geographic Information Systems (GIS)**—and increasingly, **Cloud GIS platforms** like *ArcGIS Online*. Providing the infrastructure to visualize, manipulate, analyse, and share spatial data seamlessly across devices and locations. Whether you are mapping deforestation hotspots, analysing access to clean water, or visualizing urban inequality, **Cloud GIS fosters collaboration, accessibility, and spatial intelligence at scale**.

## **Module Structure related to the use of Spatial Data**

This module offers a sequence of lectures and labs designed to build your spatial data literacy and technical competencies in direct relation to the SDGs:

**Lecture 16: Spatial Data for SDGs** Introduction to the importance of spatial data in sustainable development, focusing on key concepts and case studies that illustrate spatial inequalities and resource distribution.

**Lecture 17: Global Fundamental Geospatial Data Themes** Exploration of core geospatial data themes as recognised by the UN-GGIM (e.g., land cover, population, transport networks), and how these serve as the spatial foundation for SDG monitoring.

**Lecture 18: Where to Find Spatial Data for SDG Analysis** A guided overview of trusted spatial data sources including open repositories (e.g., UNData, World Bank GeoPortal, Copernicus), national geospatial platforms, and crowd-sourced data.

**Lecture 19: Collecting Spatial Data with Geospatial Technologies** Learn how to gather primary spatial data using tools such as Survey123, Field Maps, and mobile data collection methods. Emphasis is placed on participatory mapping and local knowledge.

**Lecture 20: Authoring Web Maps to Understand SDG Progress** Practical lab in which students create and customise web maps using ArcGIS Online, applying symbolisation, layer filtering, and pop-up configuration to communicate geographic stories.

**Lecture 21: Building Interactive Applications to Monitor SDG Indicators** Learn how to build web apps and dashboards that visualise real-time spatial data. Explore storytelling techniques and UX design for public engagement and policy communication.

## **Learning Outcomes**

By completing this part of the module, you will:

- You will have the chance to better understand spatial data science concepts and principles in the context of sustainable development goals (SDGs) and learn how to acquire spatial data from multiple sources to address sustainability challenges.
- Learn how to link spatial data to create tools for a data-driven approach to spatially represent many global challenges, including poverty, hunger, inequality, and climate change.

# **git Lab No 1: Getting Started with ArcGIS Online**

## **Overview**

By the end of this lab, students will be able to:

- Navigate and use the ArcGIS Online interface
- Add and configure data layers from ArcGIS Living Atlas
- Style demographic data using appropriate symbology
- Filter data to focus on specific geographic areas
- Apply visual effects to emphasize important data patterns
- Create a professional web map for emergency planning purposes

**Estimated time of completion:** 45 Minutes

## **Mapping Census Data for Emergency Planning**

In this lab, you will create a web map to identify areas that may need additional evacuation assistance during emergencies. You will work with census data to identify households with limited vehicle access, which is crucial information for emergency planning and resource allocation.

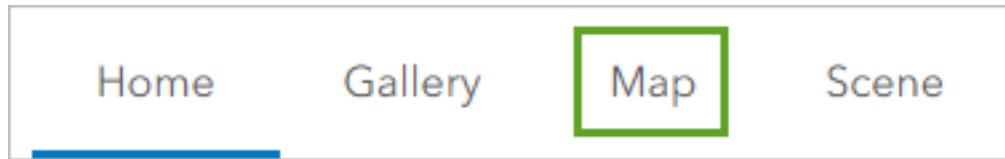
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## **Part 1: Start with a Map**

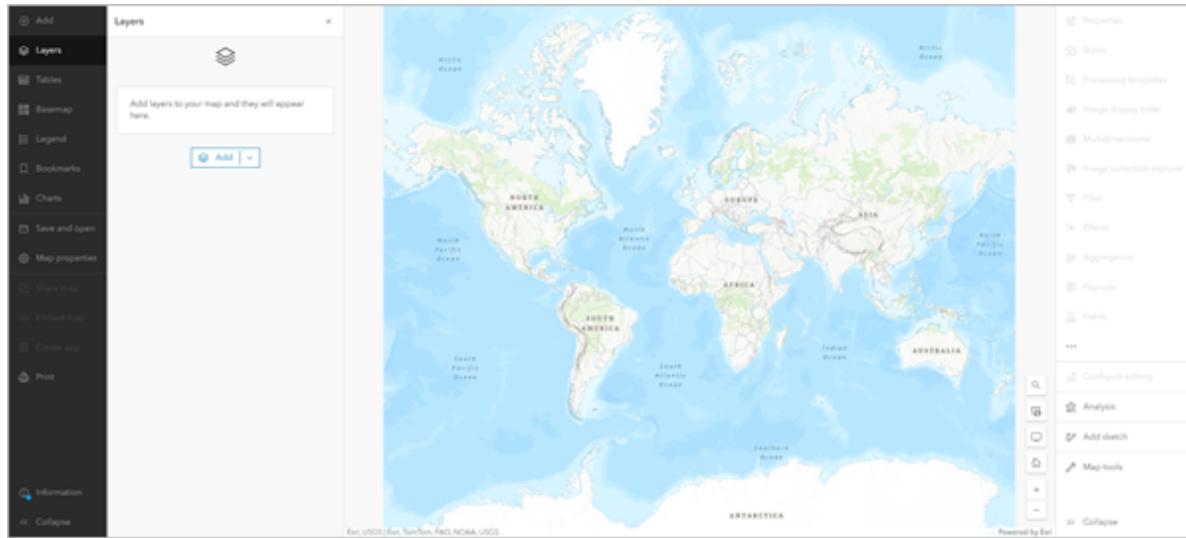
### **Step 1: Access ArcGIS Online**

1. Sign in to [ArcGISOnline](#), using your University Credentials. (see [here](#) to learn how to log in into ArcGIS)

2. On the ribbon, click the **Map** tab



A default web map appears. Your map's appearance varies based on your account or organizational settings and your browser window size. It may show the United States, the world, or another extent.



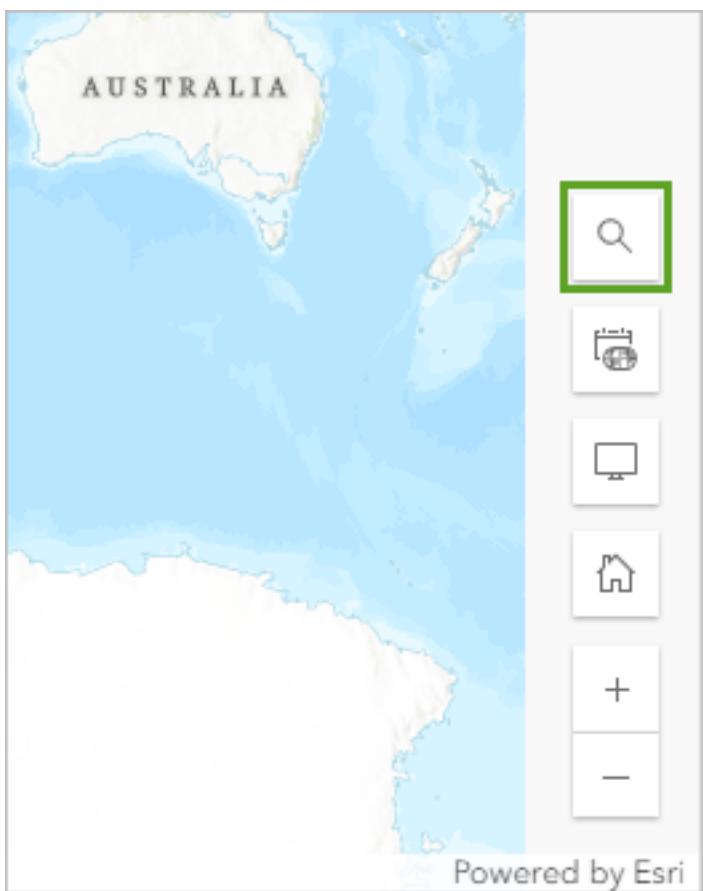
The only layer on the map is the basemap, which provides geographic context such as water bodies and political boundaries. The default basemap is **Topographic**, but your map may have a different basemap depending on your organization's settings.

On either side of the map are the toolbars:

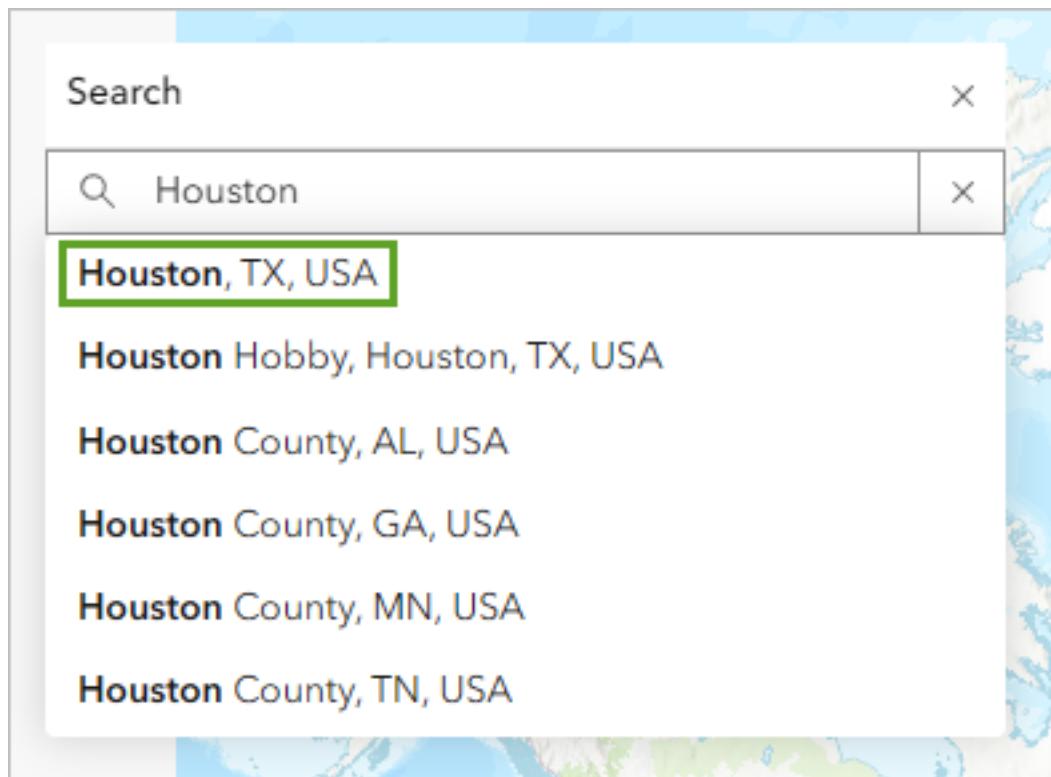
- **Contents (dark) toolbar:** Allows you to manage and view map contents
- **Settings (light) toolbar:** Provides tools and options for configuring and interacting with map layers
- **Layers pane:** Lists the data you add to the map

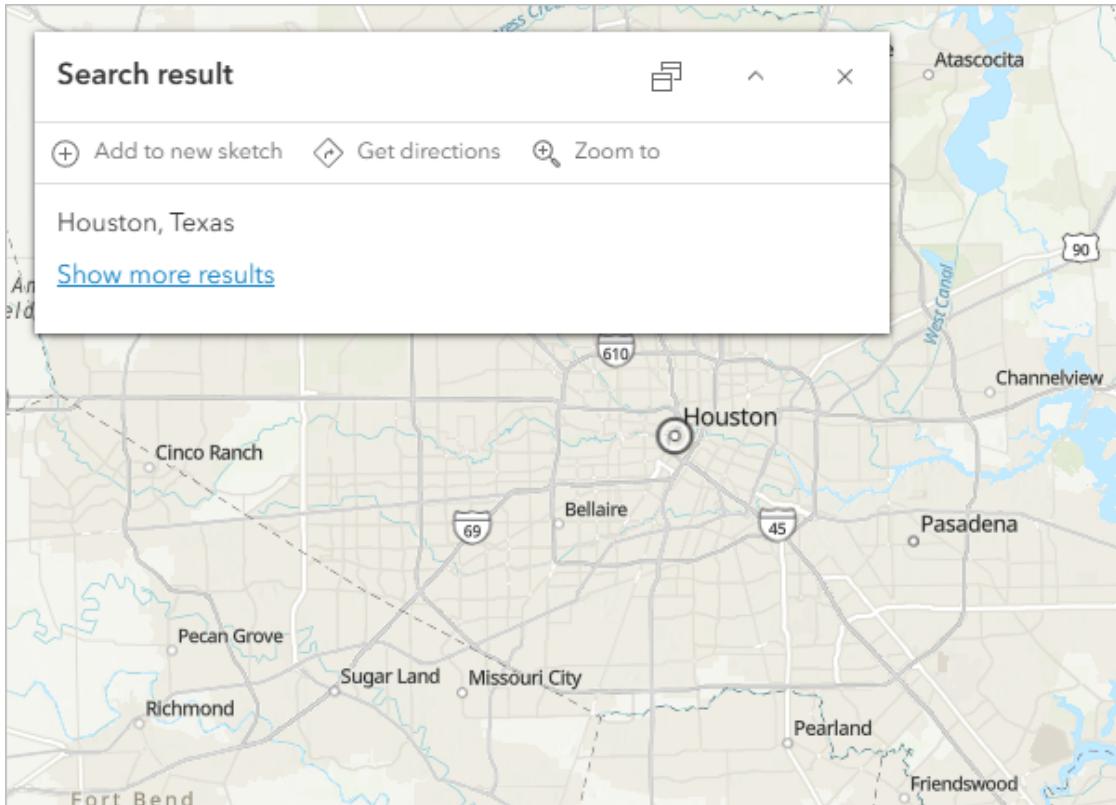
## Step 2: Navigate to Your Area of Interest

1. On the map, at the bottom corner, click the **Search** button



2. In the search box, type **Houston** and choose **Houston, TX, USA** from the list of suggested locations



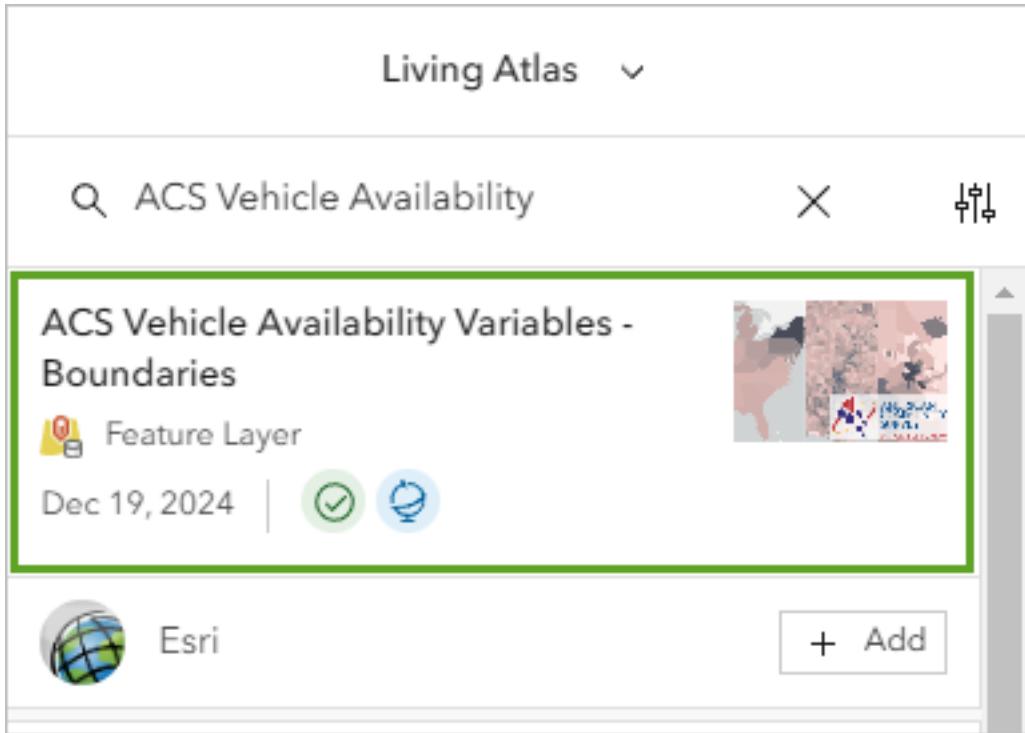


3. Close the **Search** result window when the map zooms to your location
- 

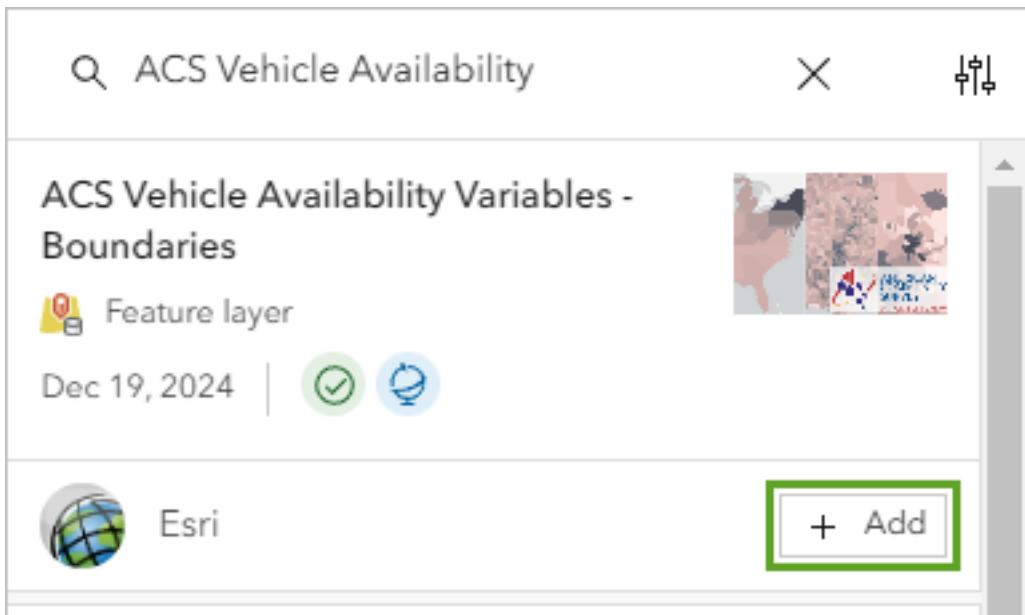
## Part 2: Add a Layer

Layers contain geographic data that can be displayed on your map. To determine areas that may need evacuation assistance, you'll add a layer containing demographic data by census tract.

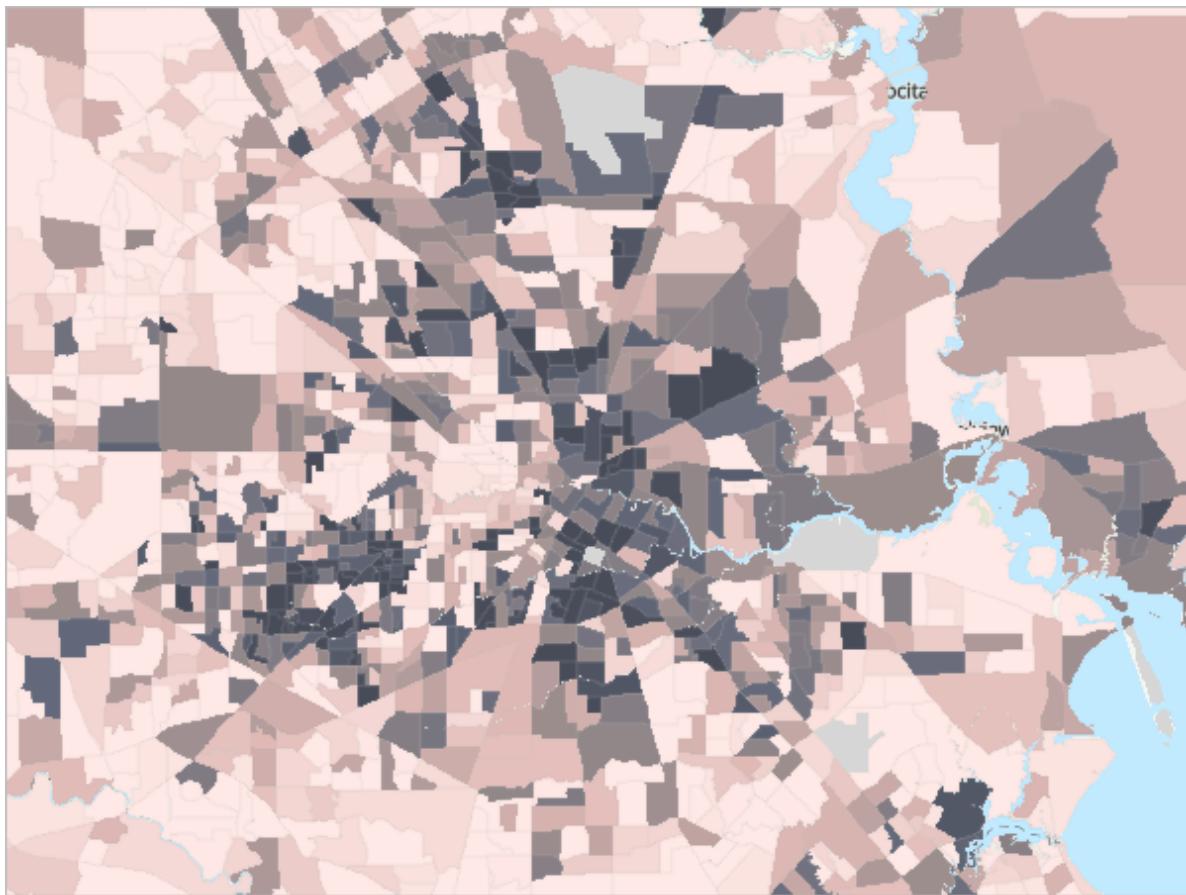
1. In the **Layers** pane, click **Add**
2. In the **Add layer** pane, click **My content** and choose **Living Atlas**
3. In the search box, type or paste **ACS Vehicle Availability**
4. Click the **ACS Vehicle Availability Variables - Boundaries** result



5. In the item pane, expand the **Description** section and read about the layer
6. Close the item pane
7. For the **ACS Vehicle Availability Variables - Boundaries** layer, click **Add**

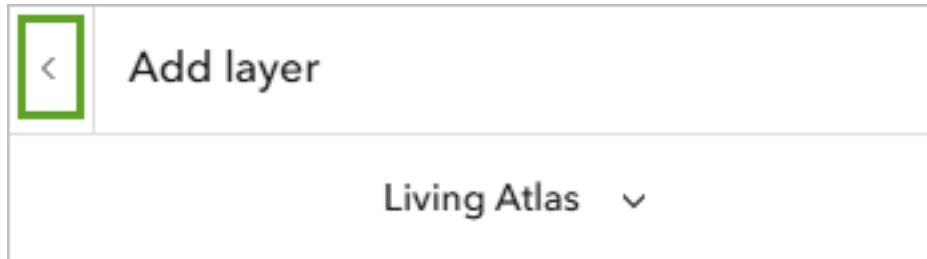


The layer is added to the map, styled to show the percentage of households with no vehicle available in each census tract. Darker areas have higher percentages of households without vehicle access.

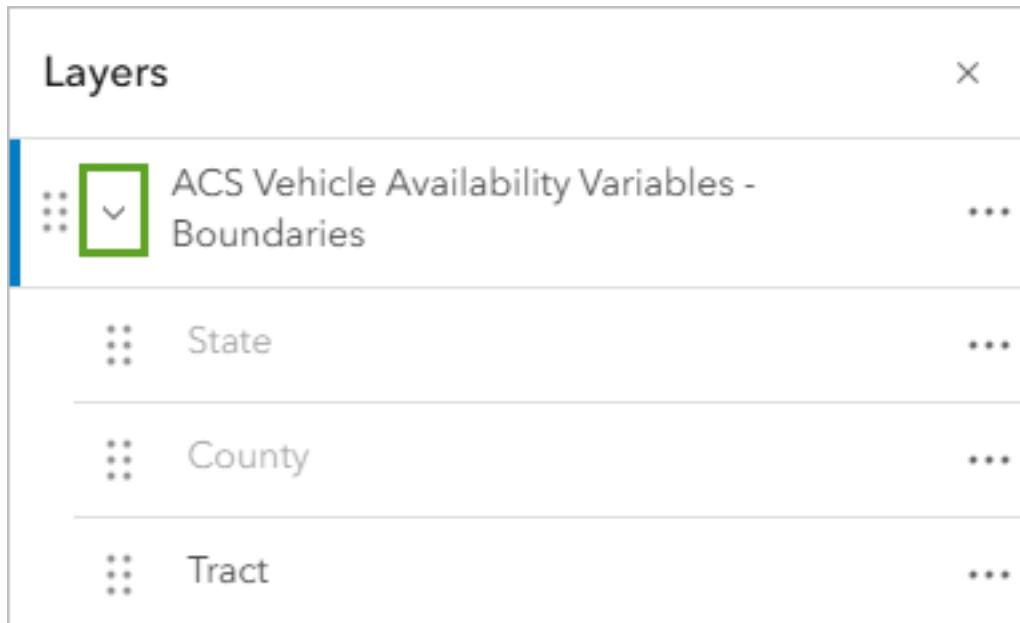


### Step 1: Manage Layer Groups

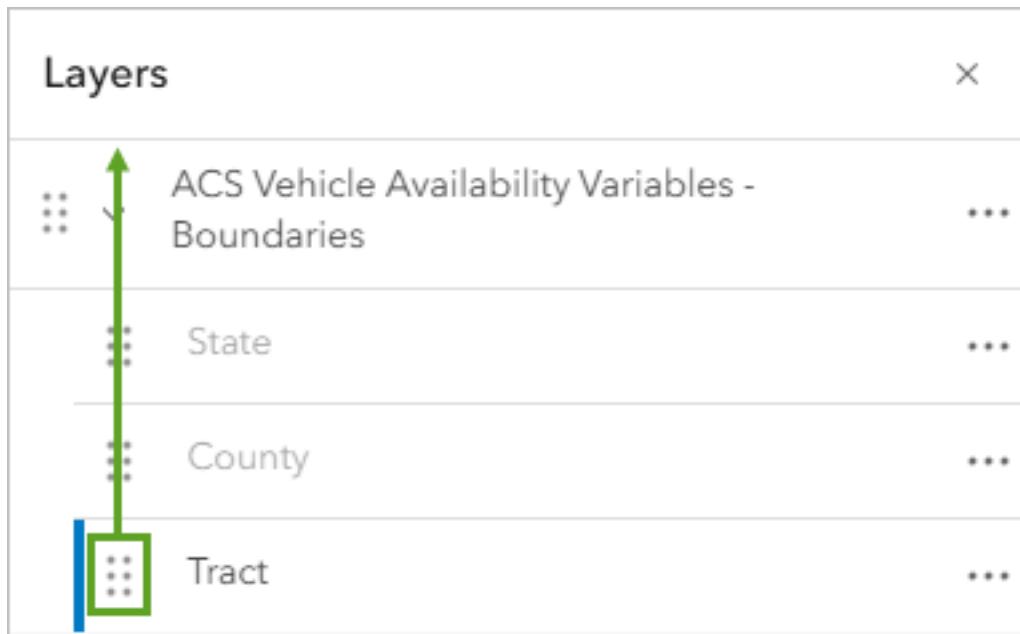
1. At the top of the Add layer pane, click the **Back** button



2. In the **Layers pane**, expand the **ACS Vehicle Availability Variables - Boundaries** group



3. Drag the ==Tract== layer above the group



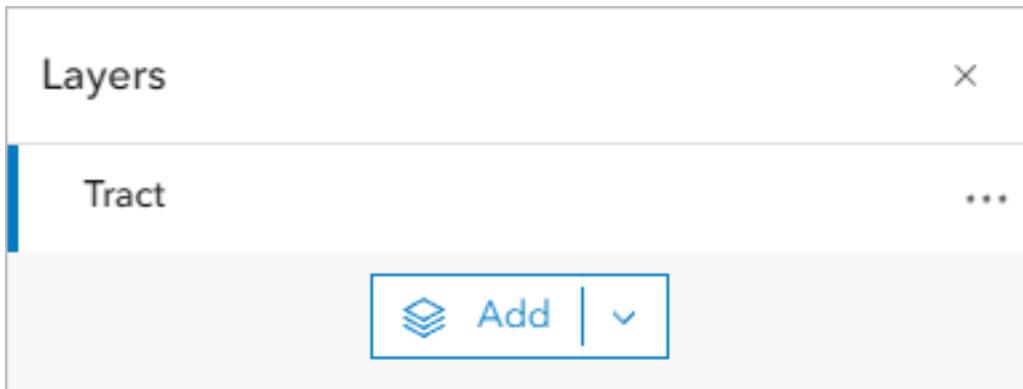
4. For the group, click the **Options** button and choose **Remove**

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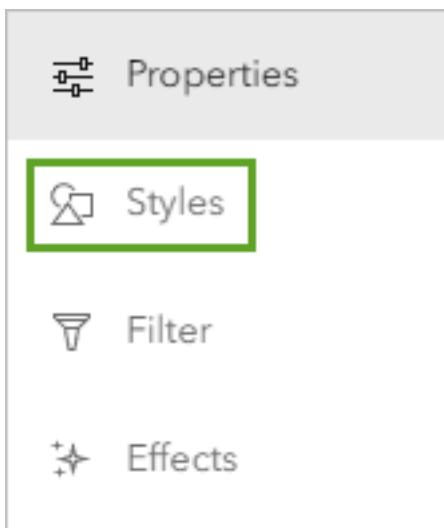
## Part 3: Style Demographic Data

### Step 1: Select Styling Options

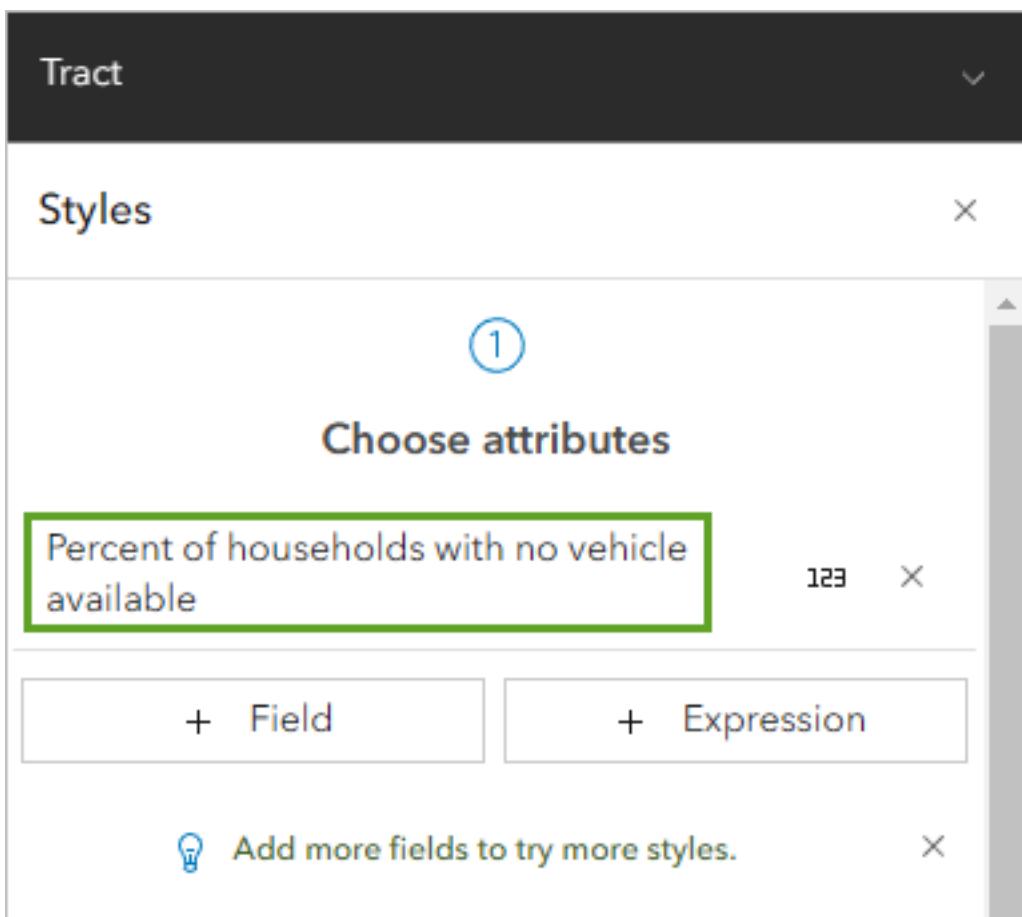
1. In the **Layers** pane, click the **Tract** layer to select it



2. On the **Settings toolbar**, click the **Styles** button



3. In the **Styles pane**, ensure ==Percent of households with no vehicle available== is selected



The list of available styles is determined by the data type. In this case, the options are for numeric data. The map shows the **Counts and Amounts (color)** style. The colors are based on the **High to low** theme. This style symbolizes each census tract with a different color based on the percentage of households without a vehicle. Census tracts with the lowest values have a light color, while those with the highest values have a dark color.

## Step 2: Customize Symbol Style

1. For **Pick a style**, on the **Counts and Amounts (color)** card, click **Style options**

## Choose attributes

Percent of households with no vehicle available 123 X

+ Field + Expression

💡 Add more fields to try more styles. X

(2)

### Pick a style

These styles are good for visualizing a single numeric field.



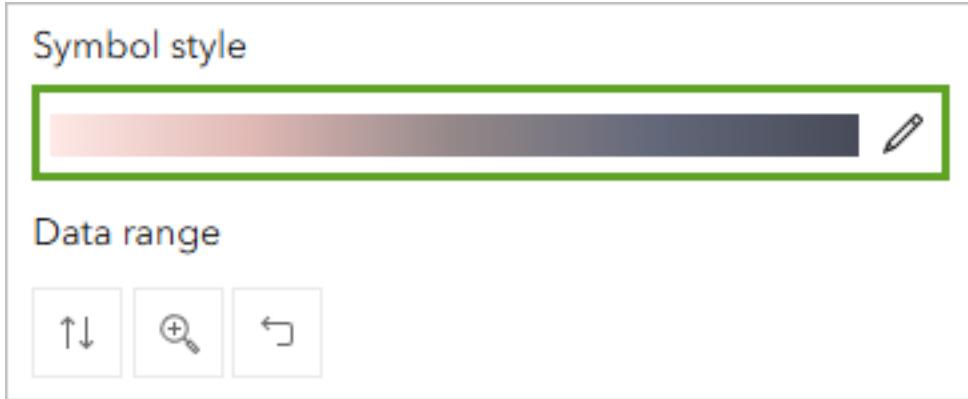
Counts and Amounts (color) ⓘ

Theme

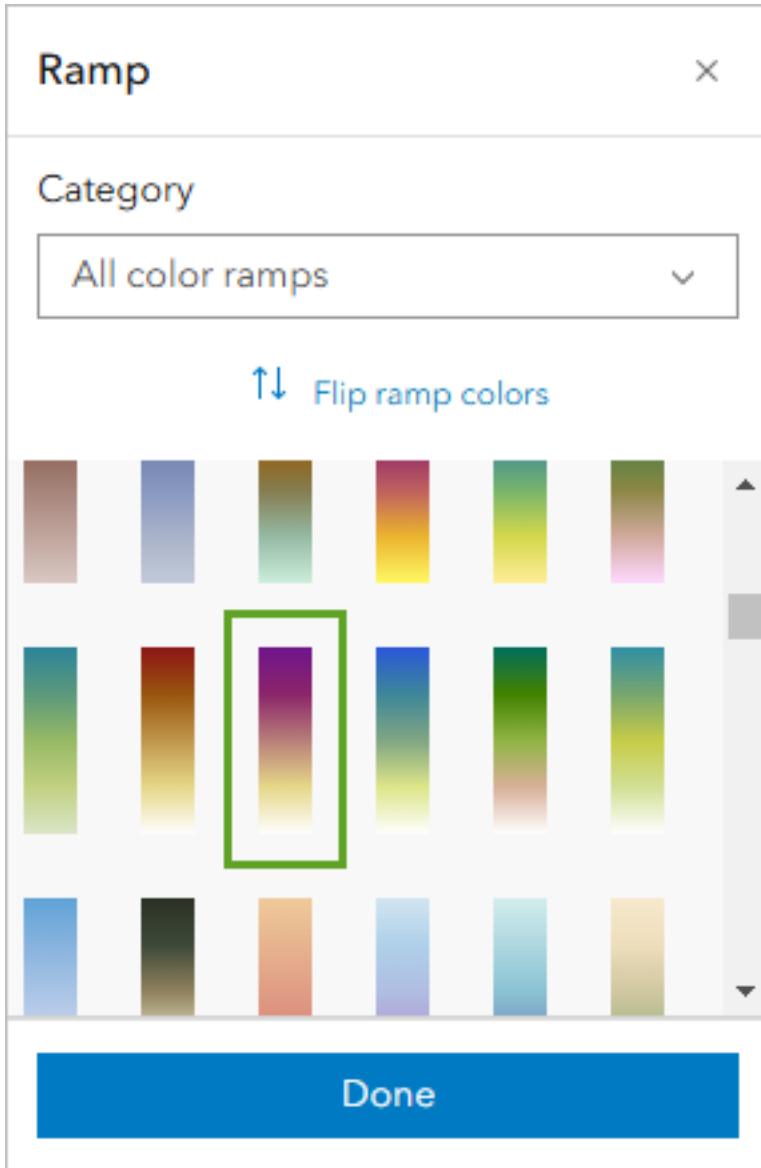
High to low

Style options

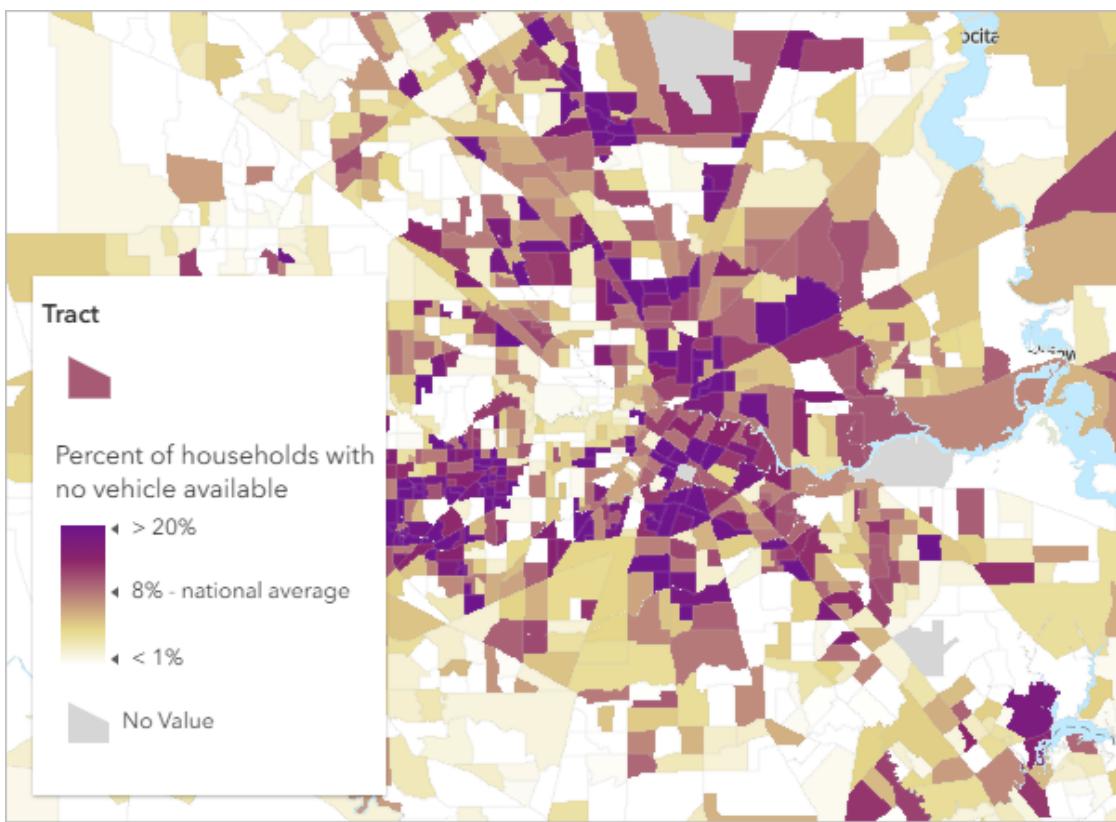
2. For **Symbol style**, click the color ramp



3. In the **Symbol style** window, for **Colors**, click the color ramp
4. In the **Ramp** window, choose **Purple 18**



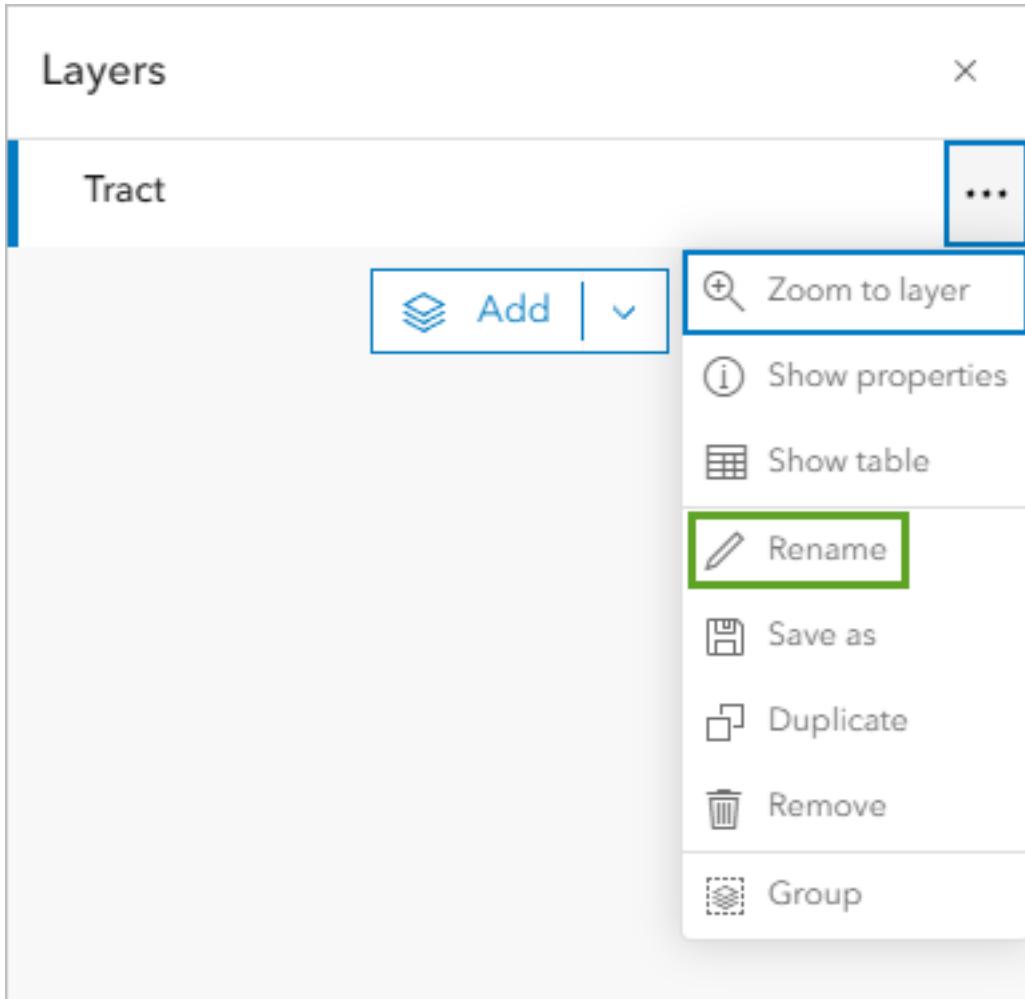
The new color ramp is applied to the map. Census tracts with high percentages are displayed in dark purple while low percentages are white.



5. If needed, click **Flip ramp colors** so high percentages show in dark purple
6. Click **Done** to close all style windows

### Step 3: Rename the Layer

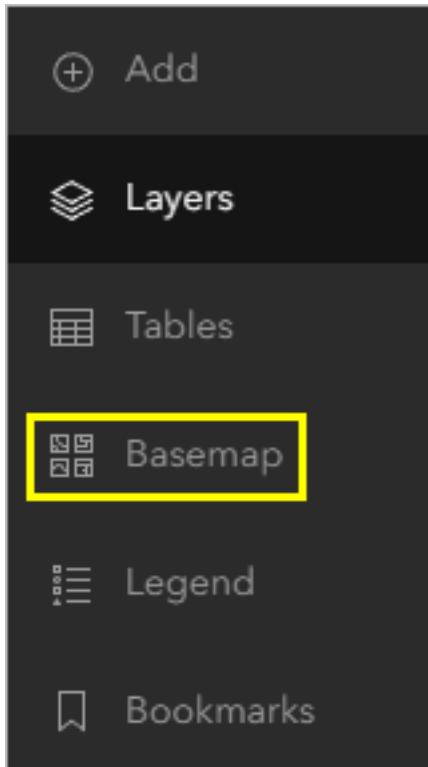
1. In the **Layers pane**, for the layer, click the **Options** button and choose **Rename**



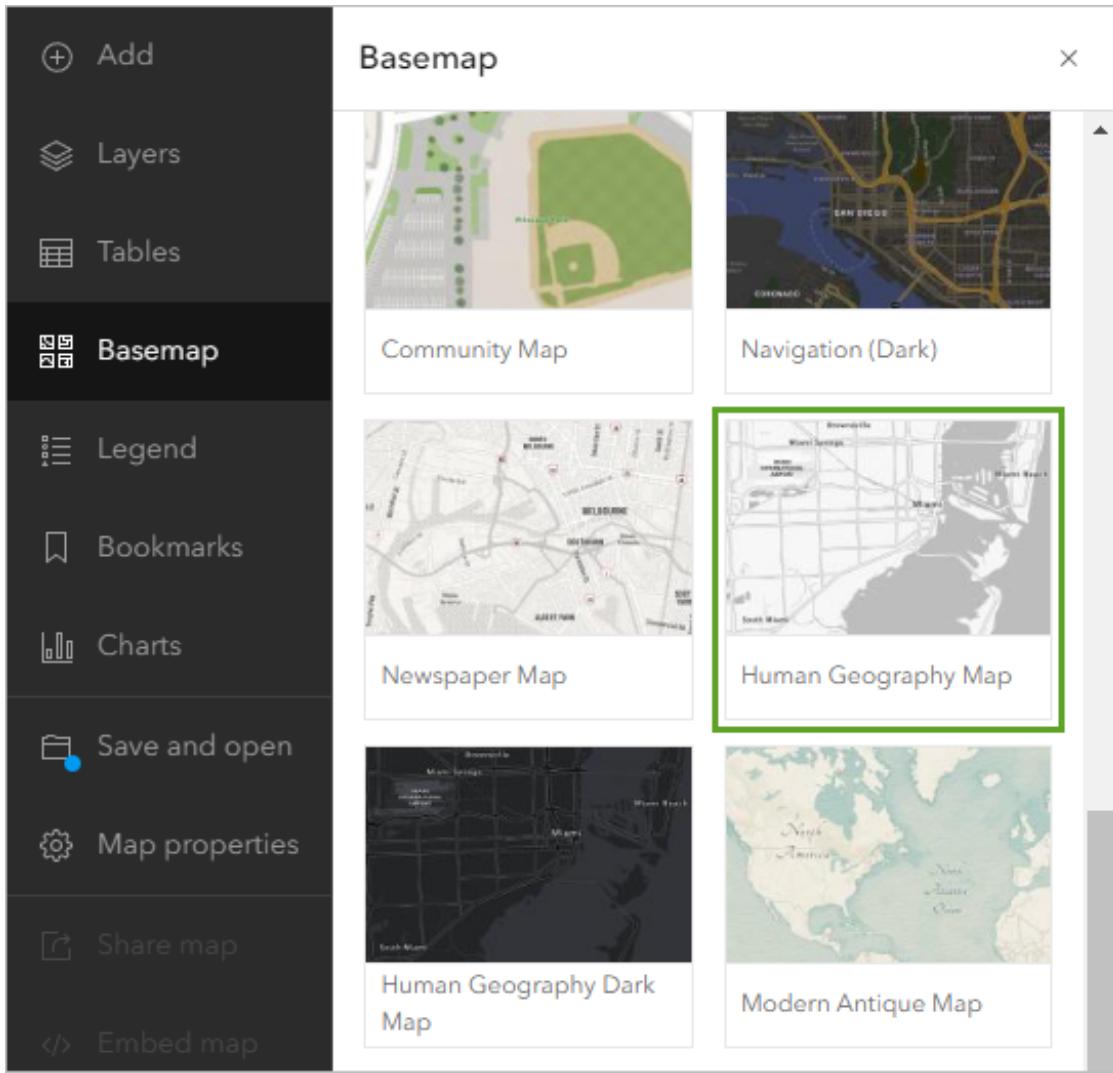
2. For **Title**, type **Percent of Households with No Vehicle Access**
  3. Click **OK**
- 

#### **Part 4: Change the Basemap**

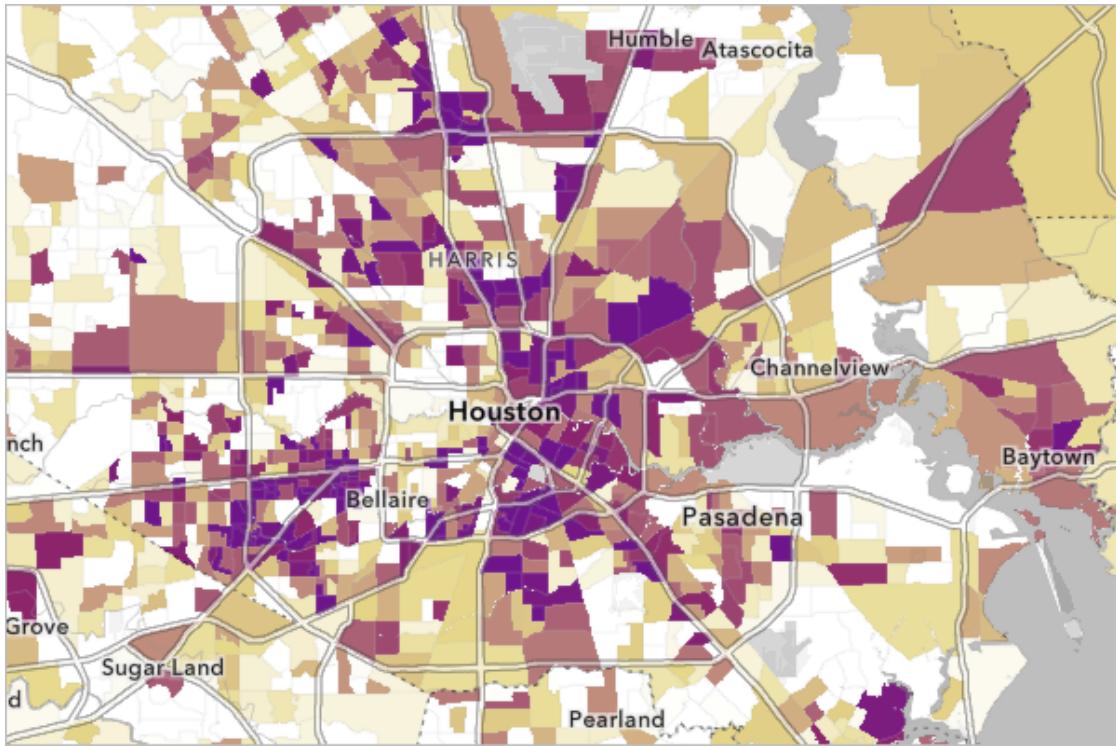
1. On the **Contents** toolbar, click **Basemap**



2. In the **Basemap** pane, find and choose **Human Geography Map**



3. On the **Contents toolbar**, click **Layers** to return to the Layers pane



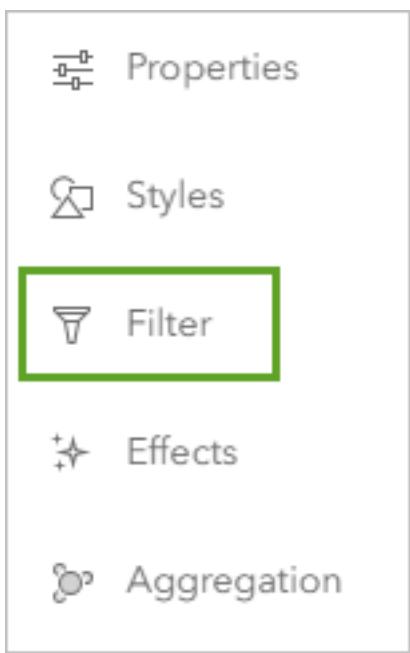
The new basemap shows labels and contextual information over the census data.

