Exercise 1: Understanding and Comparing Places: Mixed-Use Development

Instructions
Use this guide and ArcGIS Online to reproduce the results of the exercise on your own.

Notes: ArcGIS Online is a dynamic mapping solution. The screenshot graphics that you see in course materials may differ slightly from the version of ArcGIS Online that you will use.

Introduction

Location awareness is important to many fields, but you might not ask the same questions as an analyst in a different sector or industry. You might also use different kinds of data to answer your questions. GIS offers an array of analytical tools that can provide information to help you answer questions. However, you should first consider the spatial analysis approach—a seven-step workflow to solving spatial questions. Almost every spatial analysis project uses a similar approach of framing the question and defining the analysis criteria. This approach helps organize your GIS work. It ensures that your analysis provides useful and relevant information to help you gain insight, answer questions, and make better decisions. Exercises throughout this course follow the same approach.

Learn more about the language of spatial analysis.

The purpose of this example is to illustrate the type of problem that can be addressed using the spatial analysis approach.

Scenario

In this scenario, imagine that you are a real estate analyst for a local development company, and you have been monitoring the market for optimal sites where your company can build small mixed-use developments. The local development company hopes to build in a city that has a large amount of land already zoned for mixed-use development. The target demographic for both the retail businesses and the rental units is people in their 20s and 30s who already live nearby. The development company also believes that a larger rental market offers more potential for clients who would be interested in the new rental units that will be a part of the mixed-use development.

You begin the spatial analysis approach by asking questions. These questions help you identify the type of data and analysis methods to use. In this scenario, the analysis question can be framed as follows: **Is this city a good place to build a small mixed-use development?**

What information do you need to answer this question? How can you use the GIS to represent, analyze, and assess the criteria?

In this exercise, you will need to determine key information about the city:

- How much area is zoned for mixed-use development?
- Where are high rental areas within the city?
- Where do high numbers of people between the ages of 20-39 live in high rental areas?
- How many people between the ages of 20-39 live in these high rental areas?

In the exercise, you will begin by exploring and preparing the data—the second step in the spatial analysis approach.

Although the data is real, the scenario, analysis, and resulting decisions are hypothetical.

Technical notes

1. You will make full use of web mapping services throughout this course. You will need a robust web connection to complete this exercise and the exercises that follow.
2. Use the latest version of Google Chrome or Microsoft Edge. Other web browsers may not display your maps and apps correctly.

Note: For information on supported browsers, see ArcGIS Online Help: Supported browsers (https://esriurl.com/browsers).

Estimated completion time: Approximately 45-60 minutes

- Step 1: Open the map

Using ArcGIS Online, you can create a map to explore and identify layers that you will need to answer your spatial questions. For this exercise, the initial map has already been created.

Before opening the map, you will sign in to ArcGIS Online.

a Open a new private or incognito web browser tab or window.

To help prevent confusion between your ArcGIS Online accounts, we recommend that you open a private or incognito web browser window for all course work.

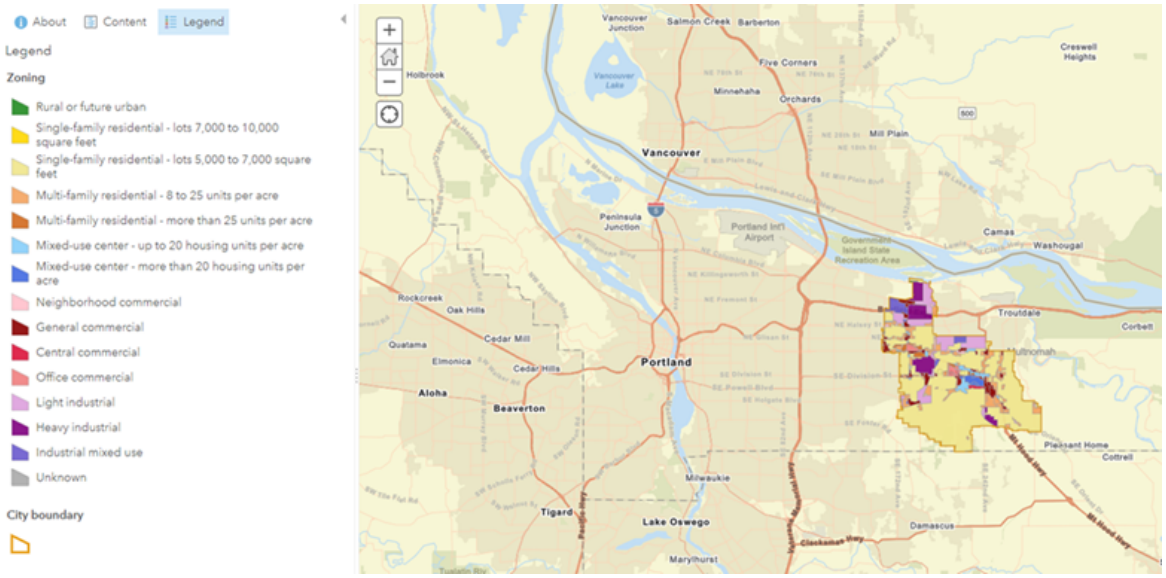
b In your private or incognito web browser window, go to https://www.arcgis.com/home/item.html?id=d0b14935c2b54626a2e47c5e59fa1ac1 (https://esriurl.com/Sec2Map).

c At the top right of the page, click Sign In.

d Sign in to ArcGIS Online using your course ArcGIS credentials.

Note: Section 1, Exercise 1 explains how to determine your course ArcGIS credentials (username and password). If you have trouble signing in, please refer to the Common Questions list on the course Help tab.

e Click the thumbnail image to open the map.



Step 1e: Open the map.

A map of the area of interest (https://esriurl.com/AOI) opens, showing the city boundary and zoning. The city boundary defines the area of interest on the map. As the market analyst for this project, you obtained the city boundary layer from the GIS database managed by the regional association of governments.

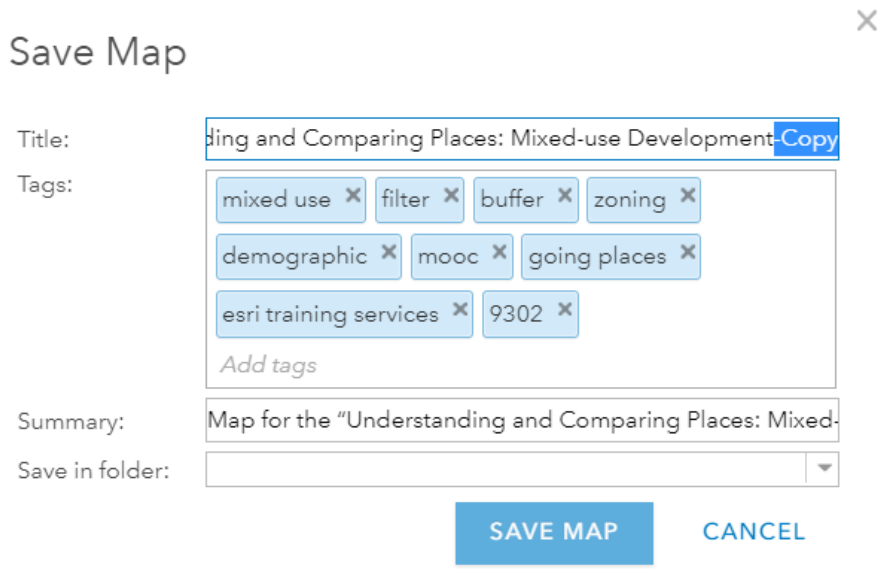
Next, you will save a copy of the map.

- Step 2: Save a copy of the map

For the purposes of this exercise, you will save a working copy of the map.

a On the ribbon above the map, click Save and choose Save As.

b In the Save Map dialog box, for Title, replace -Copy at the end of the name with your initials.



c Click Save Map.

