

Lesson

Frame the problem and explore the study area

THE VOLATILE LOS ANGELES RIVER

is the reason that America's second-largest city was founded in its present Southern California location by Spaniards in 1781. (The area was originally settled thousands of years earlier by the Gabrielino-Tongva Tribe, a California Indian tribe also known as the San Gabriel Band of Mission Indians.) Its water was tapped for drinking and irrigation, and a new city spread out from the river across the coastal plain. By the turn of the 20th century, the river was surrounded by a thriving urban center. Every few decades, raging floods would crest the banks at various points, submerging entire neighborhoods. After the historic floods of 1938 that claimed more than 100 lives and washed out bridges from Tujunga Wash to San Pedro (figure 1-1), city leaders had seen enough. By 1941, the US Army Corps of Engineers had begun to straighten, deepen, and reinforce the once wild waterway. Much of its length was eventually lined in concrete, and the river was more or less tamed.

Today, the City of Angels—home to nearly 4 million people—is a vibrant world center of business and culture. Running straight through the heart of the city, the Los Angeles River now serves as a flood control channel (figure 1-2). Sadly, this once bucolic waterway that was so instrumental to the formation of the city later became known as something ugly and marginal. Mile after mile of angled concrete appealed only to graffiti artists and filmmakers, and save for the occasional televised rescue of some hapless Angeleno swept away by a winter storm-fed torrent, the river remained a part of the city ignored by most. The negative perception has stuck with the neglected river for decades.

But in recent years, as the city has densified and much of Southern California's wild lands have been appropriated for development, new attention has focused on the river corridor and the scattered pockets of open space that line its length. Although it must always

Figure 1-1. The historic floods of 1938 washed out bridges up and down the Los Angeles River, including this one at Colfax Street and Vernon Boulevard.



Photo by Los Angeles Times staff photographer.
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Figure I-2. The Los Angeles River now serves as a flood control channel though the river corridor is the focus of city greening efforts.

serve its important flood control function, the river and adjacent lands are increasingly recognized as underutilized, providing opportunities for greening and psychic restoration for people living in an overbuilt city. Adventurous and resourceful citizens have discovered peaceful pockets of sanctuary along the river and made these places their own. A vital and concerned activist community has raised awareness of the river and pushed for its beautification and redevelopment.

In 2005, the city launched a major public works project focused on the human dimensions of the river. A landmark study, the Los Angeles River Revitalization Master Plan, demonstrated the significant potential of redevelopment to improve the quality of life for citizens living near the river corridor. Then mayor Antonio Villaraigosa said at the time, “We have an opportunity to create pocket parks and landscaped walkways ... to create places where children can play and adults can stroll.”

According to Villaraigosa, “The plan provides a 25- to 50-year blueprint for transforming the city’s 32-mile stretch of the river into an ‘emerald necklace’ of parks, walkways, and bike paths, as well as providing better connections to the neighboring communities, protecting wildlife, promoting the health of the river, and leveraging economic reinvestment.”

Although the 2005 master plan identified some of the most obvious areas for large-scale regional redevelopment along the river, it stopped short of identifying smaller (and more affordable) neighborhood projects; that work would require a more involved study. With thousands of land parcels strung out along the river, identifying the best places for park development is like looking for a needle in a haystack. Many factors come into play, among them current land use, demographics, and accessibility.

In the years since the plan's completion, the city has created a website (figure 1-3) that encourages people to learn about (and participate in) the latest developments related to its landmark resource. The website, at www.lariver.org, contains links to many resources about the river and its watershed, including scientific studies and recreational opportunities. If city leaders can find the resources and a motivated citizenry keeps up the pressure, a renaissance will transform growing stretches along the river into real versions of the revitalization effort's artists' renderings (figure 1-4).

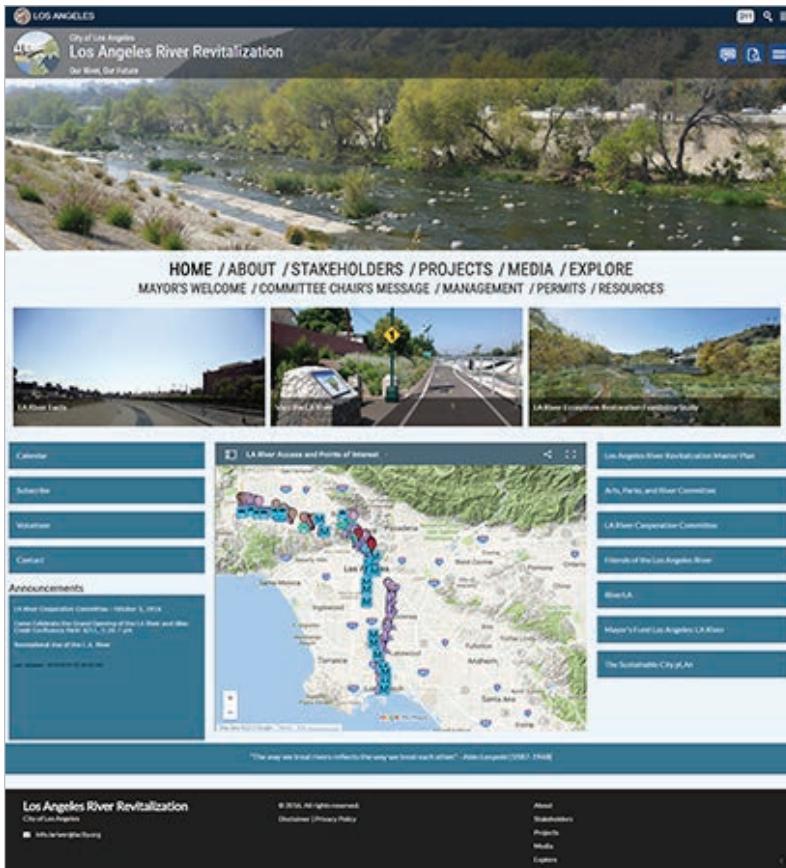


Figure 1.3. The Los Angeles River Revitalization website contains links to information about the river and its watershed.