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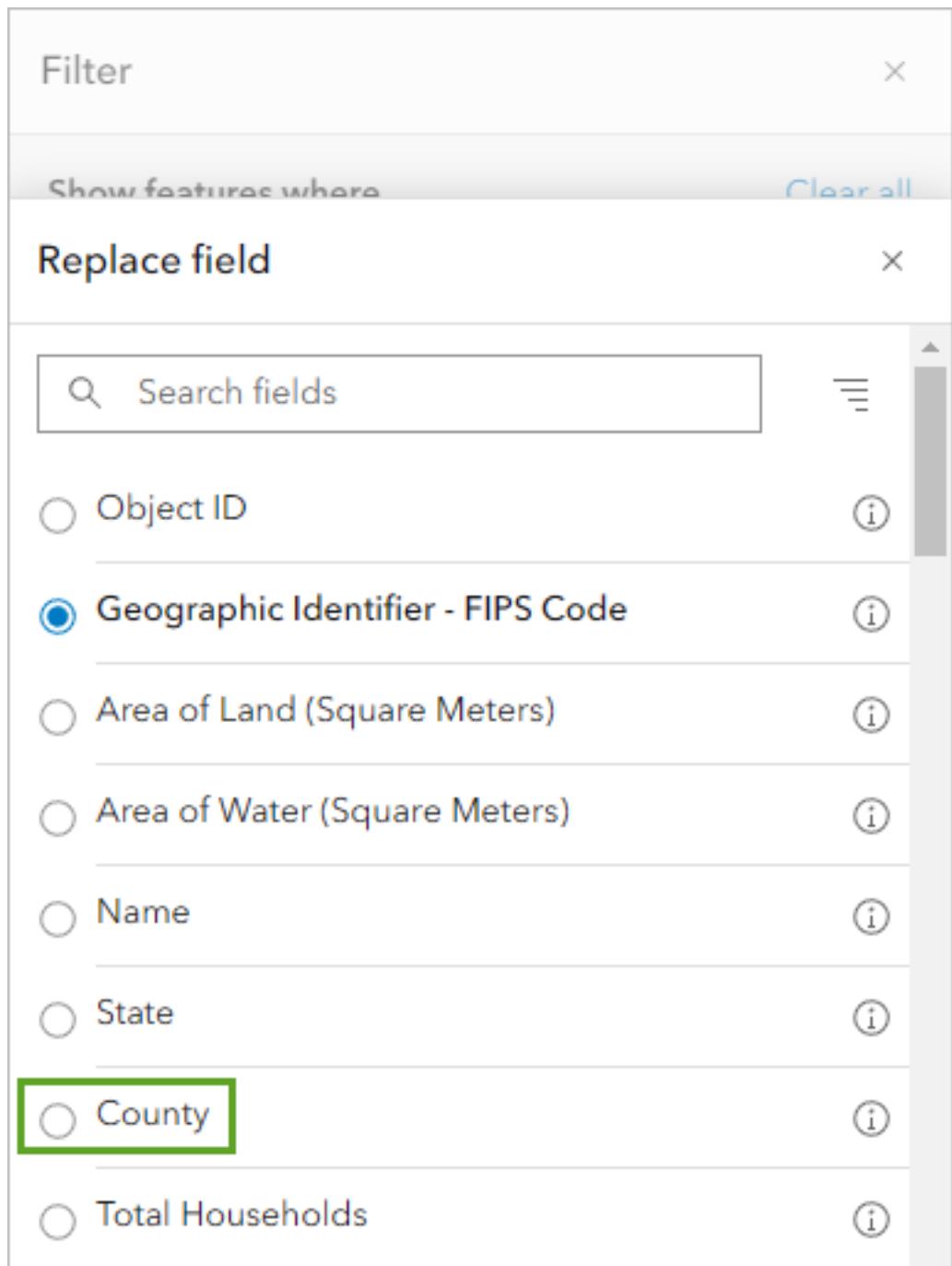
## Part 5: Filter the Map

### Step 1: Create a Geographic Filter

1. Ensure the **Percent of Households with No Vehicle Access** layer is selected
2. In the **Settings pane**, click **Filter**



3. In the **Filter pane**, click **Add new**
4. Under **Condition**, click the first box and choose **County**



5. Leave the operator as **is**
6. For the third box, click the drop-down arrow, type **Harris County** and select it

Condition ...

County ▾

is ▾

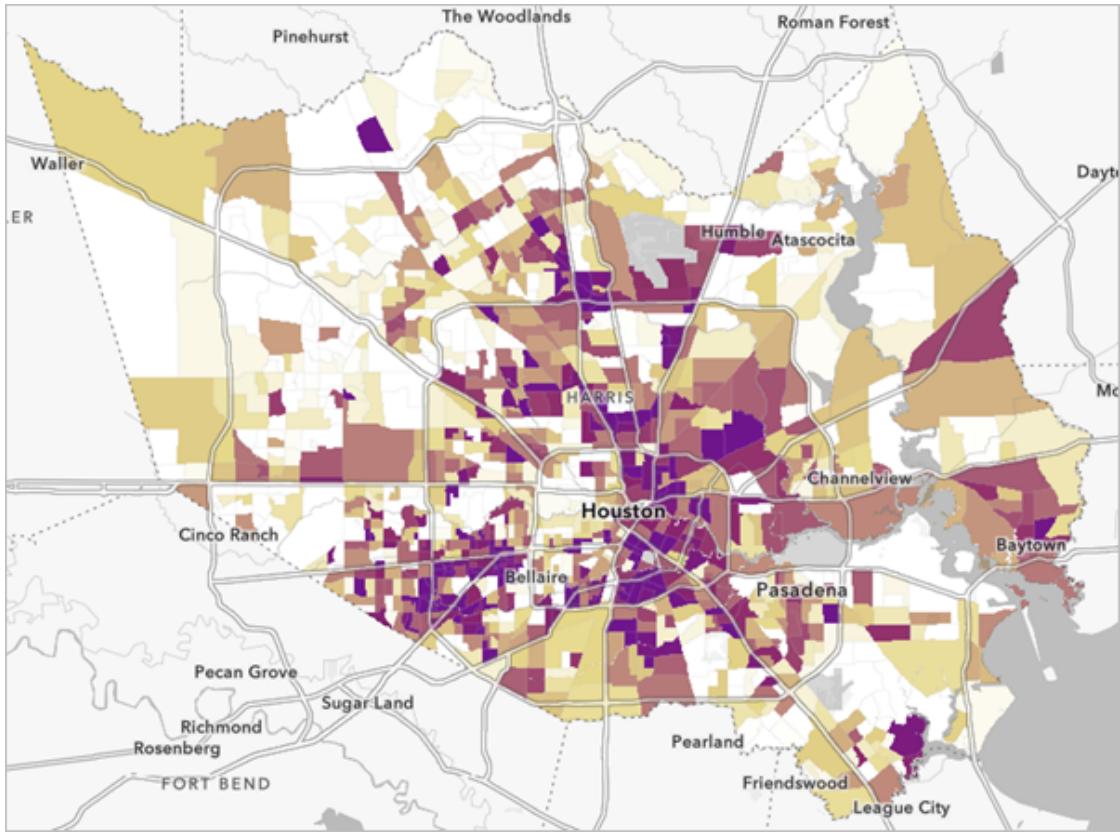
Los Angeles County ▾

Harris County X ≡

Harris County 1122

The screenshot shows a 'Condition' dialog box. It has dropdown menus for 'County' (set to 'County'), 'is' (set to 'is'), and 'Los Angeles County' (set to 'Los Angeles County'). Below these is a search bar with a magnifying glass icon containing the text 'Harris County'. To the right of the search bar are a delete button ('X') and a filter icon ('≡'). At the bottom, there is a list item with a radio button, the text 'Harris County', and the number '1122'. The 'Harris County' text is highlighted with a green border.

7. Click **Save** to apply the filter

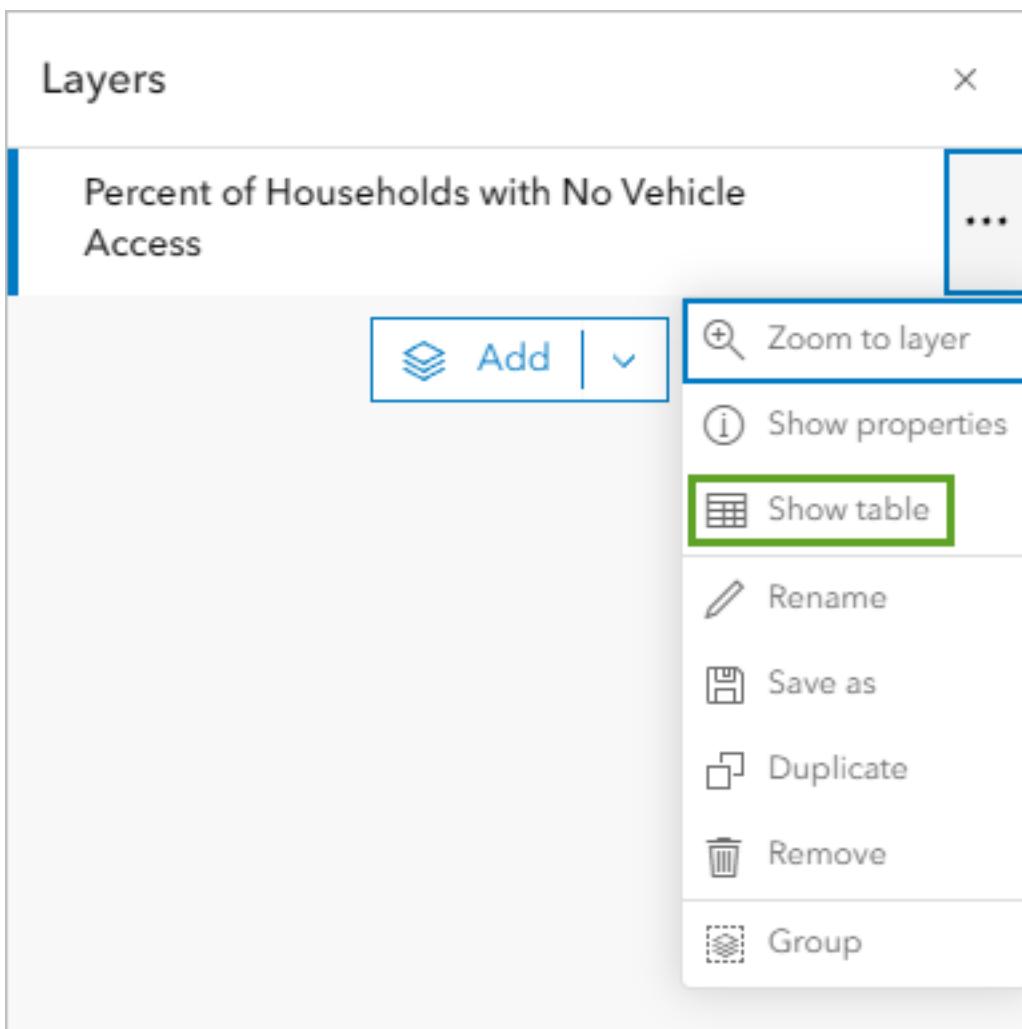


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## Part 6: Emphasize the Top Tracts

### Step 1: Examine the Attribute Table

1. For the layer, click the **Options** button and choose **Show table**



The layer's attribute table appears. The attribute table is a way of viewing all of the attributes that exist for each feature. Each row in the table represents a feature (in this case, a census tract area). The columns, or fields, provide information about the census tract features, such as the **County** attribute that you used to filter the data earlier.

The top of the table indicates that there are 1,122 census tracts in Harris County.

2. Scroll right to find the **Percent of households with no vehicle available** column

Open tabs: 1

Percent of Households with No Vehicle Access X

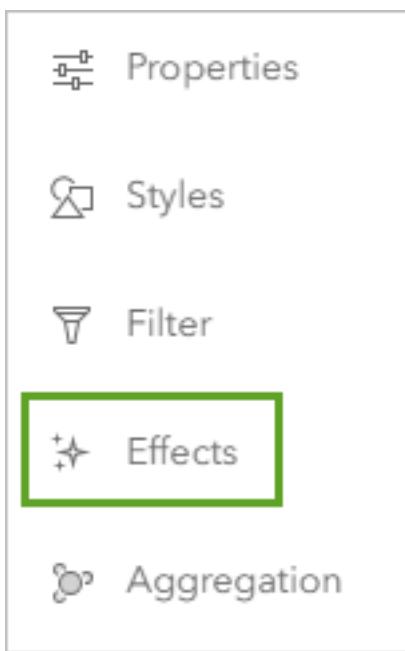
	Percent of households with no vehicle available	Percent of househ
14.5		Sort ascending
21.5		Sort descending
17.1		Information
3.3		Hide field
18.0		8.9

The table is sorted so that the **Percent of households with no vehicle available** field shows tracts in order of highest to lowest values. The highest value is 48.9 percent.

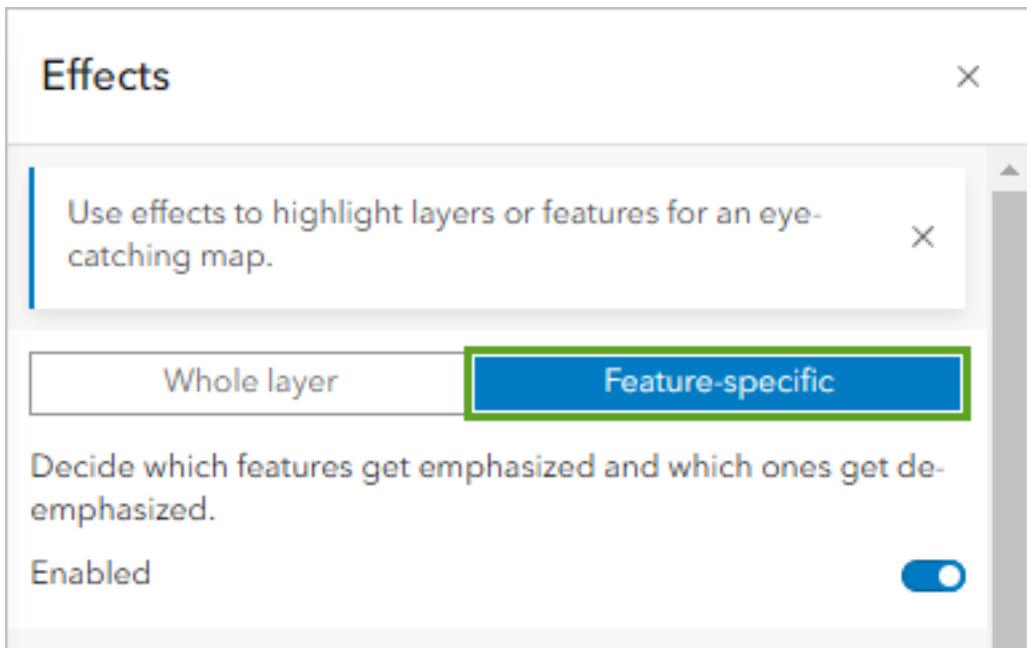
3. Click the **Menu** button for this column and choose **Sort descending**
4. Identify the 10 highest values in the table
5. Close the table

## Step 2: Apply Visual Effects

1. In the **Settings pane**, click the **Effects** button



2. In the **Effects** pane, click **Feature-specific**



3. Click the **Drop Shadow + Transparency** effect

**Effects** X

**Whole layer** **Feature-specific**

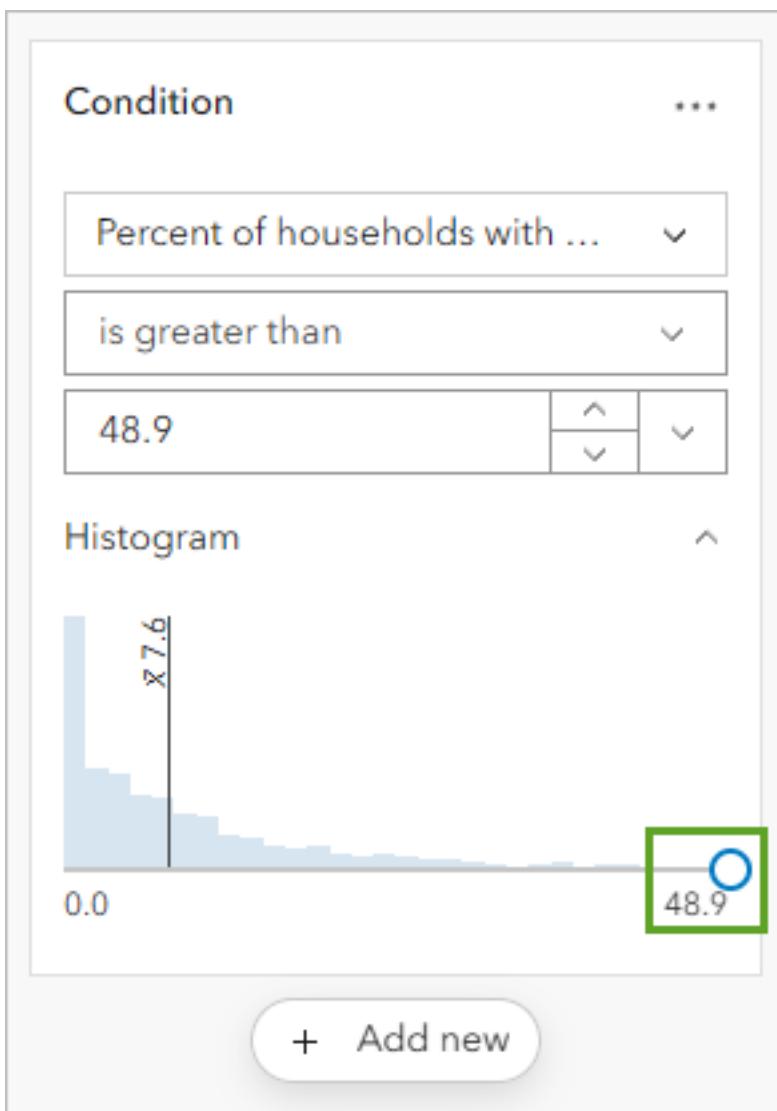
Decide which features get emphasized and which ones get de-emphasized.

Enabled

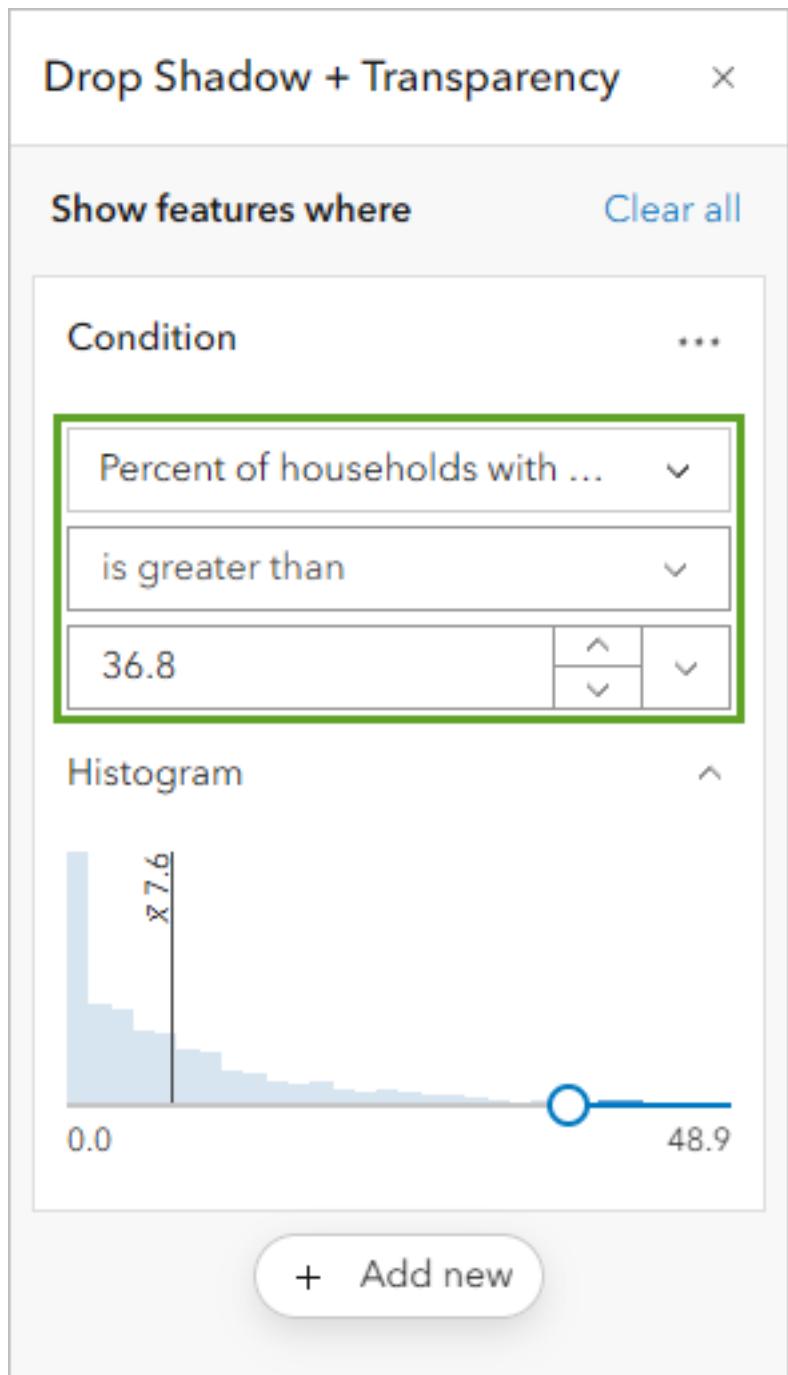
Recommended for light basemaps

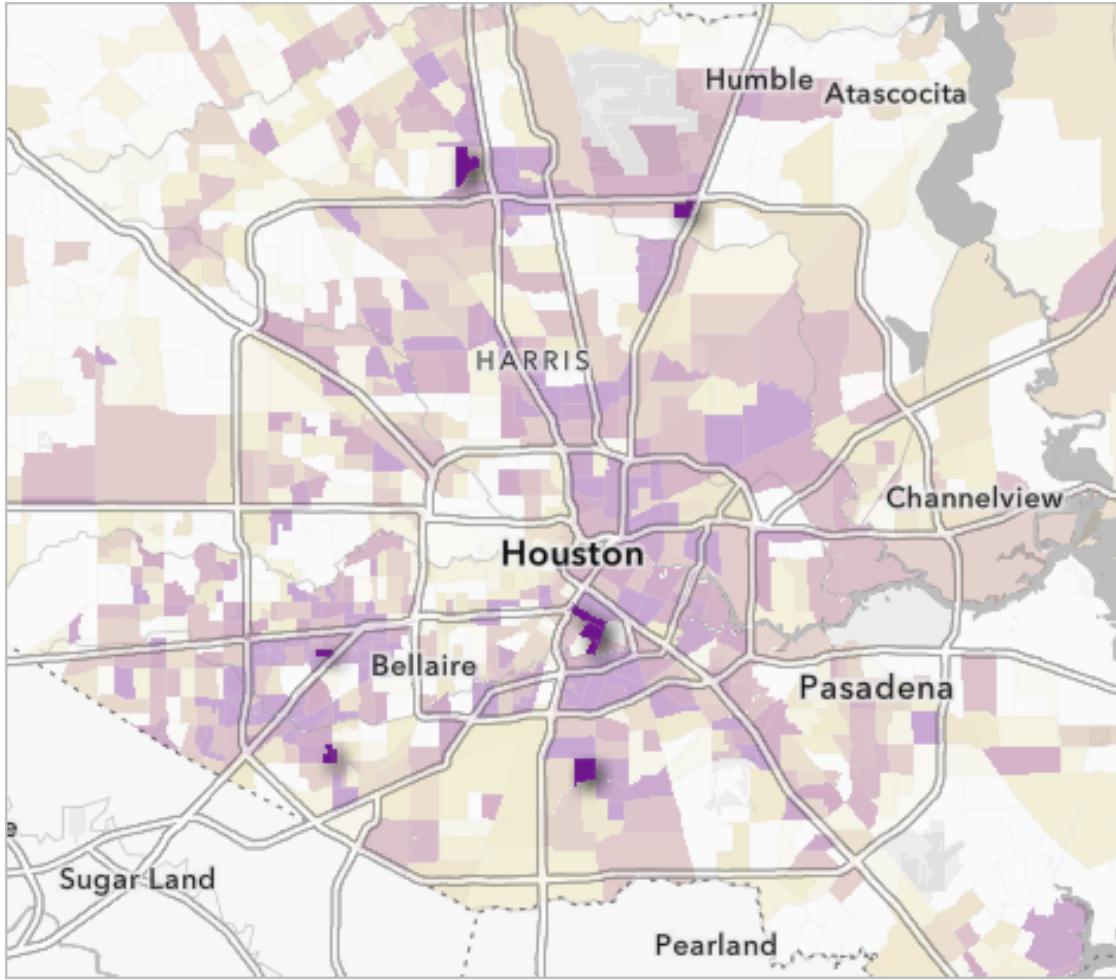
-  **Drop Shadow + Gray**  
Apply drop shadow to emphasize some features and grayscale to de-emphasize others.
-  **Strong Drop Shadow**  
Apply strong drop shadow to emphasize some features.
-  **Drop Shadow + Transparency**  
Apply drop shadow to emphasize some features and semi-transparency to de-emphasize others.
-  **Drop Shadow + Blur**  
Apply drop shadow to emphasize some features and blur to de-emphasize others.

4. In the **Drop Shadow + Transparency** pane, drag the histogram slider to the **48.9** label. This will adjust the histogram slider to emphasize the top 10 tracts



5. Modify the logical expression to highlight areas above your identified threshold. Change the logical expression to read **Percent of households with no vehicle available is greater than 36.8**.





6. Close the effects windows
- 

## Part 7: Final Documentation and Submission

### Step 1: Save Your Map

1. On the **Contents** toolbar, click **Save and open** and choose **Save as**
2. For **Title**, type: **Census tracts in Houston with low vehicle access**
3. For **Tags**, add the following (press Enter after each):

- **Hurricanes**
  - **Evacuation Assistance**
  - **Houston**
4. For **Summary**, type: This map shows census tracts in Houston, Texas, that have many households without access to a vehicle. These areas may need to be considered for evacuation assistance in case of a hurricane or other natural disaster.
  5. Click **Save**

The map is saved. It now appears in your account's content. You can access your content by clicking the options button next to the map's name and choosing **Content**. For now, you'll set the sharing permissions.

**By default, your content is private and only visible to you and your organization's administrator.** You can share content to different groups of viewers depending on the level of privacy you want to maintain and the content's audience and purpose. For example, if you choose to share it with your organization, only users with accounts in the same organization ( e.g The University of St Andrews) as you can access your content.

---

## **Final Steps:**

Well Done! You have now completed all the steps for this lab, where you (in theory) created your **first Web Map** using **ArcGIS Online**. Before moving on, make sure to:

1. **Take a screenshot** of your final web map, ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report ( see all the instructions in the handbook)
2. **For the Part B of this lab in your report.** Replicate the process independently by applying the same skills you practised in this lab, but using **spatial data from Scotland or the UK** (See the Data sources sections for a comprehensive list of data sources).

In the original lab, you created a web map using **census data for emergency planning in the U.S.** For your **independent spatial analysis**, you can choose a different theme and dataset (e.g. healthcare access, education, environmental risk), as long as you also:

- Use again **ArcGIS Online** using your university credentials. **Meet and work with your classmate to define which account want to use. You must only report one independent analysis results.**

- Apply the same techniques learned in this lab (e.g. adding layers, symbolising data, filtering, configuring pop-ups, etc).
- And create a web map with a **clear purpose** relevant to a real-world issue in Scotland or the UK.

This additional task is an opportunity to deepen your technical skills, explore new datasets, and demonstrate your ability to adapt spatial analysis methods to new contexts.

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## Additional Resources

- [ACS Vehicle Availability Variables - Boundaries data](#) is from the American Community Survey.
- [Topographic](#) map sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community
- [Human Geography Map](#) sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community

This tutorial is inspired from ArcGIS Online Learning resources available at <https://learn.arcgis.com/en/projects/get-started-with-arcgis-online/>

# **Lab No 2: Using external data**

## **Overview**

In this lab you will create your second Web map using ArcGIS Online. Now you are familiar with the platform, the idea of this tutorial is you learn how to create another web map using external data in ArcGIS Online. Add a data layer to a new map and start visualizing patterns. You will see how to add new data from external sources, format your charts, and then be able to filter and structure your map to only read and illustrate what you need.

**Estimated time of completion:** 45 Minutes

---

## **Download and Examine the Data**

First, you will download a .csv file that contains general information about public high schools in Detroit, Michigan.

1. Download the [DetroitSchoolCharacteristics.csv](#) file to your computer and open it in Microsoft Excel or another spreadsheet program like Google Sheets.

The screenshot shows a Microsoft Excel spreadsheet titled "DetroitSchoolCharacteristics". The ribbon menu is visible at the top, with "Home" selected. The table below contains data for 7 rows, with the first row serving as the header. The columns are labeled A through I. Column A is "OBJECTID", which is highlighted with a green border. The other columns contain various school-related information such as names, addresses, and location details.

OBJECTID	Unique Sc	School na	Location a	Location a	Location c	Location s	Location 5	Telep
42940	2.6E+11	Cesar Cha	1761 WATERMAN ST	DETROIT	MI	48209	(313)5	
42966	2.6E+11	Detroit Cc	12675 BURT RD	DETROIT	MI	48223	(313)5	
43015	2.6E+11	Voyageur	4366 Military St	Detroit	MI	48210	(313)3	
43021	2.6E+11	Detroit Ed	3402 St Aubin	Detroit	MI	48207	(313)8	
43029	2.6E+11	Old Redfo	8001 WEST OUTER DF	DETROIT	MI	48235	(313)5	
43095	2.6E+11	Covenant	1450 25th St	Detroit	MI	48216	(313)2	

You will see a table with columns of longitude, latitude, school name, total students eligible for free and reduced meal plans, and race and ethnicity data. This data comes from the National Center for Education Statistics' (NCES) Education Demographic and Geographic Estimate (EDGE) program.

It's hard to visualize where these schools are located or any patterns in the information from the table alone. Making a map is a better way to understand your data than viewing it as a table, so that's your next task.

**Note:** You can find data about public schools across the United States in the [Public School Characteristics - Current](#) layer.

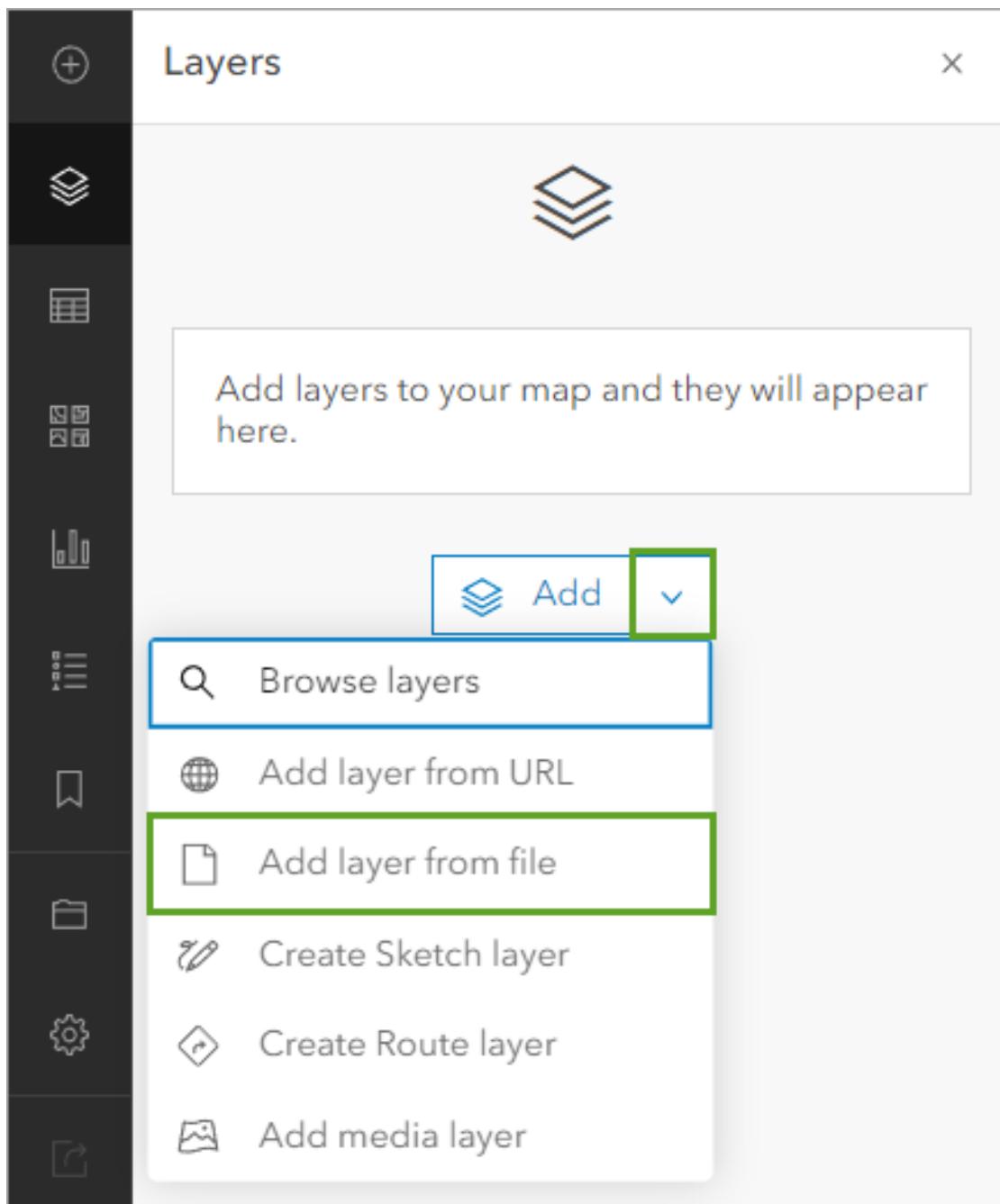
- Close the .csv file.

## Create a Map Layer

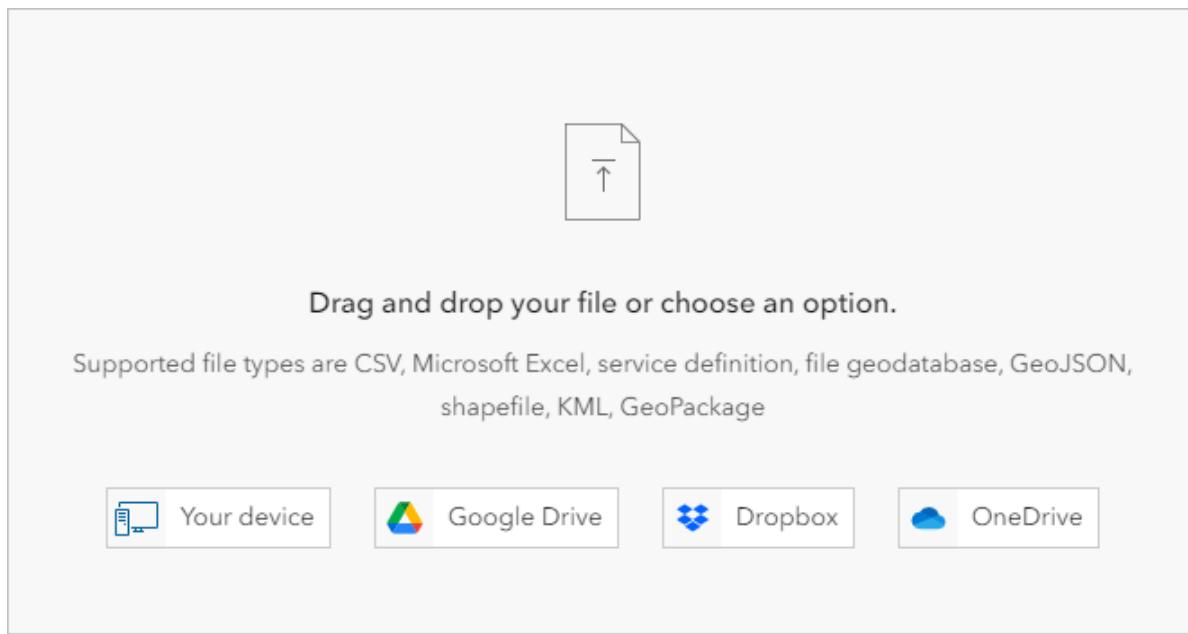
Layers are the way geographic data is organized and combined to create maps. For example, a map may consist of a roads layer, a lakes layer, and buildings layer. These layers are also the basis for geographic analysis to aid in decision making. You will create a map layer by adding your .csv file to an empty map.

- Sign in to your [ArcGIS account](#) using your university credentials.

2. On the ribbon, click the **Map** tab.
3. In Map Viewer, in the Layers pane, click the arrow next to the **Add** button and click **Add layer from file**.



The Add Layer window appears.



4. Drag the DetroitSchoolCharacteristics.csv file to the Add Layer window.

**Tip:** Alternatively, click **Your device** and browse to the .csv file.

5. For **How would you like to add this file**, choose **Create a hosted feature layer and add it to the map**. Click **Next**.

A list of fields appears. Map layers consist of spatial and tabular information. The table will contain the same columns—also called fields or attributes—as the .csv file. On this page, you can choose which fields from the .csv file you want to include, provide display names, and data type information.

The software automatically detected the fields and produced default display name and data types. This page is an opportunity for you to review that the automatic assignments are accurate.

**Add Layer** X

### Fields

Select the fields that will be included in the hosted feature layer. Optionally, update the display name and field type.

Search for field	All types <span style="font-size: small;">▼</span>	
<span style="margin-right: 10px;">21 selected</span> <span style="color: #ccc;">Clear selection</span>		
Field name	Display name	Type
<input checked="" type="checkbox"/> OBJECTID	OBJECTID	Integer <span style="font-size: small;">▼</span>
<input checked="" type="checkbox"/> Unique_School_ID	Unique School ID	Big Integer <span style="font-size: small;">▼</span>
<input checked="" type="checkbox"/> School_name	School name	String <span style="font-size: small;">▼</span>

Back
Cancel
Next

In this example, you will choose to include all the fields, so you won't adjust the check boxes.

**Display name** sets a nickname or shortened name of the field name that is more readily understandable to others. Field names cannot include spaces or numbers, so sometimes you may want these in the display name. Setting Display name allows you to provide meaningful names without changing the Field name text.

**Type** describes the data you will store in the field:

- **Date**—Date and time.
- **Double**—Numbers with decimal places.
- **Integer**—Whole numbers from -2,147,483,648 to 2,147,483,647 (long integer).
- **Big Integer**—Whole numbers between -( $2^{53}$ ) and  $2^{53}$ .

- **String**—Any sequence of characters. The default length is 256 characters.

You will accept all the default settings and continue.

6. Click **Next**.

The Location settings page appears. Spatial information for the layer will be derived from the Latitude and Longitude columns in the .csv file.

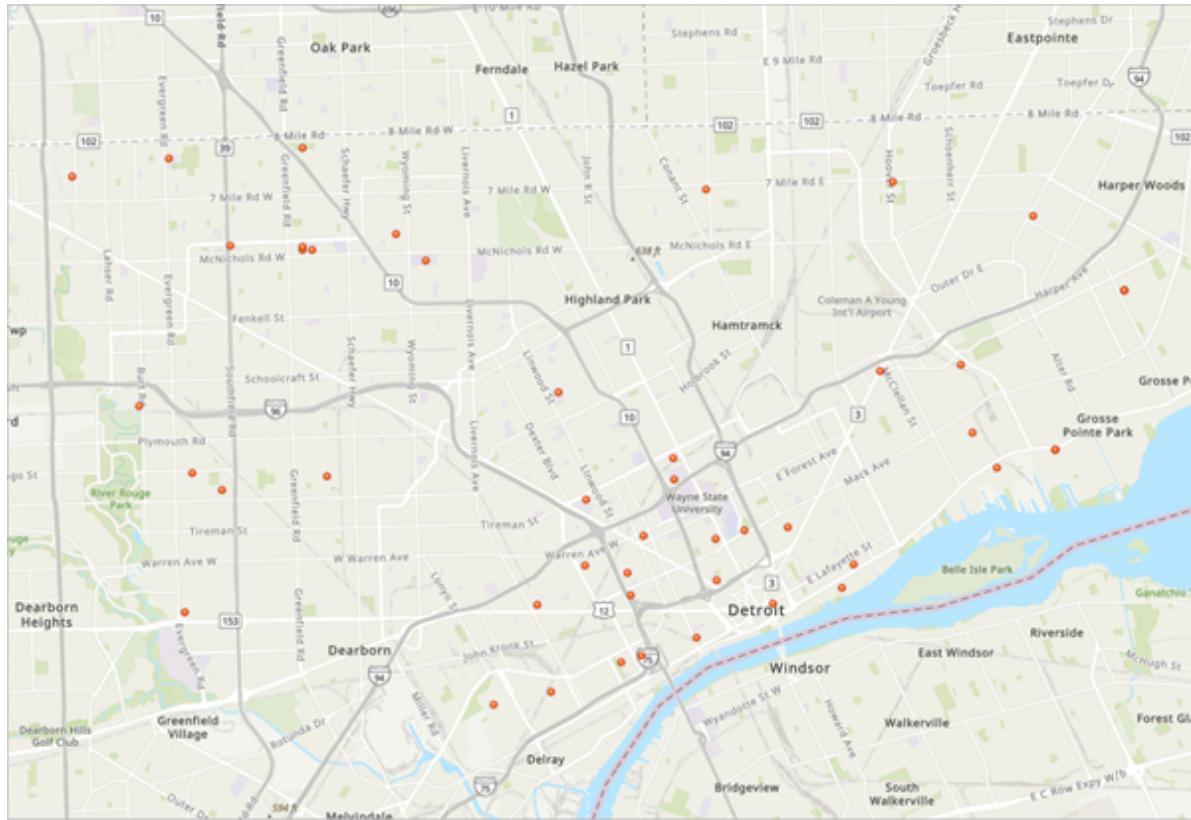
**Note:** If your table contains the names or addresses of locations (like Paris or 15 Central St. Bethlehem, PA) instead of latitude and longitude fields, try this tutorial about geocoding data: [Convert a list of historic places into a map](#).

7. Click **Next**.

8. For **Title**, type “Detroit high schools” followed by your name or initials (for example “Detroit high school (Your name)”).

**Note:** You cannot create two layers in an ArcGIS organization with the same name. Adding your initials to a layer name ensures that other people in your organization can also complete this tutorial. Once a layer has been created, you can rename it in the map to remove your initials, which will not affect the name of the underlying data layer.

9. Click **Create and add to map**.

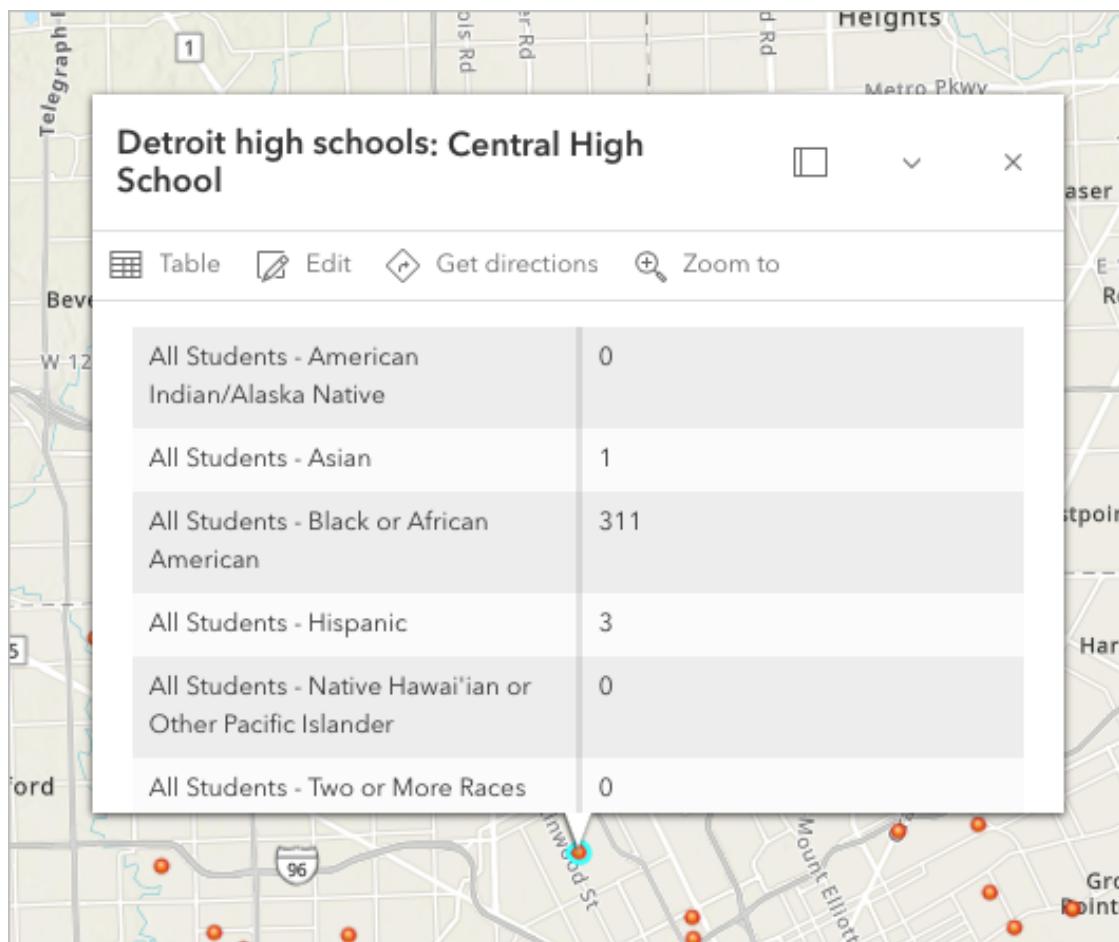


The new layer appears on the map. The map displays the locations of the schools listed in the .csv file. Each school is considered a feature in the layer. You have access to the descriptive information, or attributes, by viewing pop-ups for features on the map.