A copy of the map will be saved to your My Content collection.

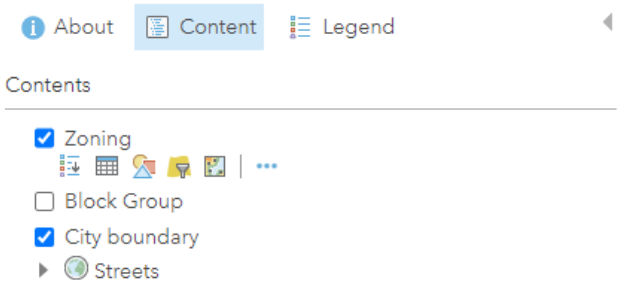
Note: ArcGIS Online does not automatically save maps; therefore, you should periodically save your map as you are working.

- Step 3: Examine attribute data

The city planning department has provided you with a layer for current zoning and a layer for census block groups (https://esriurl.com/CensusGeog) that fall mainly within the city and includes population information.

In this step, you will examine the attributes of the Zoning layer to locate areas in the city that are zoned for mixed-use development.

a In the Details pane, click the Content button .



Step 3a: Examine attribute data.

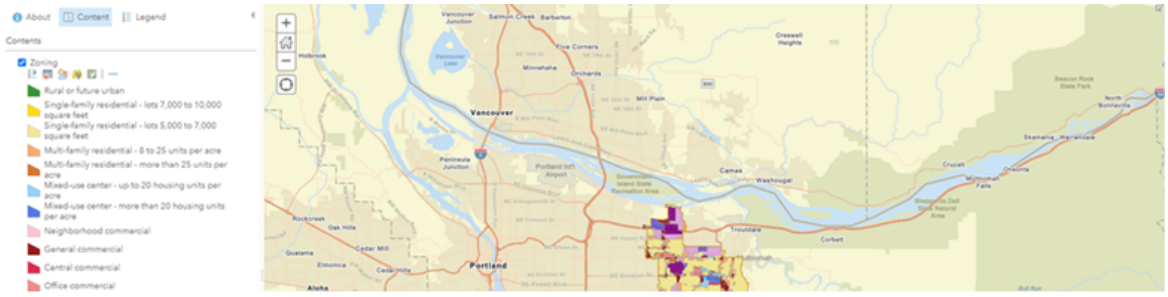
b In the Contents pane, click the Zoning layer name and click the Show Legend button .

You want to focus on mixed-use development, so your first task is to locate areas in the city that are zoned for mixed-use development. You will examine the data associated with the features. In a GIS, geographic features on a map are associated with attribute data stored in a table.

To view the attribute data for the map, you will open the table for the Zoning layer.

c Click the Zoning layer name and click the Show Table button .

The table displays, listing all the zones displayed on the map along with their attribute information.



Step 3c: Examine attribute data.

Note: Data has usually been created for general use or for some other purpose. For that reason, it often includes more information than you need for your particular analysis. In this scenario, you have obtained the data because it has the information that you need for this analysis.

d Click a row in the table and notice that the associated feature on the map is highlighted.

Note: You may have to zoom in or out to see the highlighted feature.

e Examine the attribute fields in the table.

The following information is available for each zone: area measurement, zoning type description, regulatory zone detail code, regulatory zone general code (residential, commercial, industrial, mixed-use), and number of acres.

Note: You can also click a feature on the map to see the associated highlighted row of information in the table.

f Clear the selection.

- Hint

Click the Options button ☰ and click Clear Selection.

g After you have examined the data, close the table.

- Hint

Click the Hide Table button ✕ in the upper-right corner of the table.

You just examined the information that you have available in the Zoning layer. Next, you will filter this layer to show only the areas that have the zoning type that you are interested in.

- Step 4: Filter data to limit feature display

In this step, you will prepare your data for analysis by filtering the Zoning layer to display only the areas zoned for mixed-use development on the map. This is the second step in the spatial analysis approach.

Planners have designated these areas for just the type of retail and housing the company is planning to build. The areas have regional zoning (REGZONE) codes of MUC1 (low-density mixed-use center, up to 20 housing units per acre) and MUC2 (high-density mixed-use center, more than 20 housing units per acre).

Mixed-use center - up to 20 housing units per acre

Mixed-use center - more than 20 housing units per acre

a In the Contents pane, hide the list of zones.

- Hint

  Click the Zoning layer name and click the Hide Legend button .

Under the Zoning layer name click the Filter button .

In the Filter: Zoning dialog box, you will create an expression (https://esriurl.com/exp) to filter the attribute data and limit the display to only those zones that are identified as mixed-use.

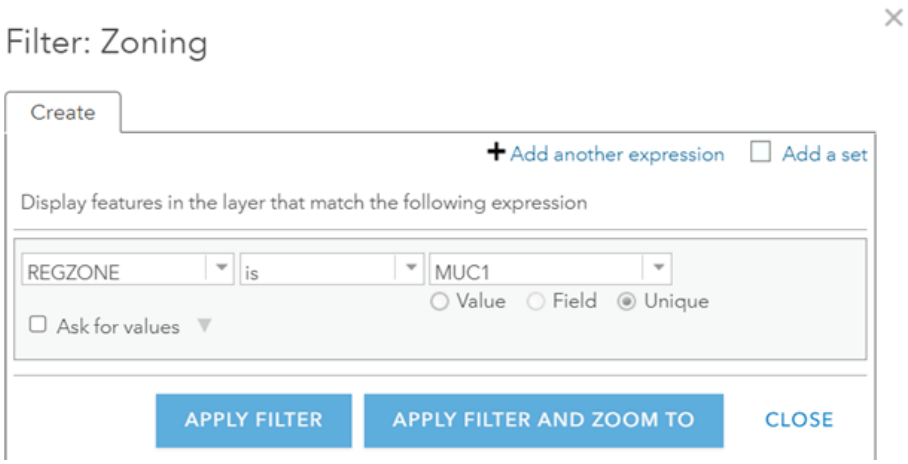
b In the Filter dialog box, for the first field, choose REGZONE.

c For the second field, leave the value set to Is.

d Under the third field, select the Unique option.

The Unique option restricts input to an existing value in the dataset. In this situation, the Value option does the same thing. If the filter field were a number field rather than a text field like REGZONE, the Unique and Value options would behave differently. If you are curious, experiment by filtering using a number field like ACRES to see whether you can determine the difference.

e For the third field, choose MUC1.



Step 4e: Filter data to limit feature display.

The expression should read `REGZONE is MUC1`.

Next, you will add a second expression for the other mixed-use zoning code.

f Click Add Another Expression.

g For the first field of the new expression, choose REGZONE.

h For the second field, leave the value set to Is.

i Under the third field, select the Unique option, if necessary.

j For the third field, choose MUC2.

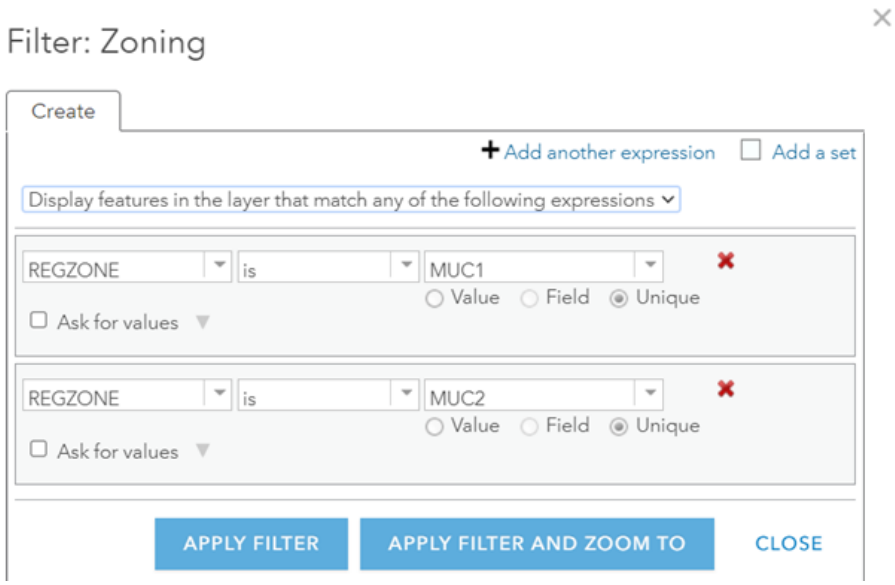
The expression should read `REGZONE is MUC2`.

k For the field above your expressions, click the drop-down arrow and choose Display Features In The Layer That Match Any Of The Following Expressions.