Courtesy of the City of Los Angeles, Los Angeles River Revitalization Master Plan

Here's where you pick up the thread in this book. You'll use the city's real need for river redevelopment as a launching point for a park siting analysis using a geographic information system (GIS). A GIS is ideal for this type of decision-making because it allows you to analyze large amounts of data in a spatial context. In this book, you'll spend a lot of time with ArcGIS Pro software, and by the end you'll have completed a project from start to finish. Along the way, you'll gain an excellent grasp of what a GIS can do.

You'll be assuming the role of a GIS analyst for the City of Los Angeles. So what exactly does a GIS analyst do, and how is that job different from other jobs that also use GIS software? Table 1-1 defines some of the various roles that a typical GIS operation might establish to accomplish its work.



Images courtesy of the City of Los Angeles, Los Angeles River Revitalization Master Plan.

Figure 1.4. The Los Angeles River Revitalization website contains artists' renderings (A to C) of a rejuvenated river corridor.

Table I-1. GIS roles

Editors	People who create, update, and correct spatial data and its attributes (statistical and descriptive information).
Cartographers	People who make and publish maps and solve information design problems.
Analysts	People who query and process geographic data to solve analytical problems.
Programmers	People who implement custom GIS functionality by developing scripts and applications for specific procedures.
Managers	People who oversee staffing and equipment, database design, workflow, new technology, and data acquisition.

The central work in this book is analytical. Your main focus will be on using ArcGIS tools and methods to find the most park-suitable land within a study area, but there is preparatory work to do before the analysis proper, and there are results to interpret and present afterward. This book has two goals. One is to present a comprehensive approach to geographic problem solving. We want to help you develop skills, habits, and ways of thinking that will be useful in projects other than this one. The second goal is to teach you how to use ArcGIS Pro software. These goals are mostly complementary. ArcGIS is a big system, however, and it wouldn't be realistic to try to cover all that it can do in a single book. Our principle has been to teach the software in the service of the project and not otherwise. You'll delve into many aspects of ArcGIS Pro—editing, modeling, and cartography, among them—but there are other aspects that we won't use, or will only touch upon lightly, because they aren't strictly relevant to our needs. We might say (with apologies to Waldo Tobler¹) that everything in a GIS is related to everything else, but some things are more closely related to analysis than others.

Frame the problem

The first step in the geographic approach to problem solving is to frame the problem. What that means, first of all, is coming up with a short statement of what it is you want to accomplish. For this project, you want to find a suitable site for a park near the Los Angeles River.

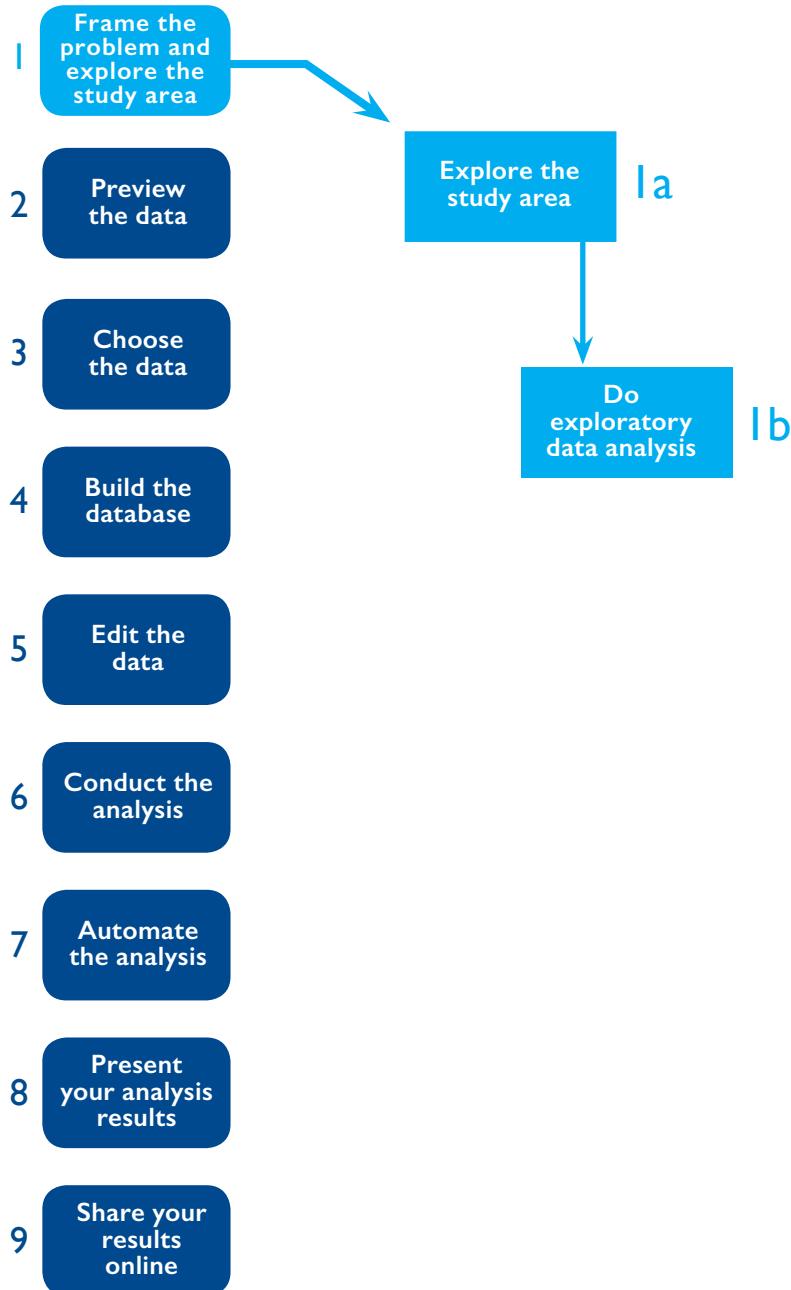
Once you have the statement, you can begin to tease out its ambiguities. What factors make a site “suitable”? In this case, the city council has already established a concise and fairly specific set of guidelines.