10. On the map, click any circle.

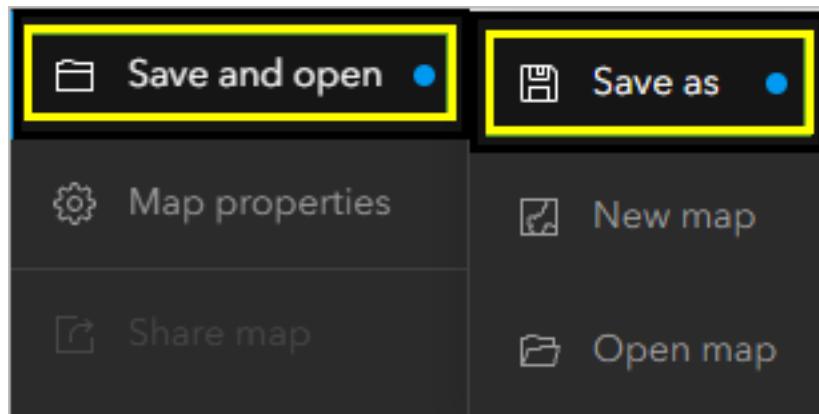
A pop-up window appears with information about the school from the layer's table.

11. Close the pop-up.



Before you continue, you will save the map.

12. In the Contents pane, click **Save and open** and click **Save as**.



13. In the Save map window, enter the following:

- For **Title**, type “Public high schools in Detroit”.
- For **Summary**, type “Map of public high schools and student body race and ethnicity data in Detroit, Michigan”.

Save map X

---

Title  
Public high schools in Detroit

Folder  
Your Folder

Categories  
Assign categories

Tags  
Add tags

Summary  
Map of public high schools and student body race and ethnicity data in Detroit, Michigan.

Characters left: 1959

---

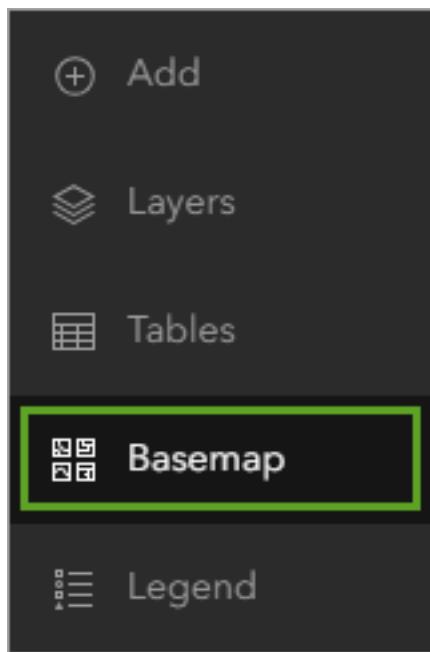
Save Cancel

14. Click **Save**.

## Change the Basemap and Layer Style

Maps in ArcGIS Online consist of layers. You added the Detroit high schools layer, but the map also has a basemap layer by default. Next, you'll change the basemap layer and the style of the feature layer.

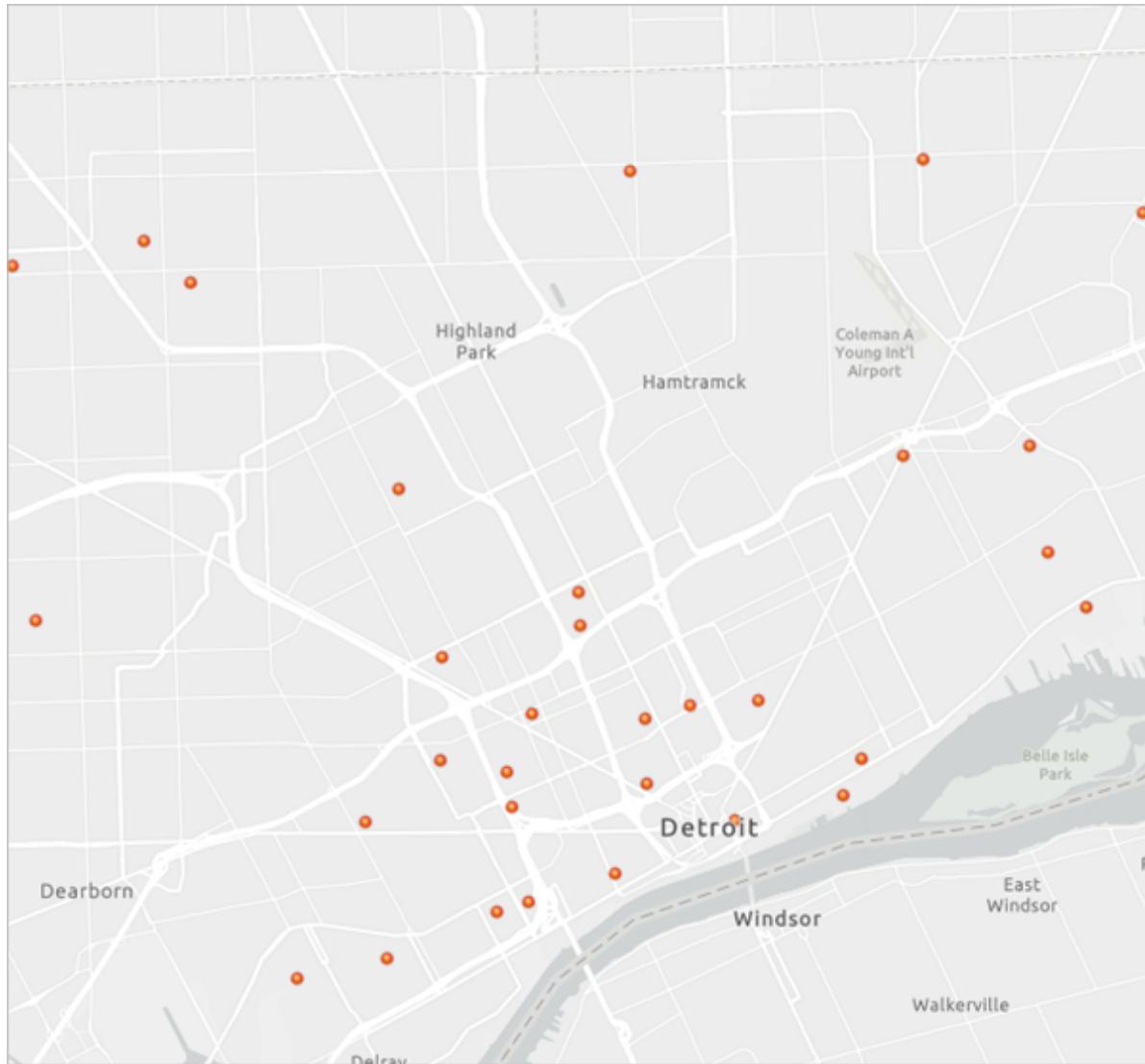
1. On the Contents (dark) toolbar, click **Basemap**.



The Basemap pane appears. The Topographic basemap is selected. This basemap looks good but is better suited for a reference map. You'll choose a more minimally designed basemap so it does not distract from the school data.

2. In the Basemap pane, click **Light Gray Canvas**. Close the Basemap pane.

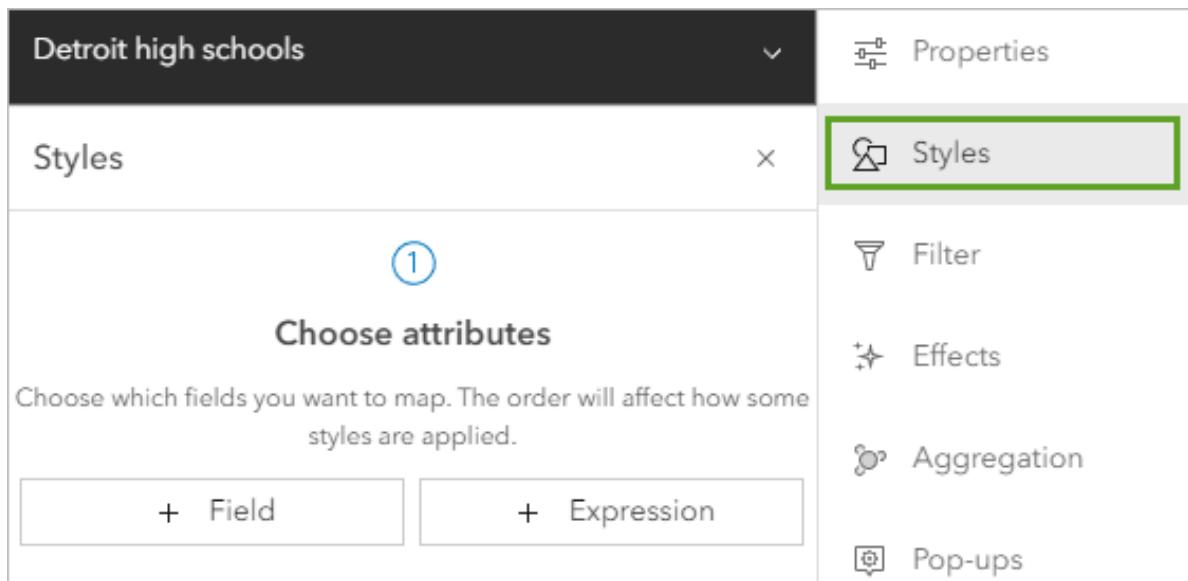
**Note:** You may see different basemaps depending on the configuration of your organization. If the Light Gray Canvas basemap is not available, skip to the next step without changing the basemap.



Next, you'll configure the high school layer's symbols so they are sized based on the number of students at each school eligible for free and reduced meal plan programs.

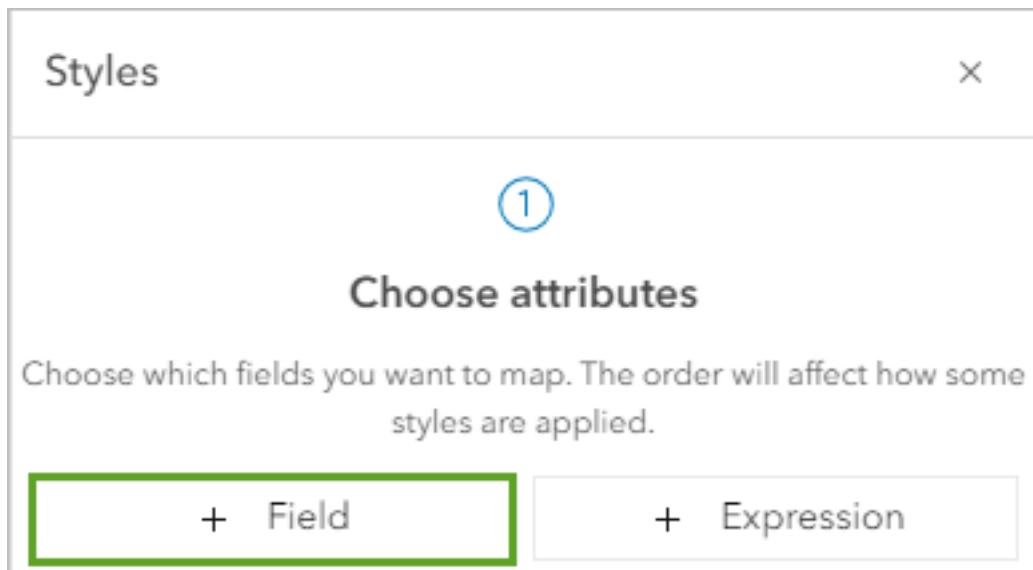
3. On the Settings (light) toolbar, click **Styles**.

**Note:** If the Settings toolbar is unavailable, on the Contents toolbar, click **Layers**. In the Layers pane, click **Detroit high schools** to select the layer.



The Styles pane appears. Currently, the style is based on the data's location only. You'll configure the symbols to convey both location and one of the data's attributes.

4. In the Styles pane, click the **Field** button.



You will choose to style the map by the number of students at each high school who are eligible for free and reduced price meal (FRPM).

Eligibility for FRPM is set by U.S. Department of Agriculture Child Nutrition Programs and is based on Federal poverty guidelines issued by the Department of Health and Human Services.

The number or percent of students eligible for FRPM is often used as an equity indicator to understand the needs of school-aged children.

5. On the Select fields menu, choose **Total of free lunch and reduced-price lunch eligible** and click **Add**.

## Select fields

X

Search fields



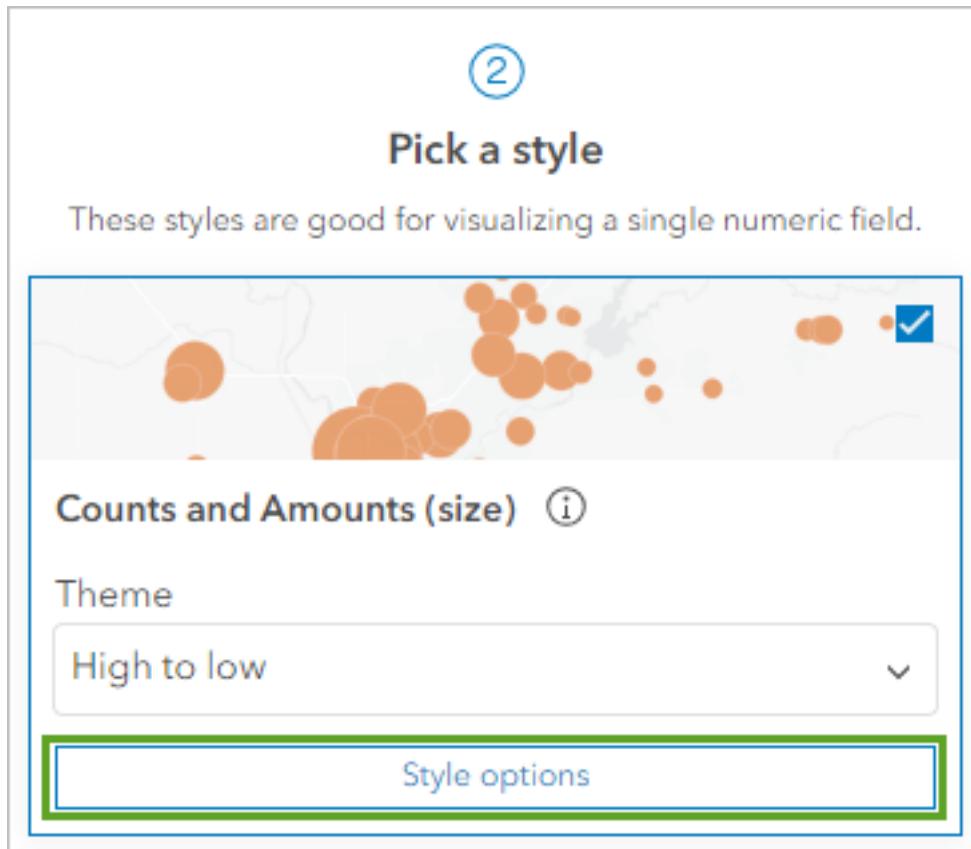
- |                                     |  |     |
|-------------------------------------|--|-----|
| <input type="checkbox"/>            | Unique School ID                                     | (i) |
| <input type="checkbox"/>            | School name  | (i) |
| <input type="checkbox"/>            | Location address, street 1                           | (i) |
| <input type="checkbox"/>            | Location address, street 2                           | (i) |
| <input type="checkbox"/>            | Location city  | (i) |
| <input type="checkbox"/>            | Location state                                       | (i) |
| <input type="checkbox"/>            | Location 5 digit ZIP code                            | (i) |
| <input type="checkbox"/>            | Telephone number                                     | (i) |
| <input type="checkbox"/>            | County Name  | (i) |
| <input checked="" type="checkbox"/> | Total of free lunch and reduced-price lunch eligible | (i) |
| <input type="checkbox"/>            | Total elementary/secondary students (excludes AE)    | (i) |
| <input type="checkbox"/>            | All Students - American Indian/Alaska Native         | (i) |

Add

Cancel

The options under Pick a style update to reflect choices that are suitable for the Total of free lunch and reduced price lunch eligible field. **Counts and Amounts (size)** is selected and the map updates to reflect this style. This style reveals some new patterns in the data. The larger the circle, the more students are eligible for FRPM at the school.

6. On the **Counts and Amounts (Size)** card, click **Style options**.



7. In the Counts and Amounts (size) pane, for **Symbol style**, click the current symbol.

**Counts and Amounts (size)**

Total of free lunch and reduced-price lunch eligible

Theme

**High to low**  
Vary the size of features from high to low.

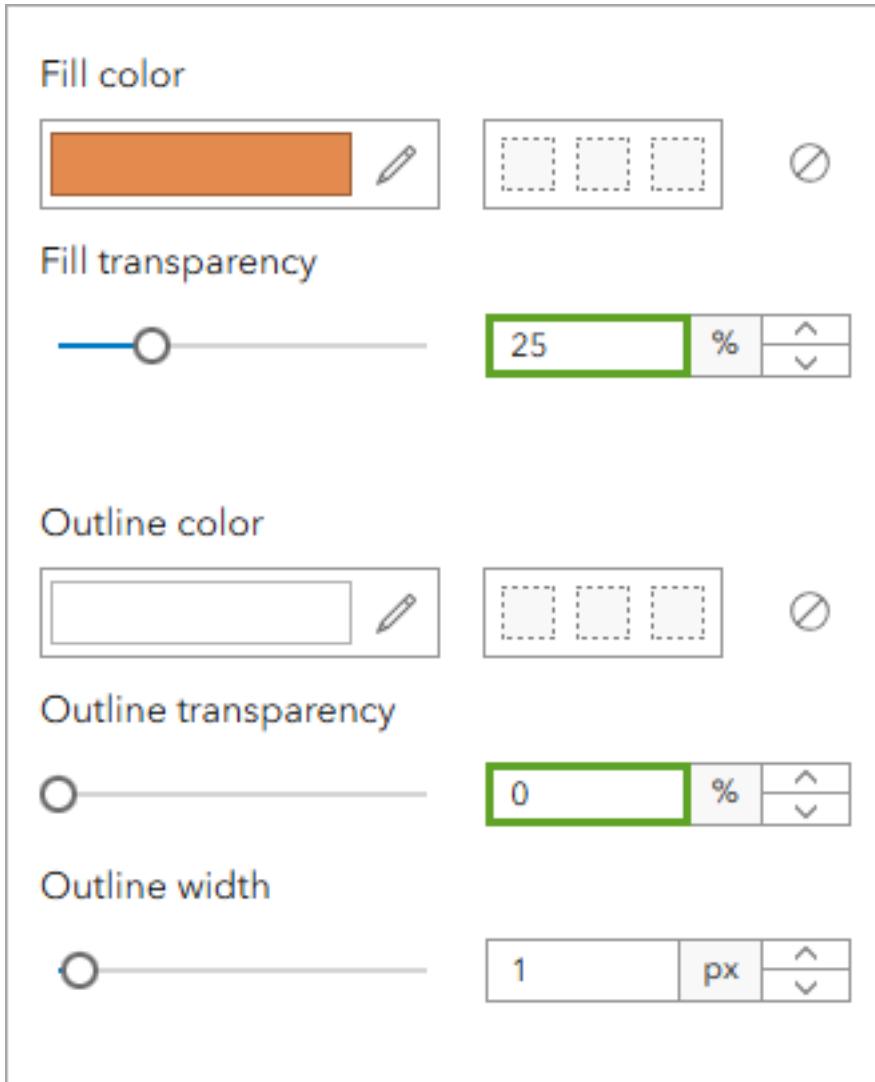
Divided by

Choose a field

Symbol style

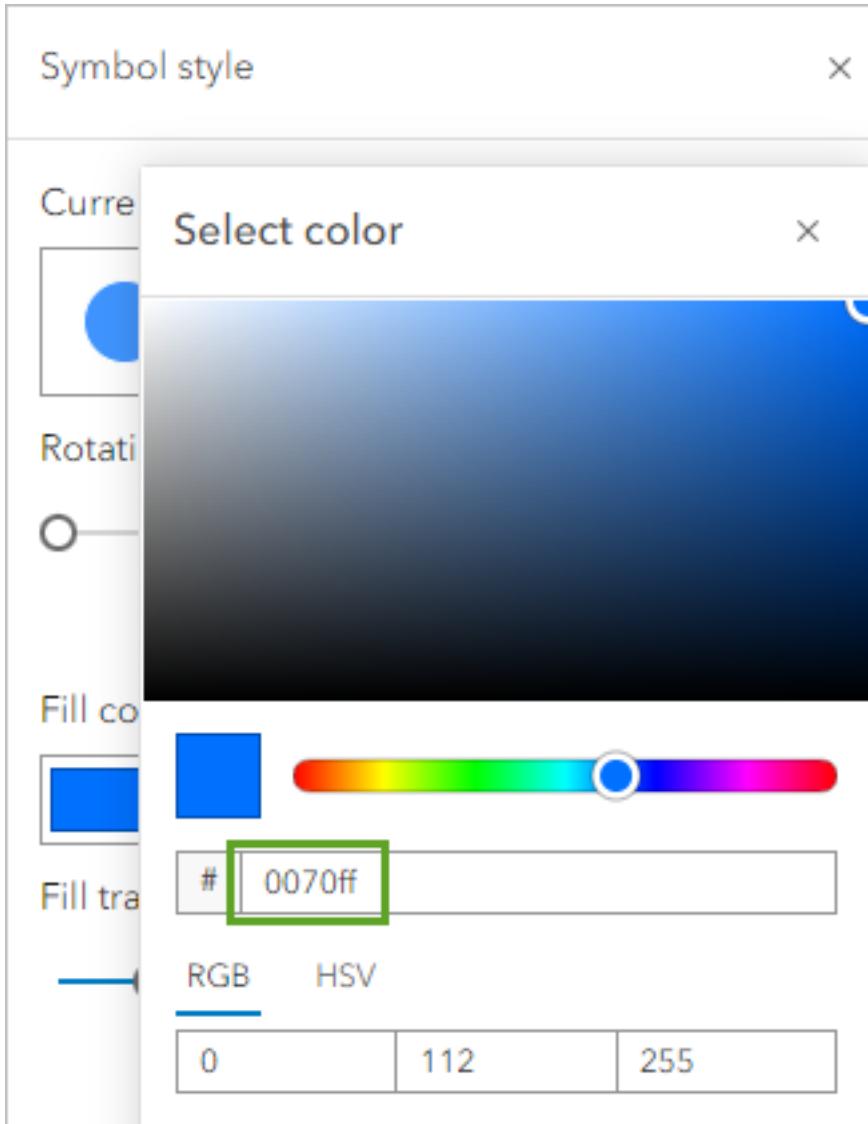
The Symbol style window appears. You'll adjust the symbol's properties so circles can be seen even when they are overlapping.

8. Set **Fill transparency** to 25. Set **Outline transparency** to 0.



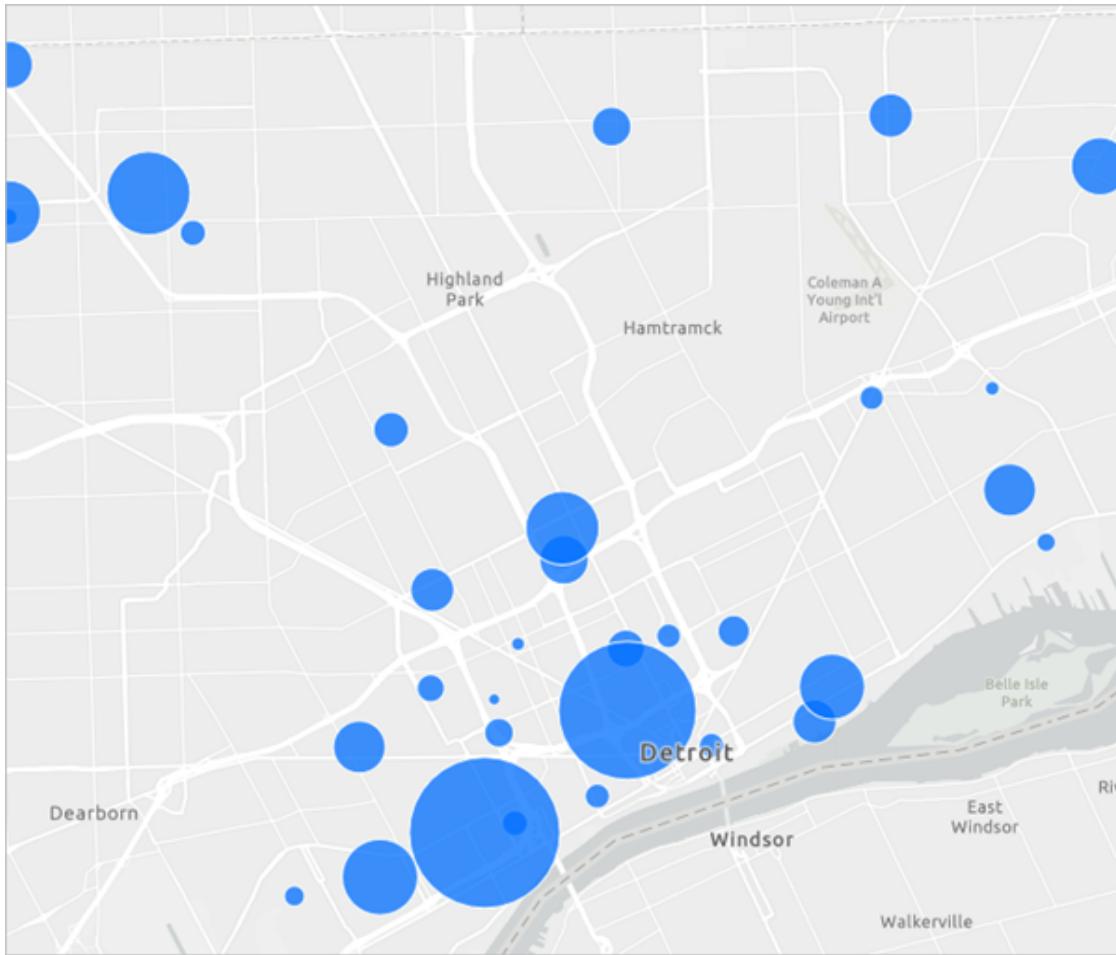
The symbols on the map update. It is now easier to see overlapping circles.

9. In the Symbol style window, for **Fill color**, click the current color. In the Select color window, for **#**, type **0070FF** and press Enter.



The color of the map symbols changes to blue.

10. Click **Done** in the Select color window, the Style options pane, and the Styles pane.



The map shows the number of students at each high school who are eligible for FRPM programs. The schools with more students who are eligible for FRPM programs are represented by larger circles. Schools represented with smaller circles have fewer students who are eligible for FRPM programs.

11. On the Contents pane, click **Save and open** and click **Save** to save your map.

## Configure Pop-ups and View a Table

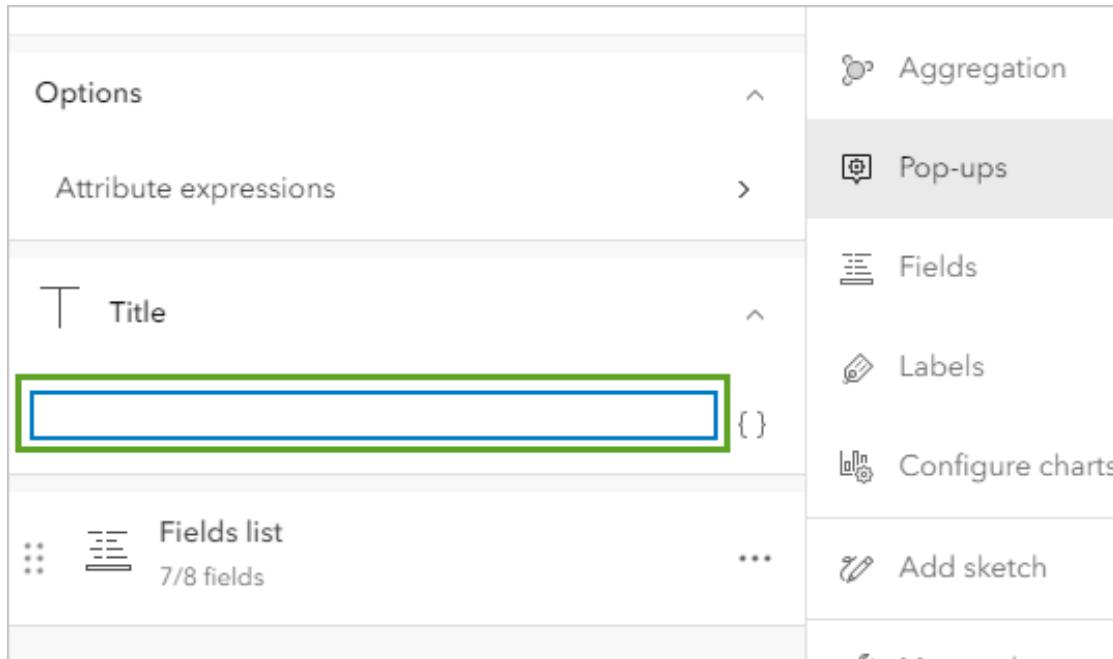
The pop-up that you viewed earlier displayed all the attributes for the features, which may be unnecessary for your map. You can configure pop-ups to show only those attributes that are important to your map. In this example, you want to show only the name of the school and the number of students eligible for FRPM programs.

1. In the Layers pane, ensure that the **Detroit high schools** layer is selected.

2. On the Settings toolbar, click **Pop-ups**.

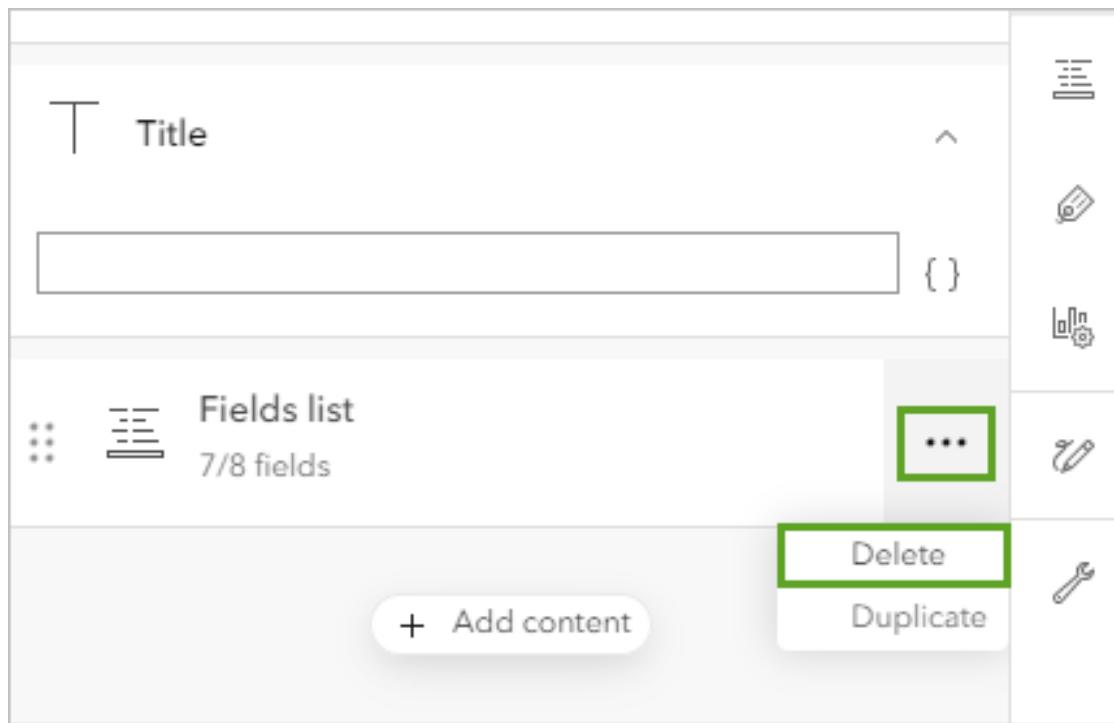
The Pop-ups pane appears and a sample pop-up appears on the map. The pop-up's title contains the name of the layer and the name of the school. This title is unnecessary for your map, so you'll remove it.

3. In the Pop-ups pane, click **Title**. Erase the text in the box.

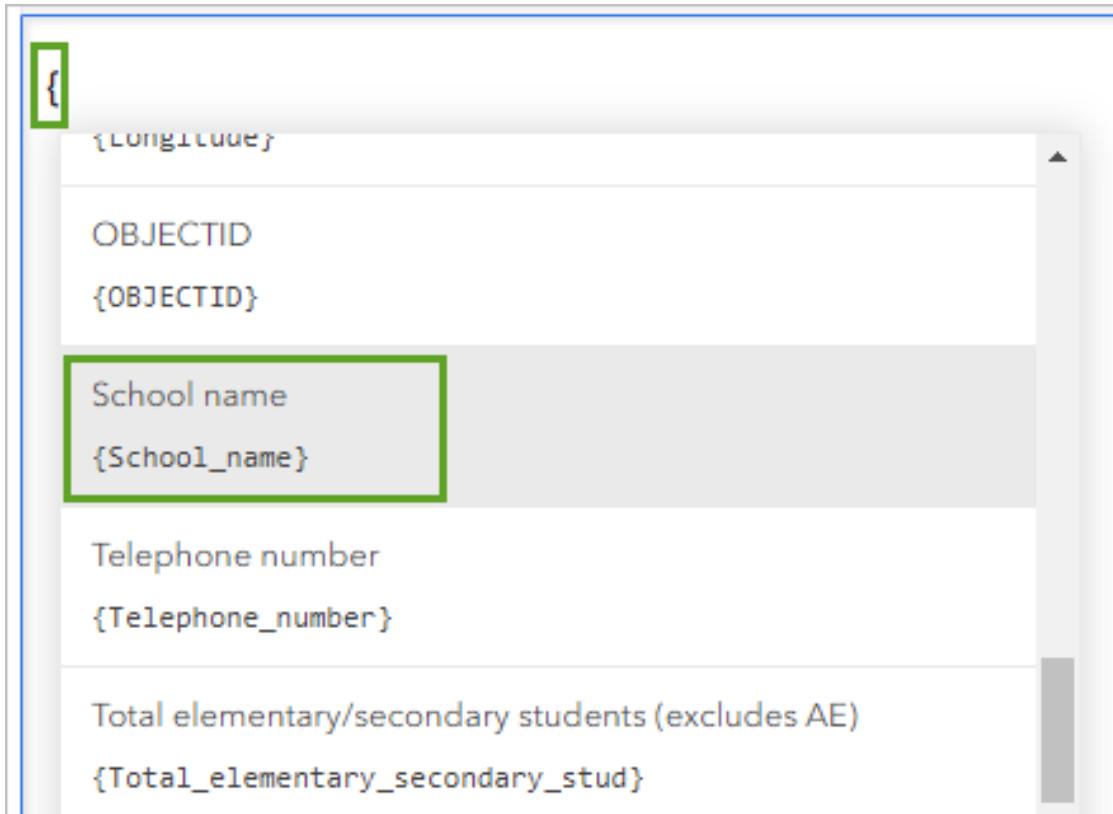


The title text disappears from the sample pop-up. You'll replace the list of fields with a sentence that includes the relevant information.

4. Next to **Fields list**, click the **Options** button. Click **Delete**.



5. Click **Add content** and click **Text**.
6. In the text editing window, type **{**. In the menu that appears, scroll almost to the bottom and click **School name**.

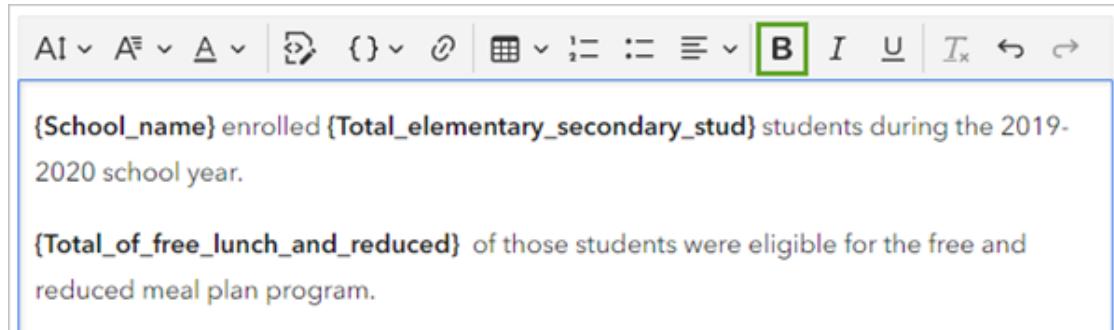


The School\_name field was one of the fields in the .csv file you used to create the feature layer. By setting the dynamic text to this field, the pop-up that displays for each school point will display the corresponding School\_name field.

7. After {School\_name}, type enrolled {Total\_elementary\_secondary\_stud} students during the 2019-2020 school year.

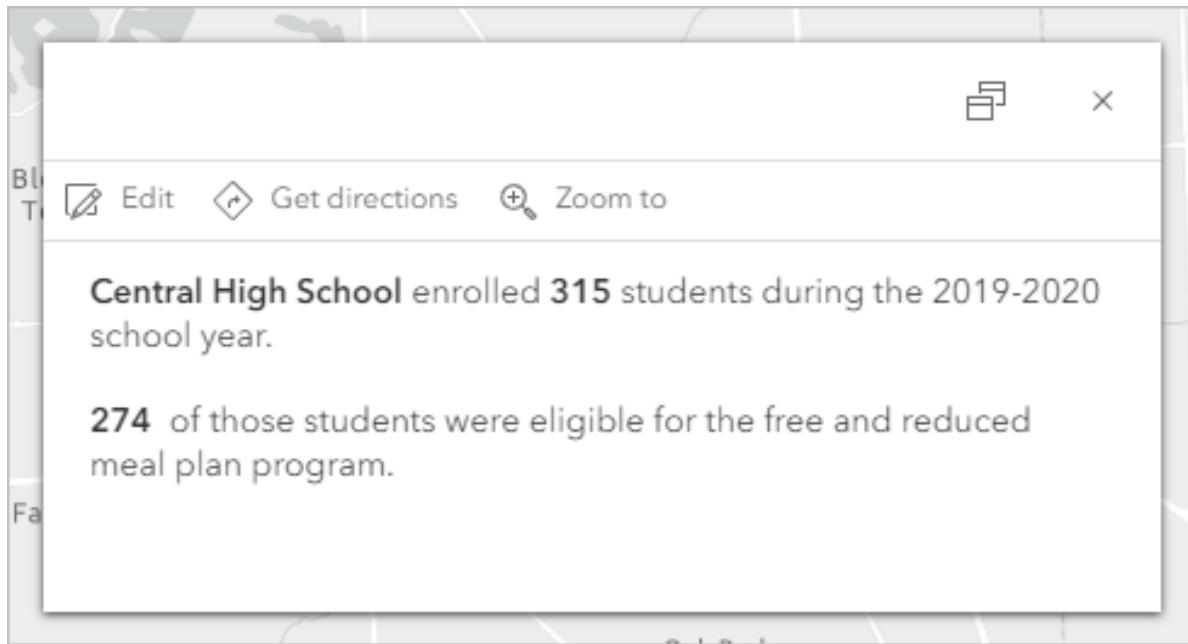
You can add fields by typing their names inside of curly brackets or by choosing them from the list that appears when you type a curly bracket.

8. Press Enter to start a new paragraph. Type {Total\_of\_free\_lunch\_and\_reduced} of those students were eligible for the free and reduced meal plan program.
9. Use the **Bold** button on the toolbar to add bold formatting to {School\_name}, {Total\_elementary\_secondary\_stud}, and {Total\_of\_free\_lunch\_and\_reduced}.



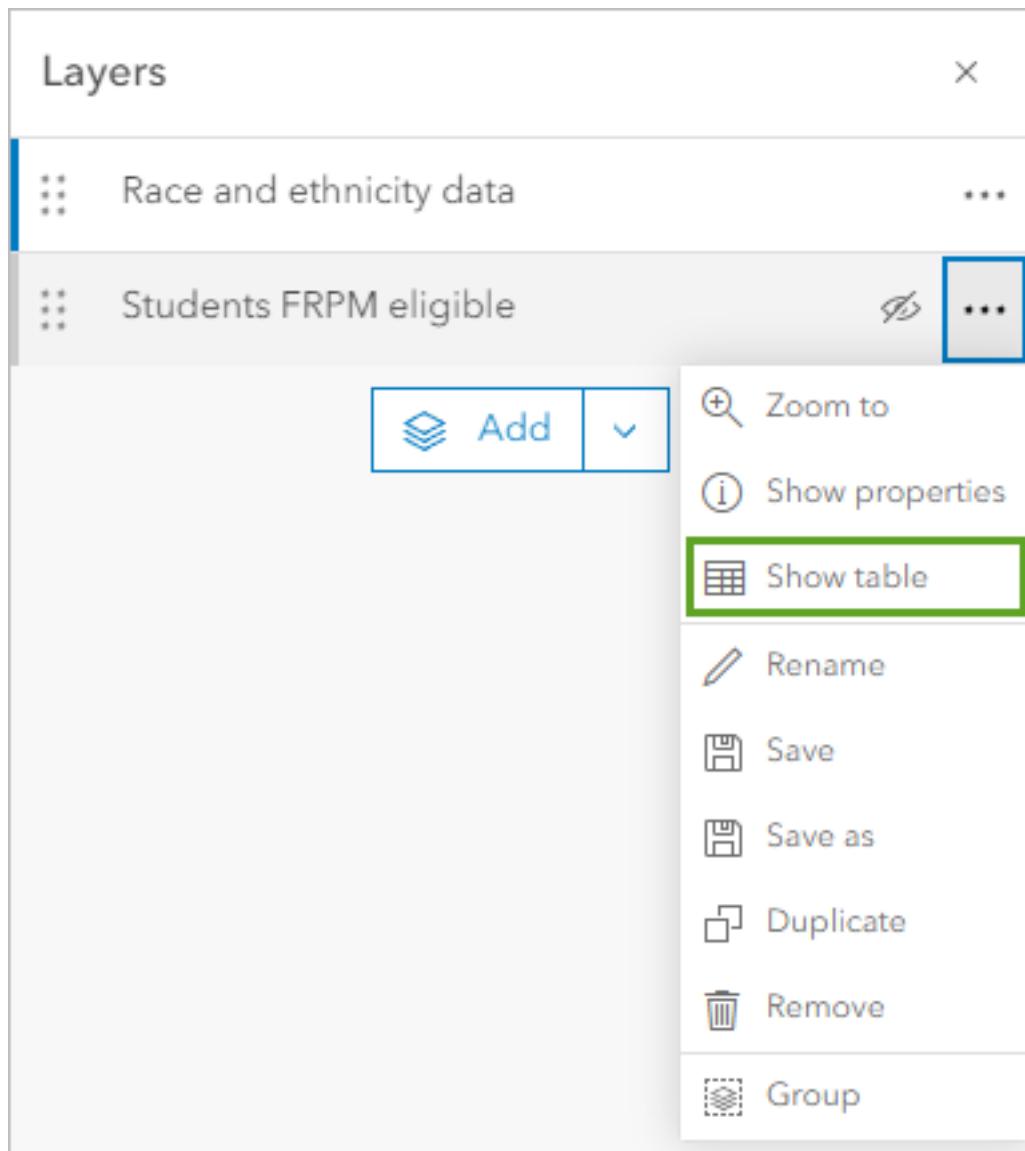
10. Click **OK**.

The preview pop-up replaces the field names with the attribute values of one of the features.



All the fields still exist in the data table, but they don't display in the pop-up. You can modify the contents of the pop-up at any time. You can still see all the attributes by showing the table.

11. In the Layers pane, next to **Detroit high schools**, click the **Options** button. Click **Show table**.



The layer's table appears below the map.

12. Review the data in the table. Close the table when you are finished.
13. Close the Pop-ups pane.
14. Save the map.

## Style the Layer in Another Way

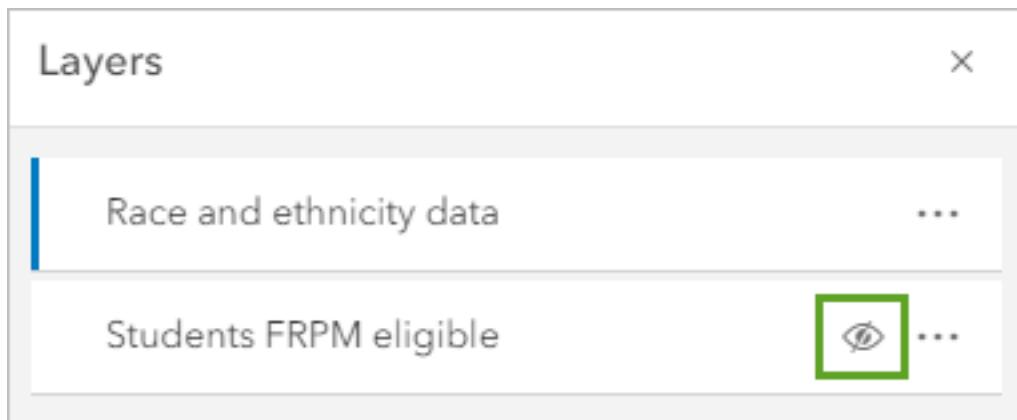
Your goal is to identify which schools would most benefit from more after-school programs. You have styled the school data by the number of students eligible for FRPM. But there are other aspects of equity that are also important to consider. Due to historic and present-day practices, race and ethnicity can play a critical role in how many resources and opportunities students have at their schools. Practices like segregation in schools and neighborhoods have widened inequities in resource allocation to schools.

Next, you will style the schools to show the race and ethnicity of the student body. First, you will rename the layer you had previously styled to show FRPM eligibility.

1. In the Layers pane, for the **Detroit high schools** layer, click the **Options** button and click **Rename**.
2. For **Title**, type **Students FRPM eligible** and click **OK**.

Next, you will make a copy of the layer.

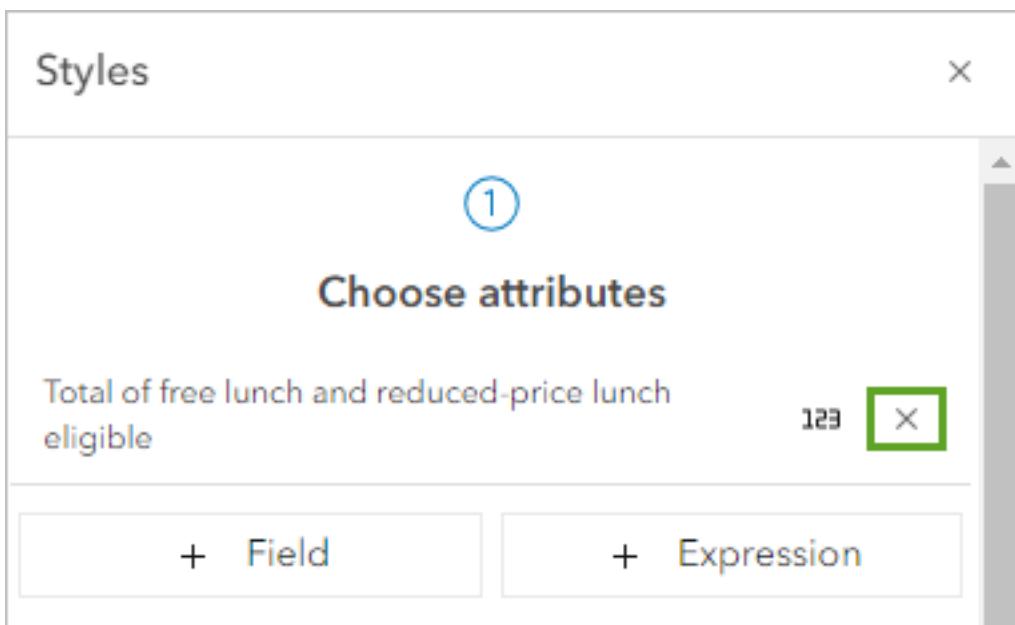
3. For the **Students FRPM eligible** layer, click the **Options** button and click **Duplicate**.



4. Rename the copied layer to be **Race and ethnicity data**.
5. Next to **Students FRPM eligible**, click the **Visibility** button to hide the layer on the map.

Next, you will style the Race and ethnicity data layer with race and ethnicity attributes.

6. Ensure that the **Race and ethnicity data** layer is selected in the Layers pane. In the Styles pane, remove the **Total FRPM eligible** attribute.