This drop-down provides logical operators. *Display features in the layer that match all of the following expressions* will only provide results if both conditions are met. *Display feature in the layer that match any of the following expressions* will provide results if either

condition is met.

Because you want to find both MUC1 (low-density mixed-use center, up to 20 housing units per acre) and MUC2 (high-density mixed-use center, more than 20 housing units per acre), you will choose Display features in the layer that match any of the following expressions, also known as an OR logical operator. This option will display features in the layer that match either of the expressions.



Step 4k: Filter data to limit feature display.

- Click Apply Filter.

The map updates to show only those zones that meet the filter criteria: the areas zoned for mixed use. These areas are symbolized with light or medium blue, the colors associated with the mixed-use center zoning codes in the legend.

Step 4l: Filter data to limit feature display.
After filtering, only the two mixed-use zoning categories appear on the map. The legend for the two categories is shown for context.

Note: Filtering is temporary. You can remove the filter for the layer and display all the features again by clicking the Filter button and, in the pop-up window, clicking Remove Filter.

- Step 5: Examine statistics for a feature

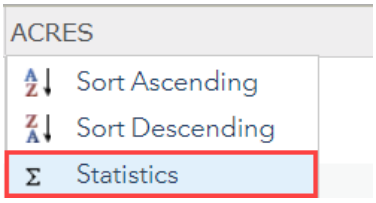
When the data is ready, the next step in the spatial analysis approach is to analyze and model. In this step, you will examine statistics for the total amount of land zoned for mixed-use development to answer one of your spatial questions: *How much area is zoned for mixed-use development?*

a Open the attribute table for the Zoning layer.

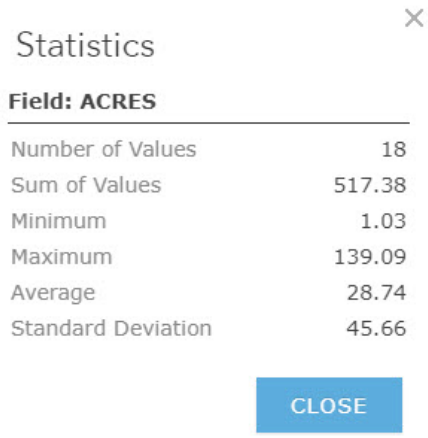
- Hint

In the Contents pane, click the Zoning layer and click the Show Table button .

b In the table, click the Acres column heading and choose Statistics, as indicated in the following graphic.



The Statistics pop-up window provides summary information about the values associated with the Acres column. There are 18 areas (Number Of Values) zoned for mixed-use.



Step 5b: Examine statistics for a feature.

The Sum Of Values field displays the total number of acres in the two mixed-use zoning categories (MUC1 and MUC2). Other categories have been filtered out. Slightly more than 517 acres meet the criteria. The Minimum and Maximum fields display the smallest and largest zones by number of acres. The smallest zone is about 1 acre; the largest zone is about 139 acres. This size range is another piece of information that could be useful for your analysis. You have calculated the amount of land within the city that is already zoned for mixed-use development and assessed the size of the available areas.

You can now use the work that you have done to address the first question in your larger analysis question.

How much area is zoned for mixed-use development? ~517 acres

c Close the Statistics pop-up window.

d Close the attribute table.

Next, you want to find out how many people between the ages of 22 and 39 live in the city.

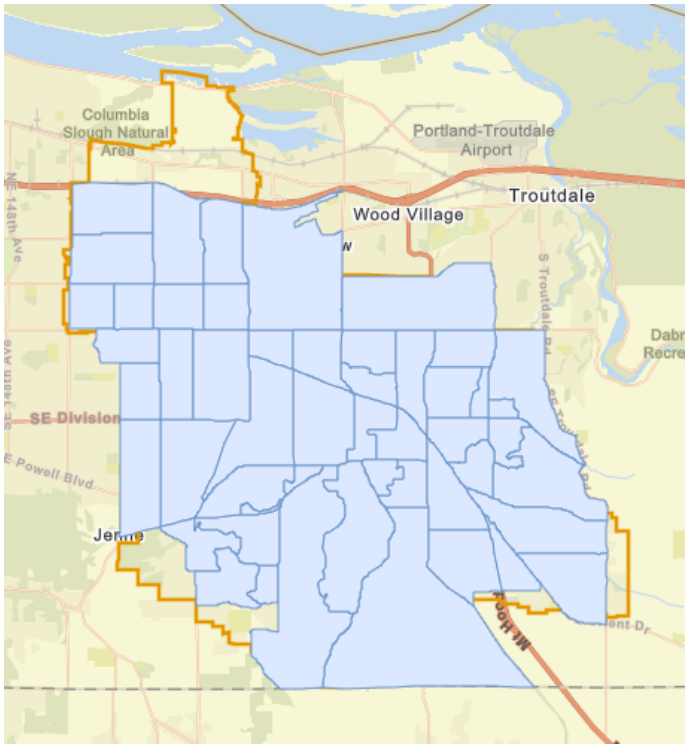
The company is targeting people between the ages of 22 to 39 years of age who live near the areas zoned for mixed use. The company also wants to know which of these areas (if any) have many people who already rent.

Data on the age of the population in various areas of the city is available at the block group level, a smaller statistical division of the geographical area. As part of this case study, the map that you are using for the analysis contains a block group layer.

e In the Contents pane, turn off the Zoning layer, and then turn on the Block Group layer.

- Hint

  Click the box to the left of a layer name to turn the layer on or off.



Step 5e: Examine statistics for a feature.

You will notice that some block groups extend outside the city boundary. These groups are included because they are mostly within the city boundary. Blank spaces within the boundary indicate areas where a greater part of a block group extends beyond the city boundary. Such areas have been removed from consideration for this analysis.

f Open the attribute table for the Block Group layer.

- Hint

  In the Contents pane, click the Block Group layer name and click the Show Table button .

Block Group (Features: 50, Selected: 0)

FIPS	POP2010	POP10_SQMI	AGE_UNDER5	AGE_5_17	AGE_18_21	AGE_22_29
410510104051	1,824	6,514.30	111	366	81	134
410510098031	2,378	3,446.40	151	526	129	173
410510100012	1,287	5,148.00	114	155	79	227
410510101004	1,462	8,122.20	81	180	53	101

Step 5f: Examine statistics for a feature.

The table contains population data, including age of residents.

g Examine the population data available in the table.

? Is there a field in the attribute table that shows the population of residents aged 22 to 39?

- Answer

There is not one field for ages 22 to 39. These age ranges are in two separate fields: ages 22 to 29 and ages 30 to 39.

You are also interested in the areas with a high number of renters and rental units. To determine this information, you will need to enrich the dataset with more demographics to prepare your data for further analysis. The spatial analysis approach is iterative, you will often determine additional data may be required to answer your spatial questions. Now, you will prepare the block groups layer to analyze and model areas with a higher number of rental units.

h Close the Block Group table.