1. Tobler, W. 1970. "A Computer Movie Simulating Urban Growth in the Detroit Region." *Economic Geography* 46 (2): 234–40.

Lesson One road map

**You
are
here:**

What you'll do in this lesson:



Park guidelines

1. On a vacant parcel of land at least one-quarter acre in size
2. Within the Los Angeles city limits
3. As close as possible to the Los Angeles River
4. Not in the vicinity of an existing park
5. In a densely populated neighborhood with lots of children
6. In a lower-income neighborhood
7. Where as many people as possible can be served

This list limits the scope of your inquiry, but it's far from a complete breakdown of the problem. Some of the guidelines are specific, but others are vague. Familiar concepts are sometimes the hardest to pin down. For example, what income level should count as "lower income"? How are the boundaries of a "neighborhood" established? You can't solve the big problem until you've solved the little problems buried inside. Usually, however, it's not possible to address (or even foresee) all the little problems ahead of time.

Data exploration influences the framing of the problem. Do you have income data on hand? If so, is it for individuals or households? Is it average, median, or total? To the extent that the questions themselves are indefinite (What is lower income? How should it be measured?), the data you have available will help shape the answer.

Analysis also influences the framing of the problem. Given that you want a quarter-acre tract of vacant land, what do you do about adjacent lots? Is there a tool to combine them? If so, does using it have unanticipated side effects, such as a loss of information? Your data processing capabilities (and your knowledge of them) may determine how you define a "one-quarter acre parcel."

Even the results of an analysis influence the framing of the problem. Suppose, after having carefully defined the guidelines, you run the analysis and don't find any suitable sites. Do you report to the city council that there's just no room for a park? More likely, you'll change some of your definitions and run the analysis again.

Framing the problem, therefore, is an ongoing process, one that will occupy you throughout much of the book.

Exercise 1a: Explore the study area

In this exercise, you'll get to know the Los Angeles River and its surrounding area with maps and data. At the same time, you'll learn the basics of working with ArcGIS Pro: how to navigate a map, add and symbolize data, and get information about map features.

Start ArcGIS Pro

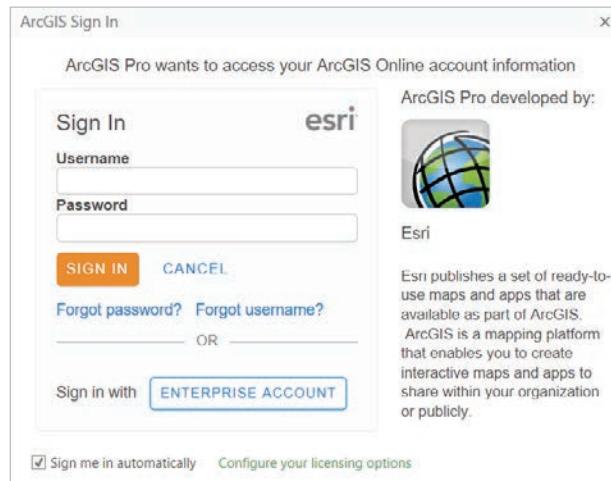
Now you'll open the ArcGIS Pro application.

▶ See the preface for how to install ArcGIS Pro.

- 1) Start ArcGIS Pro by clicking the Start button on the taskbar, and then, on the Start menu, click All Programs > ArcGIS > ArcGIS Pro > ArcGIS Pro.

To open ArcGIS Pro, you must sign in to ArcGIS Online using an organizational account. Signing in to ArcGIS Online allows you to access and share GIS content with users in your organization as well as publicly with users around the world.

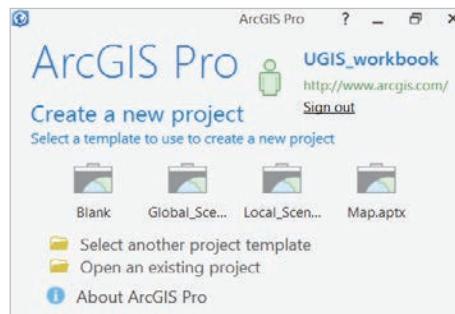
- 2) Click Sign In.



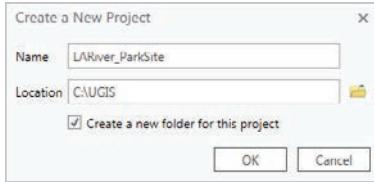
The application opens with the ArcGIS Pro dialog box.

Create a new project

- 1) To create a new project, click Blank.



- 2) Provide a New Project name: LARiver_ParkSite.
- 3) Browse to and select the UGIS (Understanding GIS) folder as the location to save the new project folder.
- 4) Click OK.