7. Click the **Field** button.
8. In the Add fields window, check the following fields:
  - All students - American Indian/Alaska Native
  - All students - Asian
  - All Students - Black or African American
  - All Students - Native Hawai'iian or Other Pacific Islander
  - All Students - Hispanic
  - All Students - Two or More Races
  - All Students - White

## Select fields

X



Search fields

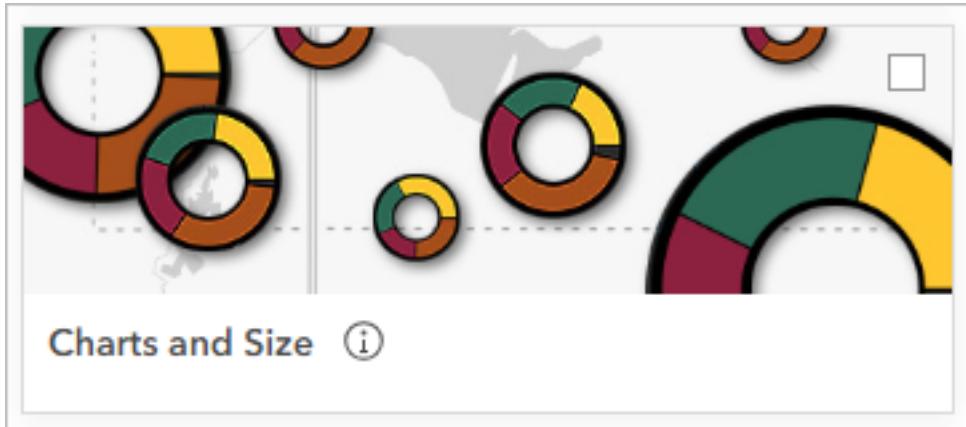


- Location 5 digit ZIP code (i)
- Telephone number (i)
- County Name (i)
- Total of free lunch and reduced-price lunch eligible (i)
- Total elementary/secondary students (excludes AE) (i)
- All Students - American Indian/Alaska Native (i)
- All Students - Asian (i)
- All Students - Black or African American (i)
- All Students - Native Hawaiian or Other Pacific Islander (i)
- All Students - Hispanic (i)
- All Students - Two or More Races (i)
- All Students - White (i)

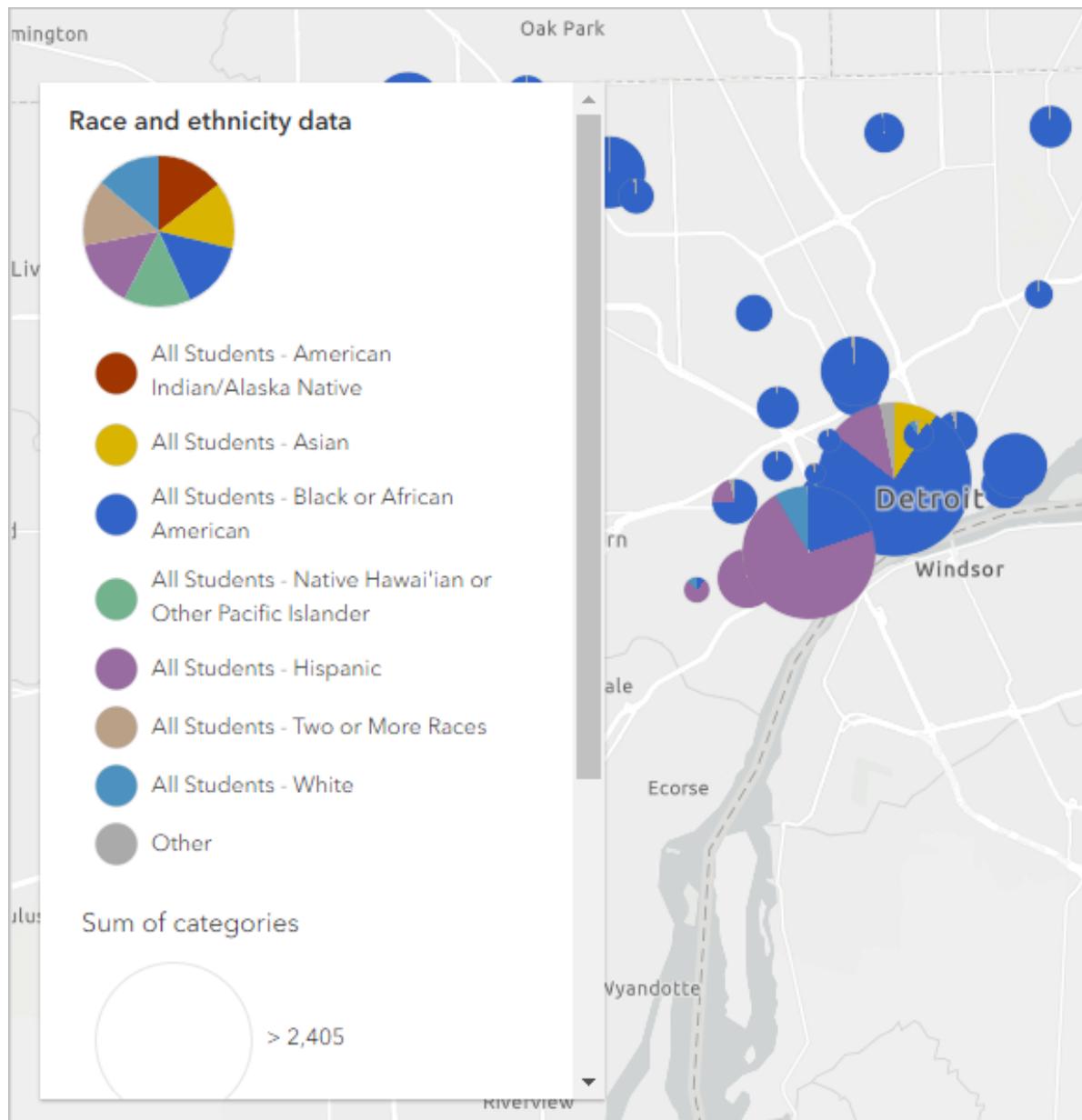
Add

Cancel

9. Click **Add**.
10. Under **Pick a style**, click the **Charts and Size** style.



The layer style updates.



The map now shows pie charts of the student body's race and ethnicity categories. The sizes of the pie charts represent the number of students at the schools.

11. Save the map.

## **Update the Item Details**

Your map now tells a story about the locations and some socioeconomic attributes of public high schools. For example, the school with the largest number of students eligible for FRPM programs is Western International High School in southwest Detroit. Many of the schools have a high percentage of students who identify as Black or African American. In southwest Detroit, there are more schools with higher percentages of Hispanic or Latino students.

By saving your map, you also created a corresponding item page that contains information, actions, options, and settings for the map.

1. On the Contents toolbar, click **Map properties**. In the Map Properties pane, click **Item details**.

Map properties X

Background ^

Enable background color

Indoor layers ▼

Map view ^

Preserve map scale  ⓘ

Time ^

Time zone  ⓘ

Device time zone

Specific time zone

Data's time zone (no adjustments)

Time slider options >

Item details

Your map's item page opens in a new browser tab. The item details are missing important attribution and descriptive information that you will fill in before you share the map. For example, you must give credit to the data providers.

2. Scroll to the bottom of the page. Next to **Credits (Attribution)**, click **Edit**.
3. Type **National Center for Education Statistics' (NCES) Education Demographic and Geographic Estimates (EDGE)**. Click **Save**.
4. Close the item page's tab.

## **Final Steps:**

Well Done! You have now completed all the steps for this lab, where you (in theory) created your **second Web Map** using **ArcGIS Online**. Before moving on, make sure to:

1. **Take a screenshot** of your final web map, ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report ( see all the instructions in the handbook)
2. **For the Part B of this lab in your report. Replicate the process independently** by applying the same skills you practised in this lab, but using **spatial data from Scotland or the UK** ( see the Data sources sections for a comprehensive list of data sources).

In the original lab, you have created a web map with a .csv file of school location and demographic data. For your **independent spatial analysis**, you can choose a different theme and dataset (e.g. healthcare access, education, environmental risk), as long as you also:

- Use again **ArcGIS Online** using your university credentials. **Meet and work with your classmate to define which account want to use . You must only report one independent analysis results.**
- Apply the same techniques learned in this lab (e.g. adding external data (excel), symbolising data, filtering, configuring pop-ups, etc).
- And create a web map with a **clear purpose** relevant to a real-world issue in Scotland or the UK.

This additional task is an opportunity to improve your technical skills, explore new datasets, and demonstrate your ability to adapt spatial analysis methods to new contexts.

---

## **Adding other data types**

There are several maybe hundreds of spatial data types, and often you will find data in formats that you even would not know about it, fortunately ArcGIS Online and other Cloud-GIS platform are supporting connections to most of the spatial data formats. Here are some resources to help you understand how to connect and manage data from not the usual **.shapefile** or **.csv** formats.

1. [ArcGIS Online: Managing Data](#)
  2. [Add Items in ArcGIS Online](#)
- 

This tutorial is inspired from ArcGIS Online Learning resources available at:

<https://learn.arcgis.com/en/projects/create-a-map/>

# **Lab No 3: Mapping Meaningful Places in Your Community**

## **Overview**

In this lab, you will learn to identify and map meaningful places in your community using ArcGIS Survey123. This project involves designing a research study, collecting data through surveys, and analyzing the results to understand what places contribute to your community's identity and resilience.

**Estimated time of completion:** 60 Minutes

## **Learning Objectives**

By the end of this lab, you will be able to:

- Design a research project with clear objectives and methodology
- Create digital surveys using ArcGIS Survey123
- Collect and analyze spatial data about community places
- Visualize data patterns using heat maps and other analytical tools
- Draw conclusions about community identity and important places

**Estimated time of completion:** 45 Minutes

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## **Part 1: Design Your Project**

### **Step 1: Formulate a Research Question**

Before collecting any data, you need to establish a clear research question that will guide your entire project. Your research question should address: **Why are you collecting data? What do you want to know?**

**Task: Write a research question to guide your project about important places in your community.**

**Examples:** - What places in my community have social, economic, and political value and add to my community's identity? - What places in my community contribute to its identity?

**Scottish Context:** - What places in Edinburgh contribute most to the city's cultural identity beyond the obvious tourist attractions? - How do community spaces in Glasgow neighborhoods support local resilience and social cohesion? - What locations in the Scottish Highlands are most valued by local residents for their cultural and economic importance?

**Step 2: Plan Your Data Collection**

Now that you have your research question, consider what kinds of data you need to collect. **Think about the who, what, when, where, and why of your data collection.**

**Task: Write five sample questions that you can use to collect data to answer your research question.**

**Example Questions:** - What is the name of this place? - Why is it important to you? - What activities do you do at this place? - How often do you visit here? - Who is there with you? - How many people are typically there with you?

**Step 3: Consider Data Types**

Different types of questions collect different types of data (numbers, text, dates, rating scales, images). Planning your data types in advance will make analysis easier later.

**Task: Write 5 survey questions, keeping in mind your research question and the types of data you want to collect about each location.**

**Sample Survey Questions Table:**

Question	Options	Data Type
What is the name of this place?		Text
Where is this place?		Map

Question	Options	Data Type
What kind of place is this?	School, Neighborhood, Park or open space, Library, Market, Shopping center, Religious space, Community center, Memorial or historic site, Restaurant, Performing Arts space, Other community space	Single select
How do you interact with this space?	To spend time with family, To spend time with friends, To exercise, For recreation, To shop, To learn, To worship, Other	Multiple select
How important is this place to you?		Rating
How many times per week do you visit this place?		Number
What kinds of challenges might this place face?	Climate threats and adaptability, Funding challenges, Land use change and development, None	Multiple select
Upload a photo of this location		Image

**Scottish Context:** For “What kind of place is this?” you might add: Village hall, Distillery, Castle/Historic site, Farmers market, Pub, Community sports club, Gaelic cultural center - For challenges: “Highland depopulation,” “Tourism pressure,” “Language preservation needs,” “Weather-related access issues”

#### Step 4: Determine Sample Size

Consider how many responses you need to answer your research question effectively. Also consider potential data bias - does your sample represent the population you’re trying to understand?

**Task: Decide how many data points you need to collect and from how many different people - Set a goal as a class for how many data points you need to collect and how many people you should survey**

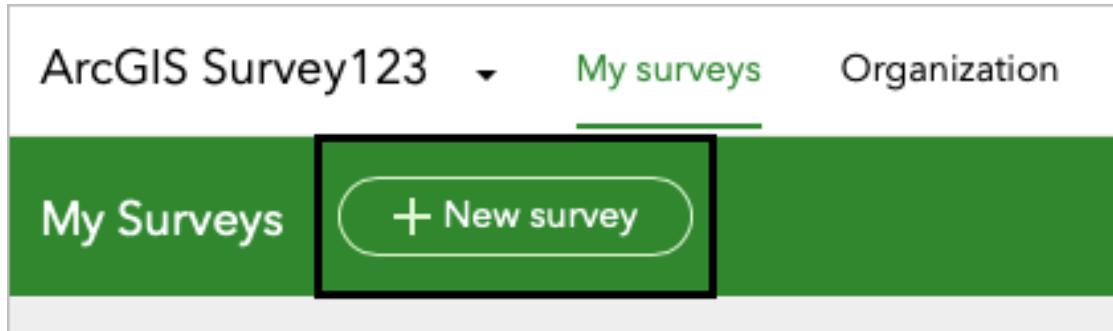
**Note:** Be aware of data bias. If you only survey your classmates, your data will tell you what's important to people your age, but may not represent the broader community.

---

## Part 2: Create the Survey

### Step 5: Set Up ArcGIS Survey123

1. Go to the [ArcGIS Survey123](#) website and sign in with your ArcGIS Online account
2. Click New survey



3. For Blank survey, click **Get started**

## USING THE WEB DESIGNER



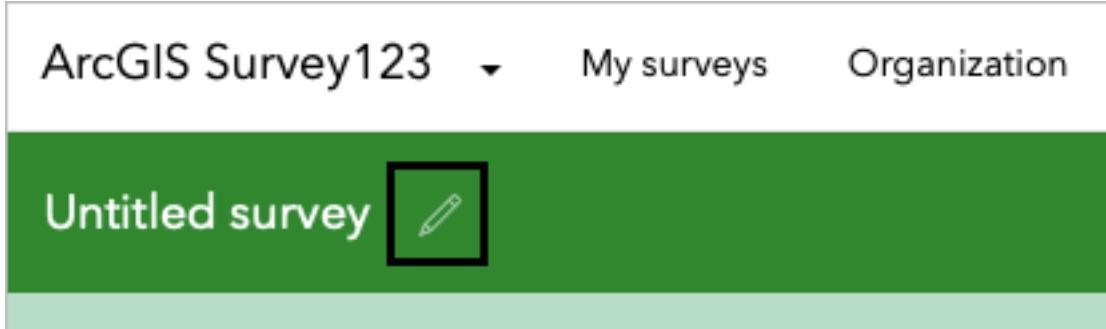
### Blank survey

- Start from scratch
- Design your own survey
- Use a drag-and-drop editor

[Get started](#)

### Step 6: Configure Survey Information

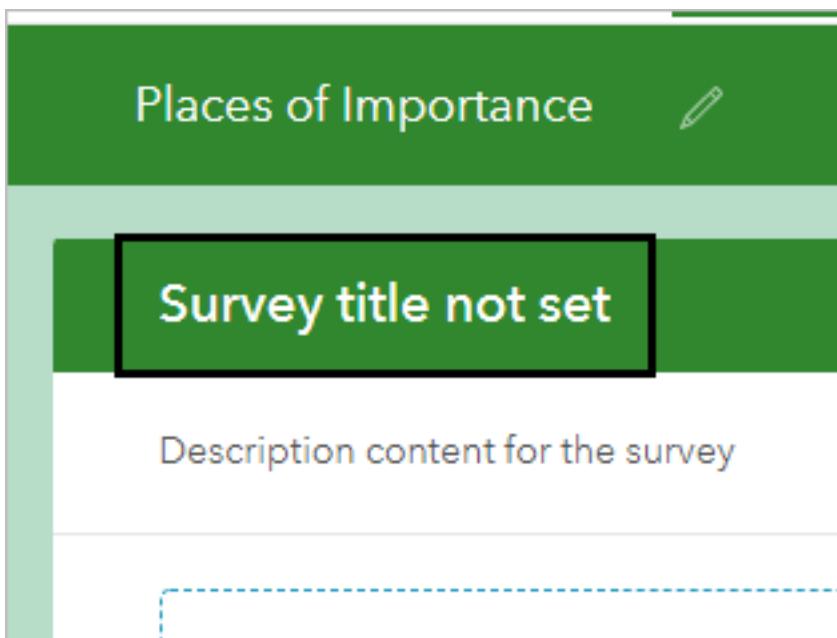
1. On the ribbon, click the **Edit survey info** button



2. In the Edit survey info window, for Name, delete “Untitled survey” and type “Places of importance”
3. Click **OK**

#### Step 7: Add Survey Title and Description

1. Click **Survey title not set**



2. In the Survey header pane, delete the existing text and type “Places of importance in our community”

**Survey header**

Text       Image

Text

Places of importance in our community

Alignment:

Tip: Header background and text color can be changed in the Appearance -> Theme section.

3. In the survey builder pane, click **Description content for the survey**

Places of importance in our community

Description content for the survey

4. In the Survey description pane, delete the existing text and type:

What places in the community have social, economic, or political value and add to my com

## Step 8: Add Questions to the Survey

### Add Text Question

1. In the Survey description pane, click the **Add** tab

The screenshot shows a software interface for creating a survey. At the top, there is a horizontal toolbar with four tabs: 'Add' (highlighted with a black border), 'Edit', 'Appearance', and 'Options'. Below the toolbar, the text 'Survey description' is displayed. Underneath this, there is a rich text editor toolbar with various formatting options like bold (B), italic (I), underline (U), and font size (x-small). The main content area contains the question text: 'What places in the community have social, economic, or political value and add to my community's resilience?'

2. Find the **Singleline text** question and drag it into the survey pane

The screenshot shows a survey creation interface. On the left, there's a list of questions with a placeholder "Your community". On the right, there are buttons for "Add" and "Edit". Below the list, a message says "You can add a social, economic, or political value and add to my survey". A callout box highlights the "Singleline text" option under "Text, number, date, and time". A dashed blue box encloses the text "on the right panel to add your first question." An arrow points from this text to the "Singleline text" option. At the bottom, there's a "Submit" button and a "Choice" section.

Text, number, date, and time

Singleline text

Email

Number

Time

Submit

Choice

3. On the Edit tab, for Label, type “What is the name of this place?”
4. For Validation, check the box for “This is a required question”

The screenshot shows the "Validation" tab settings. It includes a checked checkbox labeled "This is a required question", a "Constraint" field with a "Use an expression to restrict the answer" input, and a "Set input mask" field with a question mark icon.

Validation

This is a required question

Constraint

Edit

Use an expression to restrict the answer

Set input mask ?

## Add Map Question

1. In the Add pane, find the **Map** question type and drag it into the survey pane below the first question

The screenshot shows the ArcGIS Survey123 interface. On the left, there is a survey form with a question about landmarks in a community. On the right, there is an 'Add' pane containing various question types: Single choice, Single choice grid, Likert scale, Ranking, Location, Map, File, Image, and Signature. A large arrow points from the 'Map' button in the 'Add' pane to the 'Map' button in the survey form.

Survey Form Content:

- Question: What landmarks in our community have social, economic, or political value and add to my sense of place?
- Label: Where is this place?\*
- Hint: (empty)
- Submit button
- Powered by ArcGIS Survey123

Add Pane Content:

- Buttons: Add (green), Edit (light green)
- Question Types:
  - Single choice
  - Single choice grid
  - Likert scale
  - Ranking
  - Location
  - Map** (highlighted with a black border and an arrow pointing to it from the survey form)
  - File
  - Image
  - Signature

2. For Label, type “Where is this place?”
3. For Hint, type: “Keep in mind with maps that some information is personal: you probably shouldn’t share your home’s location nor other personal locations. But you can safely share locations like your city or a major intersection.”

## Map

### Label

Where is this place?



### Hint

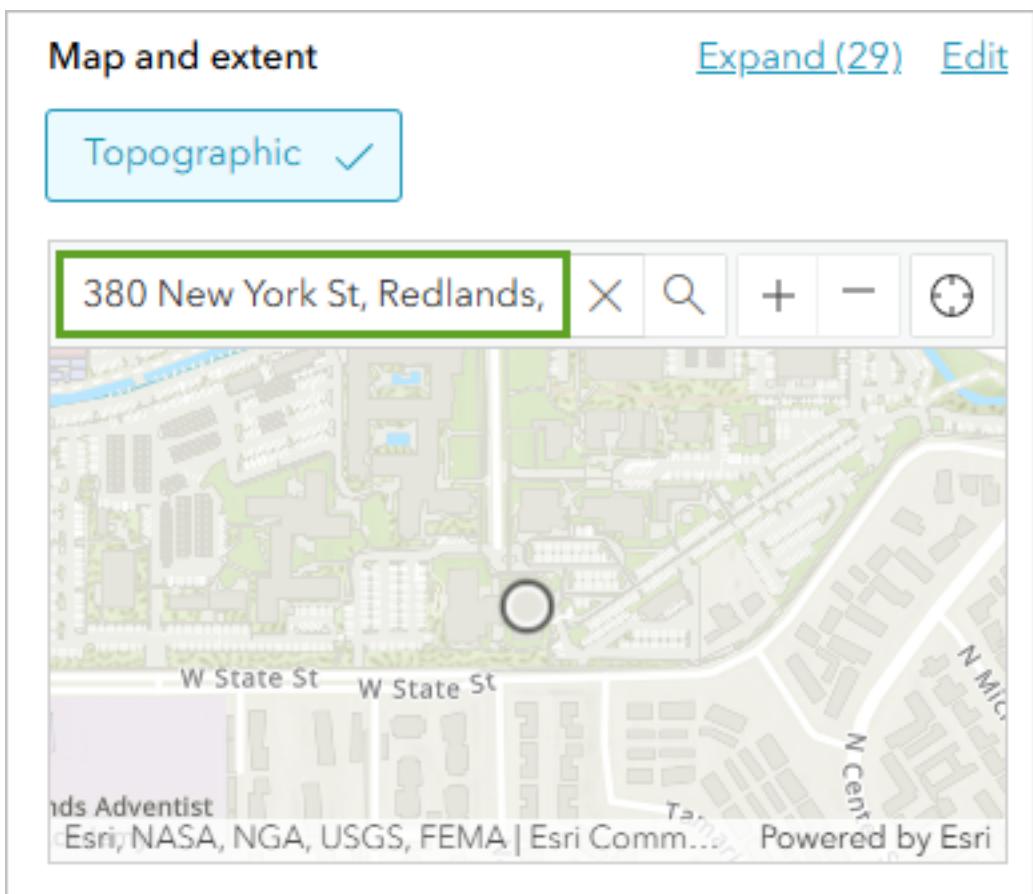
B A

≡ ≡ ≡ ≡

✖ ↕

Keep in mind with maps that some information is personal: you probably shouldn't share your home's location nor other personal locations. But you can safely share locations like your city or a major

4. For Drawing tools, make sure **Point** is selected
5. For Map and extent, type the address of your school and press Enter, or zoom and pan until you find your campus



6. For Default location, choose “Center of the map extent specified above”

## Locator

[Edit](#)

This question uses your organization's locators

ArcGIS World Geocoding Service

### Default location

- No default location
- Center of the map extent specified above
- Use device location and ask for location when answering this question 
- Use device location and ask for location when opening this survey 

7. For Validation, check the box for “This is a required question”

## Places of importance in our community

What places in the community have social, economic, or political value? How do these places contribute to the community's resilience?

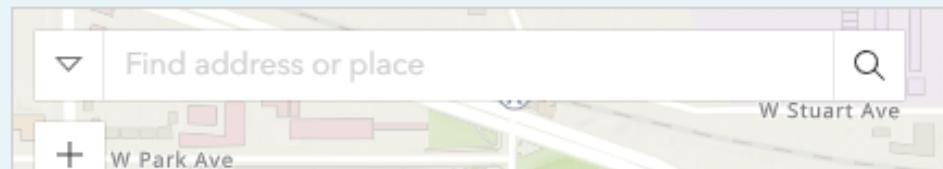
1

What is the name of this place? \*

2

Where is this place? \*

Keep in mind with maps that some information is personal: you probably don't want to share your home's location nor other personal locations. But you can safely share the location of a park or a major intersection.



### Add Additional Questions

1. Click the **Add** tab and add the rest of the questions you've formulated
2. Test various question types to see what will get you the best survey results
3. When you're finished adding your questions, at the bottom of the design pane, click **Save**

### Step 9: Publish Your Survey

1. Review your work to ensure everything's in the correct order, spelled correctly, and properly configured

2. Click **Publish** two times
  3. The survey may take a few minutes to publish
- 

## Part 3: Collect Data

### Step 10: Share Your Survey

1. In the Survey123 site, click the **Collaborate** tab



2. For “Who can submit to this survey,” check the box **Members of my organization (University of St Andrews)**

Who can submit to this survey?

Everyone (public)  
 Members of my organization (University of St Andrews)  
 Members of the following groups:

3. Click **Save**
4. For “Share this survey,” copy and share the link, or click “Show the QR code” to allow your class to open the survey

**Link**

<https://arcg.is/0na4PP>   

Open the survey in browser directly  
 Ask the user how to open the survey, in browser or in the Survey123 field app  
 Open the survey in the Survey123 field app directly. (Learn more about this option)

## **Step 11: Gather Survey Responses**

1. Have your classmates fill out and submit the survey. Ask your classmates to fill up your survey, you will need at least 20 replies to get enough data to analyse in the next part.
  2. Monitor the number of responses to ensure you meet your data collection goal
  3. Remember to consider data quality and potential bias as responses come in
- 

## **Part 4: Analyze Data**

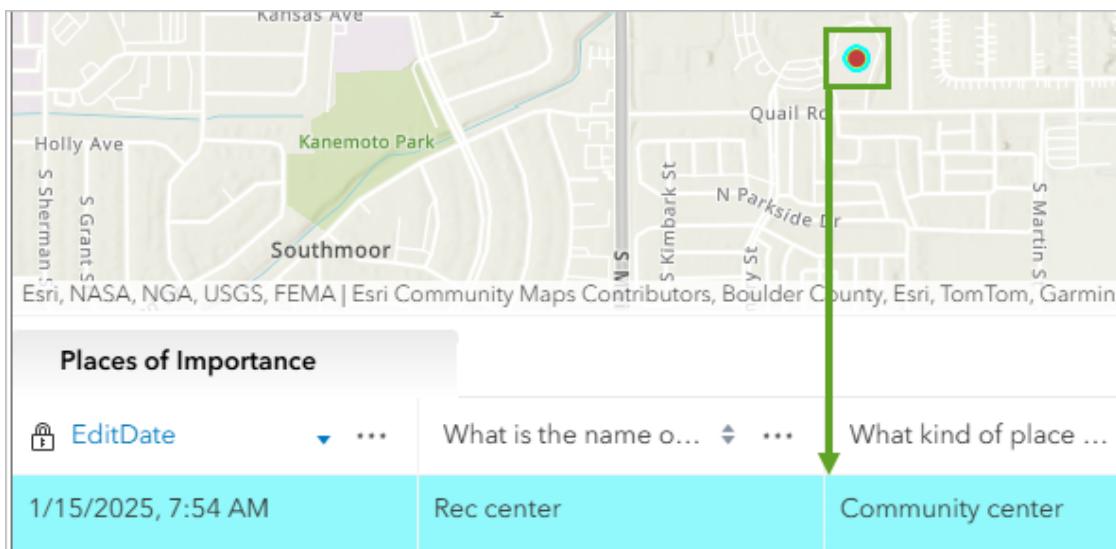
### **Step 12: Review Your Data**

1. Click the **Data** tab



The **Data** tab shows two main components—a map of the data points you've collected, and an attribute table. An attribute table is a table that organizes all the data about each point.

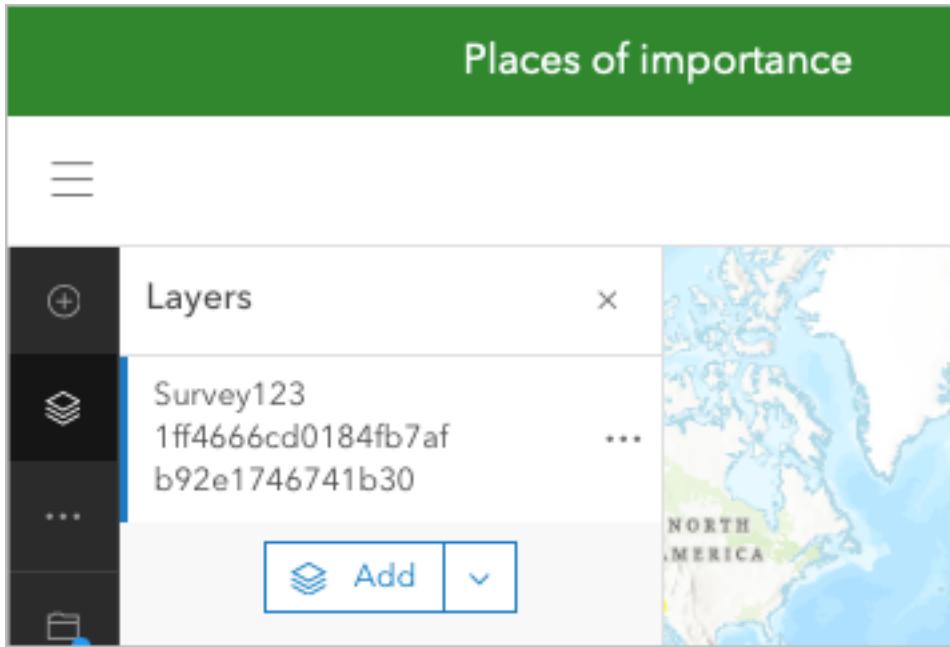
2. Examine both the map view and the attribute table
3. Click a point on the map to see the corresponding record highlighted in the attribute table



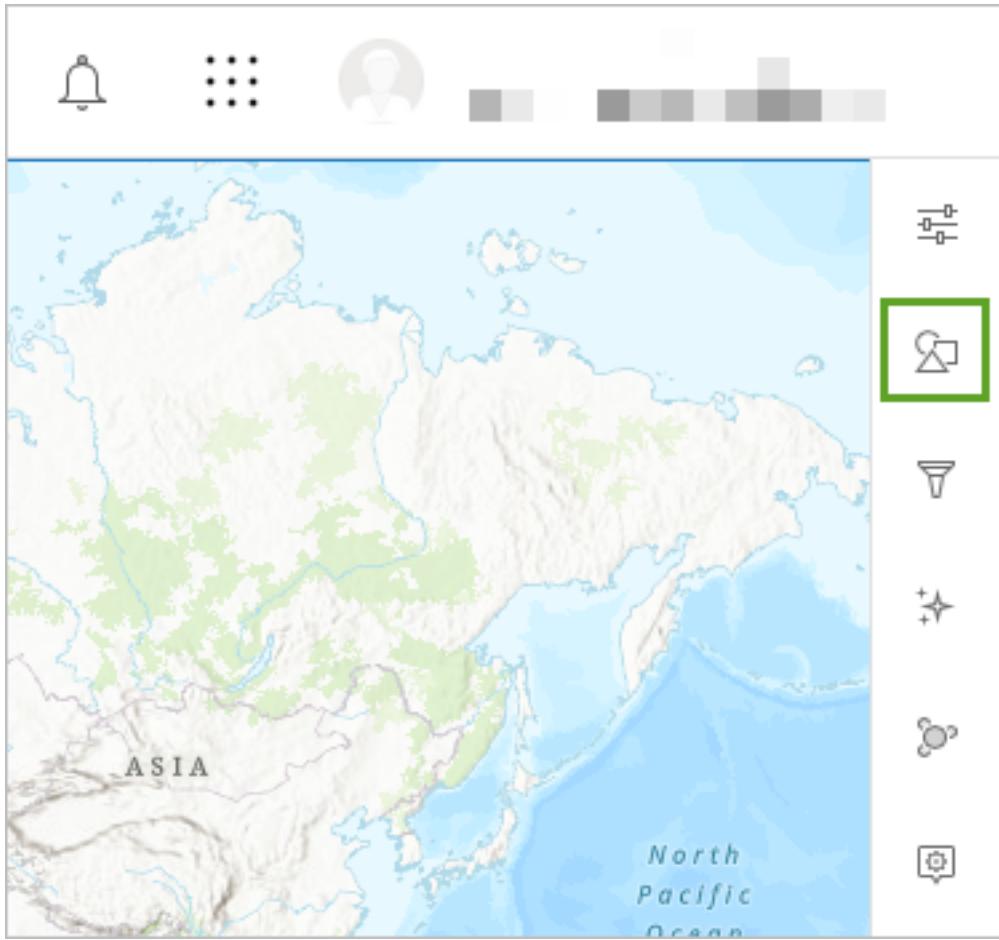
### Step 13: Create a Heat Map

1. On the Data ribbon, click **Open in Map Viewer**





2. On the Settings toolbar, click the **Styles** button



3. Under “Pick a style,” click **Heat map**, and click **Done**

Survey123 1ff4666cd0184fb7afb92 ✓

Styles X

Select the attribute or expression you want to style.

+ Field + Expression

💡 Add a field to start smart mapping. X

(2)

Pick a style

Choose attributes above for more styles.

Location (single symbol) ⓘ

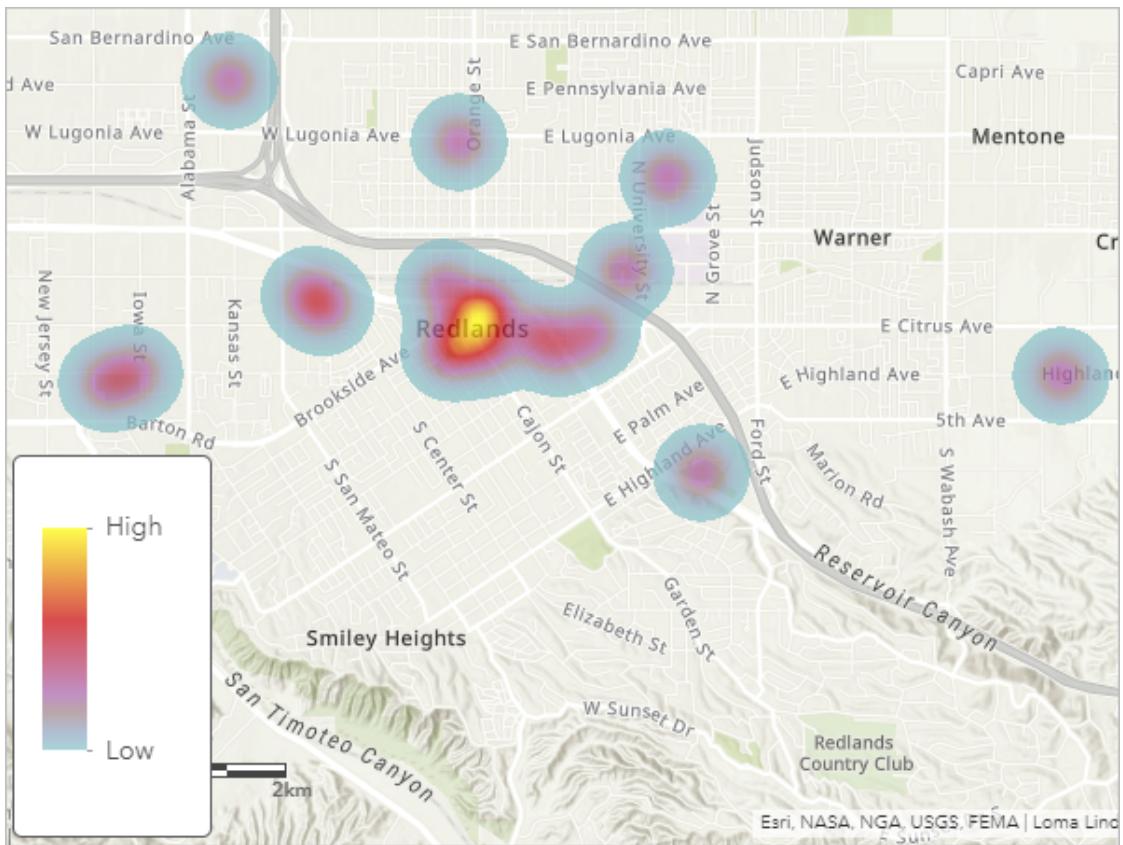
Style options

Heat Map ⓘ

Done Cancel

The screenshot shows the 'Styles' dialog box from Survey123. At the top, it displays the survey name 'Survey123' and a unique ID. Below the title, there's a note about selecting attributes for styling. Two buttons are available for adding fields or expressions. A callout bubble suggests adding a field to start 'smart mapping'. The main area is titled '(2)' and 'Pick a style'. It shows two options: 'Location (single symbol)' and 'Heat Map'. The 'Location' option is currently selected, indicated by a checked checkbox in its corner. Its details include a preview map with black dots and a 'Style options' button. The 'Heat Map' option is shown with a preview map featuring a red-to-blue gradient heatmap and an unchecked checkbox. At the bottom of the dialog are 'Done' and 'Cancel' buttons, with 'Done' being highlighted with a green border.

4. Zoom in to your study area to examine the heat map patterns

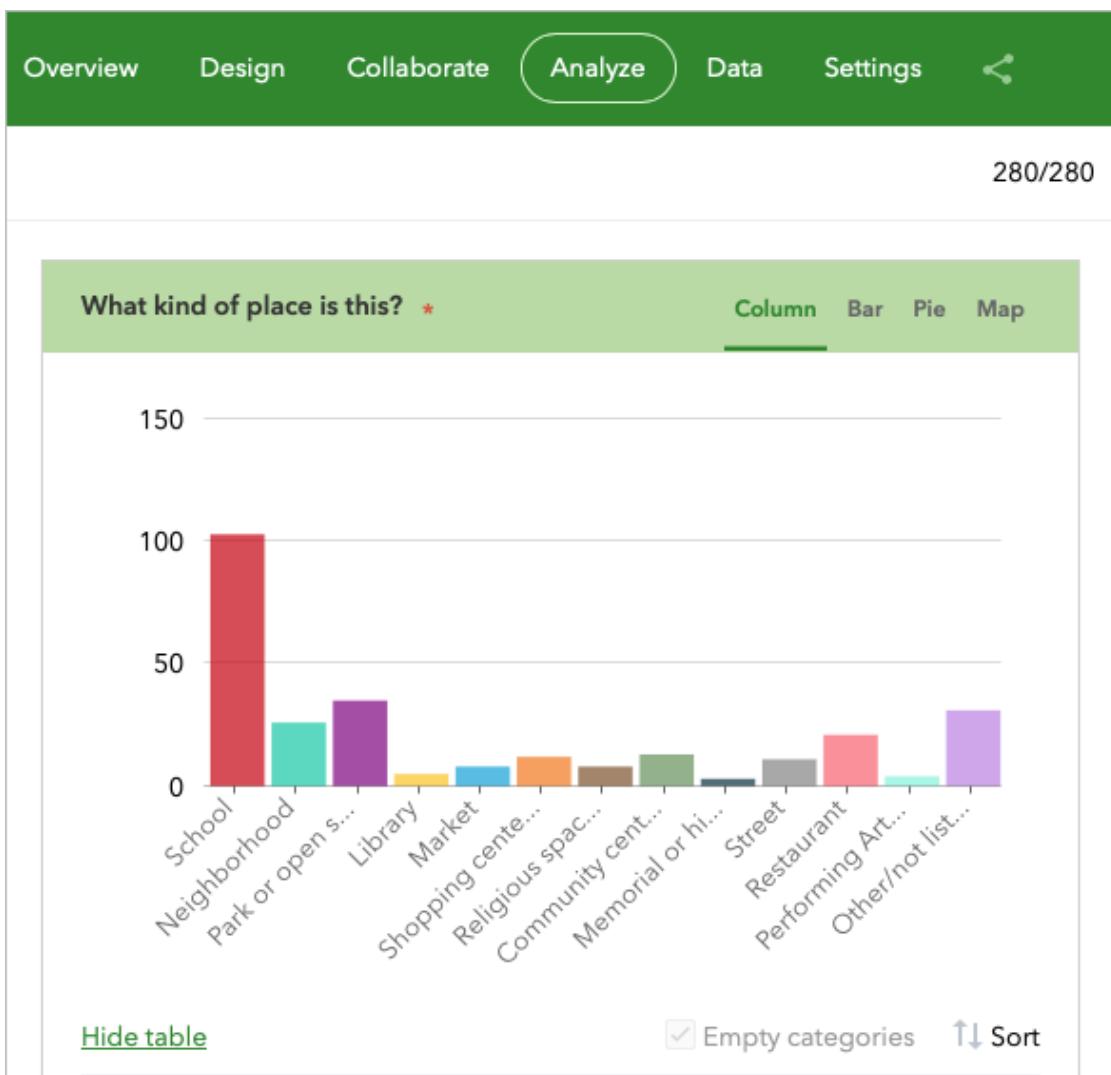


**Analysis Questions:** - Does your heat map show that many students think the same places are important? - Are there many different places that are important to students? - What patterns do you notice in the spatial distribution of important places?

**Scottish Context Analysis:** - Are important places clustered in city centers or distributed across neighborhoods? - Do rural and urban areas show different patterns of meaningful places? - Are there differences between places important to different age groups or communities?

#### Step 14: Analyze Survey Responses

1. Close the Map Viewer window
2. On the ribbon, click the **Analyze** tab



3. Review how each question was answered
4. Look for patterns, similarities, and differences in responses

**Analysis Questions:** - What similarities do you notice about your class's answers? - What differences stand out? - Are there any surprising results? - Do the results vary by demographic characteristics?

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## **Part 5: Draw Conclusions**

### **Step 15: Evaluate Your Research Question**

Return to your original research question and consider whether your data adequately answers it.

**Questions to Consider:** Does your data answer your research question? - What places in your community appear to have the most social, economic, or political value? - What contributes to your community's identity based on your findings? - Are there gaps in your data that need to be addressed?

### **Step 16: Consider Data Limitations**

Reflect on potential limitations in your data: - Who was surveyed and who was not? - What biases might exist in your sample? - What additional data might strengthen your conclusions?

**Scottish Context:** - Does your data represent different Scottish communities (urban/rural, Highland/Lowland)? - Are there cultural or linguistic factors that might affect responses? - How might seasonal variations affect the importance of certain places?

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## **Final Steps:**

Well Done! You have now completed all the steps for this lab. Before moving on, make sure to:

1. **Take one screenshot** of the map you created when you analyse the data collected. Ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report ( see all the instructions in the handbook)
2. **For the Part B of this lab in your report. Replicate the process independently** by applying the same skills you practised in this lab, but using **spatial data from Scotland or the UK**.

In the original lab, you have created a survey with the support of your classmates. For your **independent spatial analysis**, you can choose a different theme and dataset (e.g. healthcare access, education, environmental risk), as long as you also:

- Use again **ArcGIS Online** using your university credentials. **Meet and work with your classmate to define which account want to use . You must only report one independent analysis results.**
- Apply the same techniques learned in this lab. This lab demonstrates the complete process of spatial data collection and analysis, from research design through data interpretation. The skills you've learned can be applied to any research question involving spatial data and community analysis. Consider how similar methodologies might be used to study other aspects of community life, cultural heritage, or environmental issues in Scottish contexts.
- Include the screenshot of the web map created using the data collected in this new survey with a **clear purpose** relevant to a real-world issue in Scotland or the UK.

This additional task is an opportunity to improve your technical skills, explore new datasets, and demonstrate your ability to adapt spatial analysis methods to new contexts.

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# **Lab No 4: Examine Global Poverty Using UN SDGs**

## **Overview**

Have you ever considered where pockets of poverty exist and who is most affected? Unfortunately, global trends show that children are most impacted by poverty. Around the world **385 million children** live in extreme poverty, and in 2013 the World Bank found that **19.5 percent of children** in 89 countries lived in a household that survived on U.S. \$1.90 per day per person or less.

**Estimated time of completion:** 70 Minutes

## **Learning Outcomes**

By completing this tutorial, you should be able to:

- **Access and download** UN SDG data from official portals
- **Prepare and clean** spatial data for analysis
- **Create feature layers** in ArcGIS Online through geocoding
- **Perform spatial joins** to combine multiple datasets
- **Create choropleth maps** to visualize quantitative data
- **Develop bivariate maps** to compare multiple indicators
- **Configure effective pop-ups** and legends for data communication
- **Apply spatial analysis techniques** to real-world policy questions

These skills are transferable to many other contexts, including local and national policy analysis, environmental monitoring, public health studies, and economic development planning.

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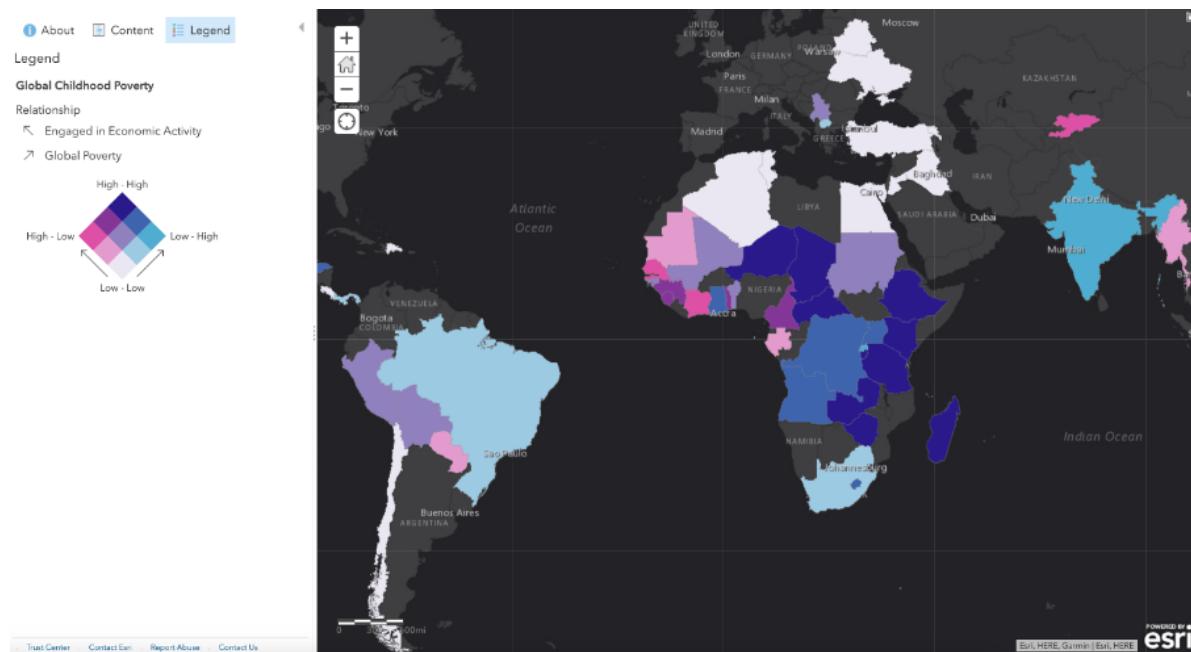
## Why is poverty such a critical issue?

Because it relates to the overall well-being of a person. Those living in poverty may lack access to basic food, housing, and healthcare. Growing up without consistent nutrition, shelter, and safety can have long-lasting developmental impacts on children and can cause lifelong problems.

**Scottish Context:** In Scotland, child poverty affects approximately 24% of children (around 240,000 children), with particular concentrations in areas like Glasgow, Dundee, and parts of Edinburgh. The Scottish Government has committed to reducing child poverty to less than 10% by 2030 through the Child Poverty (Scotland) Act 2017.

In 2015, the United Nations and world leaders developed a series of goals to improve situations for people, places and environments globally. In total, there are **17 Sustainable Development Goals** that nations are striving to meet by 2035. This activity focuses on **Goal 1: No Poverty** and corresponding indicators that can be used to measure poverty.

## Protecting Children with UN Sustainable Development Goals



## **Step 1: Visualize Global Poverty**

Sustainable Development Goal 1, “**No Poverty**” is achieved when we “End poverty in all its forms everywhere,” and “should be understood as deprivation beyond the lack of income and resources to ensure a sustainable livelihood.”