- Step 6: Enrich data with demographics

In this step, you will revisit exploring and preparing your data, the second step in the spatial analysis workflow. You will enrich the Block Group layer with more demographic data to identify areas with many rental units.

The ArcGIS Online Enrich Layer tool lets you add a wide variety of information about people and places to your existing data locations. This feature allows you to perform more analysis and answer a greater range of questions. A new layer is created that contains the additional attribute information.

a On the ribbon above the map, click Analysis.

Note: You can also access analysis tools in ArcGIS Online from the Contents pane by clicking to the layer that you want to analyze and clicking the Perform Analysis button .

The Perform Analysis pane contains several categories. Each category contains tools. To view the tools within a category, you can click the expand/collapse button on the left side of the category.

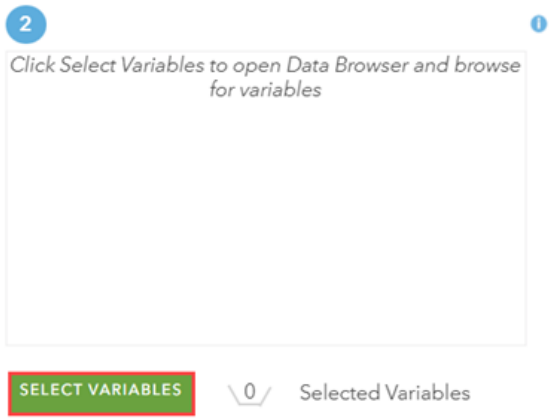
Note: To learn more about the various analysis tools available in ArcGIS Online, click the Information icon to the right of any tool name in the Perform Analysis pane.

b Expand Data Enrichment.

c Click Enrich Layer.

d In the Enrich Layer pane, for section 1, choose Block Group from the dropdown, as indicated in the following graphic.

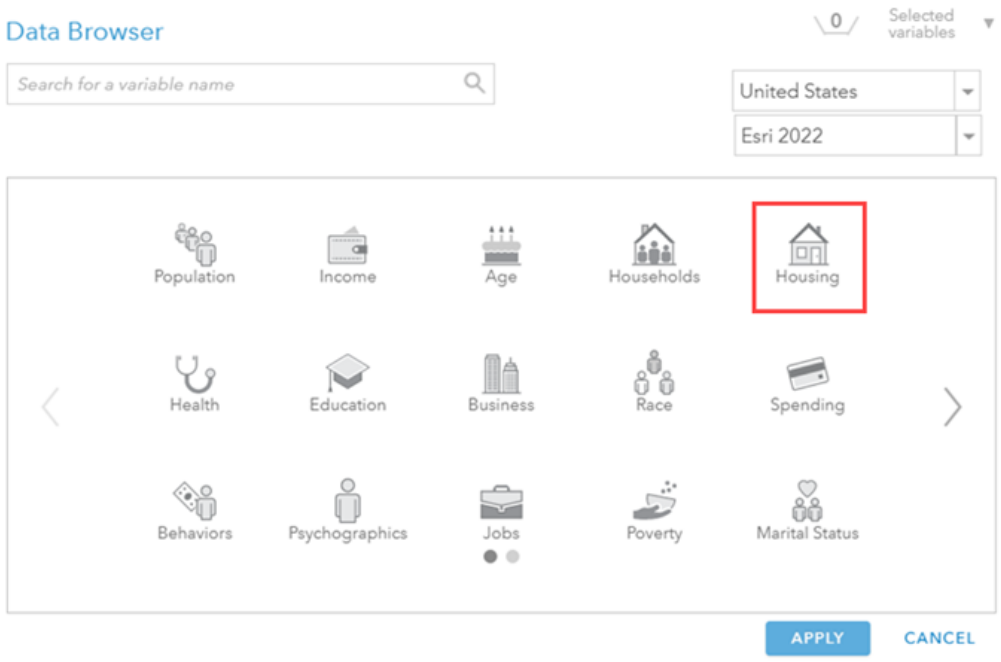
e For section 2, click Select Variables, as indicated in the following graphic.



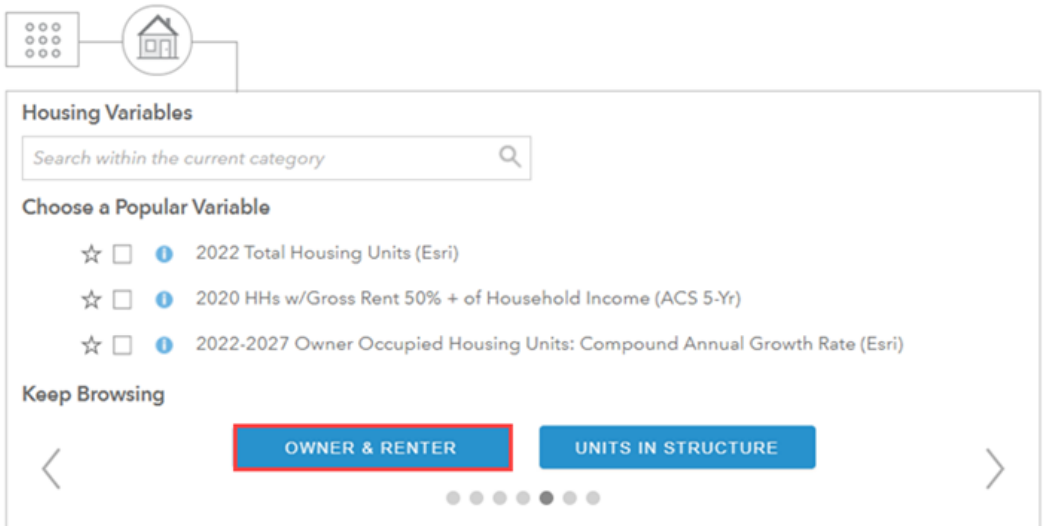
f The Data Browser dialog box opens.

g Near the upper-right corner of the Data Browser dialog box, confirm that the region is set to United States.

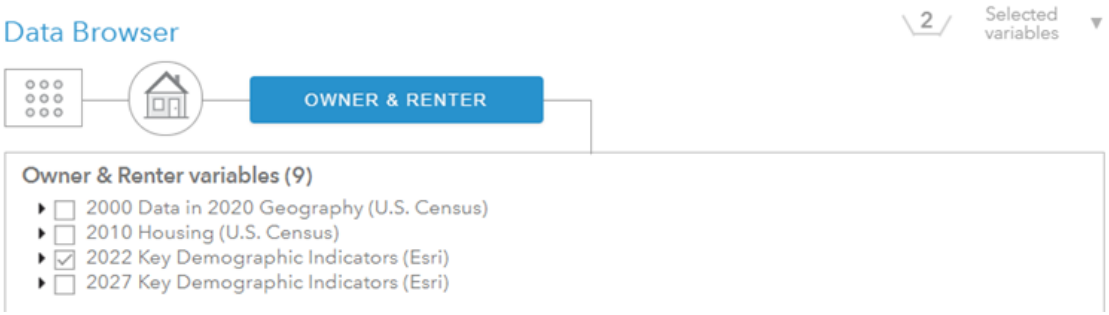
h Click Housing, as indicated in the following graphic.



i In the Keep Browsing section, use the arrows or dots to scroll horizontally through the categories, and then click Owner & Renter, as indicated in the following graphic.



j In the Owner & Renter Variables section, check the box next to 2022 Key Demographic Indicators (Esri).