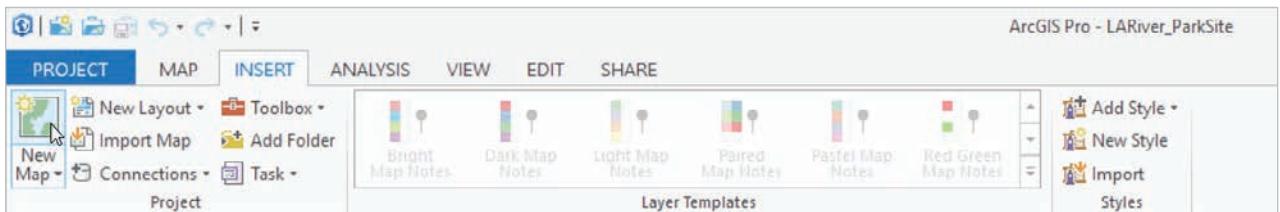


Creating the project creates a new folder in the UGIS folder with the name you gave it, along with some default items, including a new geodatabase and a toolbox.

Insert a new map

- 1) On the Insert tab, click New Map.

A new map is added to the project using the Topographic map by default.



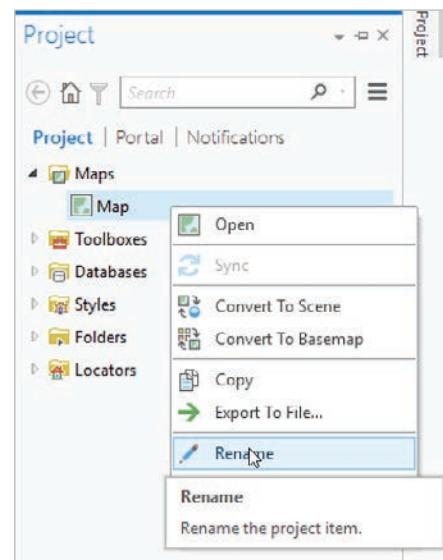
On the right side of the application is the Project pane. This pane contains all the maps, data, tools, and other resources associated with the project.

- 2) Open the Project pane (if necessary) and expand the Maps item.

Note that a new map simply named Map has been added to your project.

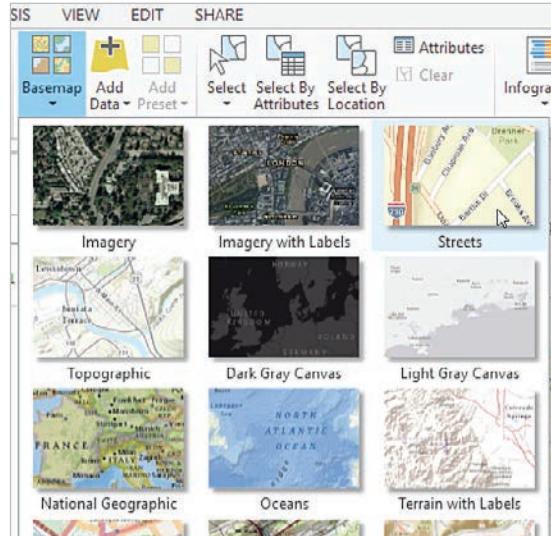
- ▶ If the Project pane is not displayed, go to the View tab and click Project.

- 3) Rename the new map by right-clicking Map in the Project pane and clicking Rename. Type Lesson1a and press Enter.