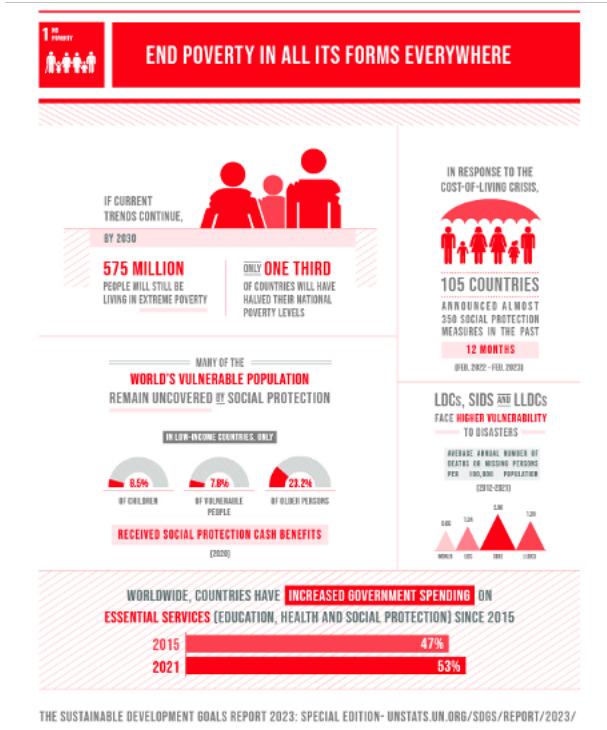
**Key Definition:** Poverty is felt through hunger, malnutrition, limited access to basic services and educational opportunities, social discrimination and exclusion. In order to secure a future of sustainable economic growth, it is essential for countries to promote economic equality.

### **Task 1.1: Understanding SDG Goal 1**

1. Visit the [UN Sustainable Development](#) site.

Most of the data for the Sustainable Development Goals is curated and maintained by the UN Statistics Division. There are also countries that host their own open data portals featured on the data page.

2. Scroll down and find the section called **Sustainable Development Goals**, click the first goal, **No Poverty**.
3. **Familiarize yourself** with this goal - take some time to understand **what this goal is about** and **why it is the first goal**.



THE SUSTAINABLE DEVELOPMENT GOALS REPORT 2023: SPECIAL EDITION- UNSTATS.UN.ORG/SDGS/REPORT/2023/

**Scottish Policy Example:** Scotland's approach to SDG 1 includes the Scottish Child Payment (£25 per week per child under 16), free school meals, and targeted support for families in the most deprived areas. The Scottish Index of Multiple Deprivation (SIMD) is used to identify areas requiring priority intervention.

### Task 1.2: Accessing UN Data Portal

- After you get a better understanding about the main facts that you can measure within this goal, now let's apply the geographical approach to create web maps and apps that help you represent spatial data related to this goal.

Go to <https://unstats.un.org/sdgs/databoarding/database> and get the data related to the **1.1.1 indicator**. Which corresponds to **Proportion of population below international poverty line (%)** -> **\$2.15 per day**. Once you are in the portal, follow the next options to get the required data.

- In the **Data Series** type or select the **1.1.1 Indicator**, in the **Countries, areas or Regions** section, click on **Countries or Areas**, and for **Period** make sure you selected only the **2017** year. (you should have around 783 observations). Click **Show Results**.

Data Series (Selected 2 of 693)  
 1.1.1 x  
 + Select

Countries, areas or regions (Selected 211 of 211) All Groupings Countries or areas  
 Afghanistan x Albania x Algeria x American Samoa x Andorra x Angola x Anguilla x + 255 ...  
 By default "All" is selected.  
 + Select

Period Range Years (1 of 61)  
 2017 x  
 You can select single year or multiple years  
 783 observations **Show Results**

**Expected Result:** You will see a couple of tabs open up at the bottom corresponding to:

- Proportion of population below international poverty line (%) SI\_POV\_DAY1
- Employed population below international poverty line, by sex and age (%) SI\_POV\_EMP1 indicators

Expand the **SI\_POV\_DAY1** tab. At this point you should have a preview of a table that includes countries and 2017 poverty values. Now click **Download XLS**.

SI\_POV\_DAY SI\_POV\_EMP1

Indicator 1.1.1, Series - Proportion of population below international poverty line(%) SI\_POV\_DAY1

Disaggregated by Age Location Sex

Country	2017
Albania	0.41%
Algeria	-
Angola	-
Argentina	0.61%
Armenia	0.81%
Australia	-
Austria	0.31%

Previous 1 2 3 4 5 ... 24 Next 7 / page Go to 488 observations **Download XLS**

### Task 1.3: Data Preparation

6. Open the downloaded file - you will see several countries are duplicated, due to data being collected at different scales (e.g., Sex, Location, Age). Filter the data to show only:

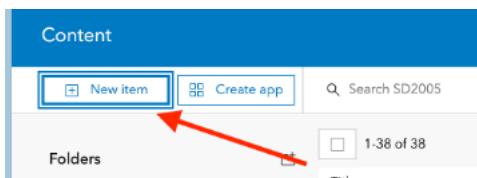
- **Sex:** BOTHSEX
- **Location:** ALLAREA
- **Age:** ALLAGE

Now you should have **75 records**. Save the filtered table as a new Excel file (name it **1\_1\_1\_indicator\_filtered.xlsx**).

**Important Note:** Data filtering is crucial for accurate spatial analysis. In Scotland, similar filtering would be applied when working with data from the Scottish Government's statistics portal, ensuring consistency across geographic areas and demographic groups.

### Task 1.4: Creating a Feature Layer in ArcGIS Online

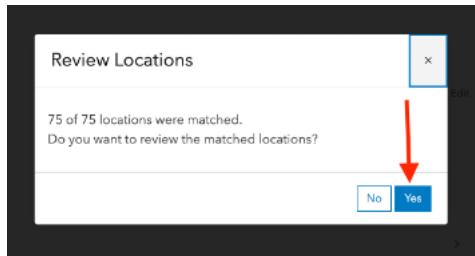
7. Go to **ArcGIS Online**, sign up with your university credentials and go to **Content**. Now you will upload the filtered Excel file and create a **Feature Layer** with the data you downloaded and filtered.
8. Click **New Item**



9. Drag and drop your file or choose **Device** option and select the filtered Excel file (e.g., `1_1_1_indicator_filtered.xlsx`)
10. When ArcGIS Online asks “**How would you like to add this file?**” Select the first option: *Add and create a hosted feature layer or table*. Click **Next**.
11. In the **Field Box**, the 13 columns are selected - no need to do anything here, just click **Next**.
12. In the **Location Settings**, select **Addresses or place names**. Open the **Advanced location settings** and select **World** in the **Region** box. Now in **Location fields**, make sure **Location information is in one field** is selected. Then in front of **Address or Place**, select the Field **GeoAreaName**, click **Next**.

**Credit Usage Warning:** You will use approximately 3 Credits from your ArcGIS Online Account for this geocoding process.

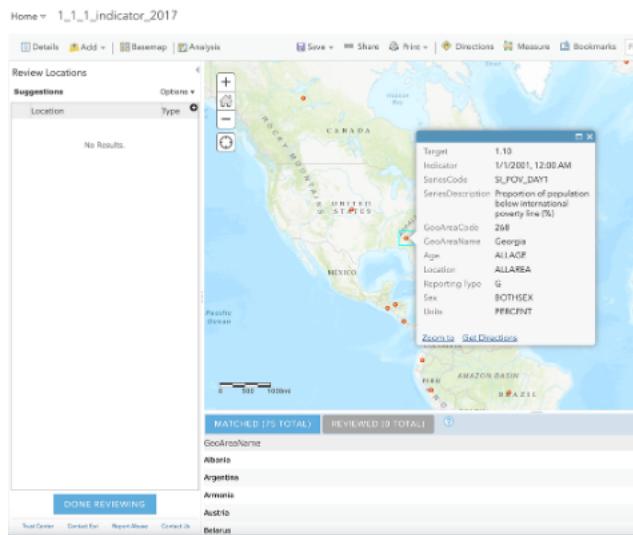
13. Finally, provide a **title**, **tag**, and **summary** of the feature layer you are creating. Click **Save**.
14. ArcGIS Online will host your Excel file, geocode all the rows based on the name of the country (that's why it uses credits) and then create a feature layer (the spatial data) that you can use to create web maps based on that indicator.
15. If you get a warning/notification, please click **YES**.



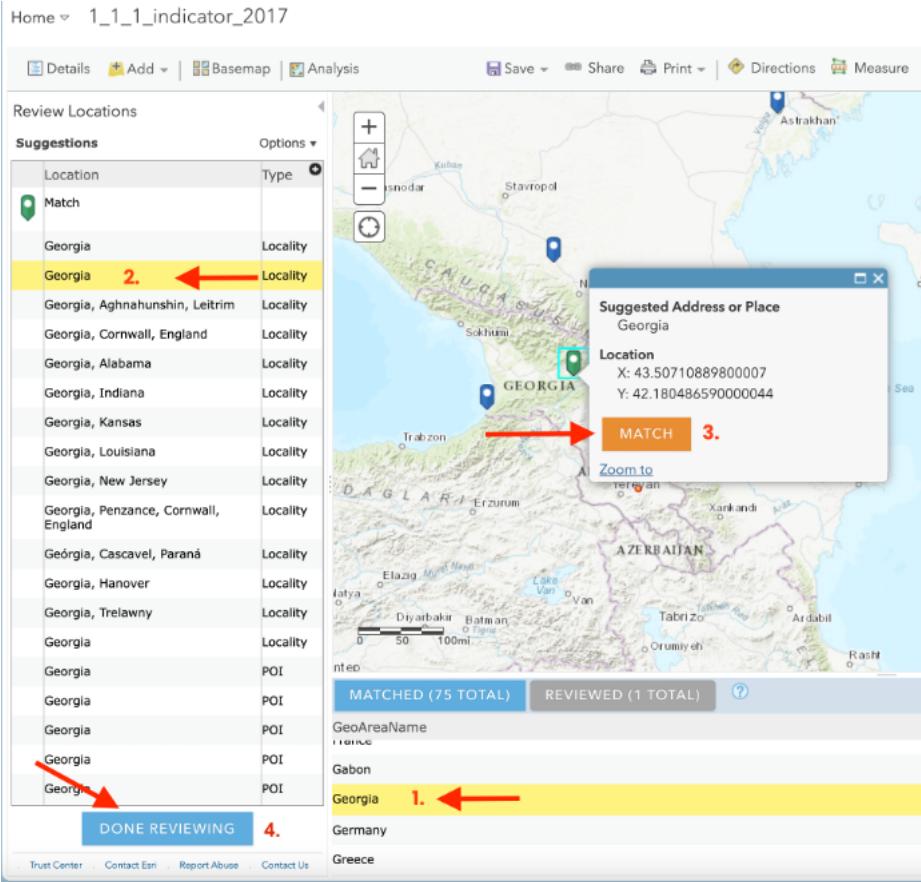
## Task 1.5: Correcting Geocoding Errors

**Common Issue:** One common problem in geocoding when using names is that you could get locations in places that do not correspond to the intended place. ArcGIS Online provides a way to correct those mislocated places.

- Once you have the Map Viewer open, you will notice that **Georgia** has been automatically coded to be in the USA.

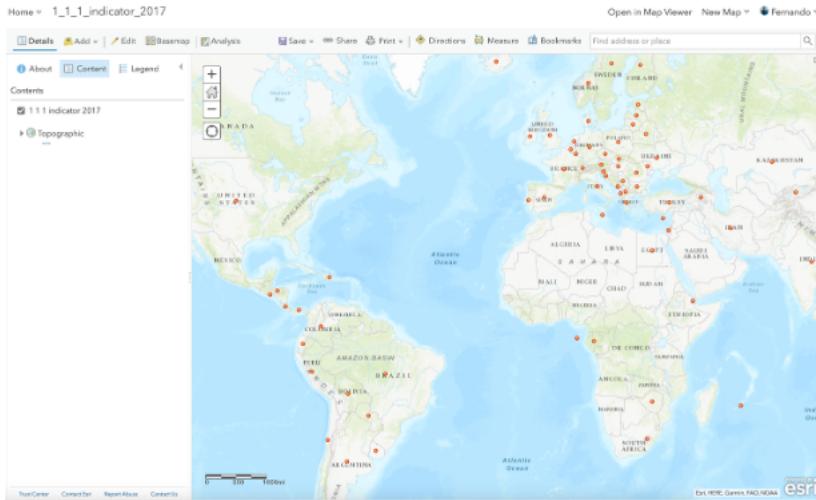


- Using the table at the bottom, locate **Georgia** and select it. You will see on your left a list of all the potential candidates that ArcGIS Online used to geocode Georgia. If you click on the **third option**, you will realize that one is the correct match (the country Georgia, not the US state). Click **Match** and then **Done Reviewing**.



**Scottish Example:** Similar geocoding issues might occur with place names like “Perth” (which could be matched to Perth, Australia instead of Perth, Scotland) or “Hamilton” (which might be matched to Hamilton, Canada instead of Hamilton, Scotland).

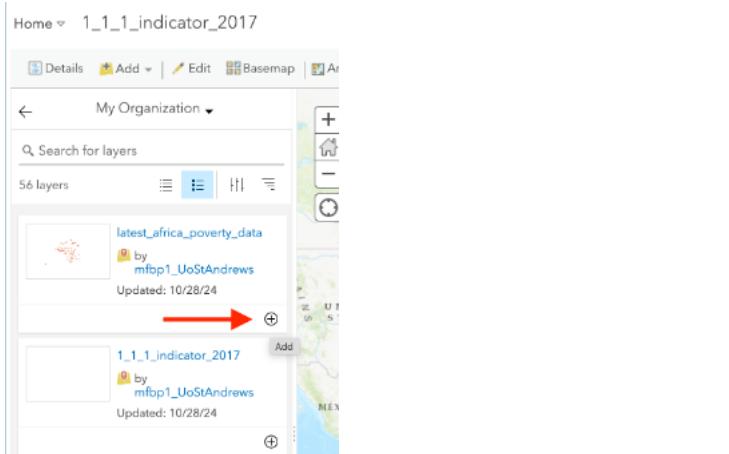
18. Once your geocoding process has finished, your map should look like this:



**Observation:** You will notice that most of the African countries have not reported any data, but here is when we can use and merge other data sources. We can use data reported by the [World Bank](#) to merge with the data you have geocoded.

### Task 1.6: Adding Additional Data Sources

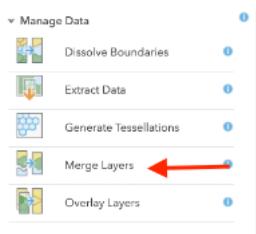
- Click **Add** and **Search For Layers** to look for a published service. Make sure you have **My Organization** selected, and then type `latest_africa_poverty_data`, and add the layer published by `mfbp1_UoStAndrews`.



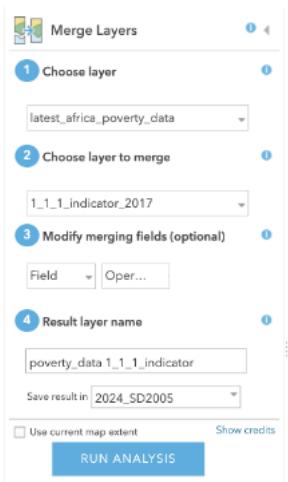
- Click **Details** again to see the table of contents with the two layers you have added to your map or click the back arrow to close the pane. In the **Contents** pane, hover over your `latest_africa_poverty_data` layer and click the **Perform Analysis** button.



21. Then in **Manage Data**, select **Merge Layers**.

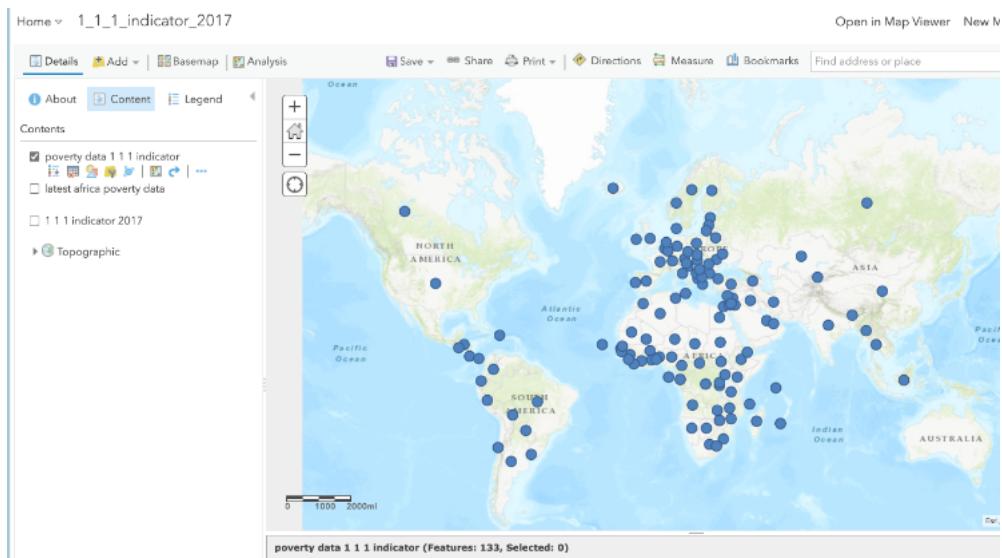


22. Make sure you have selected your poverty data layers and add a clear title (e.g., *poverty\_data\_1\_1\_1\_indicator*). **Important:** Don't forget to uncheck the “Use current map extent” option. Click **Run Analysis**.



**Processing Note:** Give ArcGIS Online some time to process your analysis, and you will have a single layer that joins the poverty data for most of the countries.

**Technical Tip:** A key aspect you need to consider for future data joins is ensuring how the attributes will be joined. In this case, both poverty values are included as integers and the heading is called “2017”, which has allowed us to have one single column with the values we need to plot a **world poverty map**.

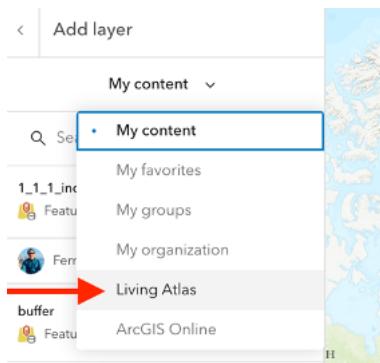


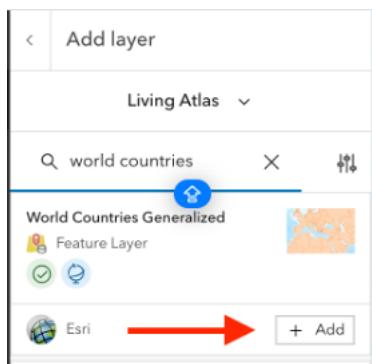
23. Click **Save** to save the current web map to your account. Add the title: “**Indicator 1.1.1: Proportion of population below the international poverty line (percent)**”

### Task 1.7: Converting Points to Polygons

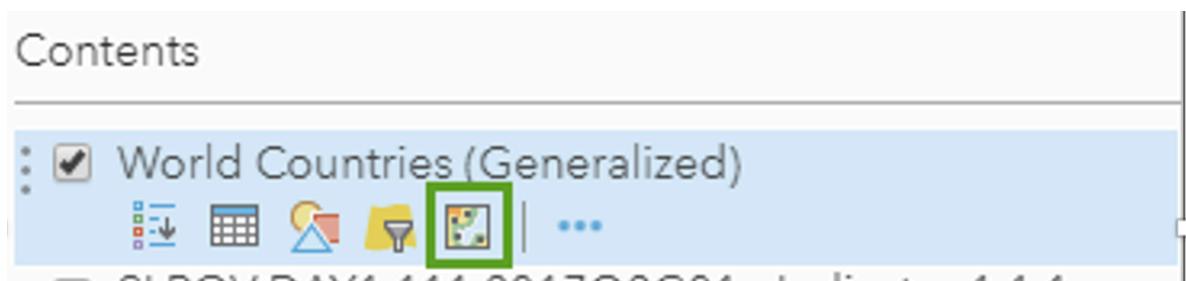
**Current Issue:** The data appears as points, but to better visualize it, the data should be converted to polygons.

24. On the ribbon **Layers**, click **Add**, then click **Living Atlas Layers**. Search for “*world countries*” and add one of Esri’s World Countries layers by clicking the plus.



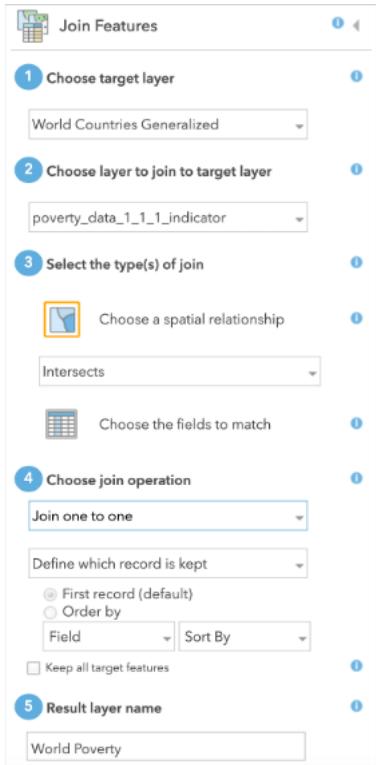


25. Click the back arrow to close the pane. In the **Contents** pane, hover over your **World Countries** layer and click the **Perform Analysis** button.



25. On the **Perform Analysis** pane, expand **Summarize Data**, then click **Join Features**.
26. Configure the join as follows:

- **Number 1, Choose target layer:** Set to **World Countries**
- **Choose layer to join to target layer:** Choose the **Indicator 1.1.1** layer
- **Select the type(s) of join:** Click **Choose a spatial relationship** and choose **Intersects**
- **Choose join operation:** Make sure **Join one to one** is selected

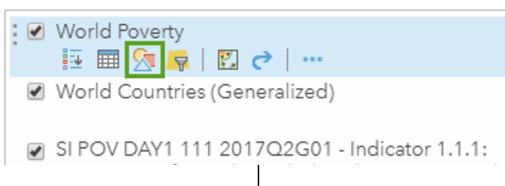


28. Name the layer **World Poverty**, uncheck the “Use current map extent” box, and click **Run Analysis**.

**Result:** When the analysis finishes, the layer will be added to the map. By default, all the countries are shown in the same color. To see the data, you’ll change the symbology to show a choropleth map.

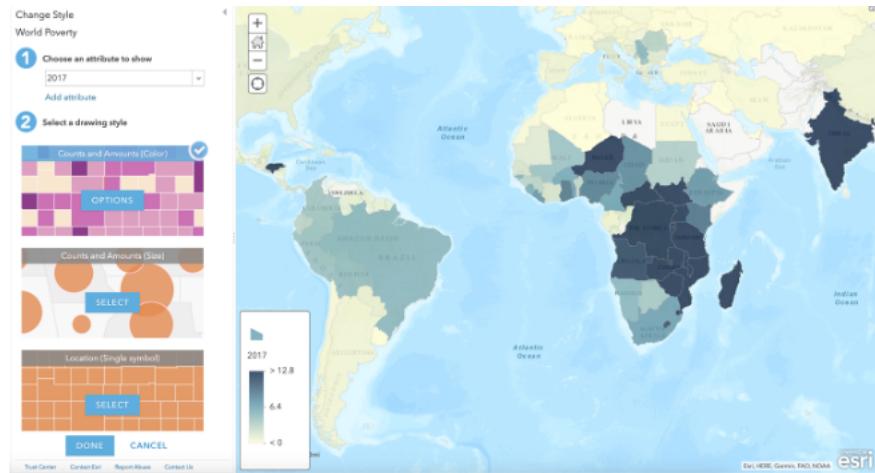
### Task 1.8: Creating a Choropleth Map

29. Uncheck all layers except for **World Poverty**, then hover over the **World Poverty** layer and click the **Change Style** button.

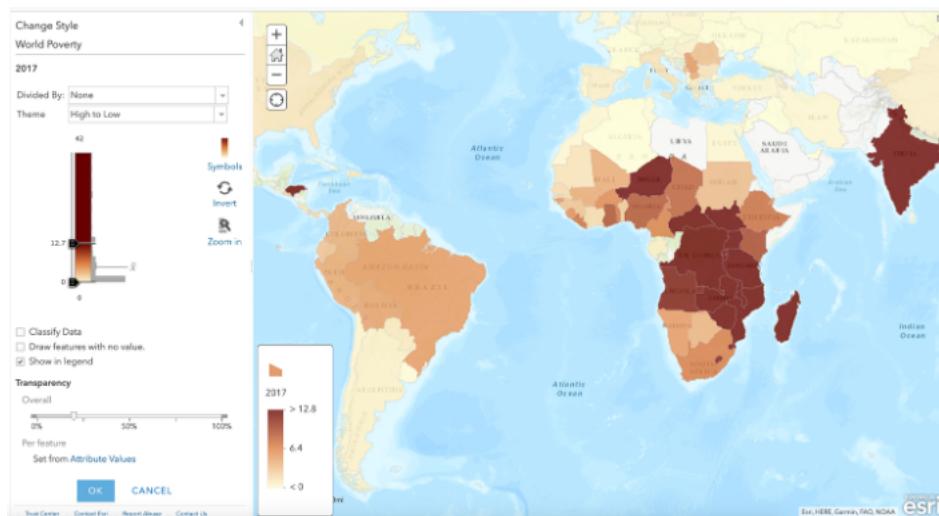


30. On the **Change Style** pane, expand the **Choose an attribute to show** menu and choose **2017**.

**Understanding the Data:** “2017” is the attribute that shows the latest reported value for any country that has reported data. The countries are symbolized with a default graduated color scheme that shows low values in light yellow and high values in dark blue. The light yellows blend into the basemap, so before analyzing the map, you’ll change the symbology.



- For **Counts and Amounts (Color)** click **Options**, then click **Symbols**. Choose a color ramp that stands out from the basemap. If necessary, click **Invert** to show the higher values in darker colors.



## Initial Analysis Results

**Visual Analysis Findings:** From a visual analysis, it appears that: - Europe, North America, and South America (partially) have the **lowest levels of poverty** - Several

African countries report high levels of poverty - Some countries (such as Libya and Saudi Arabia) haven't reported data for this metric

**Scottish Context:** Scotland, as part of the UK, would appear in the low poverty category on this global map, but this masks internal variations. Areas like the Glasgow conurbation, parts of Dundee, and some rural Highland communities experience higher poverty rates that would be visible in a more detailed, national-scale analysis.

32. Click **OK**, then **Done** and **save the map**.

**Important Reminder:** Always remember to save your map - ArcGIS Online does not automatically save your work, so constantly remember to save your progress!

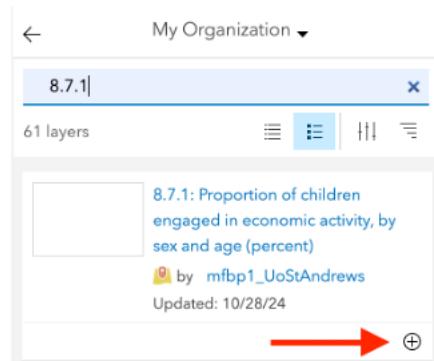
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## Step 2: Compare Child Poverty

Now that you've mapped global poverty, you'll map reported data for **percentage of children involved in economic activity**. This indicator is measured with the goal of eradicating forced labor and ending modern slavery and use of child soldiers.

### Task 2.1: Adding Child Labor Data

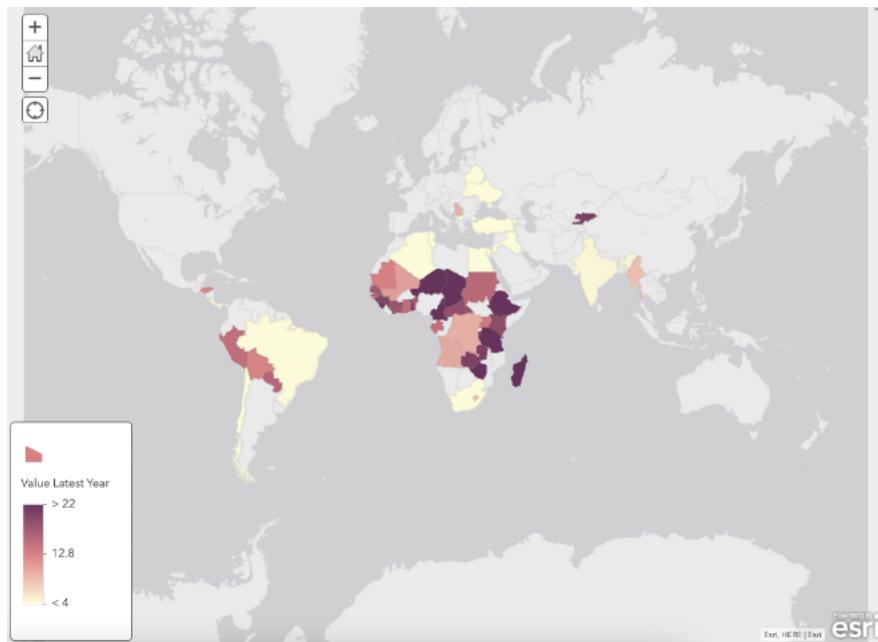
1. On the ribbon, click **Add** and choose **Search for Layers**. (At this point you should know how to do it)
2. Click **My Content** and choose **My Organization**, then search for **8.7.1**
3. Click the **plus** to add the result **Indicator 8.7.1: Proportion of children engaged in economic activity, by sex and age (percent)** to the map.



## Task 2.2: Joining Child Labor Data with Poverty Data

4. Hover over the **World Poverty** layer and click **Perform Analysis**.
5. Expand **Summarize Data** and choose **Join Features**. Enter the parameters as follows:
  - **Choose target layer:** World Poverty
  - **Choose layer to join to target layer:** Indicator 8.7.1
  - **Join type:** Spatial relationship – Intersects
  - **Join operation:** one to one
  - **Result layer:** *Childhood Poverty*
6. **Uncheck** “Use current map extent” and click **Run Analysis**.
7. **Turn off** all layers except for **Childhood Poverty**.
8. Hover over the **Childhood Poverty** layer and click **Change Style**.
9. Change the attribute to show to **Value Latest Year**.

**Technical Note:** Because you joined the datasets for global poverty and children in the workforce together, there will be many similar attribute names. Later, you’ll edit the names to make them clearer, but for now, remember that any attributes with a ‘1’ appended are from the economic labor layer.



**Observation:** Already, you can see that more countries have reported data for poverty rates. ArcGIS Online offers an easy way to visualize and compare relationships where data is present.

10. Click **Done**.
- 

## Step 3: Compare Data to Find Patterns

### Task 3.1: Creating a Bivariate Map

1. Hover over the **Childhood Poverty** layer and click the *ellipses (three dots)*. In the **More Options** menu, click **Copy**.

**Result:** An identical layer is added to the map.

2. Turn off the original layer, then open the **Change Style** pane for the **Childhood Poverty - copy**.

**Current State:** The layer currently shows Value Latest Year from Indicator 8.7.1: Children engaged in economic activity. Now you'll add the Value Latest Year attribute from Indicator 1.1.1: Global poverty for comparison.

3. Under **Choose an attribute to show**, click **Add attribute** and choose **2017**.

**Question for Understanding:** Do you remember what that attribute represents and what layer it comes from?

4. Under **Select a drawing style**, scroll down to **Relationship** and click **Select**, then click **Options**.



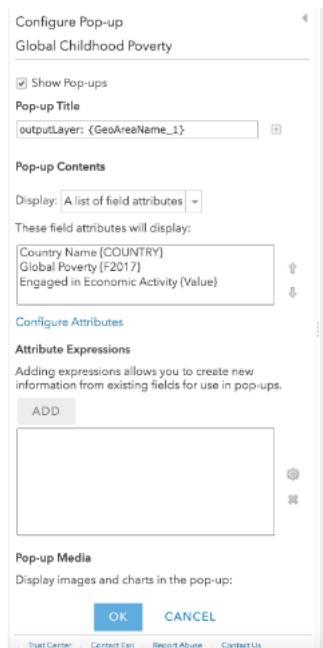
- Click **Symbols** and choose the **blue-pink-purple** color palette. Click **OK**, then **Done**.

**Understanding Bivariate Maps:** The relationship symbology style is a way of creating **bivariate maps** that lets you easily compare two topics on a single map because only the countries with data for both indicators are shown.

### Task 3.2: Improving Data Labels and Pop-ups

- Hover over the **Childhood Poverty - copy** layer and click the three-dots. In the **More Options** menu, click **Rename** and replace the default name with **Global Childhood Poverty**.
- Click the ellipses again and click **Configure Pop-up**.
- Under **Pop-up Contents**, click **Configure Attributes**.
- In the **Configure Attributes** window, **uncheck everything except for Country, Value Latest Year, and 2017**.
  - In the **Field Alias** column:
    - Click **2017** and type **Global Poverty**
    - Scroll down, click **Value** and type **Engaged in Economic Activity**

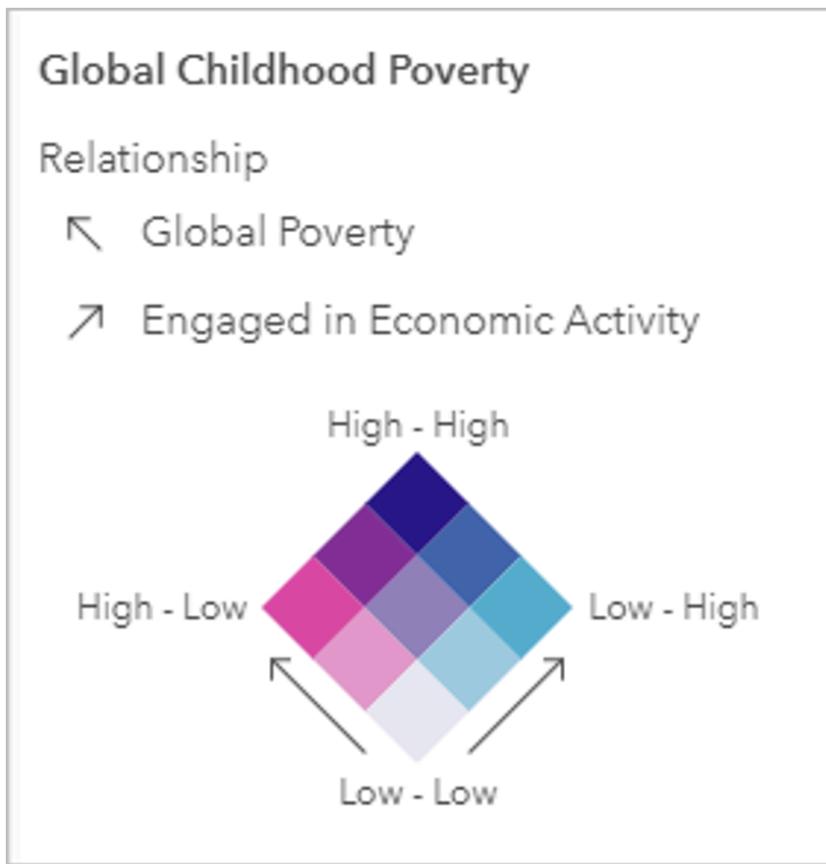
In the Configure Pop-up pane, click **OK**.



**Result:** Now when you click on a country, the pop-up shows only those three attributes with clear, understandable names.

### Task 3.3: Analyzing the Legend and Patterns

- At the top of the **Contents** pane, click **Legend**.



**Understanding the Legend:** The Legend pane shows the symbology for all the layers that are turned on, and your changes will be reflected here. By comparing the legend to the map, you can see the two extremes of the spectrum:

- Countries shaded purple have a **high poverty rate** and **large proportions of children working** to support themselves or their families
- Countries in light pink have **low poverty rates** and **small proportions of children at work**

**Complex Patterns:** In between there are countries with mixed patterns: - Countries like Senegal with relatively **low poverty rates** but **high proportions of children working**

- Countries like India with high poverty rates but small proportions of children contributing to the economy

**Scottish Example:** If we were to apply this analysis to Scotland at a regional level, we might find that:  
- **Urban areas like Edinburgh and Aberdeen** might show low poverty but some youth employment in service sectors  
- **Rural Highland areas** might show different patterns due to agricultural work and seasonal employment  
- **Post-industrial areas like parts of Glasgow or Dundee** might show higher poverty rates with different youth employment patterns

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## Questions and Policy Applications

If you toggle between layers in the Contents pane, the legend will help you perform more visual analysis on the countries. If you were looking at ways to base policy on this information, you could use the maps you created to answer the following questions (Make sure you add the response to the following questions to your data report):

### SDG 1: No-Poverty Questions

- Which countries have the highest poverty rates?
- Where does it appear that children are protected from labor?
- Where should international efforts to alleviate poverty be targeted?
- Within individual countries, what are some ways of improving the situation for children facing challenges associated with poverty?

### Questions related to Both Indicators

- Where do you see overlaps in patterns between the two maps that you have created for each indicator?
- Where are the most affected areas that efforts should be focused toward helping improve the condition for children?
- What sorts of place-based policies could be designed to help improve the conditions for children?

**Scottish Policy Examples:** Using similar spatial analysis techniques, Scottish policymakers in theory could:

- Target the Scottish Child Payment to areas with highest concentration of child poverty (using SIMD data)

- **Design place-based interventions** for areas like Inverclyde, West Dunbartonshire, or parts of Glasgow where multiple deprivation indicators overlap
  - **Develop rural-specific policies** for Highland and Island communities where geographic isolation compounds poverty challenges
  - **Create youth employment programs** in areas where high poverty correlates with limited economic opportunities for young people
- 

## **Step 5: Share Maps to a Story Map (Optional step)**

You now have three maps showing UN Sustainable Development Goals data. With a little extra work, you can share to a general audience the maps you have created in a way that everyone can understand.

- **Embed the maps in a Story Map** using [Get Started with Story Maps](#) Go to this link and replicate the steps to create a story map using the maps you have created in this lab. This step is optional.
- 

## **Final Steps:**

Well Done! You have now completed all the steps for this lab. Before moving on, make sure to:

1. **Take one screenshot** of the final map. Ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report ( see all the instructions in the handbook)
2. **For the Part B of this lab in your report. Replicate the process independently** by applying the same skills you practised in this lab, but using **spatial data from Scotland or the UK**.

In the original lab, you have created a set of maps showing UN Sustainable Development Goals data related to poverty. More importantly you learned **how to create a relationship map**, a method that help you to present two different indicators. For your **independent spatial analysis**, you can choose a different theme and dataset (e.g. healthcare access, education, environmental risk), as long as you also:

- Use again **ArcGIS Online** using your university credentials. **Meet and work with your classmate to define which account want to use . You must only report one independent analysis results.**
- Apply the same techniques learned in this lab., and create another relationship map.
- Include the screenshot of the new relationship web map created with a **clear purpose** relevant to a real-world issue in Scotland or the UK. Ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report

This additional task is an opportunity to improve your technical skills, explore new datasets, and demonstrate your ability to adapt spatial analysis methods to new contexts.

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*Tutorial inspired on: [ArcGIS Online blog entry](#)*

# Lab No 5: Build an Interactive Dashboard

## Overview

In this tutorial, you will configure a web map and use it to create an interactive dashboard for finding electric vehicle charging stations. This tutorial demonstrates how to create dashboards that can be applied to various geographic contexts, including examples relevant to Scotland such as monitoring renewable energy infrastructure, analyzing tourism patterns, or tracking public transport usage.

**Estimated time of completion:** 60 Minutes

## Learning Objectives

By the end of this tutorial, you will be able to:

- Configure web map pop-ups for dashboard use
- Create and customize dashboard elements (headers, indicators, tables, and details)
- Implement interactive selectors for data filtering
- Configure actions to connect dashboard elements
- Share dashboards within your organization

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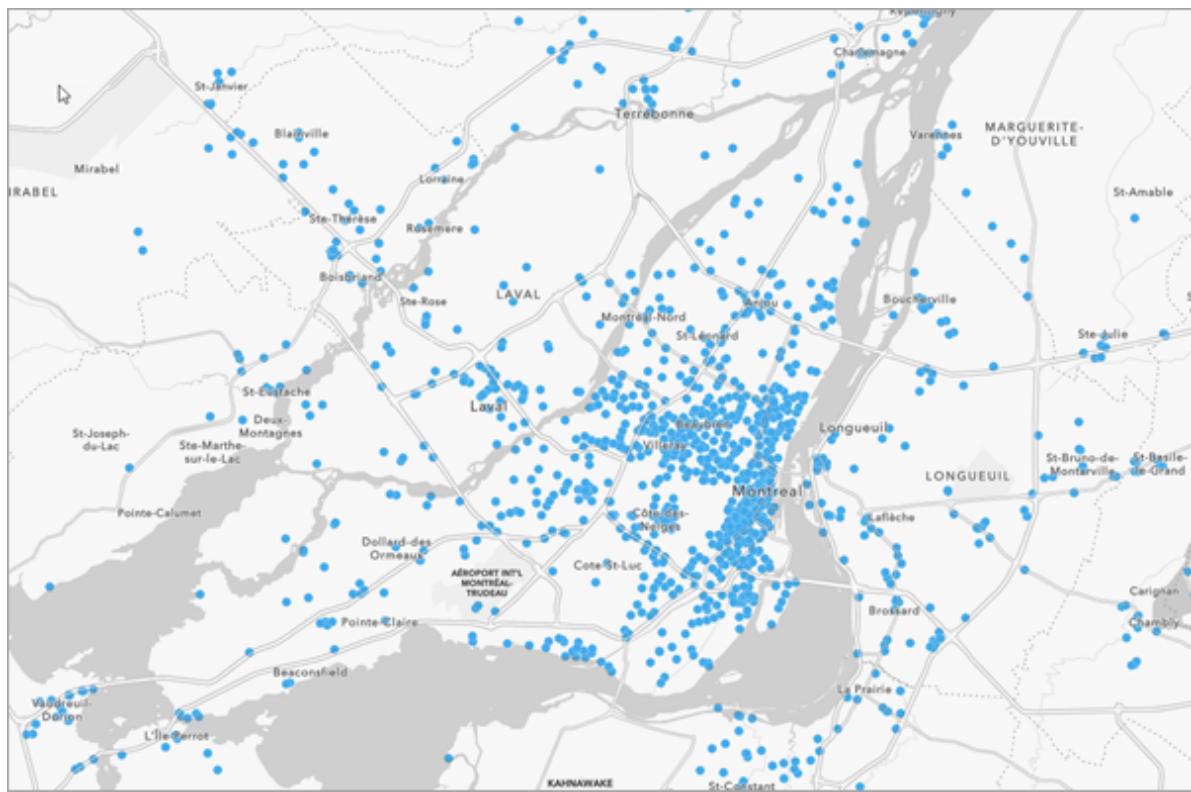
## Part 1: Configure a Web Map

### Step 1: Access the Base Map

1. Open the [Electric charging stations in Canada](#) web map
2. Click **Sign In** and sign in with your ArcGIS Online account

A map appears showing charging stations for electric vehicles across Canada. This type of infrastructure mapping is equally relevant for Scotland, where you might map:

- **Electric vehicle charging points** across Scottish cities like Edinburgh, Glasgow, and Aberdeen
- **Renewable energy installations** such as wind farms in the Highlands or solar installations in the Borders
- **Public transport hubs** including bus stations, train stations, and ferry terminals

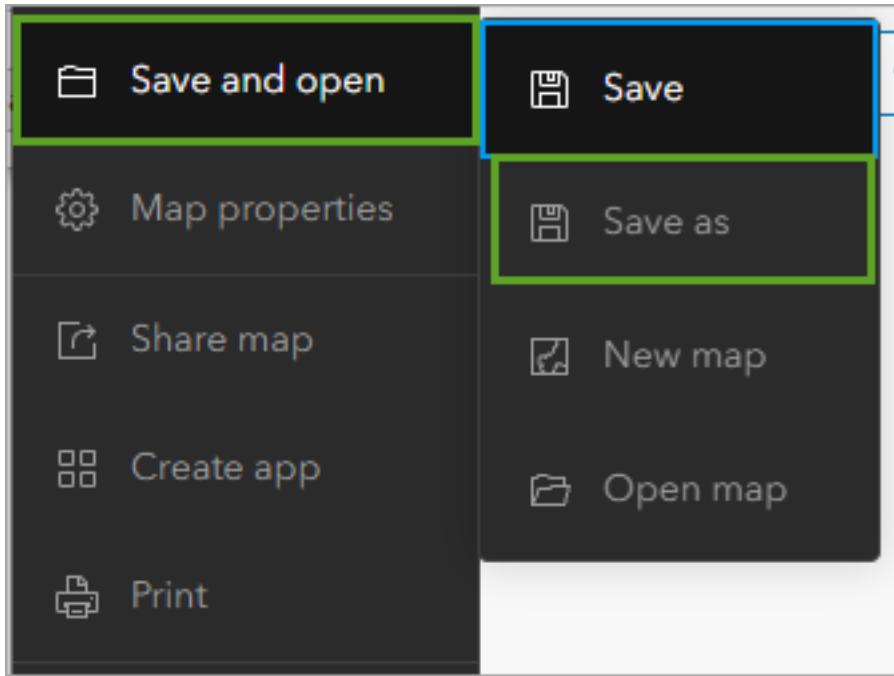


## Step 2: Save Your Copy of the Map

1. If necessary, on the Contents (dark) toolbar, at the bottom, click the **Expand** button



2. Click **Save and open** and choose **Save as**



3. In the Save map window, for **Title**, add your name or initials to the end of the existing text

**Important:** You cannot create two layers in an ArcGIS organization with the same name. Adding your initials ensures that other students can also complete this tutorial. For example, if your name is John Smith, you might title it “Electric charging stations in Canada - JS”

Save map X

Title  
Electric charging stations in Canada YourName

Folder  
Your folder

Categories  
Assign categories

Tags  
Electric vehicles X Add tags X ▼

Summary  
Map of electric vehicle charging stations across Canada

Characters left: 1993

Save Cancel

4. Click **Save**

### Step 3: Explore the Available Layers

1. On the Contents toolbar, click **Layers** to open the Layers pane

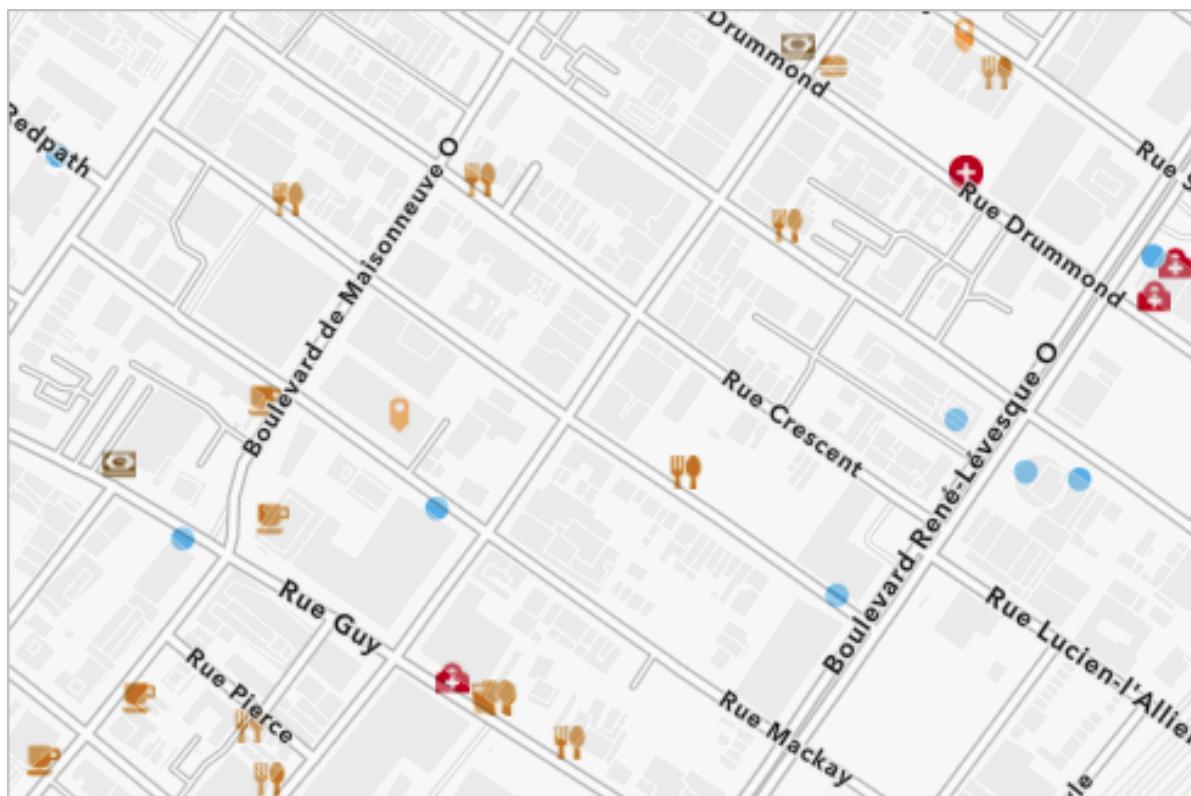
Layers

- Electric Charging Stations in Canada
- OpenStreetMap Amenities for North America
- Provinces and Territories of Canada

Three layers are available:

- Electric Charging Stations:** Blue dots representing charging locations with comprehensive attribute data
- OpenStreetMap Amenities for North America:** Context layer showing nearby facilities
- Provinces and Territories of Canada:** Boundary layer for spatial filtering