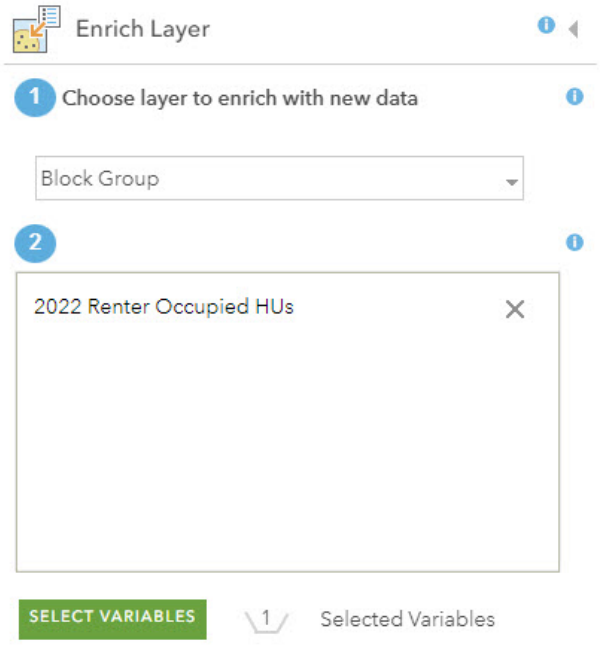
Step 6j: Enrich data with demographics.

k In the upper-right corner of the window, click the number 2 to view the two selected variables.

l Because you are only interested in renters, click the X to the right of the 2022 Owner Occupied HUs variable to delete the variable.

m Click Apply.

The variable is added to the second section of the Enrich Layer pane. This field will be added to the Block Group layer and to the attribute table.



Step 6m: Enrich data with demographics.

The type of demographic data chosen does not require an enrichment area.

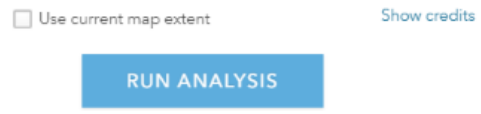
n In section 4 of the Enrich Layer pane, for Result Layer Name, type **Enriched Block Group Renters_<your first and last name>**.

Note: The name must be unique within an organization. If you run the analysis multiple times, you will need to assign a unique result layer name each time.

The Save Result In field defaults to your account name; you do not need to change this value.

o In the upper-left corner of the map, click the Default Extent button .

p At the bottom of the Enrich Layer pane, uncheck the box for Use Current Map Extent.



Step 6p: Enrich data with demographics.

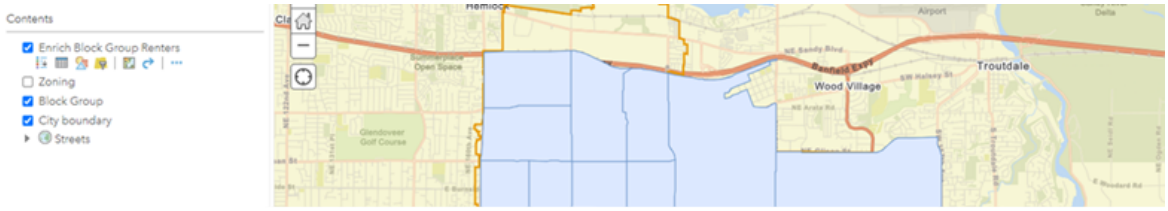
The box for Use Current Map Extent is checked by default. This setting limits the results to your current map extent. The map extent (https://esriurl.com/mapextent) refers to the portion of the map displayed on the screen at a given moment.

In this case, you want to run the analysis on all the records in the Block Group layer—not just what is currently displayed.

q Click Run Analysis.

Note: If your analysis is not complete after 4 minutes, try saving the map and refreshing the page. You can also exit ArcGIS Online and try again later.

The result map displays with the new Enriched Block Group Renters layer.



Step 6q: Enrich data with demographics.

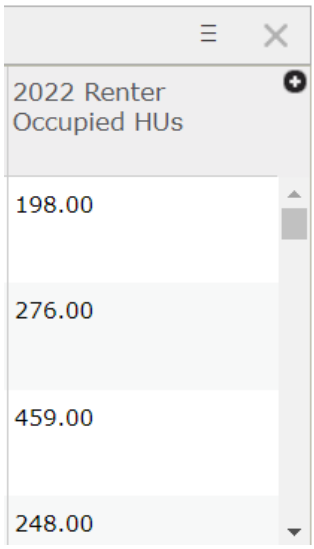
r Turn off the Block Group layer.

s Open the attribute table for the new Enriched Block Group Renters layer.

- Hint

  In the Contents pane, click the Enriched Block Group Renters layer name and choose the Show Table button .

t Scroll to the right of the table to see the new field named 2022 Renter Occupied HUs.



Step 6t: Enrich data with demographics.

This field shows the number of rental units per block group. You will be able to use this information later in your analysis to find block groups that have above average rental units.

The attribute table for the Enriched Block Group Renters layer contains all the demographic information from the original block group layer. One field includes the numbers of people aged 22 to 29. Another field includes the numbers of people aged 30 to 39. Your analysis would be easier if these values were combined into a single field showing the numbers of people aged 22 to 39, your target demographic.

- Step 7: Combine data to create a new field

In this step, you will combine the data in the two age fields. The resulting field will contain the numbers of people between the ages of 22 and 39 for each block group.

a In the upper-right corner of the table, click the Options button ☰ and choose Add Field.

b In the Add Field dialog box, specify the following parameters:

- For Field Name, type **AGE_22_39**.
- For Display Name, type **AGE_22_39**.
- For Type, choose Integer.

Step 7b: Combine data to create a new field.

c Click Add New Field.

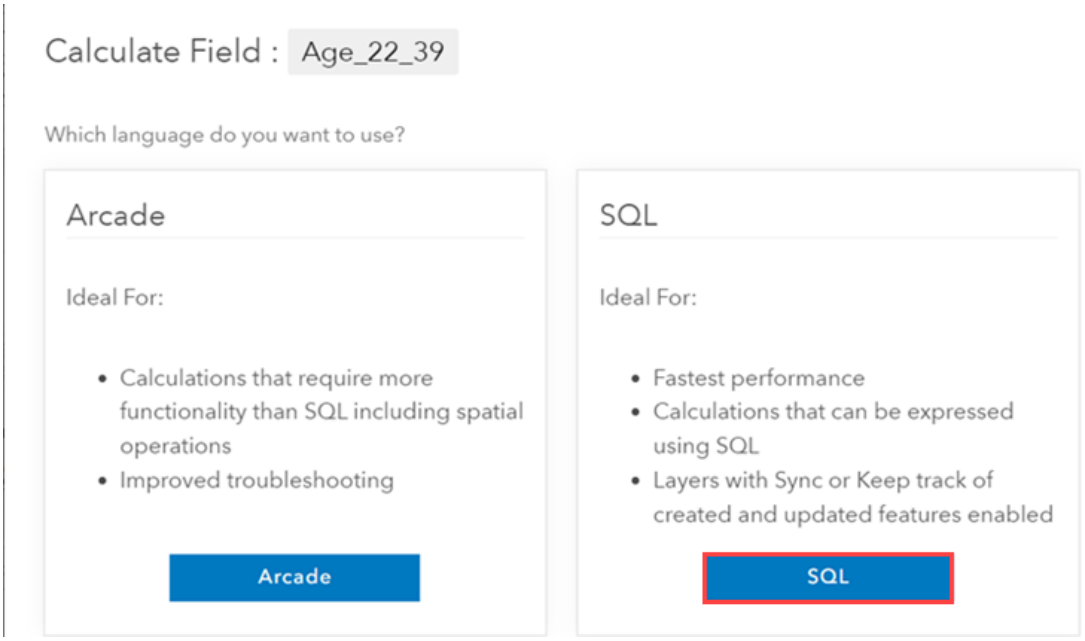
An empty field is added to the table at the far right. This field's column title displays the name that you assigned.

Step 7c: Combine data to create a new field.

You will populate the new field by combining the values from the other two age fields.

d Click the AGE_22_39 field heading and choose Calculate.