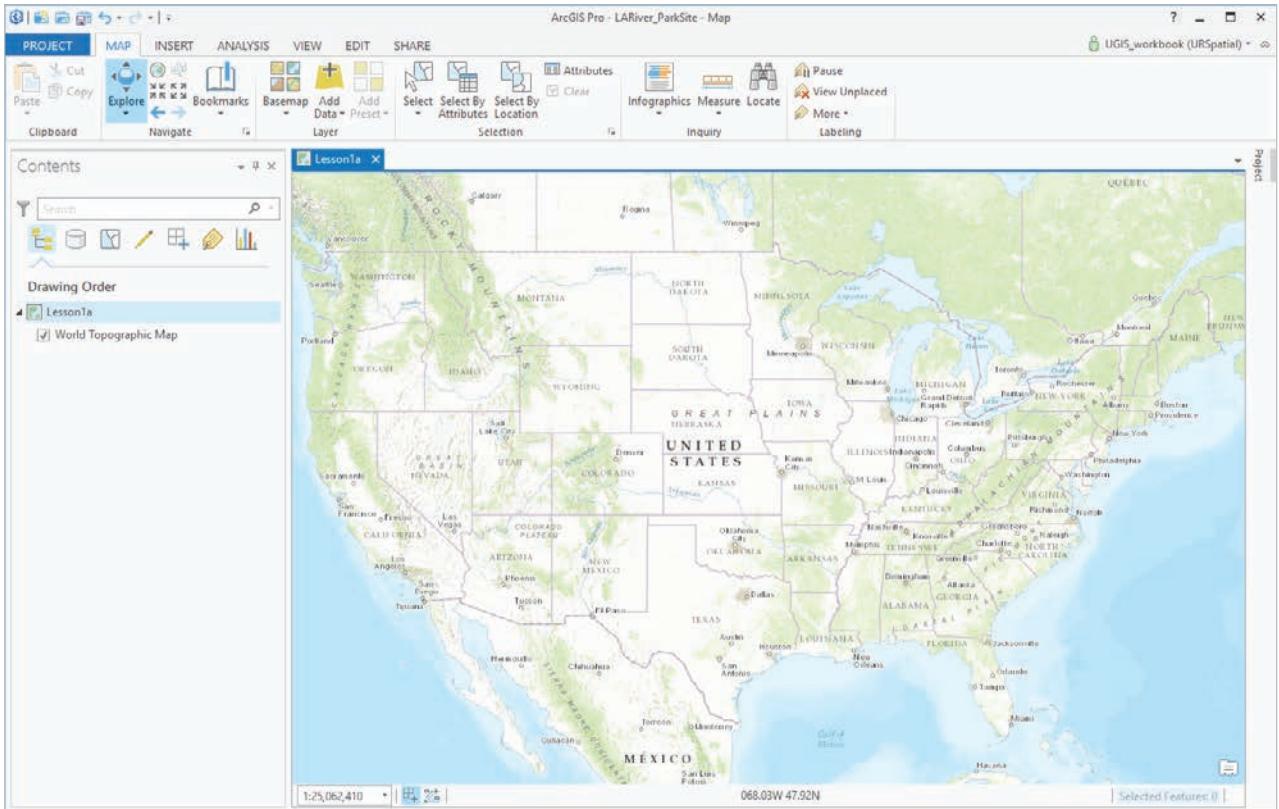
Change the basemap to Streets

- 1) On the Map tab, change the basemap by clicking the Basemap button  in the Layer group. The basemap gallery is displayed with several different basemap options.
- 2) Click the Streets basemap.



The World Street Map basemap layer is added to your Lesson1a map. It has an entry in the Contents pane on the left. Again, click the View tab, if necessary, to open the Contents pane.

The Map tab at the top of the application includes tools for navigation, layers, selections, inquiries, and labeling. As different tabs are selected—Insert, Analysis, View, Edit, and Share—different tools will appear on the ribbon. Additional contextual tabs, including Appearance, Labeling, and Data, will appear depending on the tasks that you are performing.



Zoom in to Southern California

Now you'll zoom in to your area of interest.

- 1) Experiment with navigating the map with the mouse.
 - A. Push the scroll wheel forward to zoom in.
 - B. Pull the scroll wheel back to zoom out.
 - C. Drag in any direction with the left mouse button to pan.
 - D. Drag up with the right mouse button to zoom out.
 - E. Drag down with the right mouse button to zoom in.
 - F. Press and hold the Shift key and drag a box with the left mouse button to zoom in.
 - G. In the map window, use the Shift key to drag to draw a box around Southern California, as shown in the figure.

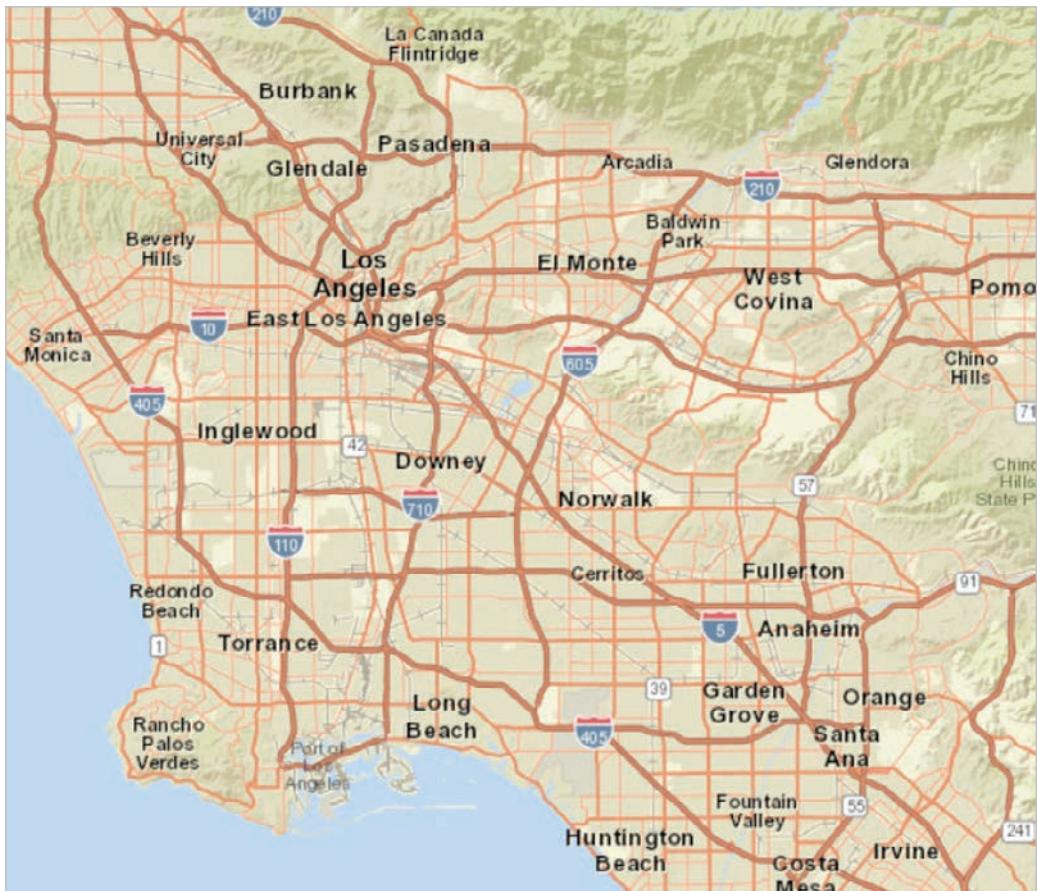
Your box doesn't have to match exactly.