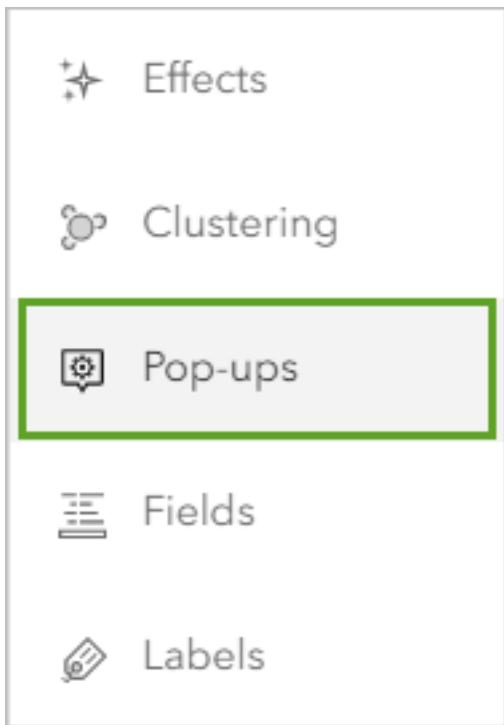
- Zoom in on the map until more symbols appear to see the OpenStreetMap amenities layer



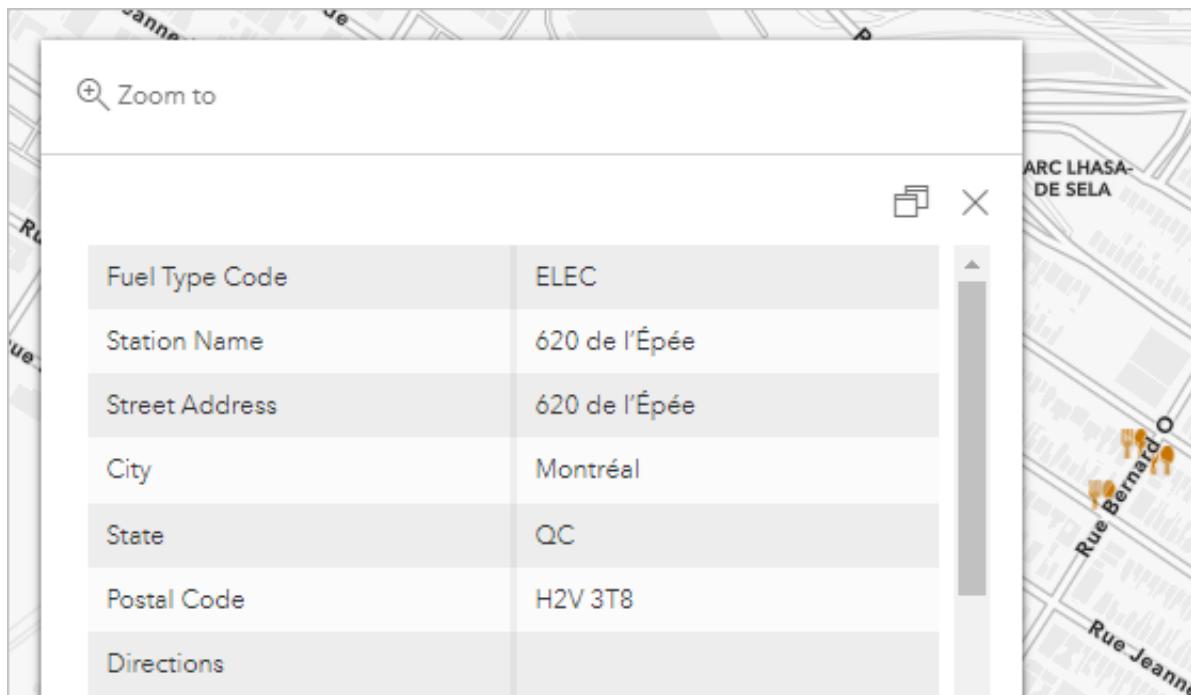
The amenities layer provides crucial context - since vehicle charging takes time, proximity to restaurants, shops, or libraries makes stations more attractive. In a Scottish context, this could include: - **Proximity to tourist attractions** (castles, distilleries, hiking trails) - **Access to amenities** (shops, cafes, accommodation) - **Integration with public transport** (bus stops, railway stations)

#### Step 4: Configure Pop-ups

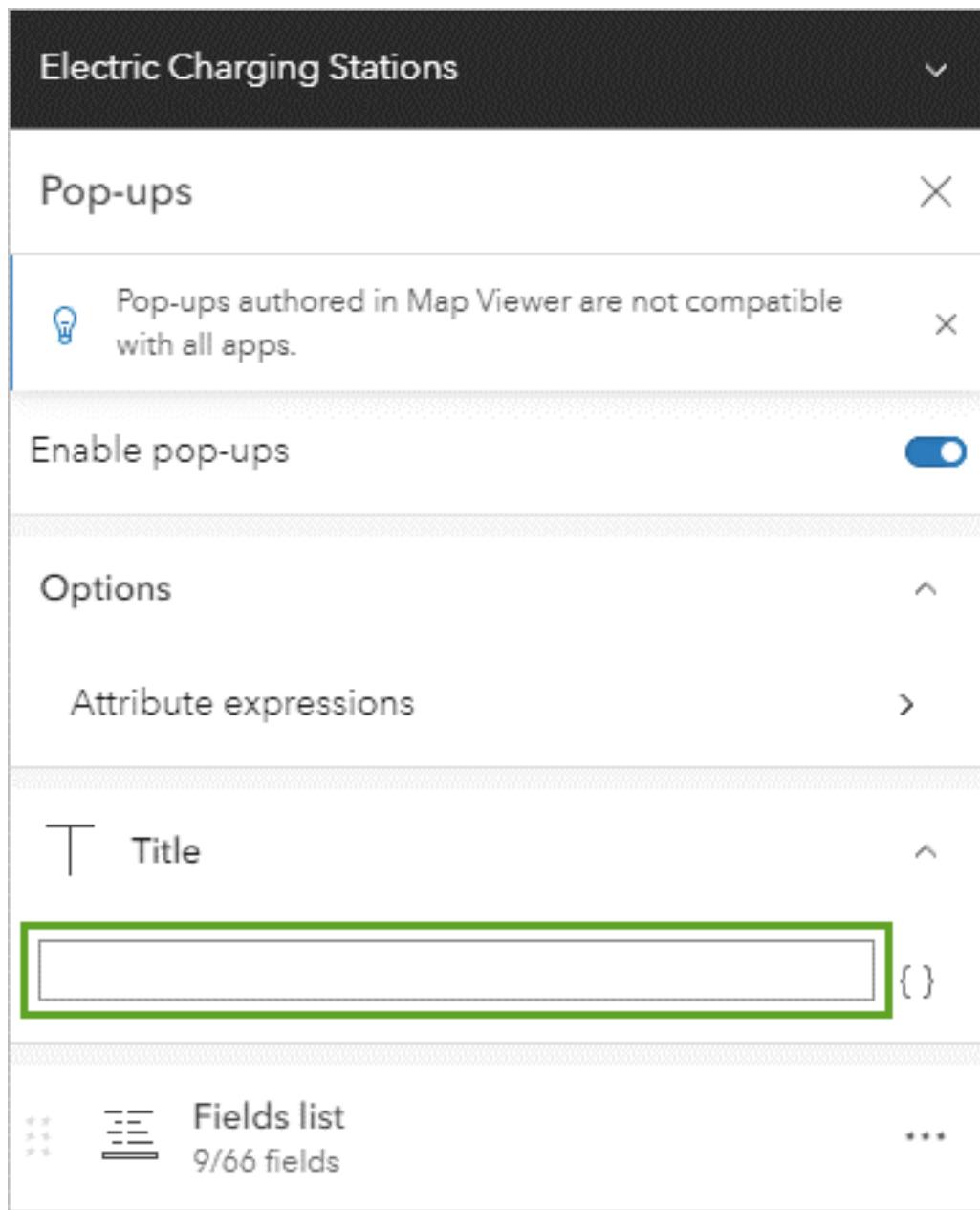
1. In the Layers pane, click the **Electric Charging Stations** layer to select it
2. Expand the Settings (light) toolbar and click **Pop-ups**



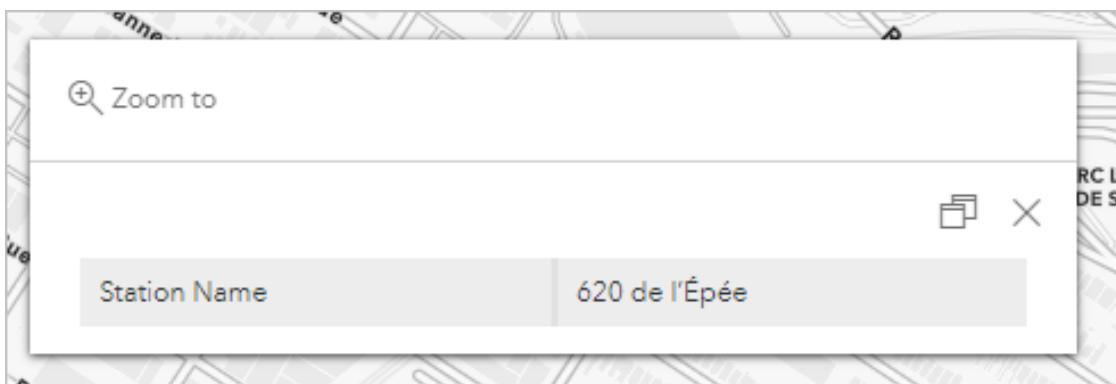
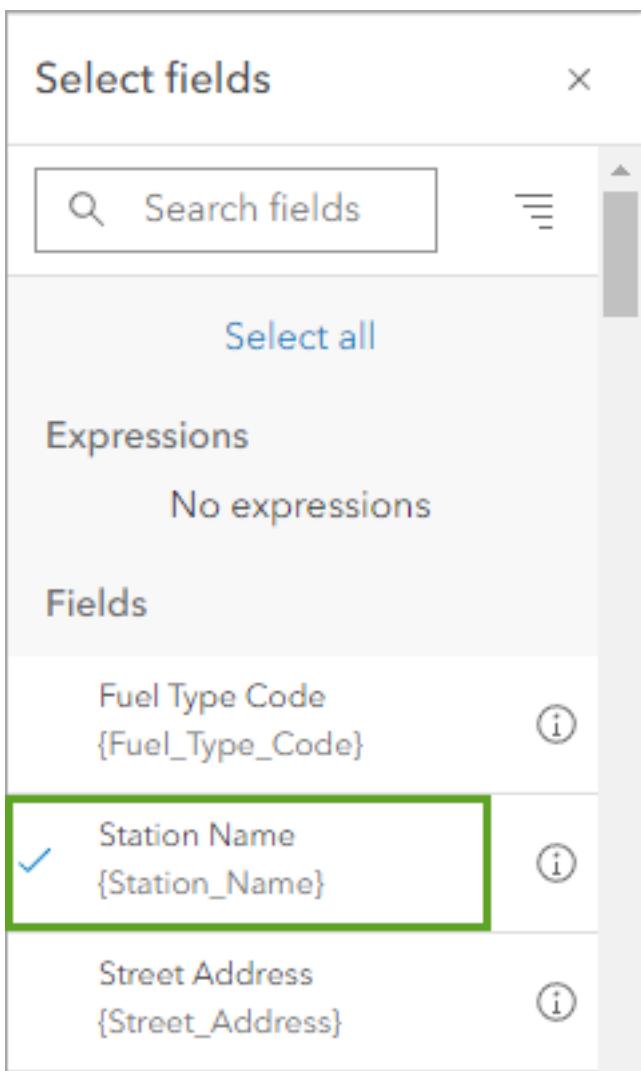
A sample pop-up appears over the map showing all available fields, many of which may be empty.



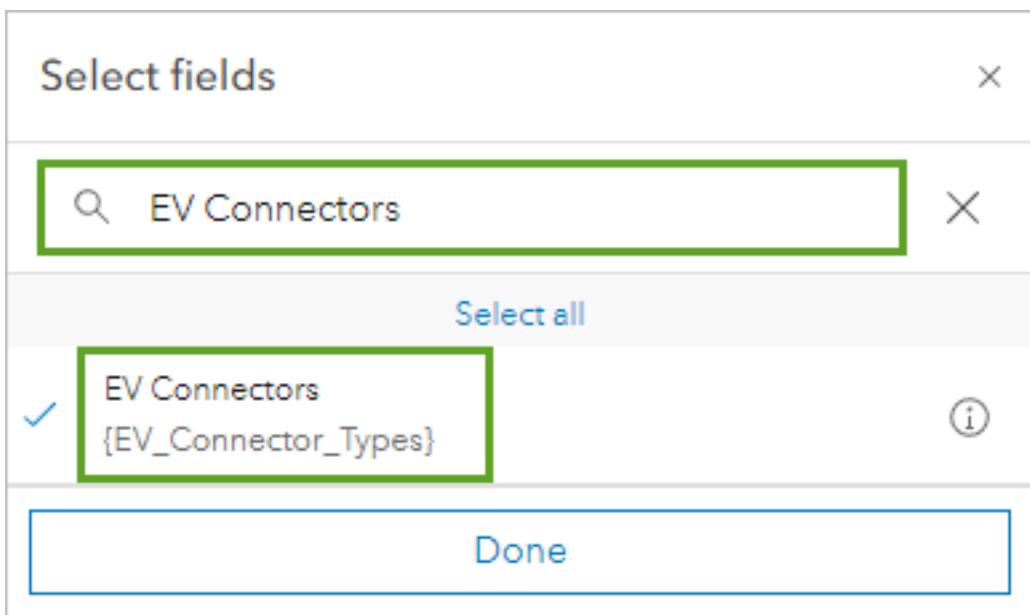
3. In the Pop-ups pane, click **Title** and confirm that the field is blank



4. Click **Fields list** and click **Select fields**
5. In the Select fields window, click **Deselect all** to clear all fields
6. Click the **Station Name** field to select it



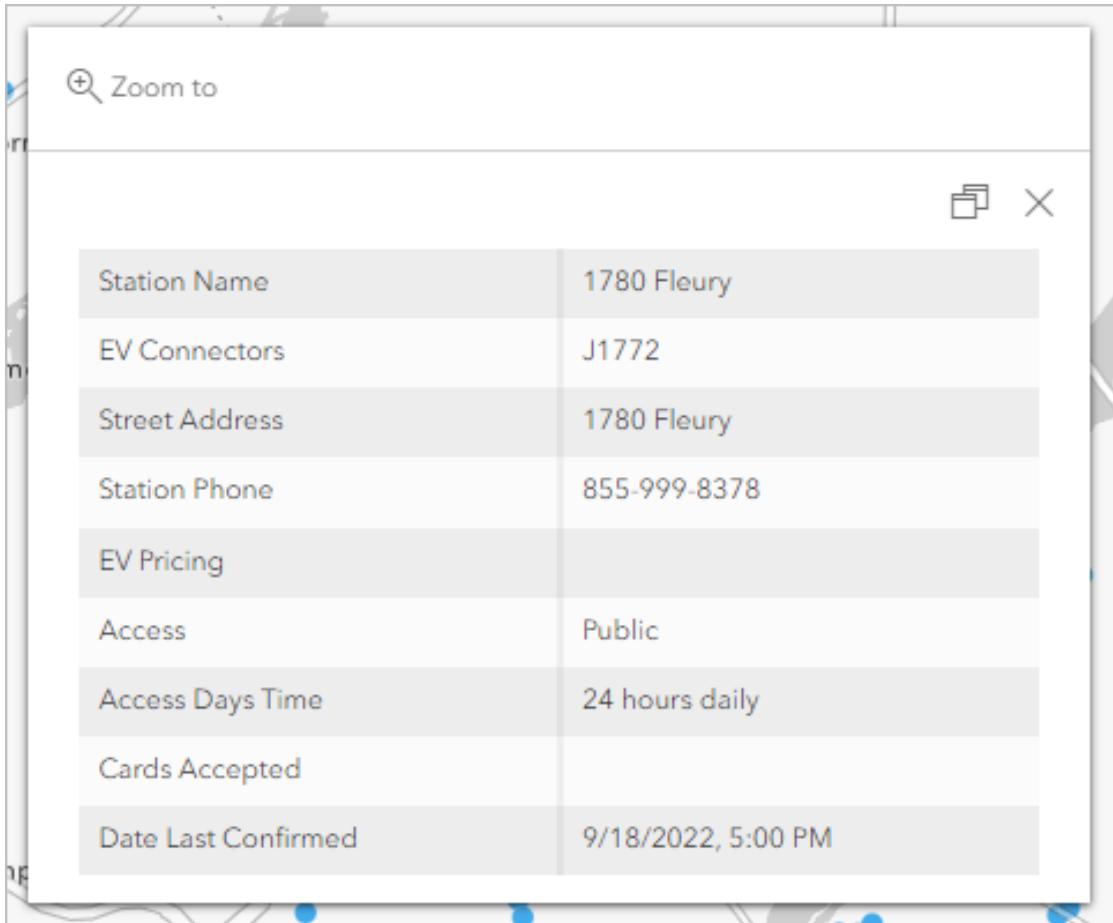
7. Click **Search fields** and type “EV Connectors”, then select the **EV Connectors** field



8. Search for and add the following fields:

- Street Address
- Station Phone
- EV Pricing
- Access
- Access Days Time
- Cards Accepted
- Date Last Confirmed

9. Click **Done**



10. Close the Pop-ups pane

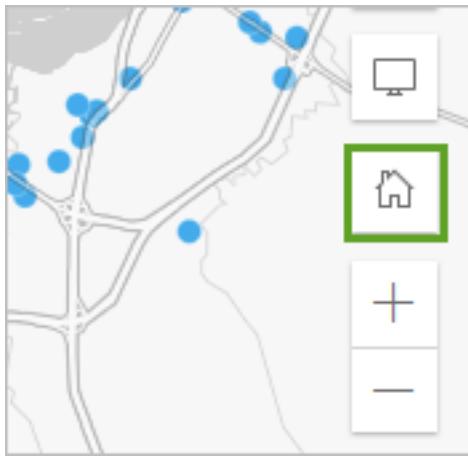
**Scottish Context Example:** If creating a similar dashboard for Scotland, you might include fields such as: - **Accessibility information** (wheelchair access, disabled parking) - **Pricing in GBP** (including contactless payment options) - **Network provider** (ChargePlace Scotland, Polar, etc.) - **Connection to renewable energy** (wind or solar powered)

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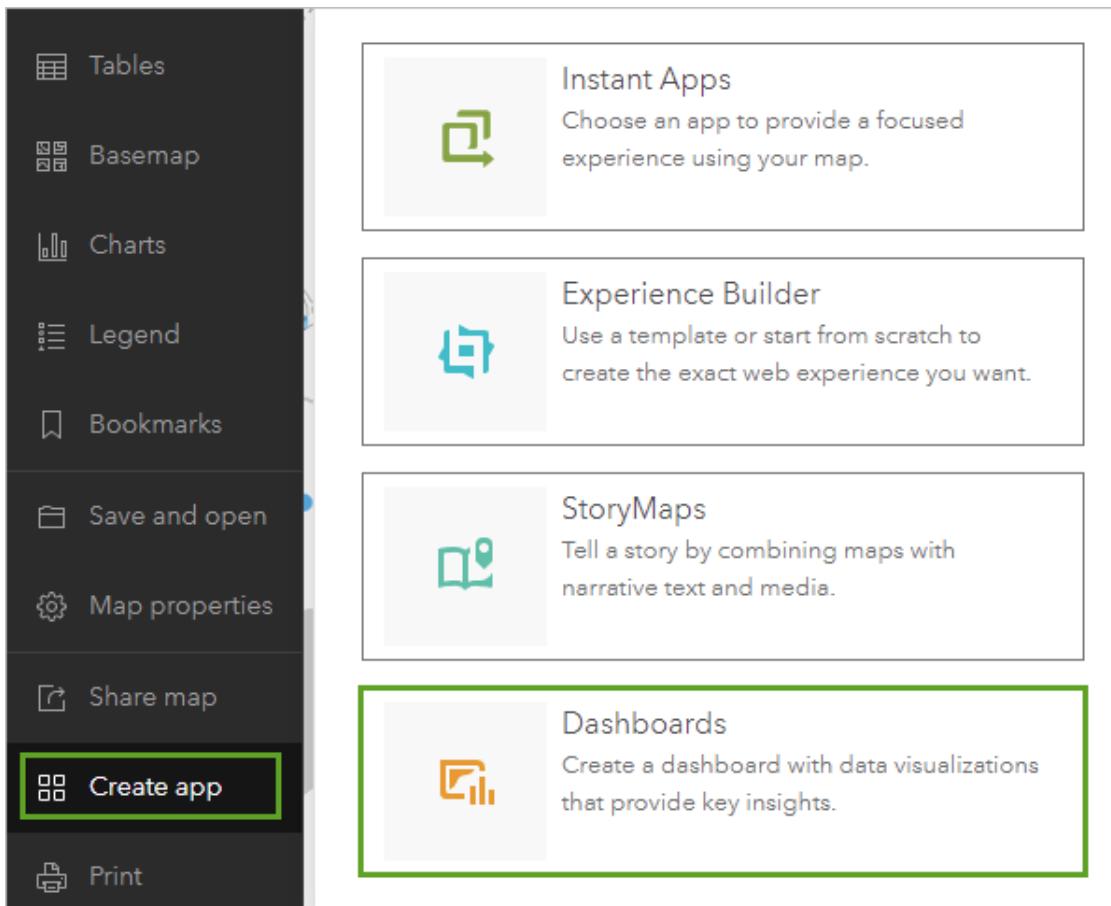
## Part 2: Create a Dashboard from the Web Map

### Step 1: Set Default View and Create Dashboard

1. Click the **Default map view** button to return to the default map view



2. On the Contents toolbar, click **Save and open** and click **Save**
3. On the Contents toolbar, click **Create app** and click **Dashboards**



4. In the Create new dashboard window, type:

- **Title:** Vehicle charging stations
- **Tags:** electric vehicles (press Enter)
- **Summary:** Delete existing text and type “This dashboard allows you to find electric vehicle charging stations near you.”

5. Click **Create dashboard**

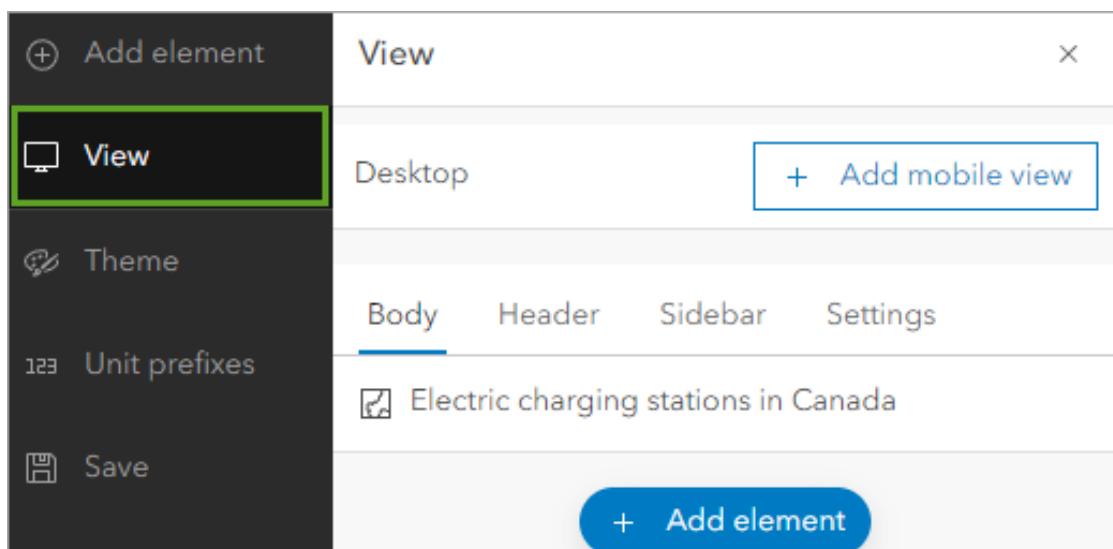
The new dashboard appears with your configured web map taking up the full space.

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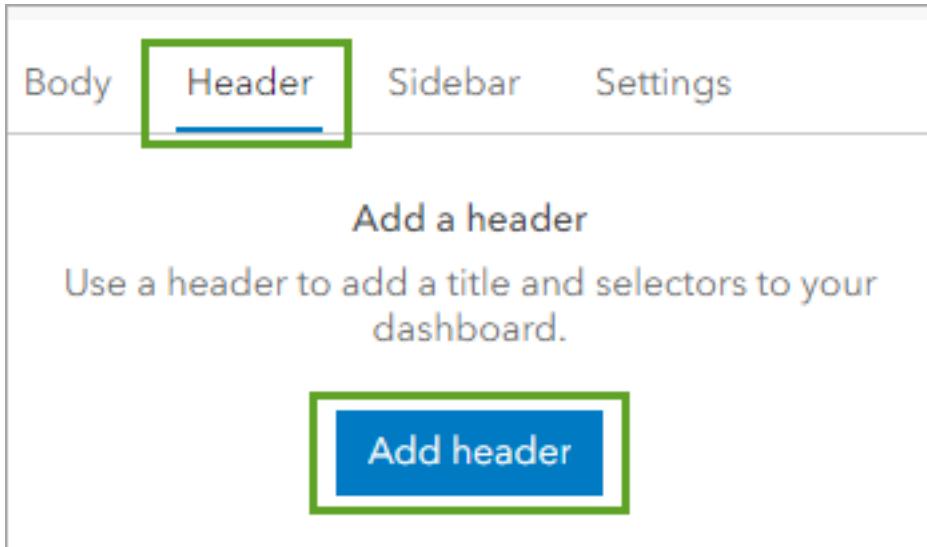
## Part 3: Configure Dashboard Information Elements

### Step 1: Add a Header

1. At the bottom of the dashboard toolbar, click the **Expand** button
2. On the toolbar, click the **View** button to open the View pane



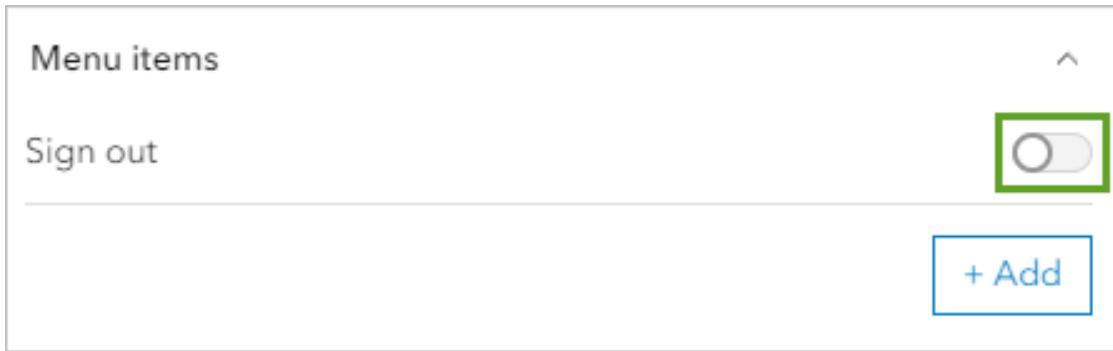
3. Click the **Header** tab and click **Add header**



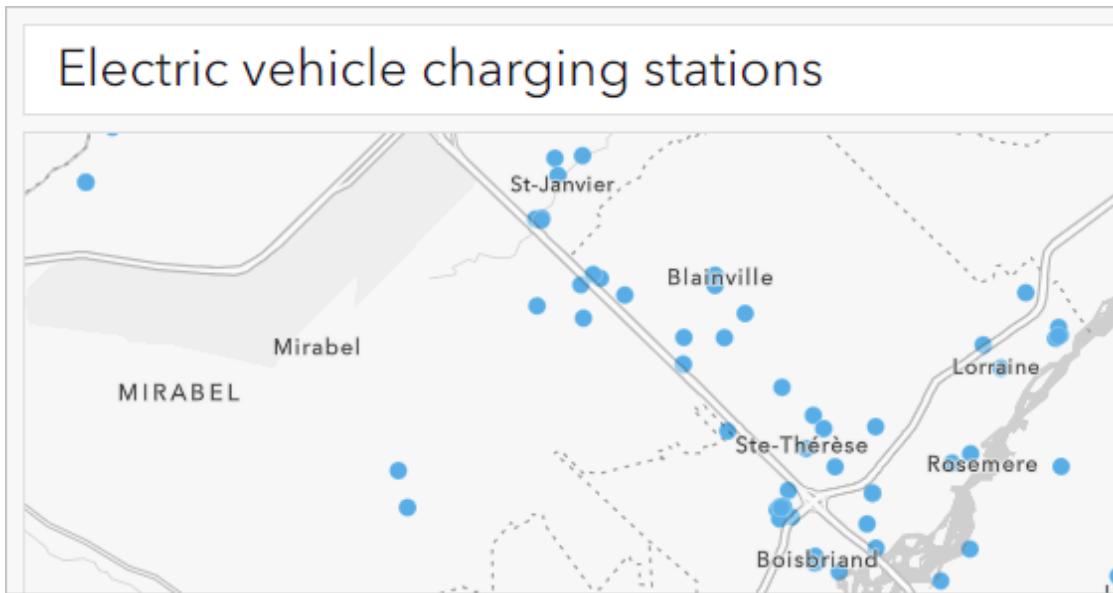
4. For **Title**, type “Electric vehicle charging stations”

This screenshot shows the 'Header' configuration panel. It includes sections for 'Header', 'Appearance', and 'Settings'. Under 'Settings', there is a 'Title' section with a text input field containing the placeholder '{ }' and the text 'Electric vehicle charging stations'.

5. Expand the **Menu links** section and turn off **Sign out**

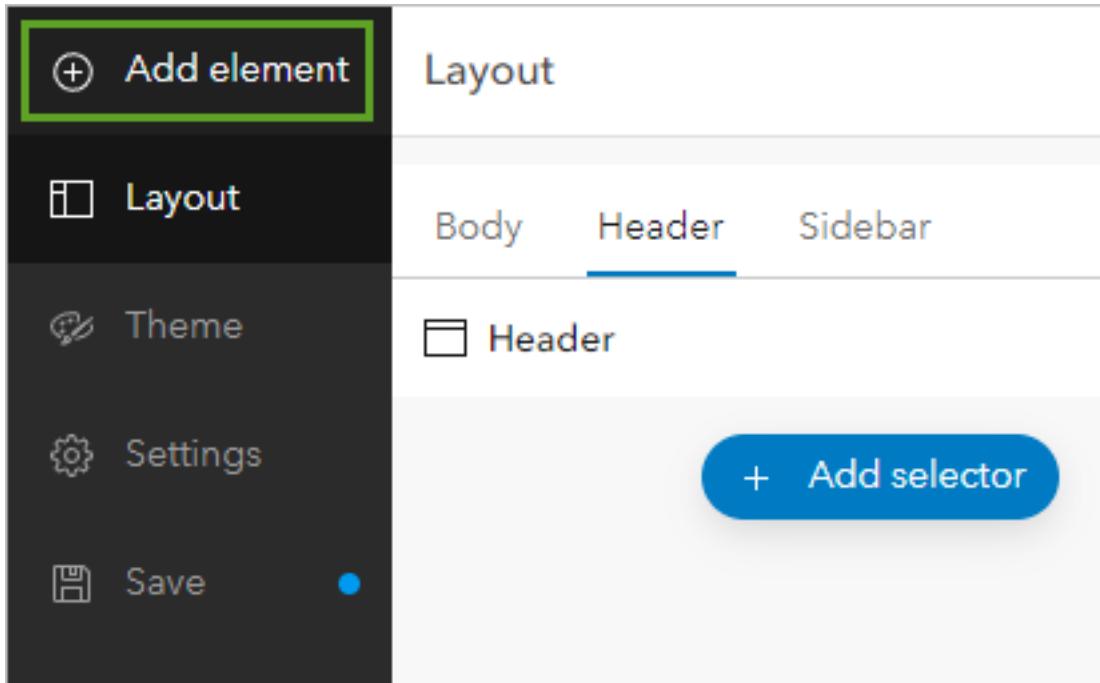


6. Click **Done**

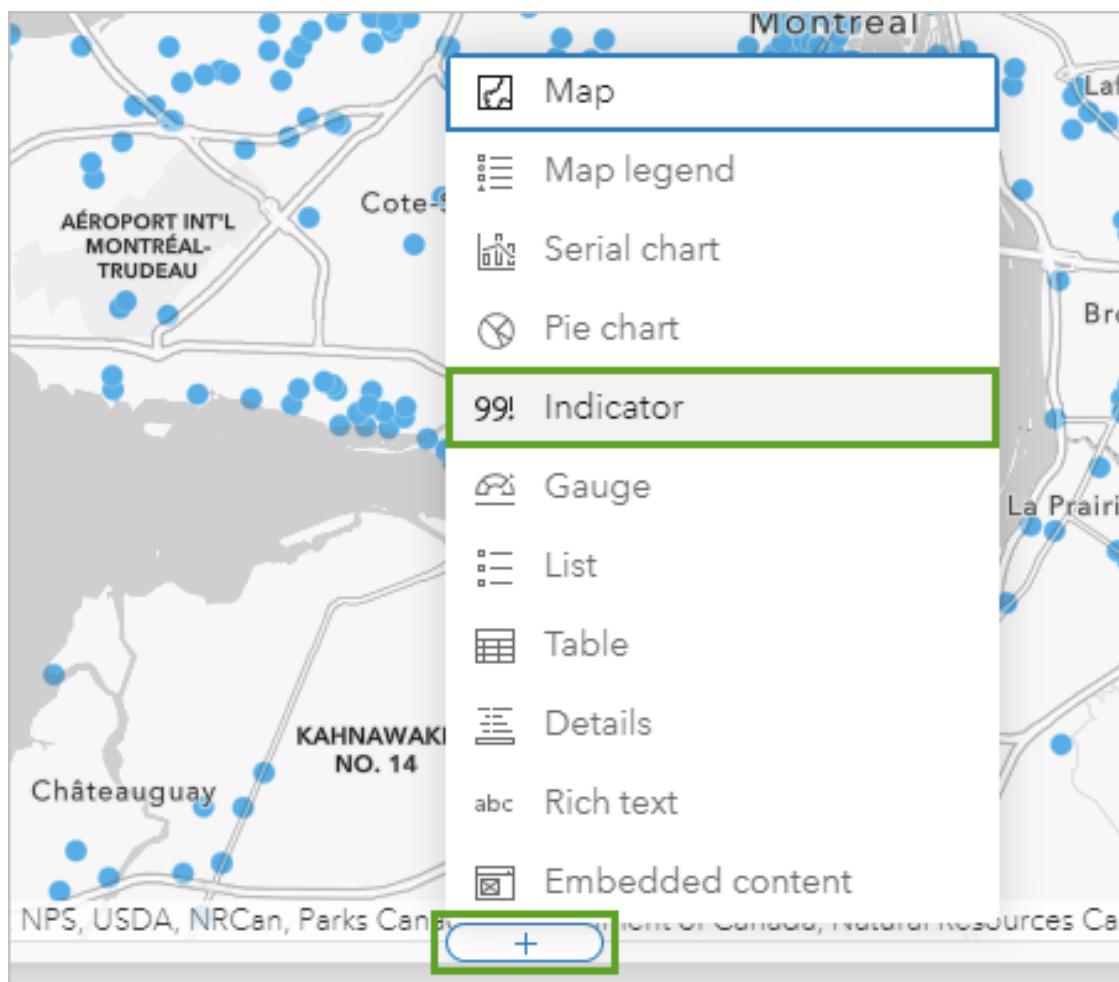


## Step 2: Add an Indicator for Operational Stations

1. On the toolbar, click **Add element**



2. Below the map, click the **Add** button and click **Indicator**

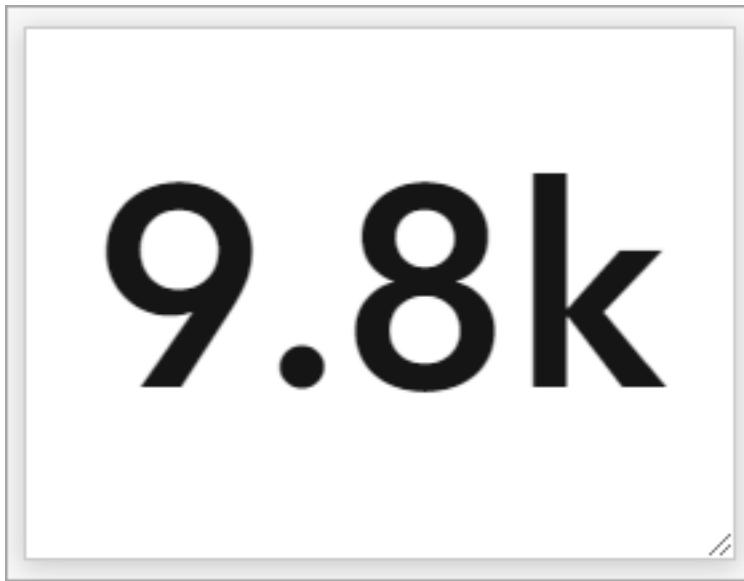


3. In the Select a layer window, click **Electric Charging Stations**

Layers from 'Electric charging stations in Canada' map:

- Electric Charging Stations
- OpenStreetMap Amenities for North America
- Provinces and Territories of Canada

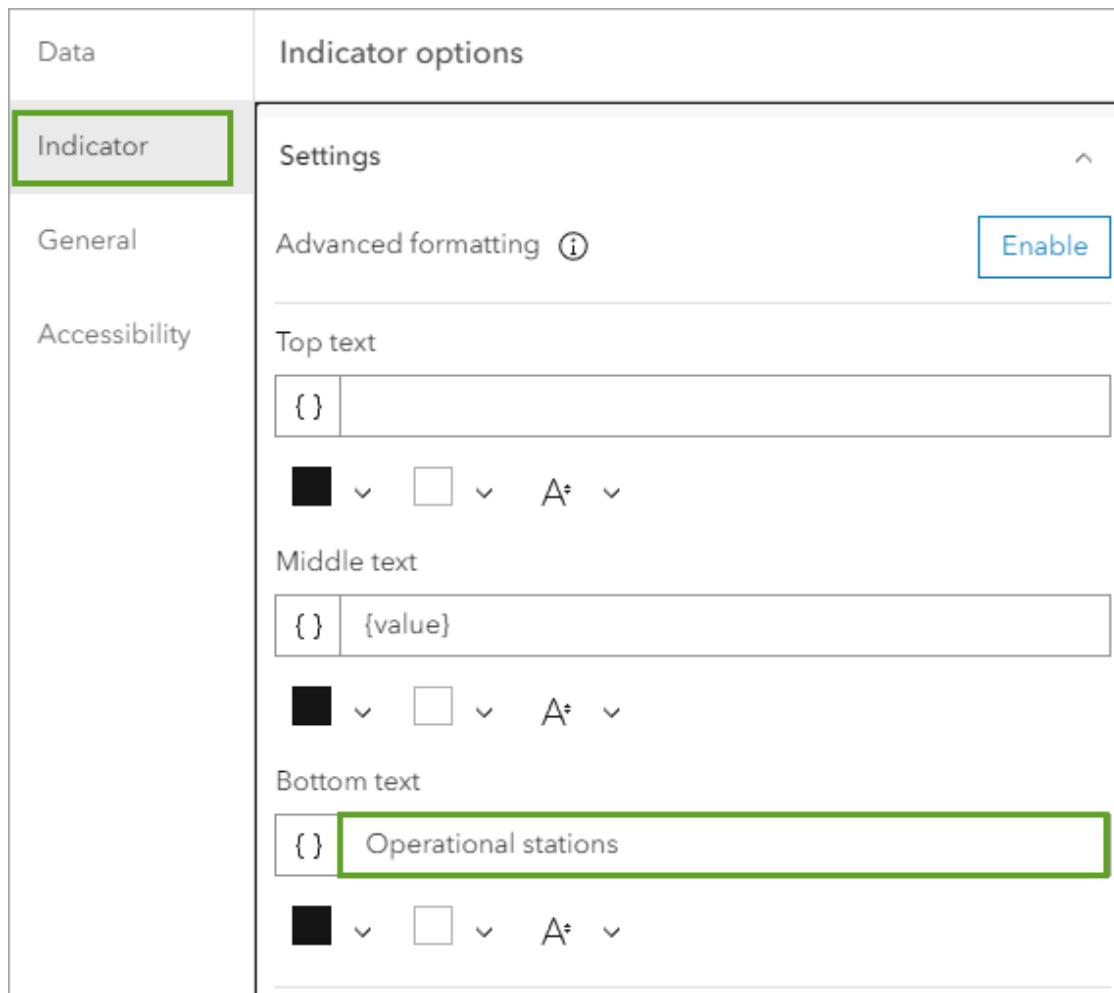
A preview of the indicator appears.



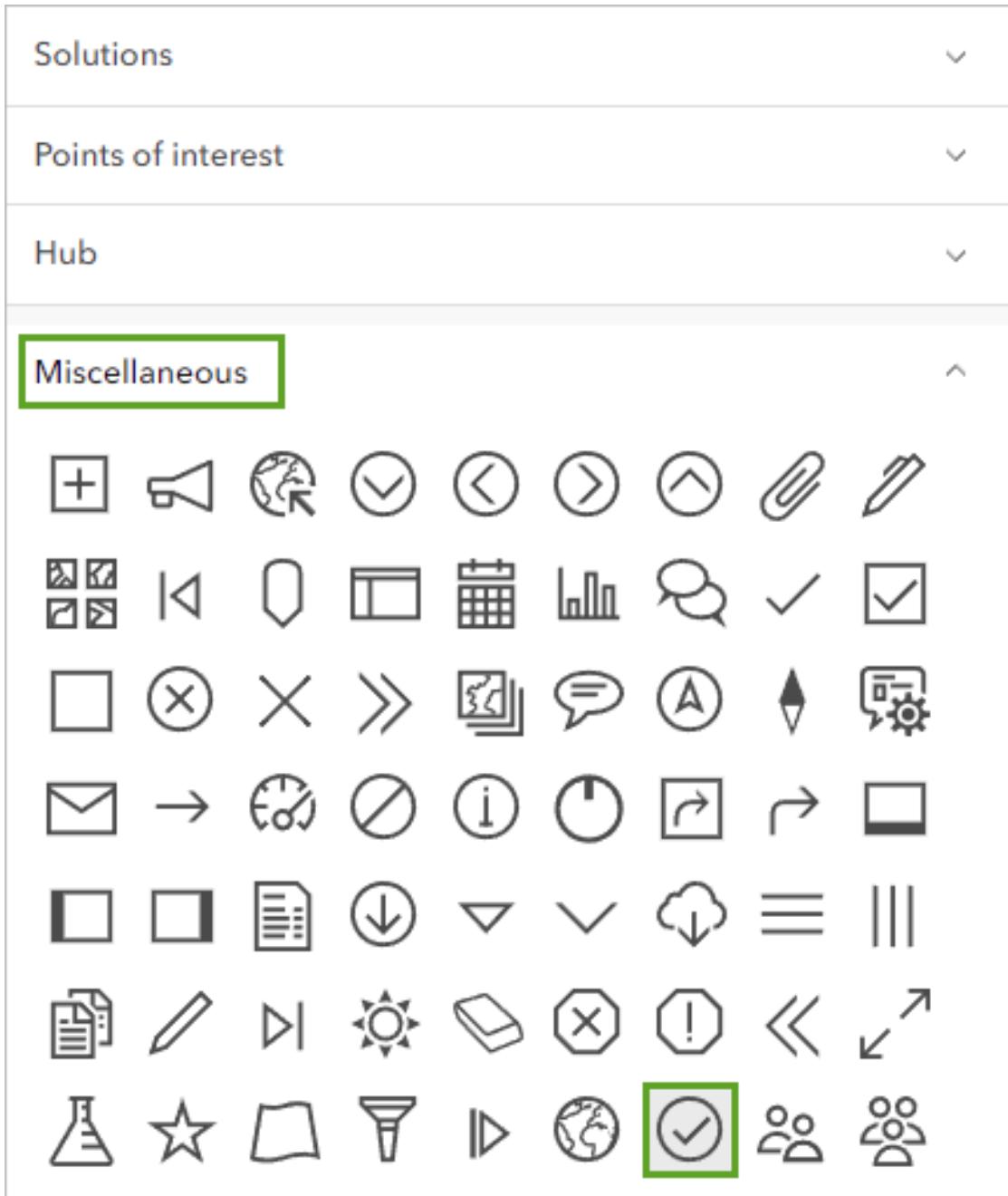
By default, an indicator's value is the count of features in the data source. In this case, the value is the total number of operational stations across Canada. Since this layer receives updates daily, the preview may show a different number than the images in this tutorial.

The indicator has no context to explain the meaning of the number. You'll add labels to explain its meaning.

4. Click the **Indicator** tab
5. For **Bottom text**, type “Operational stations”

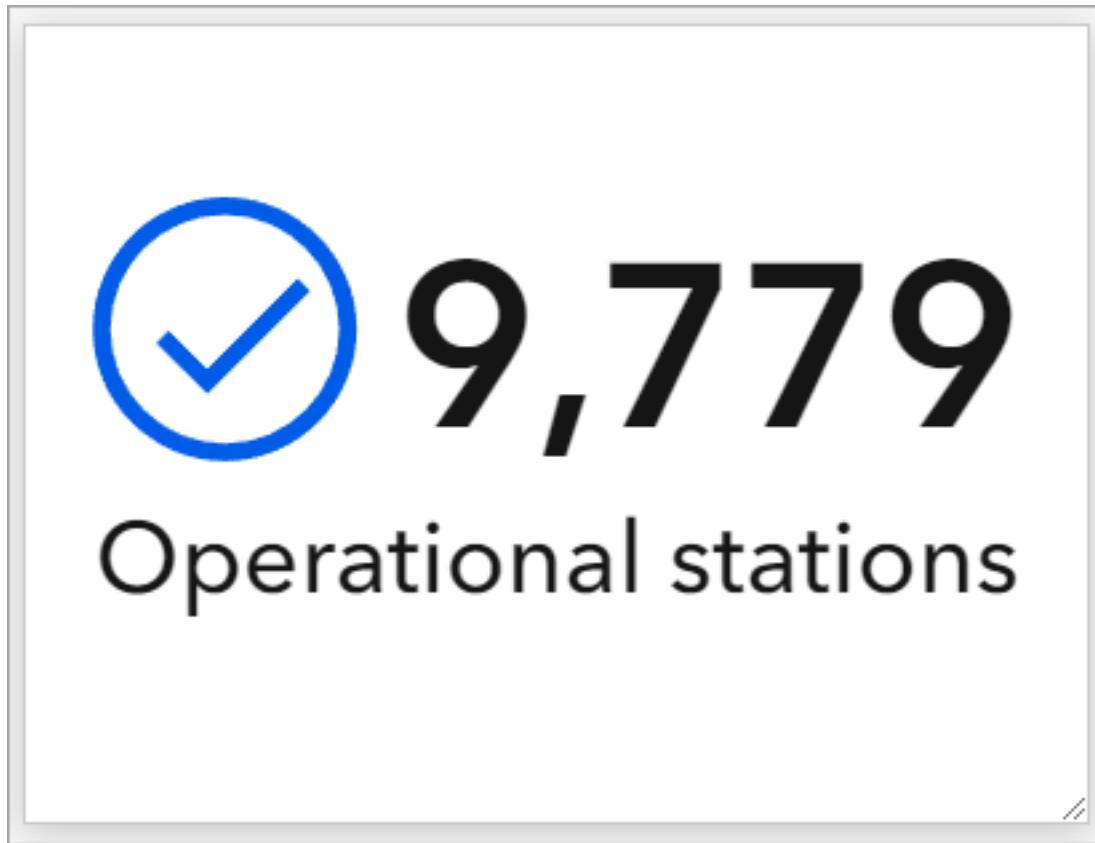


6. Click **Add icon**
7. Expand **Miscellaneous** and click the check mark in a circle icon



8. Click **OK**
9. Ensure **Position** is set to **Left**
10. Click the **Fill color**. For **Hex**, type **005ce6** and press Enter
11. Expand **Value formatting** and turn off **Unit prefix**

The preview now shows the exact number of stations instead of a rounded number.