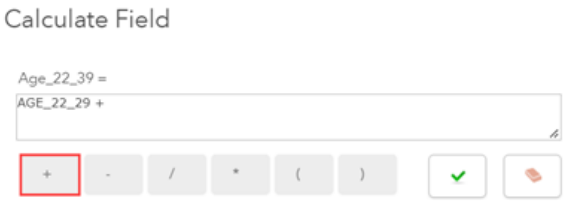
e In the Calculate Field window, select SQL, as indicated in the following graphic.



Note: You could also use Arcade to calculate values (https://esriurl.com/ArcadeFieldCalc) for the new field.

f From the Fields list, click AGE_22_29.

g Click the addition button to add a plus sign to the expression, as indicated in the following graphic.



h From the Fields list, click AGE_30_39.

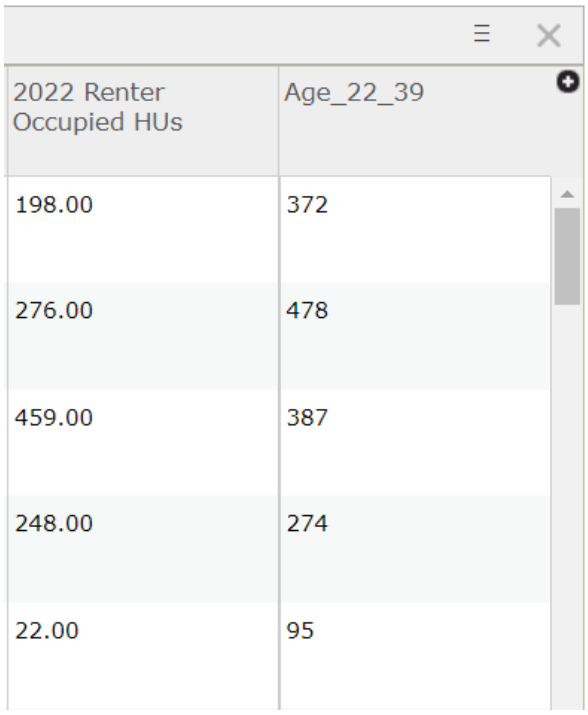
Step 7h: Combine data to create a new field.

The expression in the field at the top of the window should read `AGE_22_39 = AGE_22_29 + AGE_30_39`.

i Under Fields, verify that the Numeric field is selected.

j Click Calculate.

The values in the AGE_22_39 field in the table are filled in, indicating how many people in each block group fall into the specified age range.



2022 Renter Occupied HUs	Age_22_39
198.00	372
276.00	478
459.00	387
248.00	274
22.00	95

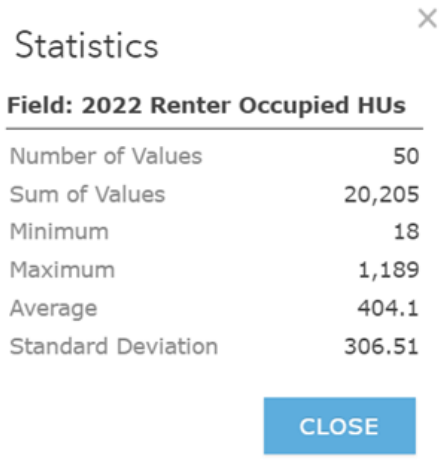
Step 7j: Combine data to create a new field.

All the attributes that you need are available. Now, you can find block groups with many rental housing units and display the number of residents aged 22 to 39 within those block groups.

- Step 8: Find areas that meet a criterion

In this step, you will apply filters to your data to find areas with a higher than average number of rental units per block group.

a In the table, click the 2022 Renter Occupied HUs field heading and choose Statistics.



Step 8a: Find areas that meet a criterion.

The numbers indicate that there are, on average, 404 renter-occupied housing units per block group.

b Close the Statistics pop-up window.

c Close the table.

To find those areas with a higher than average number, you will filter the data.

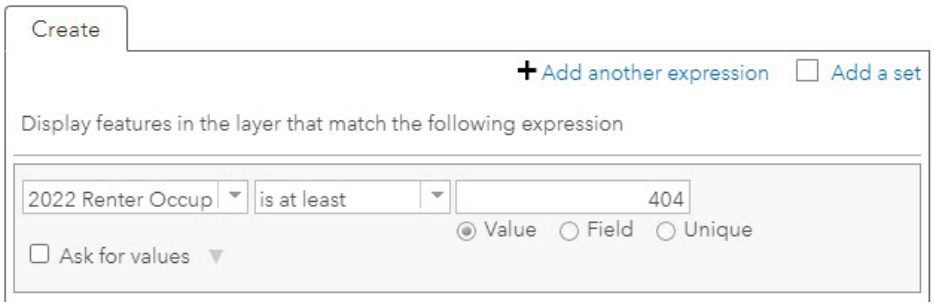
d In the Contents pane, click the Enriched Block Group Renters layer name and click the Filter button .

e In the Filter dialog box, for the first field, choose 2022 Renter Occupied HUs, if necessary.

The filter will be applied to the values in this field.

f For the second field, choose Is At Least.

g For the third field, type a value of **404**.



Step 8g: Find areas that meet a criterion.

In plain language, the expression that you created will display areas in the map with at least 404 rental housing units per block group.

h Click Apply Filter.

The map display updates to show those block groups with a greater than average number of rental housing units in them.

i In the Contents pane, confirm that the Block Group layer is turned off.

Step 8i: Find areas that meet a criterion.

The map now updates to show those block groups with a greater than average number of rental housing units in them, answering another spatial analysis question: *Where do renters live within the city?* Looking at the map, you can see most rentals are found in block groups closer to the city center in Gresham or northwest of the city center.

The development company believes that a larger rental market offers more potential for clients who would be interested in the new rental units that will be a part of the mixed-use development. Because the development company wants to focus on the specific areas with higher numbers of people between the ages of 22-39, the map style needs to be adjusted to represent this.

Next, you will enhance the map by changing the map style to represent where higher numbers of people between the ages of 22-39 reside.

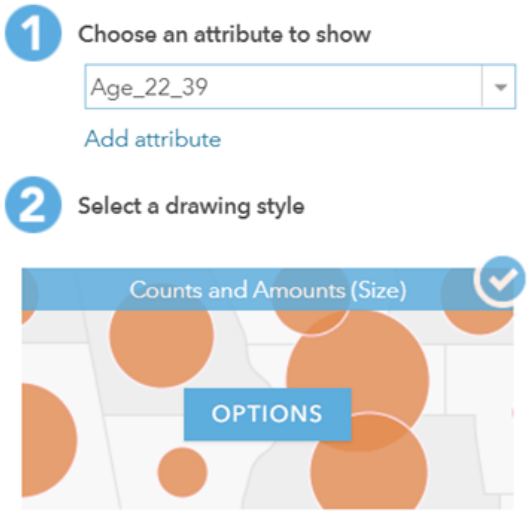
- Step 9: Change the map style

In this step, you will change the map style used to identify areas with higher numbers of residents between the ages of 22-39 who live in areas with above average rental units.

a In the Contents pane, click the Enriched Block Group Renters layer name and click the Change Style button .

b In the Change Style pane, for Choose An Attribute To Show, choose AGE_22_39.

c For Select A Drawing Style, confirm that Counts And Amounts (Size) is selected.

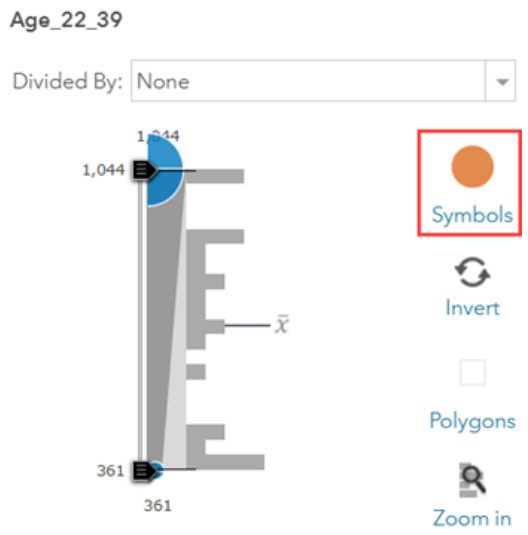


Step 9c: Change the map style.