- 2) Zoom in again to get closer. When you see city names and major roads, pan (left mouse button) to center the view on the Los Angeles area.
- 3) Keep zooming in (try the Fixed Zoom In button , too) until you can easily distinguish cities, freeways, and landmarks such as airports.
- 4) If you zoom in further than you want, zoom out (pull the scroll wheel back), or click Fixed Zoom Out  in the Navigate group to go back.

You probably noticed that no streets were visible at the global scale, and that as you kept zooming in, more and more detail appeared. This is because the basemap is a multiscale map—really, a set of maps that turn on and off to display features and symbology that are appropriate to your map scale.

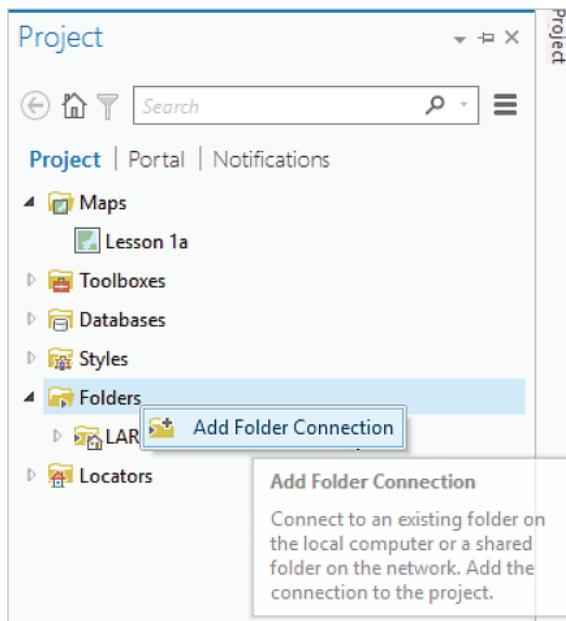
The figure shows Greater Los Angeles, an area that includes scores of incorporated communities and nearby cities.



Add a layer of project data

On top of the basemap, you'll add a layer from the data that has been put together for this project and is stored on your computer. In lesson 2, we'll talk more about where this data comes from and how to acquire data of your own.

- 1) In the Project pane, right-click Folders and click Add Folder Connection.



- 2) Browse to your UGIS folder and select the ParkSite folder. Then click OK.

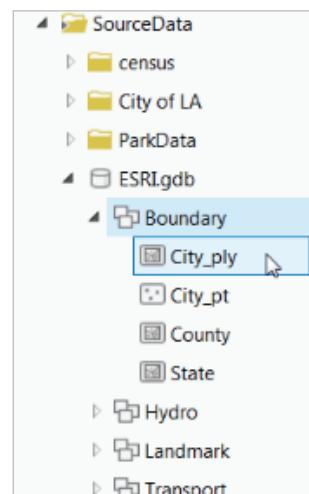
Selecting a folder adds a new folder connection to ParkSite.

- 3) After making the folder connection, expand ParkSite\SourceData and then ESRI.gdb, and finally the Boundary item.
- 4) Drag and drop the City_ply layer on your map. Default layer colors vary so don't worry if the color of your layer looks different from the figure.

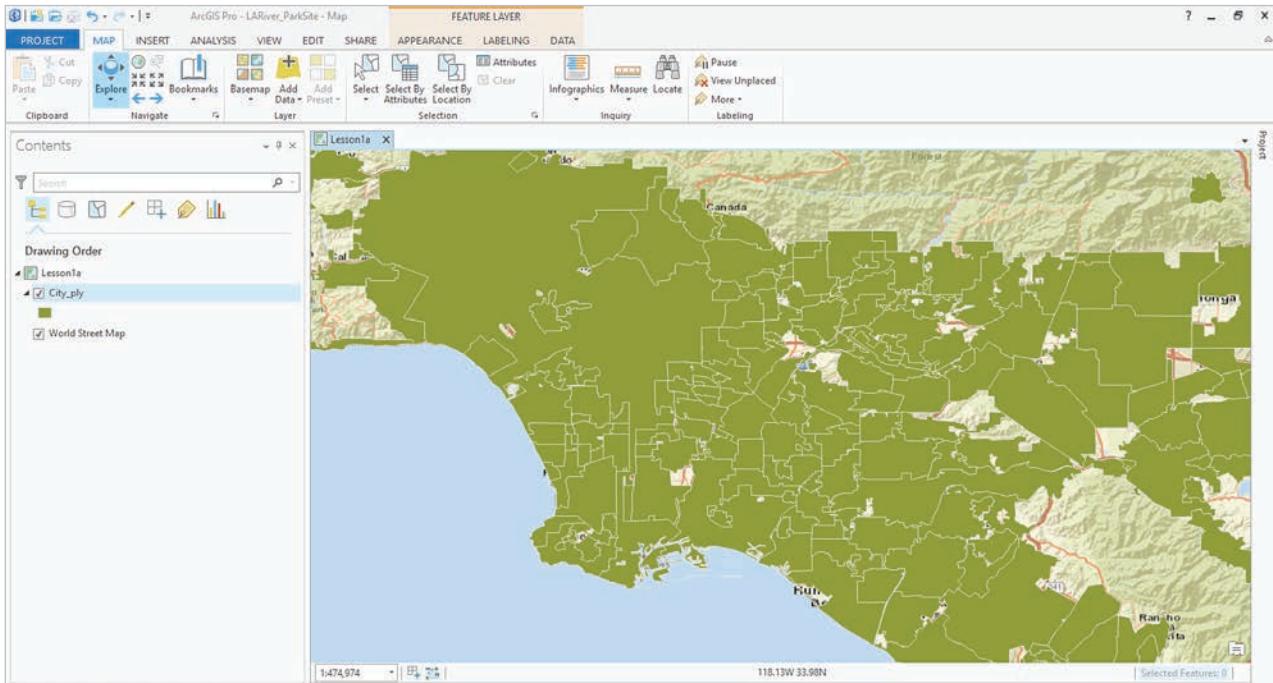
We'll discuss GIS data formats in the sidebar "Representing the real world as data" in lesson 2. For now, you just want to dig down to your data.