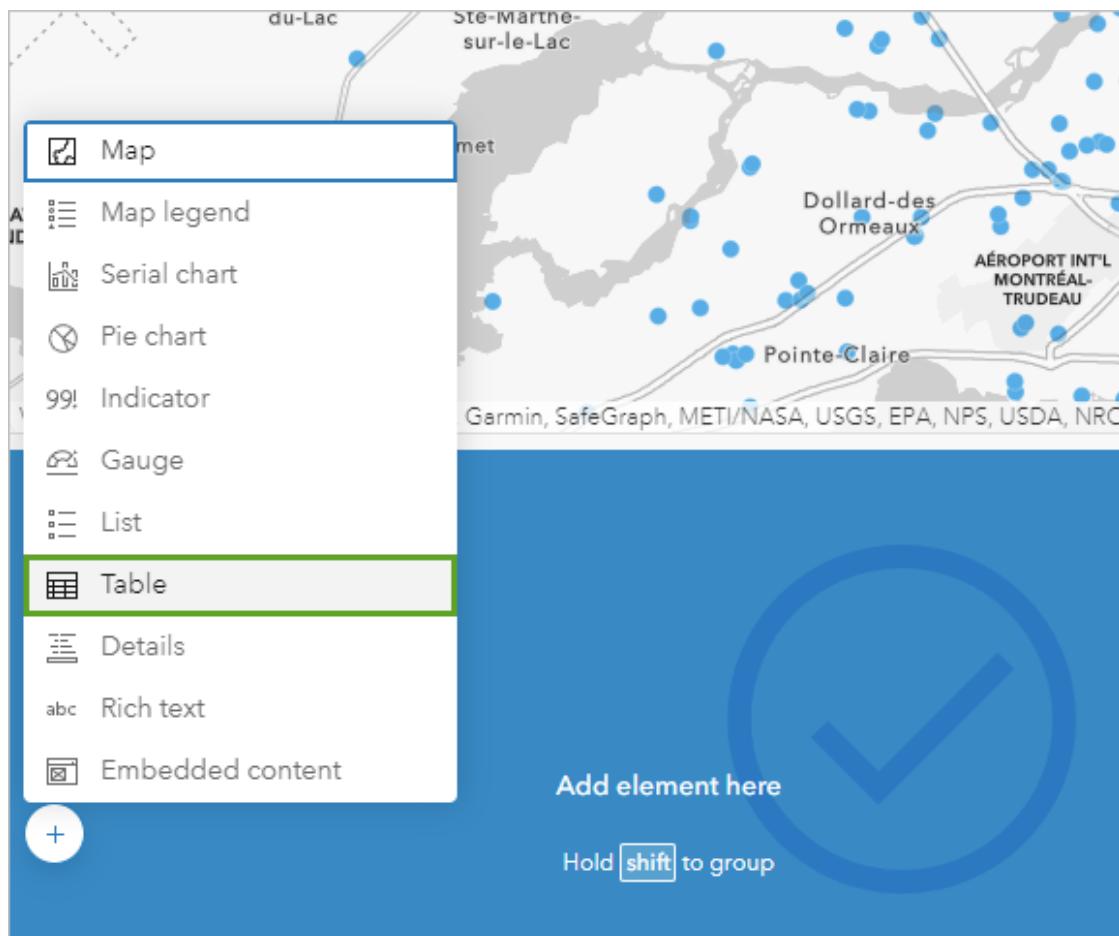
Later, you will connect the indicator element to others on the dashboard, so the number can change based on filters that the user applies. For now, you'll give the indicator element a meaningful name so it is easier for you to identify it later when you configure actions.

12. Click the **General** tab
13. For **Name field**, type “Operational stations indicator”
14. Click **Done**

**Scottish Application:** For a Scottish renewable energy dashboard, you might create indicators showing: - **Active wind turbines** in the Highlands - **Solar installations** generating power - **Hydroelectric facilities** operational - **Carbon offset** achieved through renewable sources

### Step 3: Add a Table

1. On the toolbar, click **Add element**
2. Point to the indicator element and click the **Add** button on the left side
3. Click **Table**



4. In the Select a layer window, click **Electric Charging Stations**
5. For **Table type**, choose **Features**
6. For **Value fields**, click **Add field** and choose **Station\_Name**

Data	Data options		
Table	Layer: Electric Charging Stations	Change	
Header	Filter	+ Filter	
Values	Table type		
General	Grouped values	Features	
Actions	Value fields	Add field	▼
Accessibility	No value	Fuel_Type_Code	abc
	Maximum rows	Station_Name	abc
	1000	Street_Address	abc

The **Station Name** field appears in the **Value fields** list and as the first column in the preview table.

Data options
Station\_Name

---

Layer: Electric Charging Stations
[Change](#)

---

Filter
[+ Filter](#)

---

Table type

[Grouped values](#)
[Features](#)

Value fields
[Add field](#) ▾

⋮ Station\_Name X

UFV EV STATION AB L2 LOT 6A.3

Ramada

UFV EV STATION CHIL L2 LOT 1

Davis Chevrolet

Dalhousie University - McCain Building Parkade

Don Wheaton Chevrolet

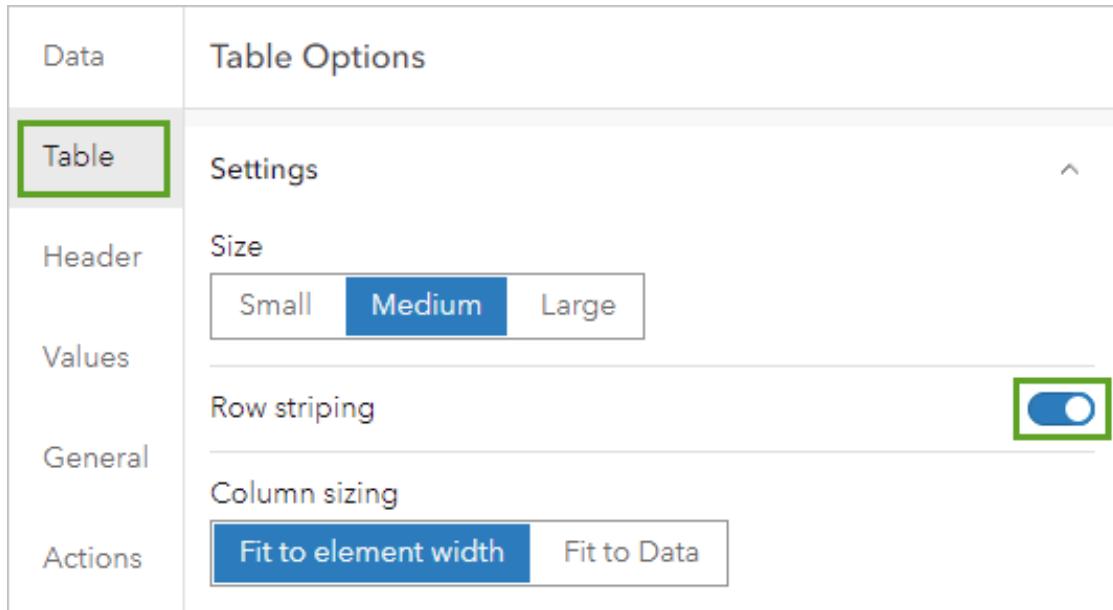
Peavey Industries

The **Value fields** section determines the columns of the table, with each row representing an individual feature.

7. Add four more fields:

- Street\_Address
- City
- ZIP
- Facility\_Type

8. Click the **Table** tab and turn on **Row striping**



9. Click the **Header** tab

10. In the **Label override** section, remove underscores from labels (e.g., “Station Name”, “Street Address”, “Facility Type”)

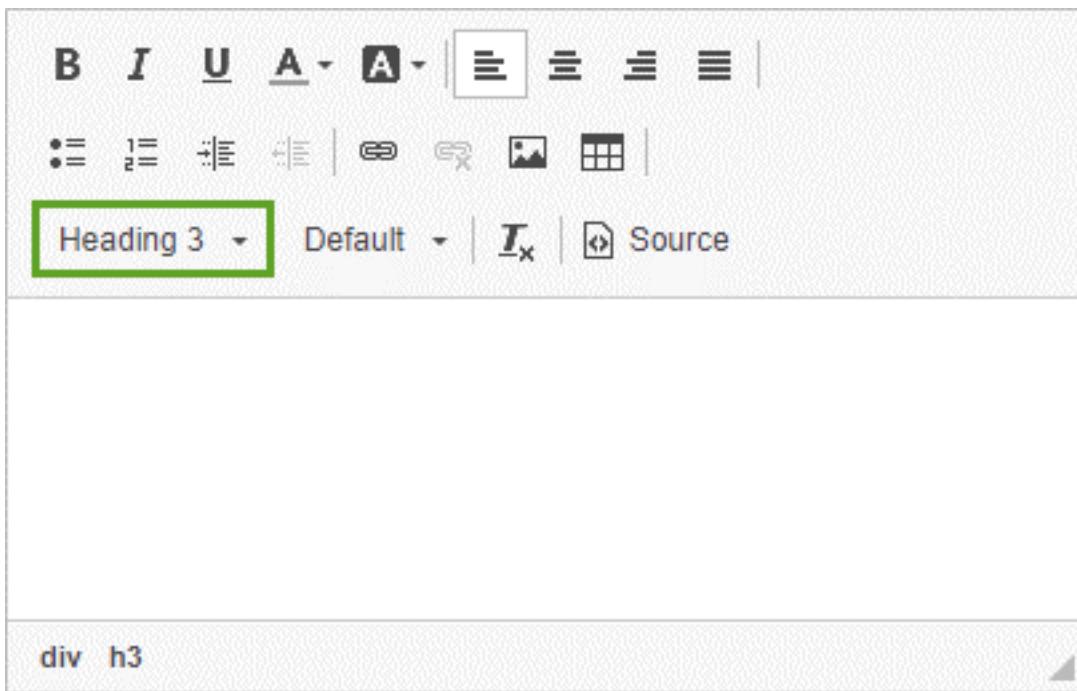
11. Change **Text color** to #ffffff and **Background color** to #004da8

The table's header changes to a dark blue color with white text.

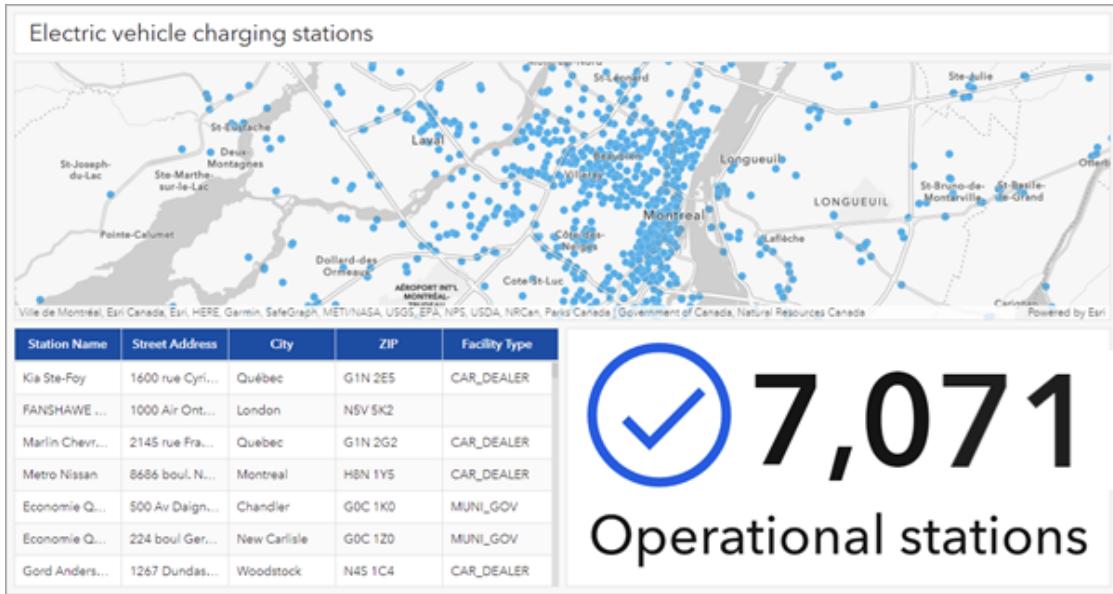
Station Name	Street Address	City	ZIP
Kia Ste-Foy	1600 rue Cyrill...	Québec	G1N 2E5
FANSHAWE EV...	1000 Air Ontari...	London	N5V 5K2
Marlin Chevrolet	2145 rue Frank...	Quebec	G1N 2G2
Metro Nissan	8686 boul. Ne...	Montreal	H8N 1Y5

The table's visual area is now configured. Next, you will name the table so it is easier to identify later when you set up actions.

12. Click the **General** tab and set **Name** to “Station table”
13. Expand the **No selection** section and click **Edit** next to Label
14. Click **Format** and choose **Heading 3**

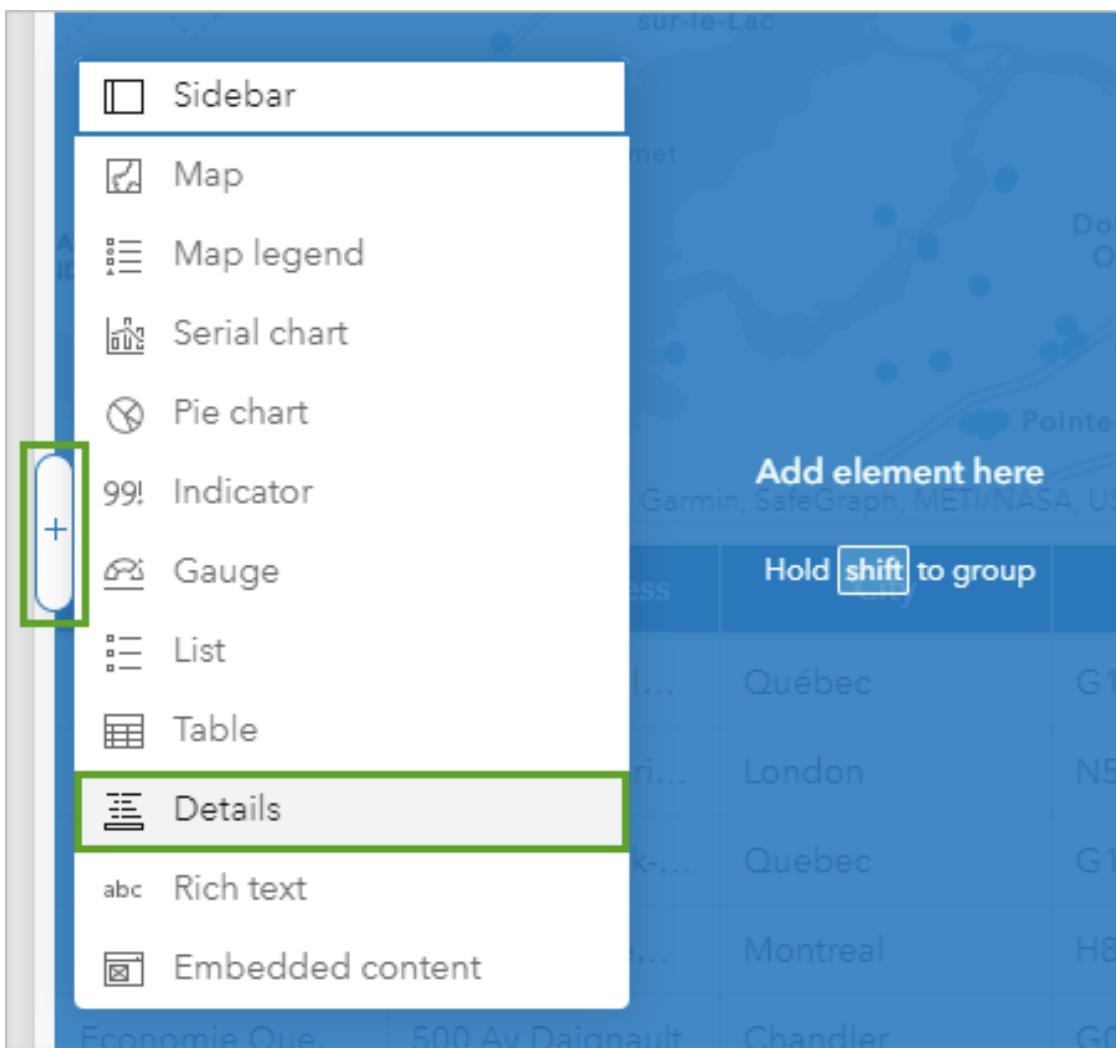


15. Type “Select a province to start viewing stations”
16. Click **Done**

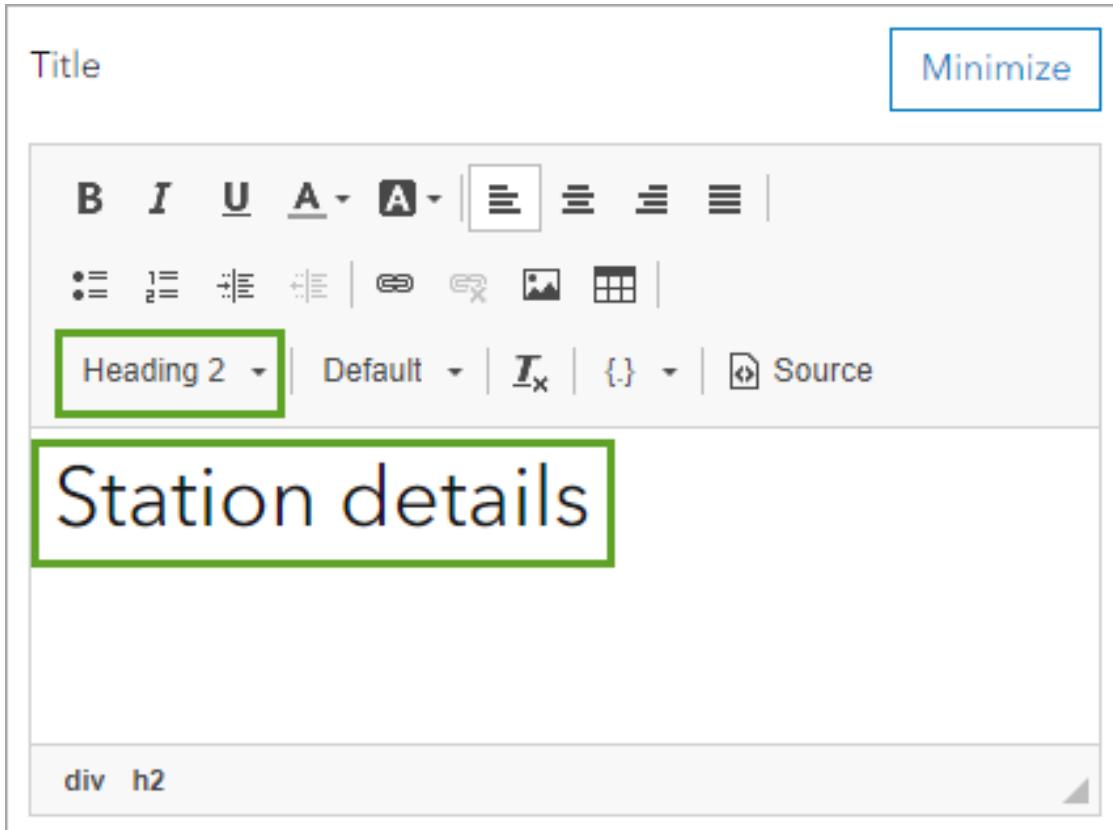


#### Step 4: Add a Details Element

1. On the toolbar, click **Add element**
2. Click the **Add** button on the left of the dashboard and click **Details**



3. Choose **Electric Charging Stations**
4. Click the **General** tab and set **Name** to “Station details”
5. For **Title**, click **Edit**
6. Click **Format**, choose **Heading 2**, and type “Station details”

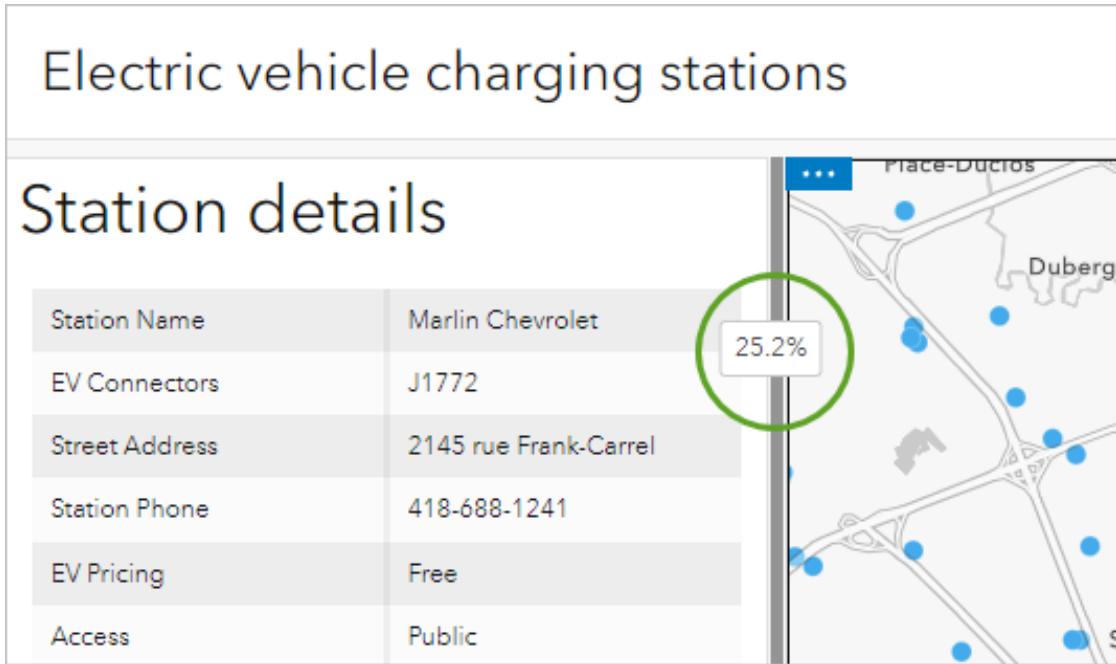


The title appears on the preview.

## Station details

Station Name	Kia Ste-Foy
EV Connectors	J1772
Street Address	1600 rue Cyrille-Duquet
Station Phone	418-654-2929
EV Pricing	Free
Access	Public - Call ahead
Access Days Time	Dealership business hours; for client use only
Cards Accepted	
Date Last Confirmed	4/11/2021, 7:00 PM

7. Expand **No selection** section, click **Edit** next to Label
8. Click **Format**, choose **Heading 3**, and type “Select a station to view details”
9. Click **Done**
10. Drag the right edge of the details pane until it takes up about 25% of the dashboard width



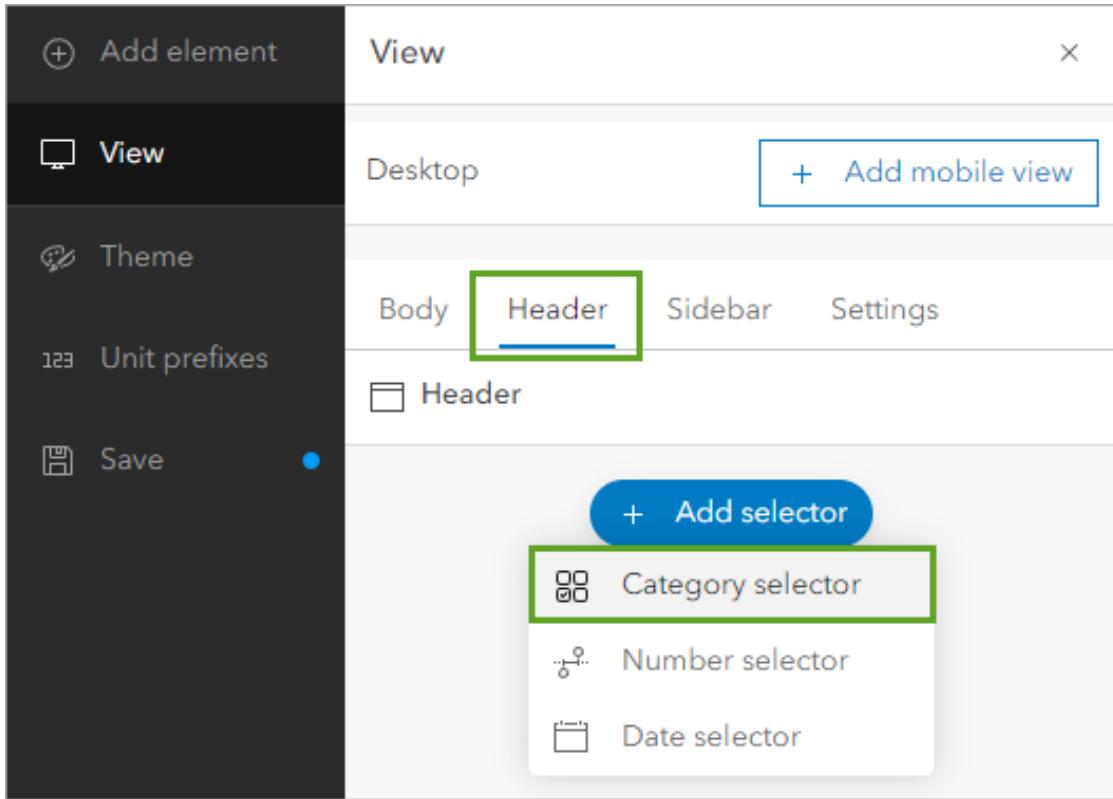
The dashboard is now configured with a map, a header, an indicator, a table, and a details element. Next, you'll give users the ability to filter the data on the dashboard.

---

## Part 4: Configure Dashboard Selectors

### Step 1: Add a Province Selector

1. In the View pane, click the **Header** tab
2. Click **Add selector** and choose **Category selector**



3. For **Categories** from, choose **Features**
4. Select **Provinces and Territories of Canada**

**Layers from 'Electric charging stations in Canada' map:**

- Electric Charging Stations
- OpenStreetMap Amenities for North America
- Provinces and Territories of Canada

5. For **Line item template**, click **Add field** and choose **PRENAME**

Line item template

{}	{PRENAME}
----	-----------

PRUID  
{PRUID}

DGUID  
{DGUID}

PRNAME  
{PRNAME}

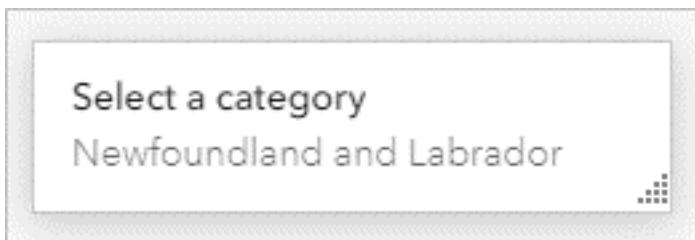
**PRENAME**  
**{PRENAME}**

PRFNAME  
{PRFNAME}

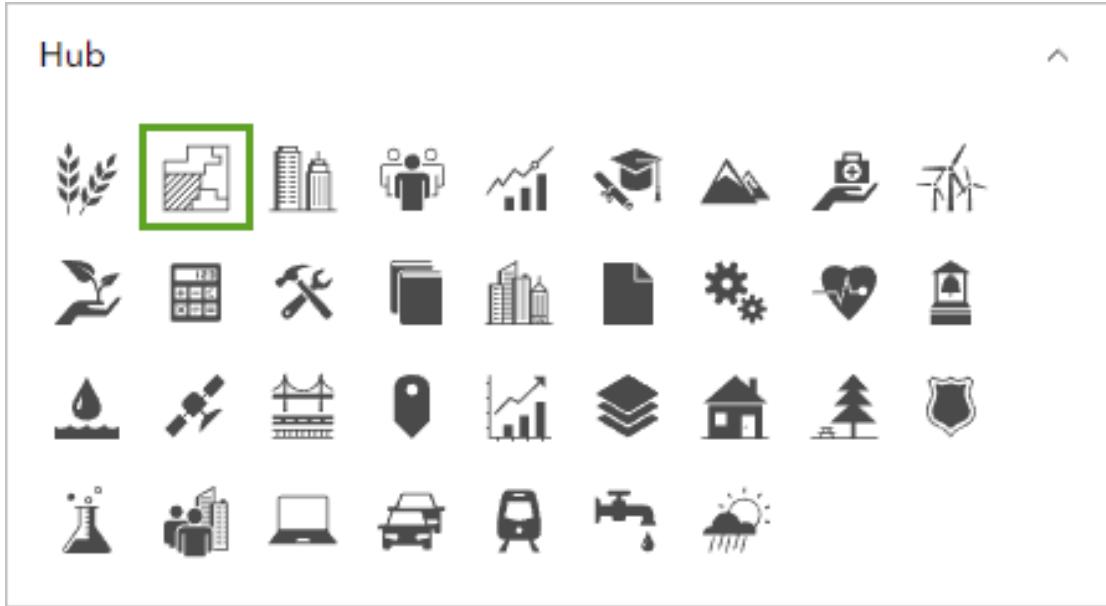
**Add field** ▾

^  
▼

**PRENAME** is short for province English name. The preview updates to show a province name.



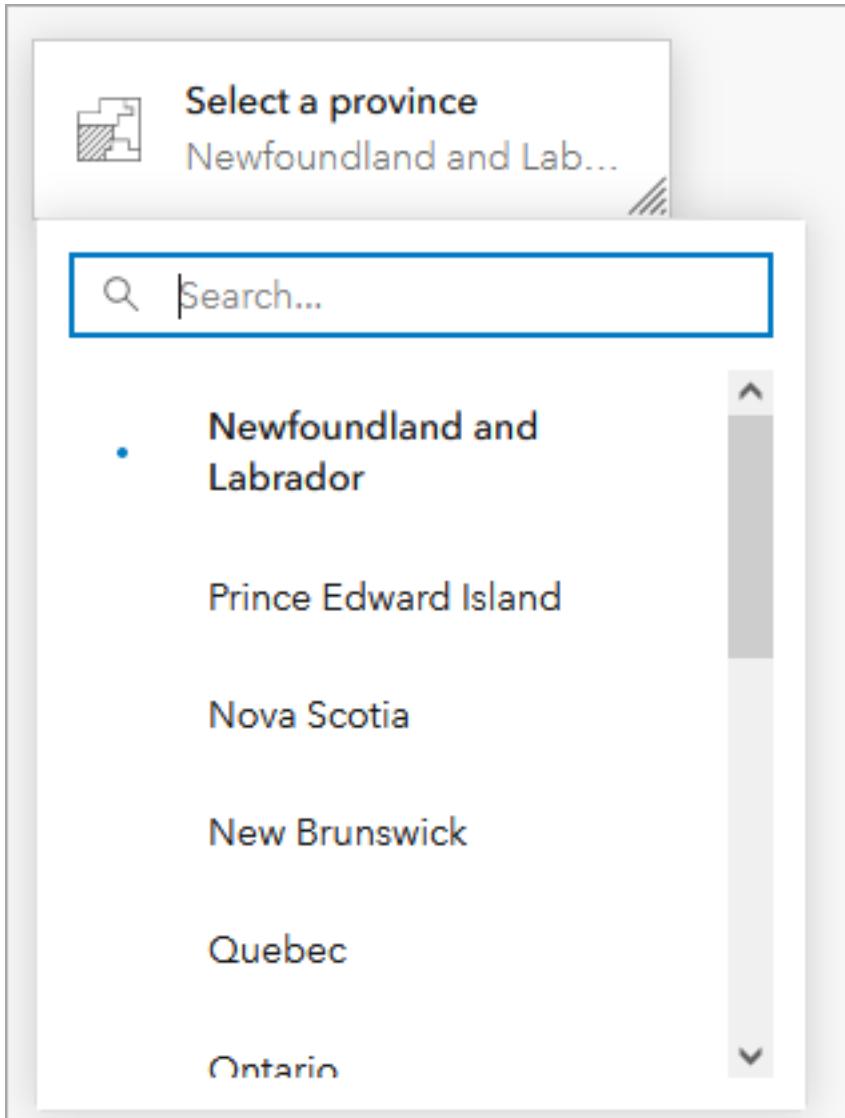
6. Click the **Selector** tab
7. For **Label**, type “Select a province”
8. Click **Add icon**, expand **Hub** section, choose **Boundaries** icon, and click **OK**



9. Turn on **Show search**

10. Click the preview.

The list of provinces appears. At the top is a search bar that allows you to search the list with text.



You'll add an item to this list that allows users to select no province or territory.

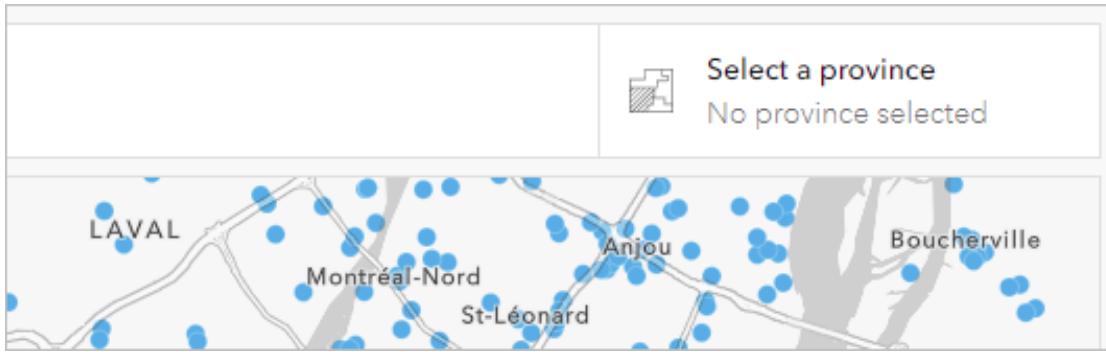
11. Turn on **None option** and set **Label for none** to "No province selected"



12. Expand **General** section and set **Name** to “Province selector”

13. Click **Done**

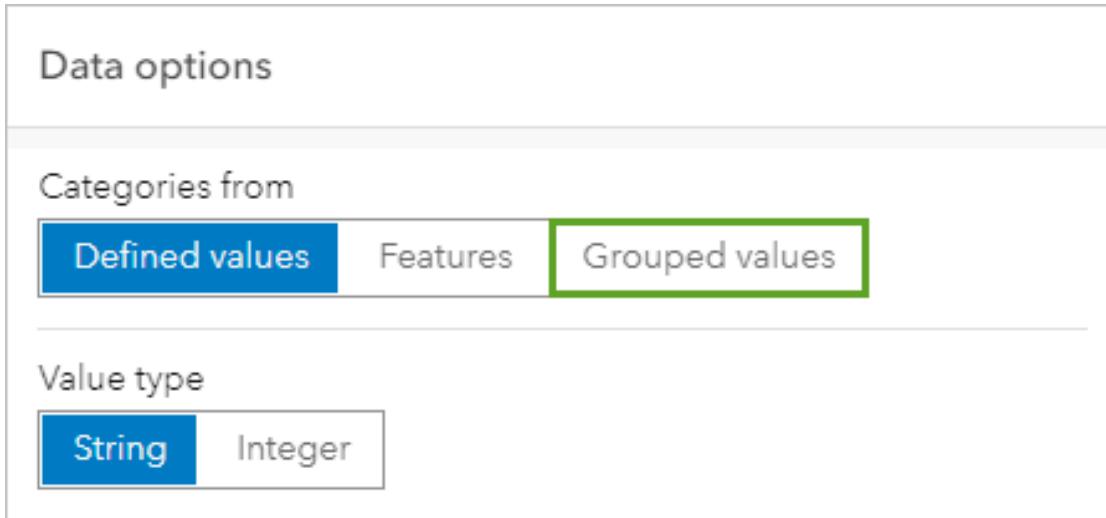
The province selector appears on the dashboard’s header, above the map.



## Step 2: Add a City Selector

1. Click **Add selector** and choose **Category selector**

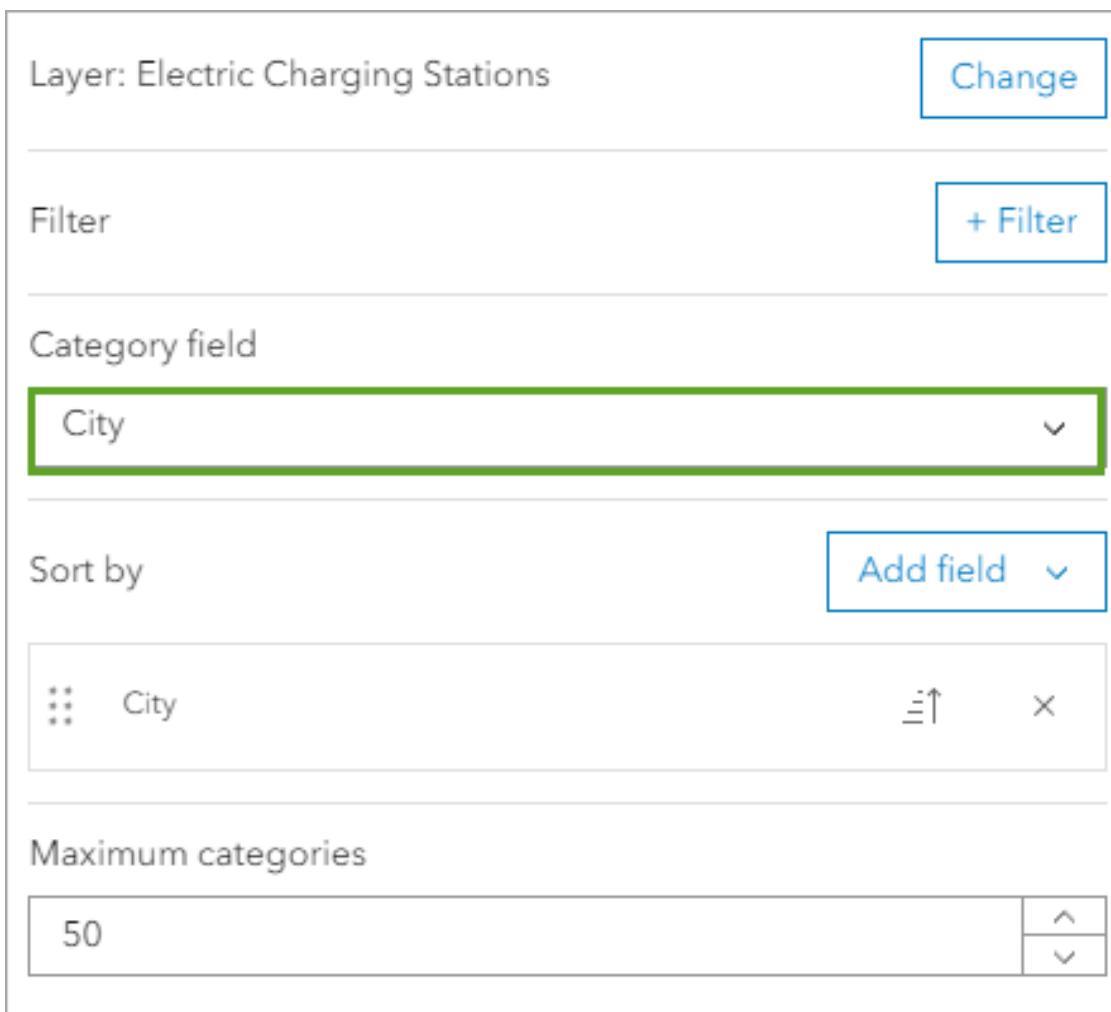
2. For **Categories from**, choose **Grouped values**



3. Choose **Electric Charging Stations**

4. For **Category field**, choose **City**

The **City** field is also added to the **Sort by** section. This will sort the cities alphabetically in the selector to make them easier to find.

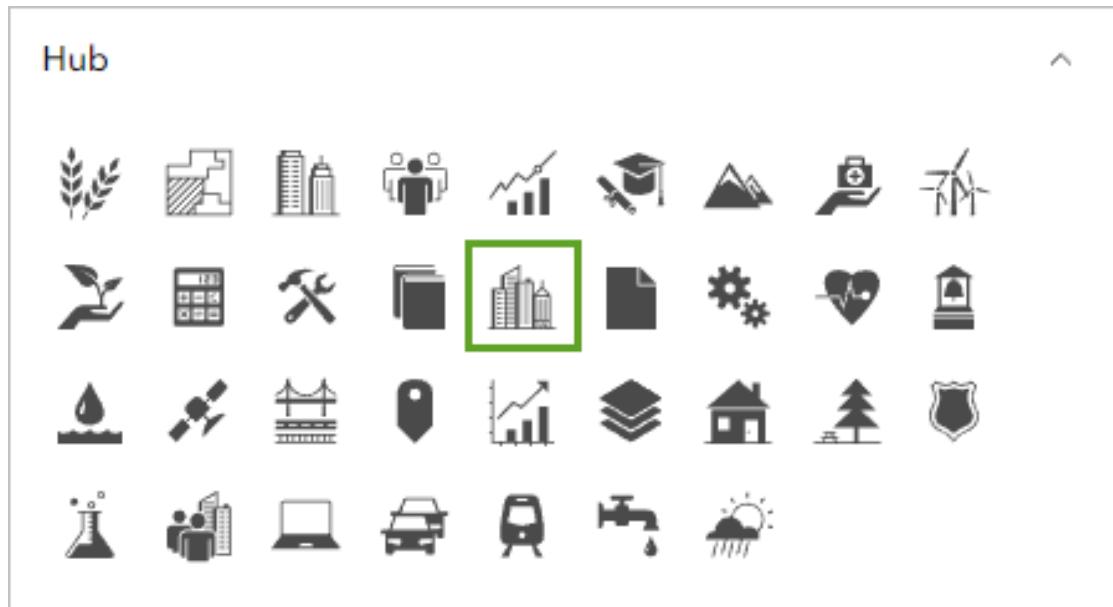


**Maximum categories** is set to 50, which means that only the first 50 cities will appear in the selector. There are more than 50 cities and towns in most provinces, so you will increase this limit.

5. For **Maximum categories**, type 350
6. Click the **Selector** tab
7. For **Label**, type “Select a city”



8. Click **Add icon**, expand **Hub** section, choose **City icon**, and click **OK**



9. For **Selection**, choose **Multiple**
10. Set **Placeholder text** to “No city selected”

**Settings**

Label

Select a city

Placeholder text

No city selected

Icon

Change

Icon

Presentation mode

Inline

Dropdown

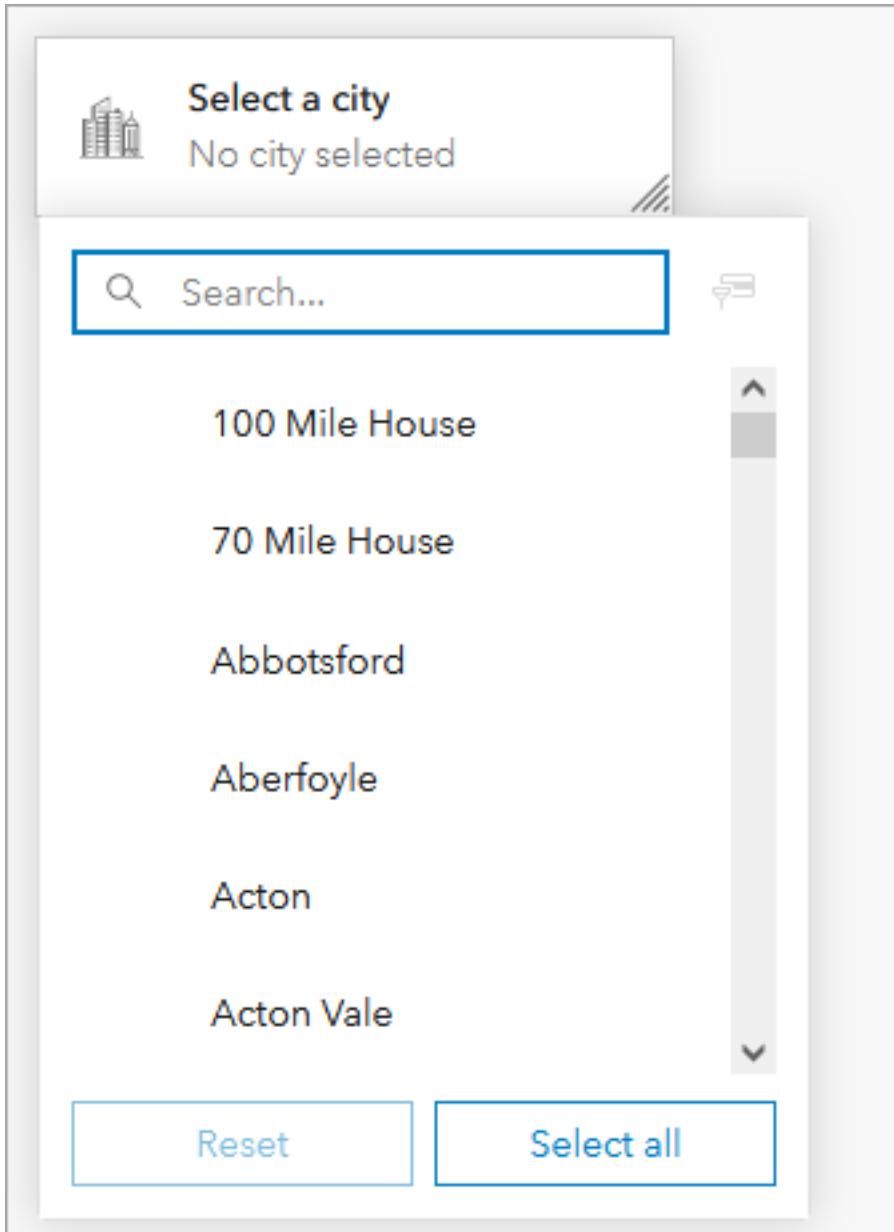
Selection

Single

Multiple

This image shows a configuration interface for a dropdown component. It includes sections for 'Label' (with placeholder 'Select a city'), 'Placeholder text' (containing 'No city selected'), 'Icon' (with a 'Change' button and a trash icon), 'Presentation mode' (set to 'Dropdown'), and 'Selection' (set to 'Multiple'). The 'Placeholder text' and 'Selection' sections have green borders around their respective input fields.

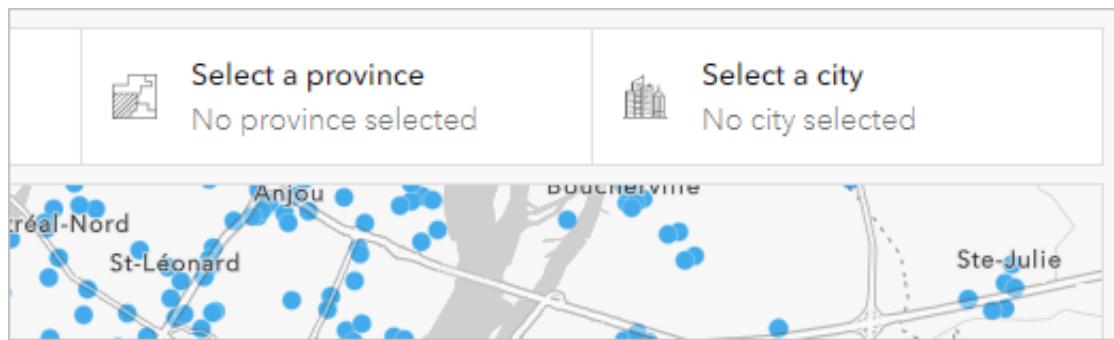
11. Turn on **Show search** and **Show reset and select all**
12. Click the preview to expand the list of cities.



**Reset** and **Select all** buttons appear below the list. These tools can help users interact with longer lists more easily.

13. Expand **General** section and set **Name** to “City selector”
14. Click **Done**

The new selector appears on the dashboard’s header.



### Step 3: Add a Connector Selector

1. Click **Add selector** and choose **Category selector**
2. For **Categories from**, choose **Grouped values**
3. Choose **Electric Charging Stations**
4. For **Category field**, choose **EV\_Connector\_Types**

**Data options**

**Categories from**

Defined values   Features   **Grouped values**

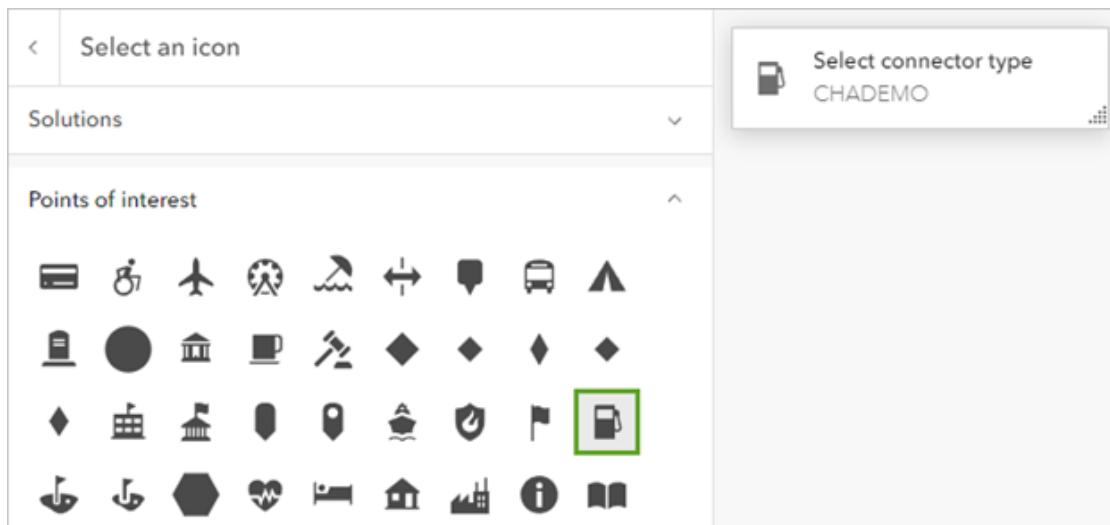
Layer: Electric Charging Stations   [Change](#)

Filter   [+ Filter](#)

**Category field**

**EV\_Connector\_Types** [▼](#)

5. Click the **Selector** tab
6. For **Label**, type “Select connector type”
7. Click **Add icon**, expand **Points of interest** section, choose **fueling station** icon, and click **OK**



8. For **Selection**, choose **Multiple**
9. Set **Placeholder text** to “No connector selected”
10. Turn on **Show search** and **Show reset and select all**

**Settings**

**Label**

Select connector type

**Placeholder text**

No connector selected

**Icon**

Change 

**Presentation mode**

Inline **Dropdown**

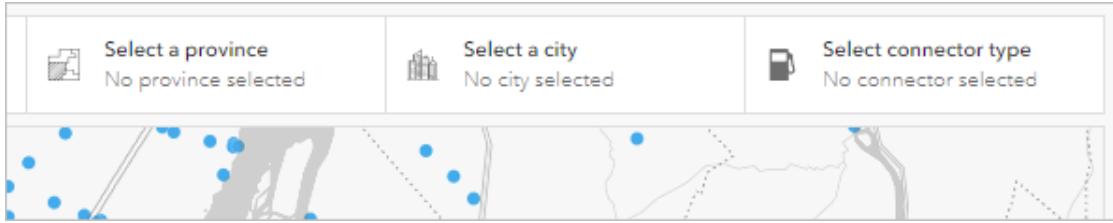
**Selection**

Single **Multiple**

Show search 

Show reset and select all 

11. Expand **General** section and set **Name** to “Connector selector”
12. Click **Done**



All three of the selectors are now configured. However, they can't yet be used to filter data on the dashboard. Next, you'll configure actions to connect all of the dashboard's elements so users can tailor the dashboard to their needs.