Note: This setting will result in a proportional symbol map in which larger symbols equate to larger numbers. The check mark in the upper right corner indicates the current styling of the layer.

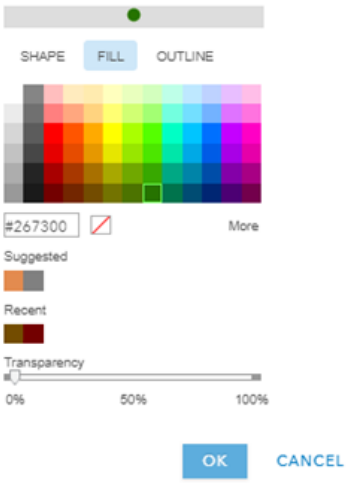
d To configure the look of the layer, click Options, as indicated in the following graphic.

e Click Symbols, as indicated in the following graphic.



f In the Change Symbols window, at the top, click the Fill tab.

g From the palette, choose a fill color, such as dark green (hex color #267300).



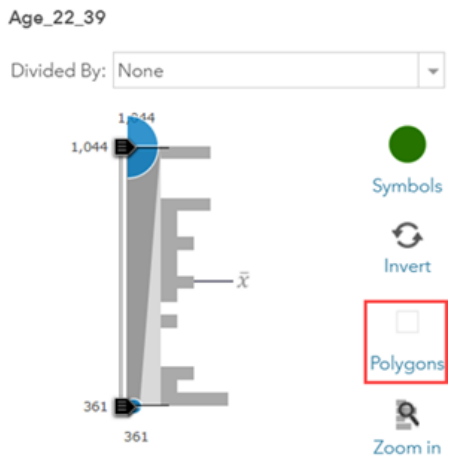
Step 9g: Change the map style.

h At the top of the Change Symbols window, click the Outline tab.

i From the palette, choose an outline color, such as light green (hex color #55FF00).

j Click OK to close the Change Symbols window.

k Click Polygons, as indicated in the following graphic.



l For Fill, click No Color.

m For Outline, choose a dark color, such as black (hex color #1A1A1A).

n For Outline, set the Transparency to 0%.

o Click OK to close the Polygons window.

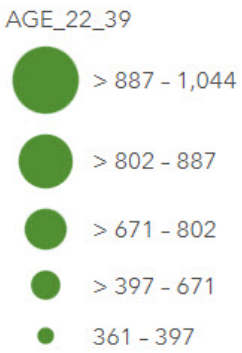
The map dynamically updates to show the new style. The block group polygons are outlined in black. To further generalize your map, you will classify the data.

p Near the bottom of the Change Style pane, check the Classify Data box.

q Classify the data using the Quantile classification method with 5 classes.

Step 9q: Change the map style.

The Quantile classification is based on creating classes with the same number of features in each class.



Step 9q: Change the map style.

Proportional symbols use intuitive logic: Larger symbols equate to larger numbers. Adjusting the size of the symbols can clarify the story that you are telling. ArcGIS Online can adjust the size range automatically, or you can manually specify a size range.

r For Size, set a minimum of 10 px and a maximum of 40 px.

Step 9r: Change the map style.

Note: These values are suggestions; if you want, you can adjust the values or select Adjust Size Range Automatically.

s Click OK, and then click Done to close the Change Style pane.

t View the updated map.

The map style has been updated to show an attribute (population) using circles. The circles represent the number of people aged 22 to 39 by block group, with the larger circles indicating a greater number within an area. You will notice that only the filtered block groups continue to be displayed (groups with a greater than average number of rental units) because of the filter that was applied earlier.

Modeling the data answers the question: *Where do high numbers of people between the ages of 22-39 live in high rental areas?* Most people between the ages of 22-39 live in block groups that surround the city center.

u In the Contents pane, turn on the Zoning layer.

The map display updates to show block groups where the AGE_22_39 field was added to the Enriched Block Group Renters layer. The layer has been filtered to show block groups with a greater than average number of rental units.

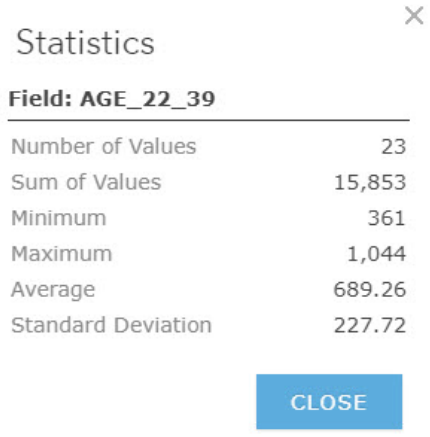
- Step 10: Analyze statistics

Next, you will use statistics to determine how many potential renters live in the areas identified on the map.

a View the statistics for potential renters in the 22-39 age group.

- Hint

To view statistics, click the Enriched Block Group Renters layer name and click the Show Table button . In the table, click the AGE_22_39 column header and choose Statistics.



Step 10a: Analyze statistics.

Based on your analysis, there are 23 areas that meet the criterion, and there are 15,853 people between the ages of 22-39 in these areas. This answers the remaining question: *How many people between the ages of 22-39 live in these high rental areas?* ~15,853

Many of these residents are likely already renting and could be potential tenants for the new apartments.

b Close the Statistics pop-up window.

c Close the table.

- Step 11: Buffer features

In this step, you will highlight areas within a half mile of the mixed-use zones that have many people between the ages of 22-39 and rental housing units. Determining the proximity of features or the relationship between a selected point and its neighboring features is known as proximity analysis (https://esriurl.com/proximity).

A buffer can be used to create an area around a feature. You will use a buffer to visually depict which of these areas are located near the potential development zones.

a In the Contents pane, click the Zoning layer name and click the Perform Analysis button .

b Expand Use Proximity.

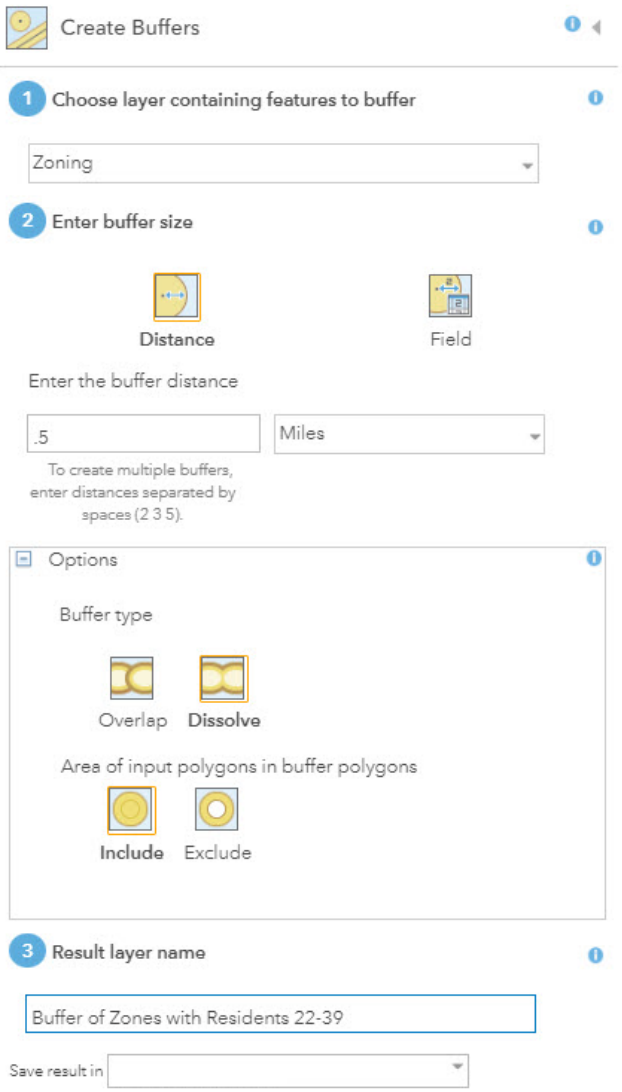
c Click Create Buffers.