Basemap layers

Basemap layers show reference geography such as street maps, imagery, topography, and physical relief. The ones available in ArcGIS Pro are remotely hosted map services that you can navigate, view, and use as backdrops to other data. Basemaps are stored at multiple scales, so that as you zoom in or out, you see different amounts of detail. As you navigate a basemap, the various pieces of it (called *tiles*) that compose your current view are stored locally on your computer in a so-called "display cache." When you zoom or pan to a new area, the map may be a little slow to draw, but anyplace you return to will redraw quickly because the data comes from your cache, not from the remote server.



When the layer of city boundaries is added to the map, it may zoom to the full extent of the dataset. If so, click the Previous Extent button ← in the Navigate group on the Map tab.



Each city in the layer is called a *feature*. These features are polygons, which are one of the three basic shapes used to represent geographic objects in a GIS. (The others are lines and points.)

In the Contents pane, the order of entries matches the drawing order of layers in the map. City_ply is listed above World Street Map, and on the map, the cities cover the basemap. You can control a layer's visibility with its check box in the Contents pane.

5) In the Contents pane, click the check box next to City_ply.

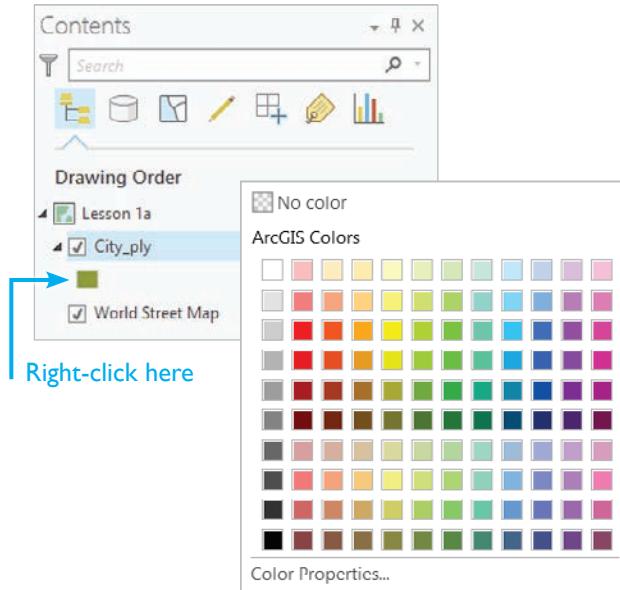
The layer is turned off.

6) Click its check box again to turn the layer back on.

Set layer properties

Every layer has properties you can set and change. For example, you just changed the visibility property of the City_ply layer.

- 1) In the Contents pane, right-click the color patch underneath the City_ply layer name. A color palette opens. Moving the pointer over any color square shows its name as a ToolTip.



- 2) On the color palette, click any color you like to change the layer color.

On the map, the cities redraw in the color you chose.

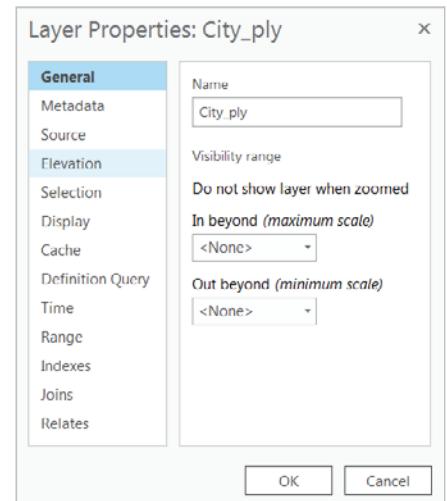
- 3) In the Contents pane, right-click the City_ply layer name to open its context menu. At the bottom of the menu, click Properties.

The Layer Properties dialog box opens. Here is where you access the full set of properties for a layer.

- 4) If necessary, click the General tab at the top of the left column on the dialog box.

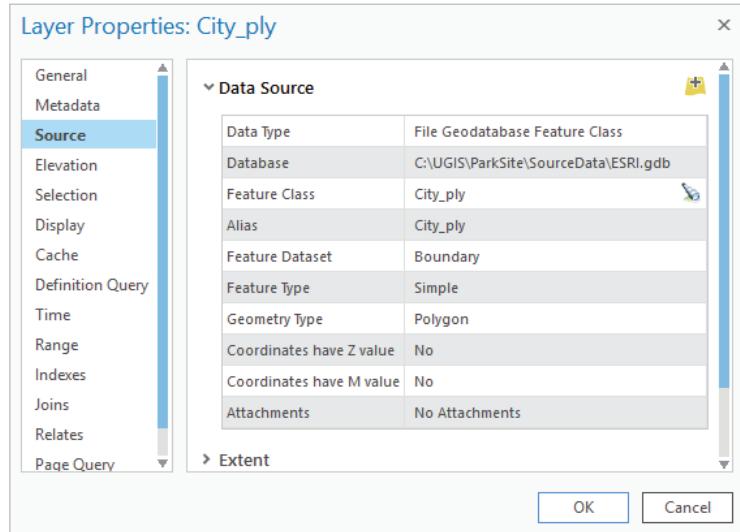
The layer's name, City_ply, is one of its properties. This name is cryptic (it stands for "city polygons") and unattractive, so now you can change it.