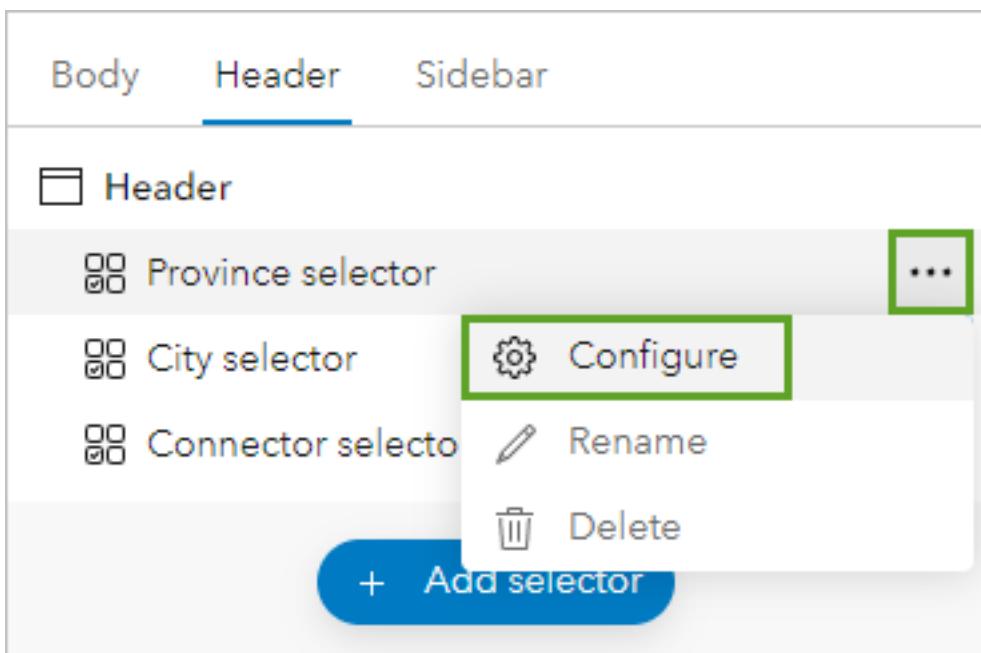
**Scottish Context Example:** For a Scottish tourism dashboard, selectors might include: - **Council areas** (Highland, Fife, Glasgow City, etc.) - **Attraction types** (Castles, Distilleries, Museums, Natural sites) - **Accessibility features** (Wheelchair accessible, Family-friendly, Dog-friendly) - **Seasonal availability** (Year-round, Summer only, Winter sports)

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## Part 5: Configure Actions

### Step 1: Configure Province Selector Actions

1. In the View pane, Header tab, point to **Province selector**
2. Click the options button and click **Configure**



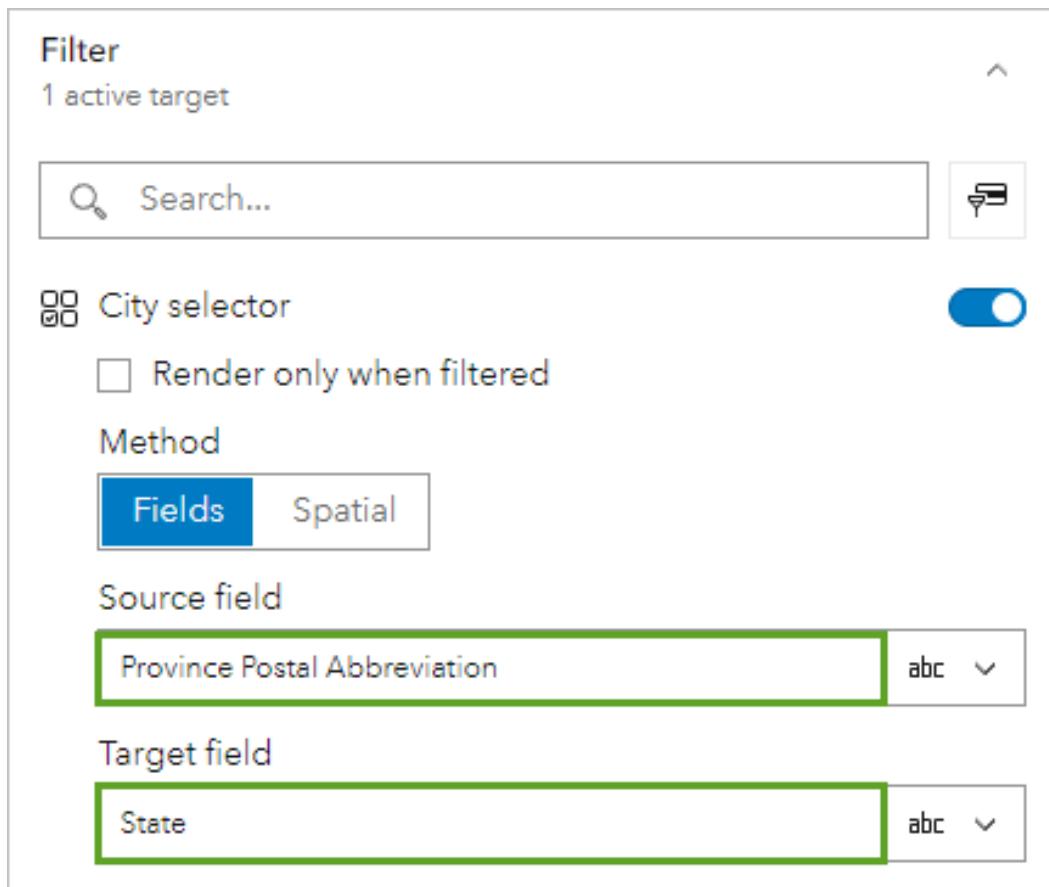
3. Click the **Actions** tab

You can configure a **Filter**, **Flash**, **Show pop-up**, **Pan**, or **Zoom** action to occur when a new province is selected.

Data	Actions
Selector	When selection changes
Actions	<b>Filter</b> Active targets: 0
	<b>Flash</b> Active targets: 0
	<b>Show pop-up</b> Active targets: 0
	<b>Pan</b> Active targets: 0
	<b>Zoom</b> Active targets: 0

The first action that you'll configure is a filter action. When users select a province in the province selector, it will filter the city selector to only show cities within that province.

4. Expand the **Filter** section
5. Turn on **City selector** and set:
  - **Source field:** Province Postal Abbreviation
  - **Target field:** State



6. Turn on filter actions for **Electric Charging Stations**, **Operational stations indicator**, and **Station table**
7. For each, set **Source field** to **Province Postal Abbreviation** and **Target field** to **State**

Electric charging stations in Canada

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Electric Charging Stations

Render only when filtered

Method

Fields  Spatial

Source field

Province Postal Abbreviation abc ▾

Target field

State abc ▾

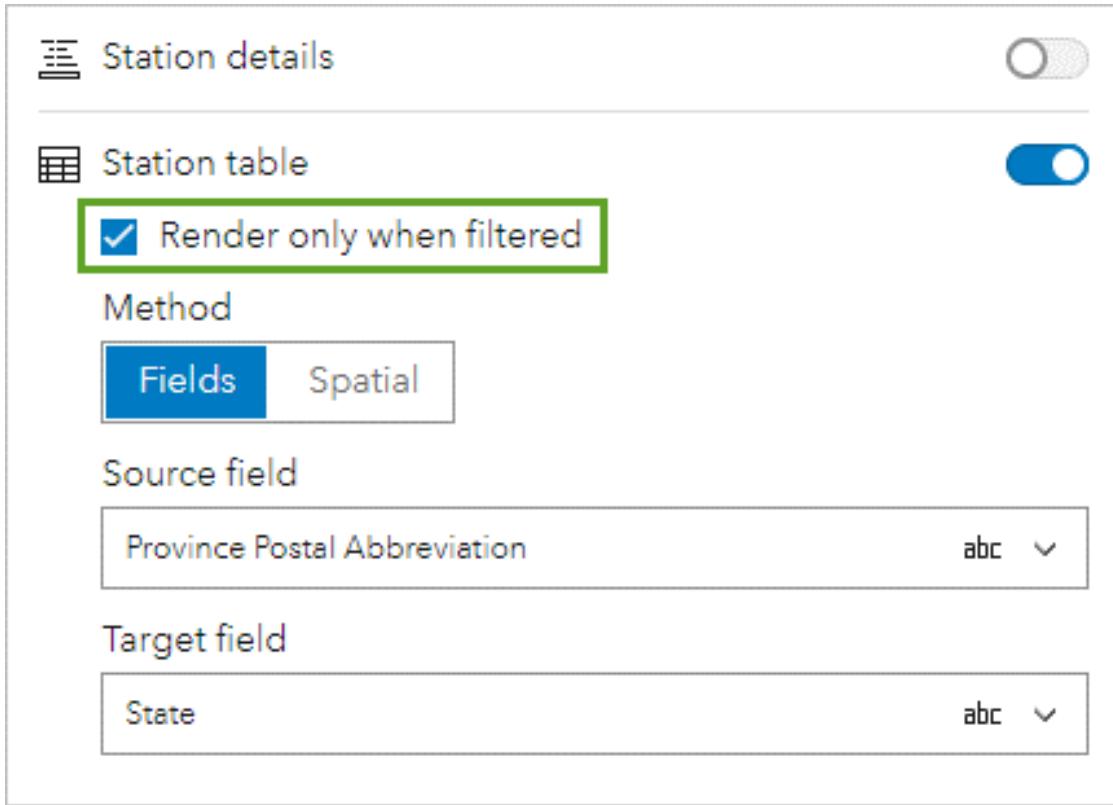
---

OpenStreetMap Amenities for North America

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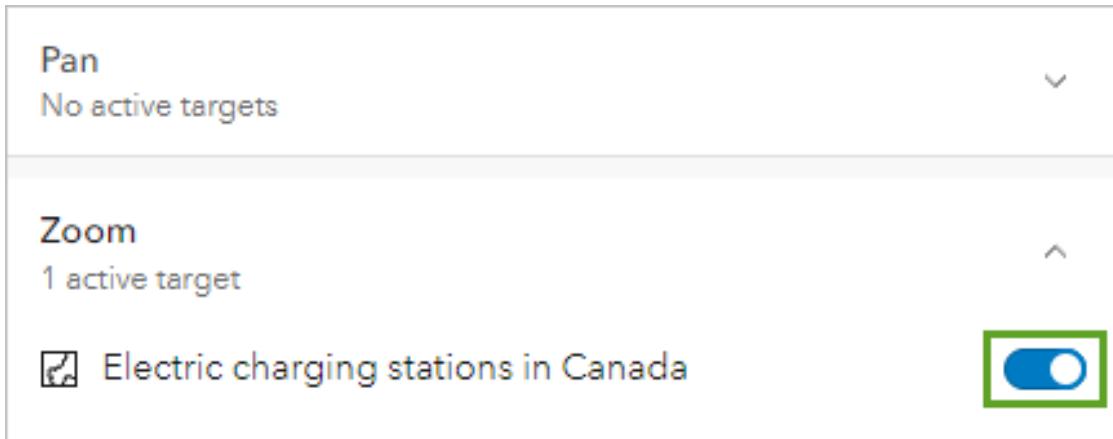
Provinces and Territories of Canada

8. For Station table, check **Render only when filtered**



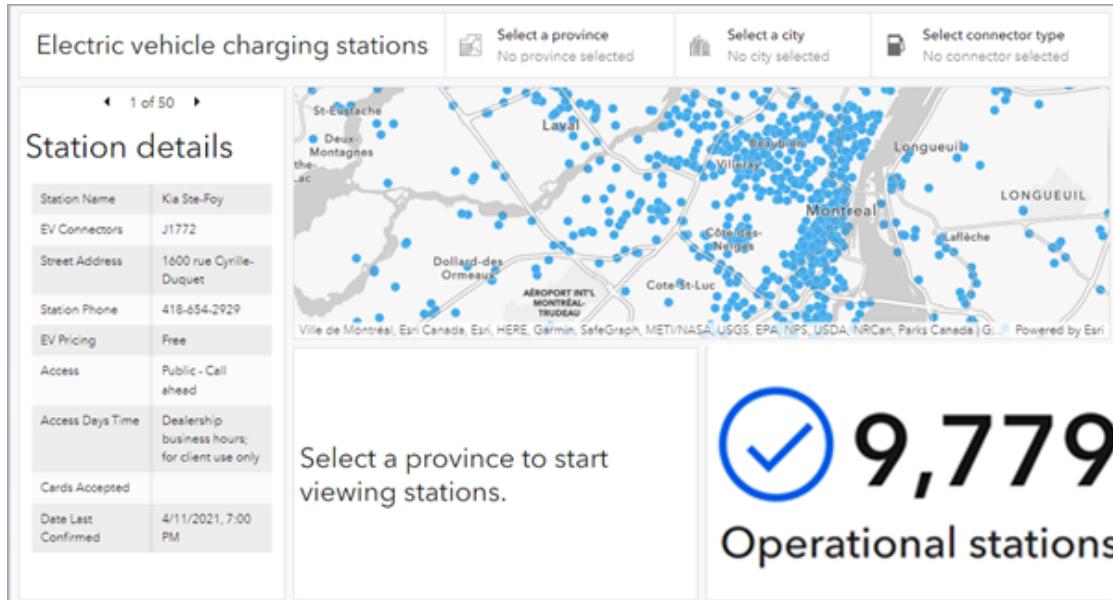
You'll add one more action to the province selector, to make the map zoom to the selected province.

9. Expand **Zoom** section and turn on **Electric charging stations in Canada**



10. Click **Done**

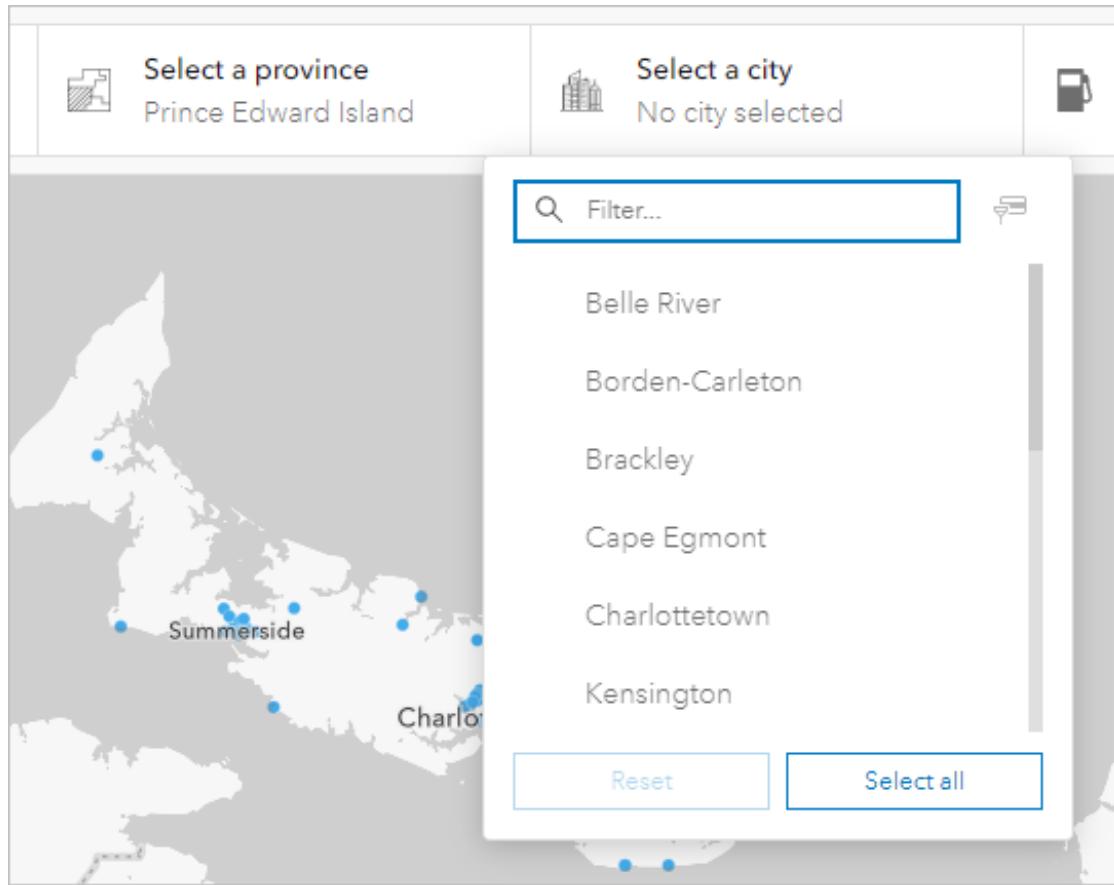
The dashboard looks the same as before, except that the table has been replaced by a message.



You'll test that the actions you configured are working as expected.

## Step 2: Test Province Selector

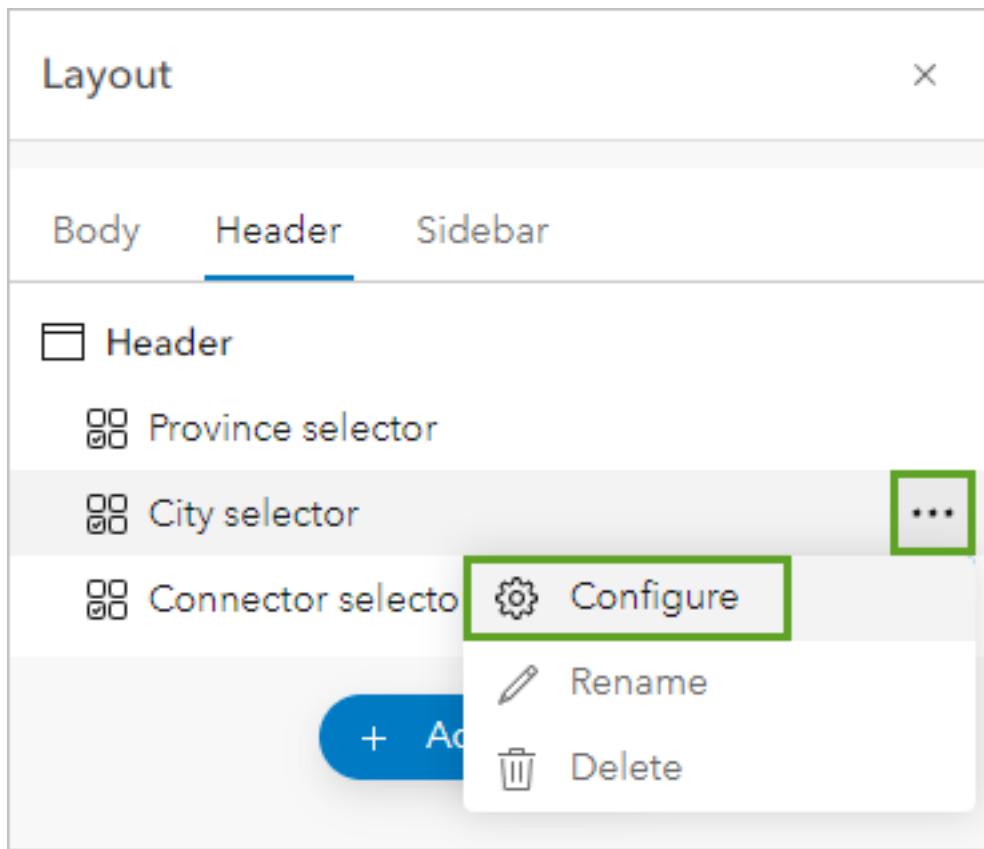
1. Click **Select a province** and choose **Prince Edward Island**
2. Observe how the map zooms, table populates, and indicator updates
3. Click **Select a city** to see only relevant cities listed



### Step 3: Configure City and Connector Selector Actions

#### 1. Configure City selector:

- Point to City selector, click options, and **Configure**
- Click **Actions** tab, expand **Filter** section
- Turn on **Connector selector**, **Electric Charging Stations**, **Operational stations** indicator, and **Station table**
- Click **Done**



2. Configure **Connector selector**:

- Point to Connector selector, click options, and **Configure**
- Click **Actions** tab, expand **Filter** section
- Turn on **Electric Charging Stations**, **Operational stations indicator**, and **Station table**

The screenshot shows the ArcGIS Pro Layout pane with a search bar at the top. Below the search bar are several configuration sections for different layers:

- Connector selector**: Turned on (blue switch). Includes a checkbox for "Render only when filtered".
- Electric charging stations in Canada**: Turned on (blue switch). Includes a checkbox for "Render only when filtered".
- Electric Charging Stations**: Turned on (blue switch). Includes a checkbox for "Render only when filtered".
- OpenStreetMap Amenities for North America**: Turned off (gray switch).
- Provinces and Territories of Canada**: Turned off (gray switch).
- 99! Operational stations indicator**: Turned on (blue switch). Includes a checkbox for "Render only when filtered".
- Province selector**: Turned off (gray switch).
- Station details**: Turned off (gray switch).
- Station table**: Turned on (blue switch). Includes a checkbox for "Render only when filtered".

You don't need to define matching fields this time because all of the connected elements are based on the same layer: **Electric charging stations in Canada**.

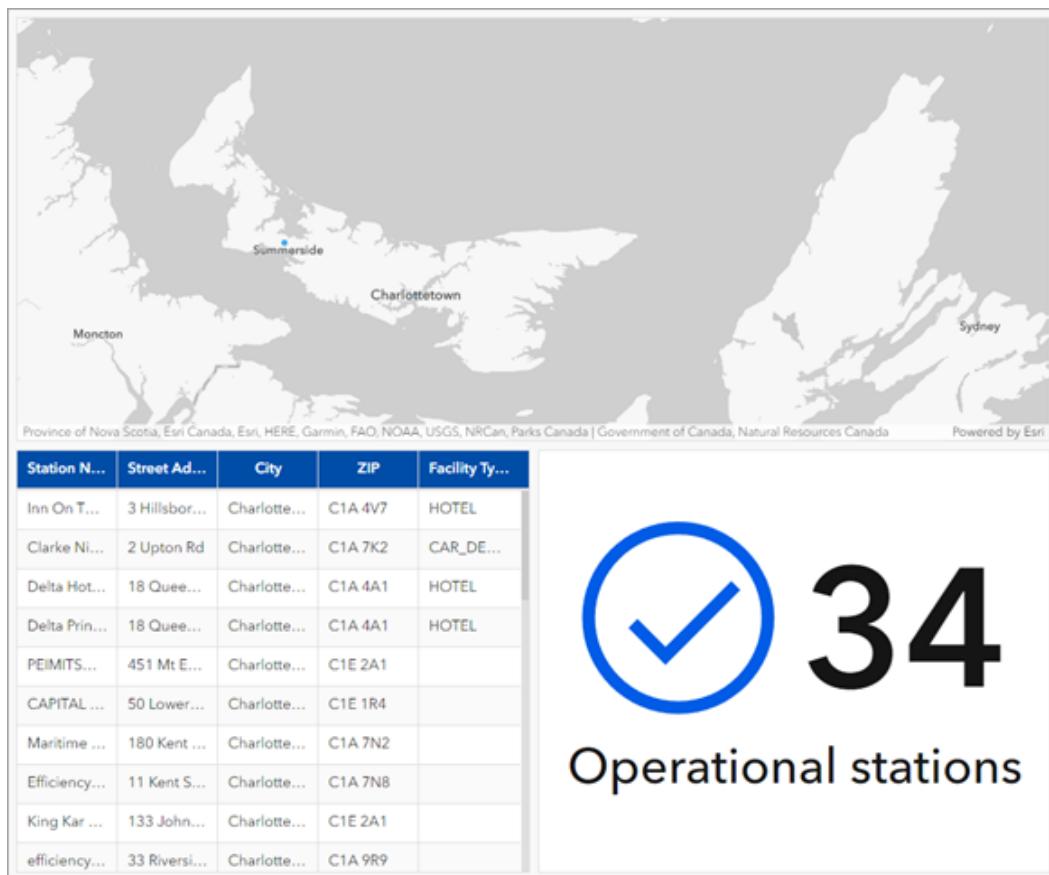
- Click **Done**
- In the **Layout** pane, point to **Connector selector**, click the options button, and click **Configure**.
- Click the **Actions** tab and expand the **Filter** section.
- Turn on **Electric Charging Stations**, **Operational stations indicator**, and

### Station table.

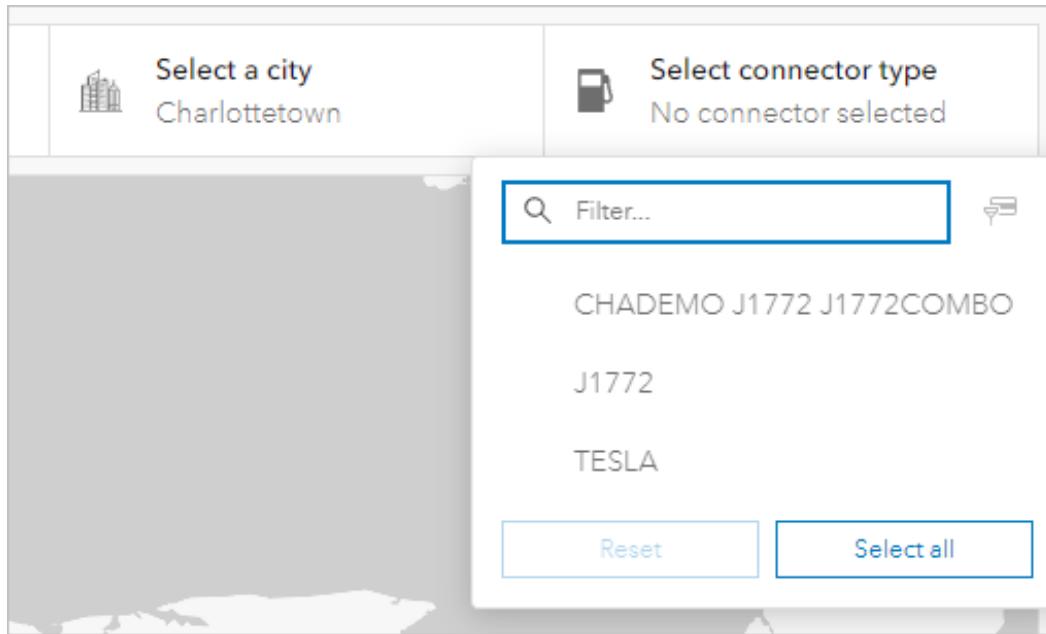
The screenshot shows a list of configuration items for a station table:

- City selector: Enabled (blue switch)
- Electric charging stations in Canada: Enabled (blue switch)
- Electric Charging Stations: Enabled (blue switch)
  - Render only when filtered: Disabled (grey switch)
- OpenStreetMap Amenities for North America: Enabled (blue switch)
- Provinces and Territories of Canada: Enabled (blue switch)
- 99! Operational stations indicator: Enabled (blue switch)
  - Render only when filtered: Disabled (grey switch)
- Province selector: Enabled (blue switch)
- Station details: Enabled (blue switch)
- Station table: Enabled (blue switch)
  - Render only when filtered: Enabled (blue switch)

- Click **Done**.  
You'll test that the actions behave as expected together.
- If necessary, on the header, click **Select a province** and choose **Prince Edward Island**.
- Click **Select a city** and choose **Charlottetown**.  
The map, table, and indicator all update to show fewer stations.



- On the header, click **Select connector type**.

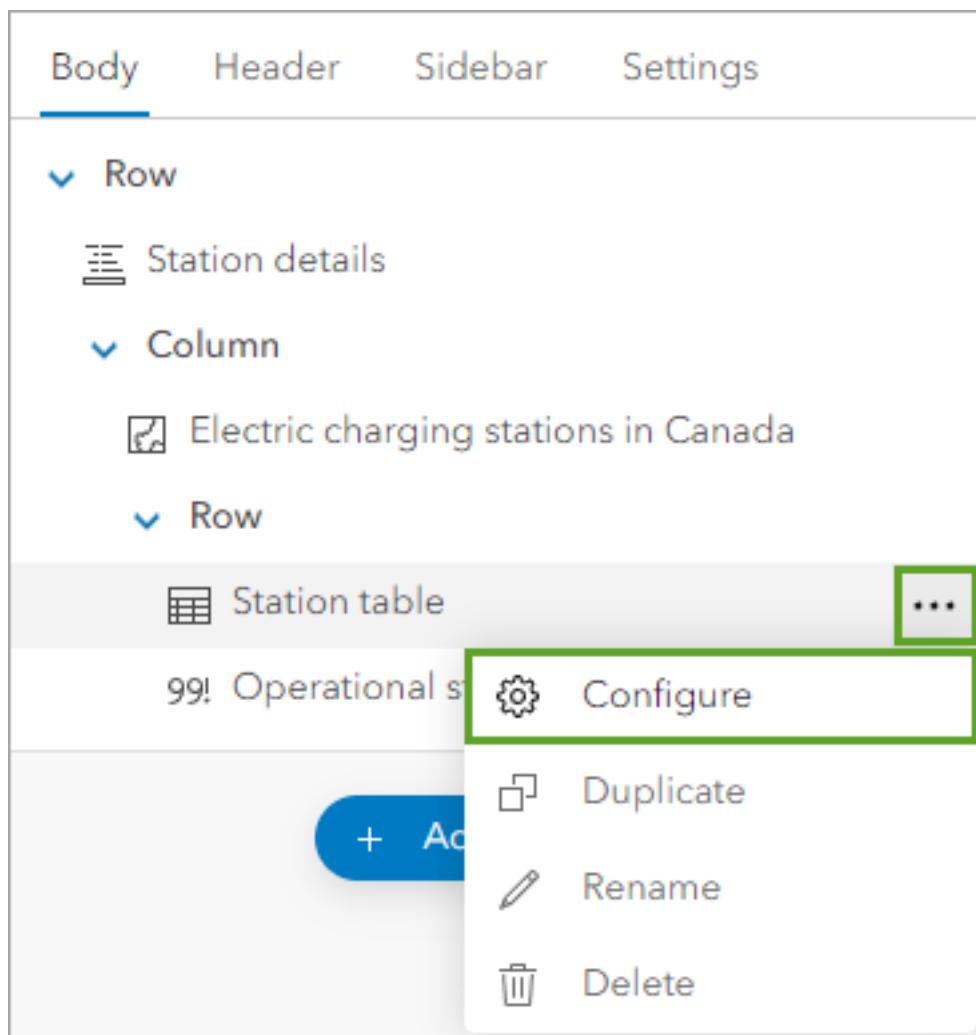


- The list has fewer options than before.
- In the connector selector, click **TESLA**.  
The map, table, and indicator all update to show fewer stations.

#### Step 4: Configure Table Actions

The last actions you will configure are on the table. The table only populates once a province is selected on the header. Similarly, you will ensure that the details element only populates when a station is selected in the table. Otherwise, viewers will see details for stations that are probably not relevant to them. When there is no selection on the table, the message you configured earlier will display.

1. In the View pane, click the **Body** tab
2. Point to **Station table**, click options, and **Configure**



3. Click **Actions** tab, expand **Filter** section
4. Turn on **Station details** and check **Render only when filtered**

99! Operational stations indicator

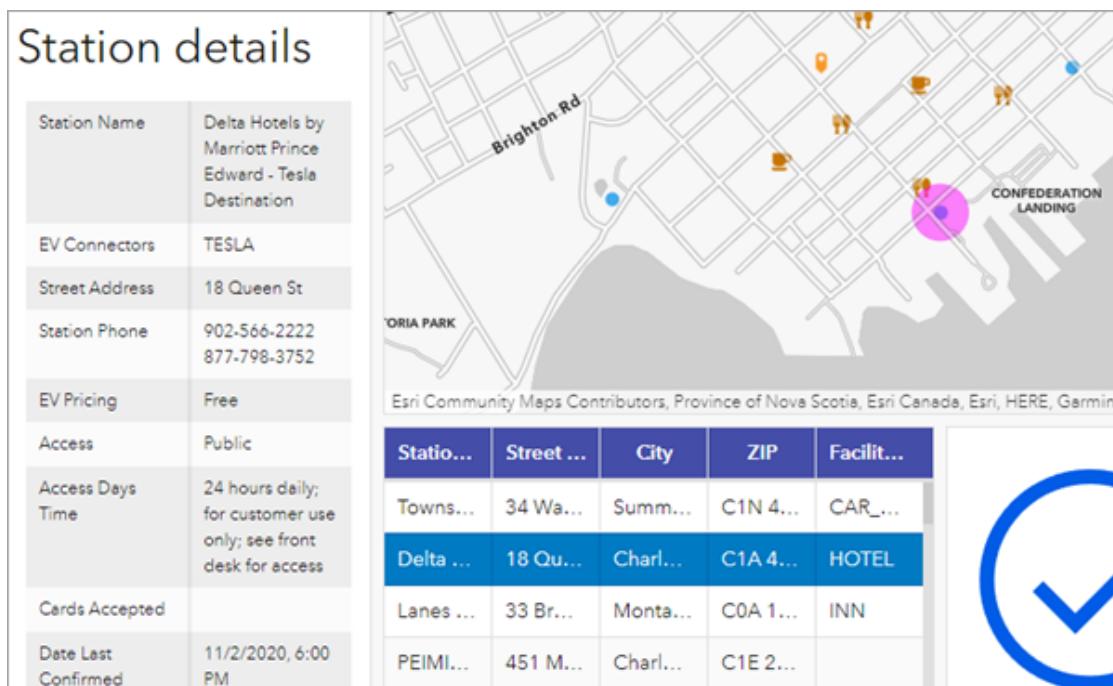
00 Province selector

 Station details

Render only when filtered

5. Expand **Flash** section and turn on **Electric charging stations in Canada**
6. Expand **Zoom** section and turn on **Electric charging stations in Canada**
7. Click **Done**

On the dashboard, click any row in the table.



## Step 5: Test Complete Functionality

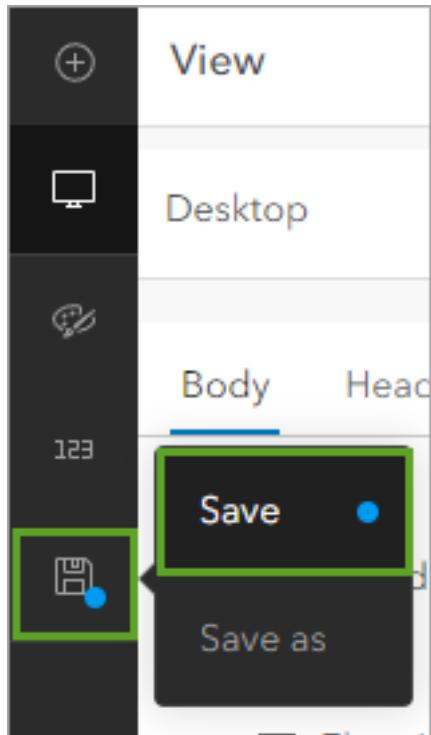
1. Select **Prince Edward Island** from province selector
2. Select **Charlottetown** from city selector

3. Select **TESLA** from connector selector
  4. Click any row in the table to see details populate and map zoom/flash
- 

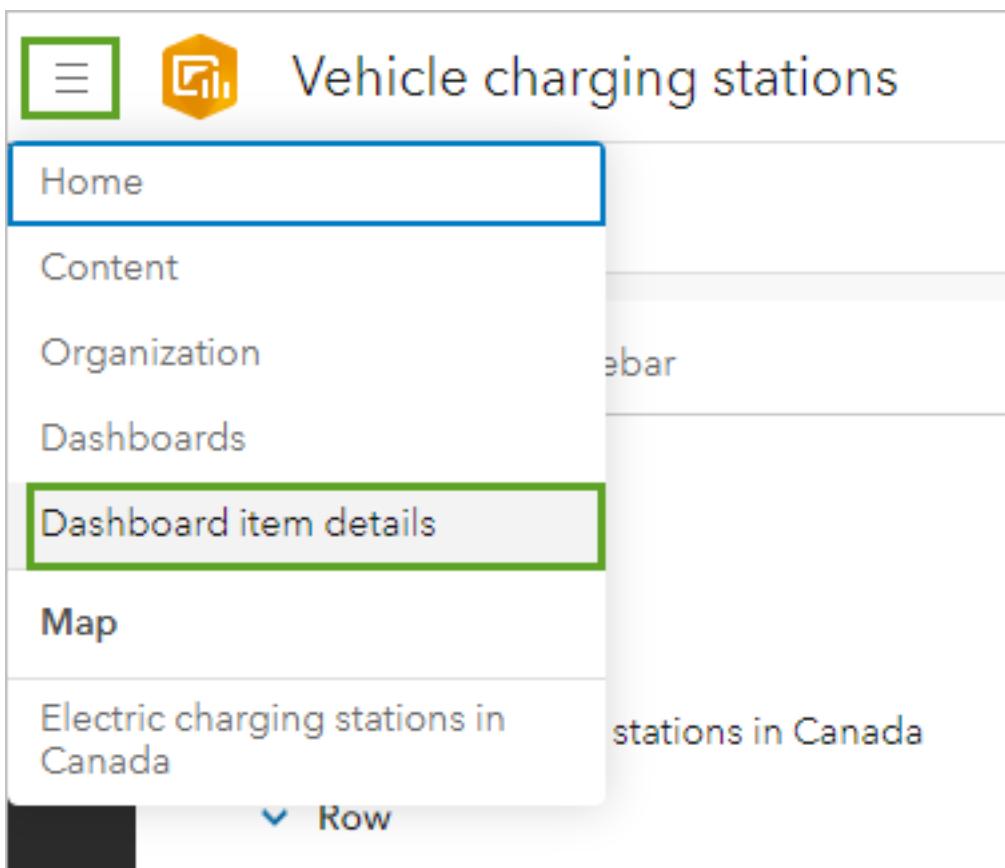
## Part 6: Share the Dashboard

### Step 1: Save and Access Dashboard Settings

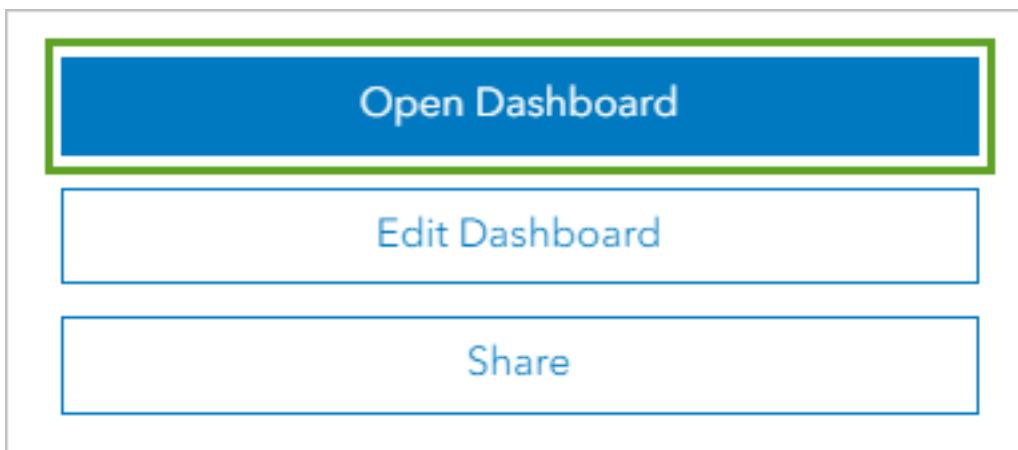
1. On the dashboard toolbar, click **Save** and click **Save**



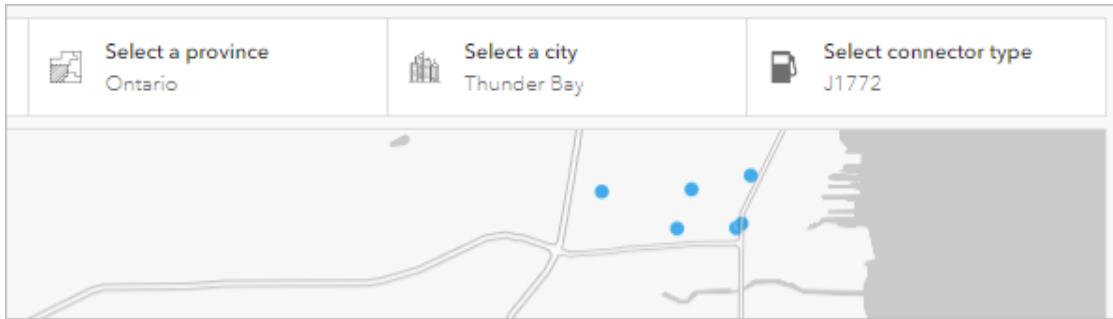
2. Next to the dashboard title, click the menu button and click **Dashboard item details**



3. Click **Open Dashboard** to test in a new browser tab



4. Test the dashboard functionality (e.g., find J1772 charging stations in Thunder Bay, Ontario)



## Step 2: Share the Dashboard

1. Return to the item page and click **Share**
2. **Important:** In the Share window, choose **Members of my organization (University of St Andrews)** and click **Save**

**Note:** This differs from the original tutorial which shared publicly. We're restricting to University of St Andrews members only.

## Step 3: Share the Associated Web Map

1. On the ribbon, click **Content**
  2. Find “Electric charging stations in Canada” and click the **Update sharing** icon
  3. In the Share window, choose **Members of my organization (University of St Andrews)** and click **Save**
- 

## Final Steps:

Well Done! You have now completed all the steps for this lab. Before moving on, make sure to:

1. **Take one screenshot** of the final map. Ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report ( see all the instructions in the handbook). **Dashboard fully loaded** - showing all elements working - **Demonstration of functionality** - show the dashboard with: - A province selected - A city selected - A connector type selected - Station details displayed - Table populated with filtered results.

**2. For the Part B of this lab in your report. Replicate the process independently by applying the same skills you practised in this lab, but using spatial data from Scotland or the UK.**

In the original lab, you have created a operational dashboard. For your **independent spatial analysis**, you can choose a different theme and dataset (e.g. healthcare access, education, environmental risk), as long as you also:

- Use again **ArcGIS Online Dashboards** using your university credentials. **Meet and work with your classmate to define which account want to use . You must only report one independent analysis results.**
- Apply the same techniques learned in this lab., and create another operational dashboard app, to represent the thematic of your preference.
- Include the screenshot of the new dashboard created with a **clear purpose** relevant to a real-world issue in Scotland or the UK. Ensuring your **full screen is visible**, including the **date and time**. This screenshot will be required for your report. As you did for the first screenshot, make sure you the **dashboard is fully loaded** - showing all elements working - **demonstrate the functionality** - show the dashboard with: - List section, items details displayed - table populated with filtered results. Take a full screen screenshot (not just browser window) 5. Include this screenshot with your report (see the instructions in the handbook)

This additional task is an opportunity to improve your technical skills, explore new datasets, and demonstrate your ability to adapt spatial analysis methods to new contexts.

### **Scottish Context Examples:**

Here are some examples of potential operational dashboards you could create for the Scottish contexts:

- **Renewable energy monitoring** (wind farms, solar installations)
  - **Tourism infrastructure** (attractions, accommodation, transport links)
  - **Public transport optimization** (bus routes, train connections, ferry services)
  - **Environmental monitoring** (air quality, weather stations, flood warnings)
  - **Economic development** (business locations, employment centers, investment zones)
- 

Tutorial inspired from <https://learn.arcgis.com/en/projects/build-an-interactive-dashboard/>

## **Additional Resources**

- [ArcGIS Dashboard Documentation](#)
- [Tutorial Gallery](#)
- [ArcGIS Online Help](#)

# Data Sources

This is a list of web portals where you can access open and authoritative **geospatial data** for the UK and Scotland. These sources can be used to download shapefiles, connect to live web services, and enrich your **ArcGIS Online** projects with meaningful local datasets.

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## 1. Scottish Spatial Data Infrastructure (SSDI)

The official portal for discovering and accessing spatial datasets from Scottish public bodies.

**Data Available:** - Administrative boundaries - Environmental and natural heritage data - Planning and infrastructure - Marine and coastal datasets - Data formats: Shapefiles, GeoJSON, WMS, WFS

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## 2. Scotland's Environment Web

A partnership platform providing environmental datasets and interactive maps.

**Data Available:** - Land cover and land use - Air and water quality - Biodiversity and habitats - Climate and emissions - Tools: Map viewers, WMS services, downloadable shapefiles

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## 3. Spatial Hub (Improvement Service)

Aggregates and publishes spatial data provided by all 32 Scottish local authorities.

**Data Available:** - Planning applications - Housing land audits - School catchments - Local development plans - Data formats: Shapefiles, WMS, GeoJSON (registration may be required)

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## **4. UK Government Data Portal ([data.gov.uk](http://data.gov.uk))**

The central open data portal for the UK government.

**Data Available:** - Transport networks - Health and social care - Demographics and census  
- Crime and safety - Environment and energy - Formats: CSV, GeoJSON, Shapefiles, APIs, WMS/WFS services

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## **5. Ordnance Survey OpenData**

The UK's national mapping agency providing a range of open and premium geographic datasets.

**Data Available:** - OpenMap Local (general-purpose vector mapping) - OS Open Roads, OS Open Rivers - Boundary-Line (administrative boundaries) - Access via: Downloads, APIs, and ArcGIS-ready formats

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## **6. National Records of Scotland (NRS) Geography**

Provides the official statistical geographies for Scotland.

**Data Available:** - Data zones and Intermediate Zones - Census output areas - Health boards, local authorities - Formats: Shapefiles, GeoJSON

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## **7. Office for National Statistics (ONS) Geography**

Geospatial portal from the ONS offering boundary data and census geography.

**Data Available:** - Statistical geographies (LSOA, MSOA) - Census 2011 and 2021 boundaries  
- Parliamentary constituencies - Downloadable in ESRI Shapefile and GeoPackage formats

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## **8. DEFRA Data Services Platform**

UK Government's portal for environment-related data and services.

**Data Available:** - Flood risk zones - Agricultural land classification - River networks and water quality - Waste and recycling facilities - Access via: Shapefiles, APIs, WMS/WFS

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## **9. OpenStreetMap (Geofabrik UK Extracts)**

Extracts from OpenStreetMap for Great Britain, including Scotland.

**Data Available:** - Buildings, highways, land use, points of interest - Routable and editable map data - Formats: .osm.pbf, shapefiles (via tools like osmconvert or QGIS plugins)

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## **10. Edinburgh GeoPortal**

A geospatial data repository from Edinburgh with open datasets.

**Data Available:** - Local and global environmental data - Terrain and elevation - Land cover and vegetation indexes - Datasets relevant for climate change, ecology, and earth observation

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## **11. Glasgow GeoPortal**

A geospatial data repository from Glasgow with open datasets.

**Data Available:** - Local and global environmental data - Terrain and elevation - Land cover and vegetation indexes - Datasets relevant for climate change, ecology, and earth observation

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## **12. ArcGIS Living Atlas (UK content)**

ESRI's curated collection of geographic information, including UK-specific content.

**Data Available:** - Demographics, base maps, boundaries - Real-time environmental data - Accessible directly from ArcGIS Online for instant use

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## **13. ArcGIS Living Atlas (UK content)**

ESRI's curated collection of geographic information, including UK-specific content.

**Data Available:** - Demographics, base maps, boundaries - Real-time environmental data - Accessible directly from ArcGIS Online for instant use

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## **14. Urban Big Data Centre**

Urban Big Data Centre is a dynamic national research hub and data service, championing the use of smart data to inform policymaking and enhance the quality of urban life.

**Data Available:** - Transport and Mobility, Housing and property, Labor Market, Environment.

### **Tips for students**

- Many of these platforms offer **shapefiles**, **WMS** or **ArcGIS REST endpoints**, which can be added directly to your **ArcGIS Online** web map.
- Make sure to always **cite the data source** in your apps or reports.
- For reproducibility, **record the download date** and dataset version.
- Use **filtering and geoprocessing tools** in ArcGIS Online to tailor data to your study area.

## References

<https://www.sdg.org/>

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