- Hint

  Remember that you can learn more about an analysis tool by clicking the Information icon next to the tool name.

d In the Create Buffers pane, set the following parameters:

- For Choose Layer Containing Features To Buffer, select Zoning.
- For the buffer size, click Distance to enter a single distance value.
- Type **.5** as the buffer size.
- Choose Miles as the measurement, if necessary.
- Expand the Options section.
- For Buffer Type (to combine areas where buffers overlap), select Dissolve.
- For Area Of Input Polygons In Buffer Polygons, select Include.
- For Result Layer Name, type **Buffer of Zones with Residents 22-39_<your first and last name>**.



Step 11d: Buffer features.

Note: If you run the analysis multiple times, you will need to give a unique result layer name each time to avoid encountering an error message.

The Save Result In field defaults to your account name; you do not need to change this value.

e In the upper-left corner of the map, click the Default Extent button .

f At the bottom of the Create Buffers pane, uncheck the box for Use Current Map Extent.

Step 11f: Buffer features.

You want to run the analysis on all records in the Zoning layer that meet your criteria—not just what is currently displayed.

g Click Run Analysis.

Note: If your analysis is not complete after 4 minutes, try saving the map and refreshing the page. You can also exit ArcGIS Online and try again later.

The result map displays with a default shaded buffer.

Step 11g: Buffer features.

After looking at your results, you notice that the shaded buffers make the map difficult to read. You decide to change the map style for a more effective visual presentation.

- Step 12: Change the style of a buffer feature

In this step, you will change the default style for the buffer.

a In the Contents pane, click the Buffer of Zones with Residents 22-39 layer name and click the Change Style button .

b In the Change Style pane, for Choose An Attribute To Show, choose Show Location Only, if necessary.

Drawing your data with just a single symbol gives you a sense of how features are distributed—whether they are clustered or distributed—and may reveal hidden patterns.

c For Select A Drawing Style, accept the default Location (Single Symbol) style.

d Click Options to configure the look of the buffer.

e Click Symbols to change the fill color of the buffer.

f In the Change Symbols window, at the top, click the Fill tab, if necessary.

g Click No Color .

h For Outline, choose a dark color, such as purple (hex color #4C0073).

i For Line Width, choose 3 px.

j Click OK to close the Change Symbols window.

k Click OK, and then click Done to close the Change Style pane.

l In the Details pane, click the Legend button to view the legend.

Step 12l: Change the style of a buffer feature.

Now you can see which block groups with high numbers of residents 22-39 and renters are actually located near the mixed-use zones. The areas within the buffer identify several potential development areas in the prime candidate city.

- Step 13: Save the map

To complete your work on this project, you will save the map before exiting ArcGIS Online.

a On the ribbon above the map, click Save and choose Save.

Your map will be saved to your My Content collection.

- Step 14: Conclusion

In this exercise, you learned how to implement the spatial analysis approach to answer spatial questions by using analysis and modeling tools in ArcGIS Online. Next, you will review how each step of the spatial analysis approach was used throughout this exercise.

Ask questions
For this exercise scenario, the following questions were asked:

Is this city a good place to build a small mixed-use development?

- How much area is zoned for mixed-use development?
- Where are high rental areas within the city?
- How many people between the ages of 22-39 live in high rental areas?
- Where do high numbers of people between the ages of 22-39 live in high rental areas?

Explore and prepare data
You explored and prepared the data by examining the attribute table and statistics, enriching layer data by adding additional

information, and combining attribute data to create a new field to identify the information needed for analysis.

Analyze and model
You analyzed and modeled the data by filtering to limit feature display, creating a spatial buffer, and changing the map style for appropriate visualization.

Interpret results
As you analyzed the data, you identified the answers to your spatial questions.

Is this city a good place to build a small mixed-use development?

The map displays which block groups have a high number of rental units and residents between the ages of 22-39 and their location near the mixed-use zones. The areas within the buffer identify several potential development areas for this city.

Through the analysis, you found that approximately 517 acres is zoned for mixed-use development, block groups with higher than average renters live closer to the city center in Gresham, most people between the ages of 22-39 live in block groups that surround the city center, and approximately 15,853 people live in those block groups.

Repeat or modify
The spatial analysis approach is intended to be iterative. Now, you have several options for continuing your company's evaluation process. You could further investigate the areas that you identified by asking additional spatial questions. For example, the developers also need to adhere to the city's affordable housing and equitable transportation policies. To enhance the map, you could include a layer showing regional light-rail access and further enrich the data with median household income. You could also repeat your analysis for the other cities under consideration.

Present results
After you are satisfied that your spatial questions have been answered, you can share the results with leadership within your local development company.

Make decisions
The answers to your spatial questions contribute to the company's decision-making process. The results may stand on their own, contribute to other analyses, or lead to more spatial questions.

a If you would like to further investigate the areas that you identified to determine which sites will adhere to the city's affordable housing and equitable transportation policies, proceed to the optional stretch goal.

b When you have finished your work for this section, close the private or incognito web browser window.

- Step 15: Stretch goal (optional)

Using the spatial analysis approach, you determined several potential future development sites. These sites had a high number of rental units and a high number of people in their 20s and 30s, all nearby existing mixed-used development. However, it is important to consider and identify additional information to create solutions with diversity, equity, and inclusion in mind for the community to be innovative and inclusive.

To select the most appropriate site that also complies with the affordable housing and equitable transportation policies, you can continue with this stretch goal to further practice implementing the spatial analysis approach to answer two more spatial questions.

The areas within the buffer identify several potential development areas in the prime candidate city. Now, you will further refine the potential sites by using the spatial analysis approach to answer these two questions.

- *Which block groups have a median household income less than $50,000?*
- *Which block groups have access to the MAX Light Rail blue line?*

The tasks for this stretch goal have been grouped to more clearly define the workflow that you are completing.

If you need assistance completing the following tasks, refer to these resources:

- ArcGIS Online Help: Enrich Layer
- ArcGIS Online Help: Apply filters (Map Viewer Classic)
- ArcGIS Online Help: Change style

- ArcGIS Online Help: Add layers to maps (Map Viewer Classic)
- ArcGIS Online Help: Create Buffers

You will use the spatial analysis approach to determine which block groups have a median household income less than $50,000. To do this, you will enrich your existing data and filter your results.

a If necessary, turn on the Enrich Block Group Renters, Buffer Zones with Residents 22-39, and Zoning layers.

b Enrich your existing Enriched Block Group Renters with 2022 Median Household Income.

c Filter to visualize the block groups with a median household income below $50,000.

Now, you will determine which block groups have access to the MAX Light Rail blue line.

d Add the MAX Light Rail layer to the existing web map.

- Hint

  In the search, type **MAX Light Rail owner: EsriTrainingSvc**.

e Find which areas are accessible to the light rail.

Note: Block groups must be within .25 of a mile of the light rail to be considered accessible.

f Using previous analysis results, identify which block groups with a median household income less than $50,000 intersect with accessible areas of the light rail.

g Change symbology to visualize the optimal block groups for development.

h In the forum, share the FIPS code of the optimal block group(s) for the development site.