- 5) In the Name box, delete the text and type Cities.



6) In the Layer Properties dialog box, click the Source tab.

This tab shows technical information about the layer, including the path to the data on your computer.



7) Click OK on the Layer Properties dialog box to close it.

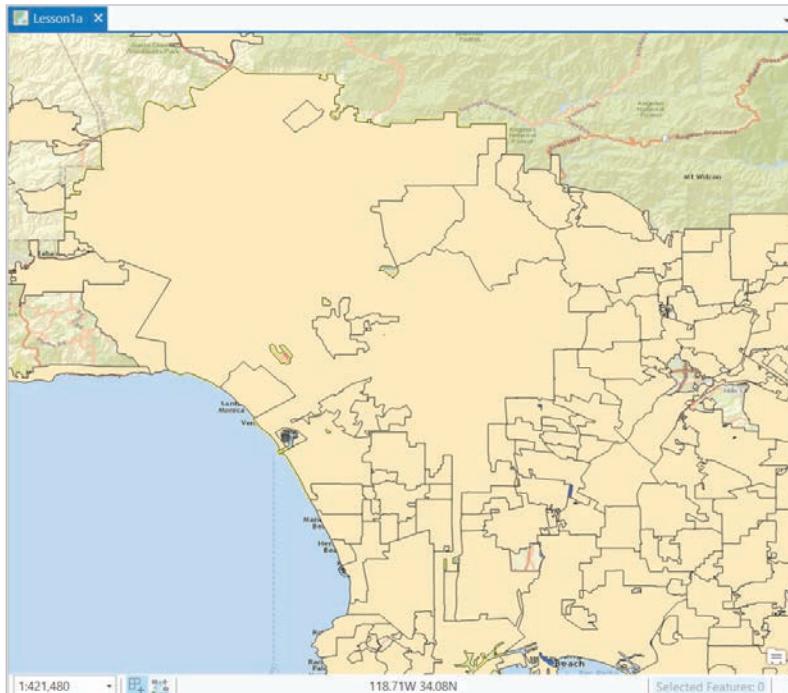
Notice that the name is updated in the Contents pane.

Renaming the layer in the map simply makes it easier to identify in the map, it doesn't change the source data file's name (which is still City_ply). A layer is a representation or rendering of the data, not the data itself. You can make any changes you want to a layer's properties without affecting the data on which the layer is based.

Get information about cities

Now see what you can find out about the cities on the map.

- 1) Click any city polygon on the map.



The city flashes blue, and a pop-up window opens. In the title bar of the pop-up window, you see the name of the city you identified. In the pop-up window, you see its attributes, or the information that this layer stores about cities. Some of the attributes aren't obviously meaningful, but others are. If POP2010 is population for the year 2010, and POP10_SQMI is population per square mile for the same year, you know that Los Angeles (if that's the city you identified) had 3,792,621 inhabitants at the time of the 2010 census, and its population density was 8,018 people per square mile.

- 2) If necessary, move the pop-up window away from the map. Identify a few more cities.

The pop-up window updates with information about the new city. All the cities have the same set of attributes; it's the values of the attributes that change.

- 3) Close the pop-up window.

A screenshot of a pop-up window titled 'Cities - Los Angeles'. The window displays a list of attributes and their values for the selected city, Los Angeles. The attributes include OBJECTID, NAME, CLASS, ST, STFIPS, PLACEFIPS, HOUSEUNITS, POP2010, POP_CLASS, POP10_SQMI, SQMI, Shape_Length, and Shape_Area. The window has a title bar with standard window controls (minimize, maximize, close) and a toolbar at the bottom with icons for search, refresh, and other map functions.

Attribute	Value
OBJECTID	3568
NAME	Los Angeles
CLASS	city
ST	CA
STFIPS	06
PLACEFIPS	44000
HOUSEUNITS	1413995
POP2010	3792621
POP_CLASS	10
POP10_SQMI	8018.7
SQMI	472.97
Shape_Length	5.460156
Shape_Area	0.119704

- 4) In the Contents pane, right-click Cities and click Attribute Table.

OBJECTID	Shape	NAME	CLASS	ST	STFIPS	PLACEFIPS	HOUSEUNITS	POP2010	POP_CLASS
1	Polygon	East Honolulu	CDP	HI	15	06290	18774	49914	6
2	Polygon	Ahuimanu	CDP	HI	15	00400	2826	8810	5
3	Polygon	Heeia	CDP	HI	15	13900	1614	4963	5
4	Polygon	Kahaluu	CDP	HI	15	21200	1473	4738	5
5	Polygon	Kailua	CDP	HI	15	23150	13650	38635	6
6	Polygon	Kaneohe	CDP	HI	15	28250	11553	34597	6
7	Polygon	Kaneohe Station	CDP	HI	15	28400	2208	9517	5
8	Polygon	Maunawili	CDP	HI	15	50750	688	2040	4

- 5) Scroll across the table, if necessary, to look at all the field names (the gray column headings).

This is a different presentation of the same information you saw when you identified cities on the map.

- 6) Scroll back to the beginning of the table, and then scroll a little way down through the records (the table rows).

This table has a lot of records: in fact, 29,259 of them, as you can see at the bottom. Each record corresponds to a unique feature—that is, a unique city—on the map. So there must be a lot of cities you’re not seeing in the current view.

- 7) Leave the table open. It will stay docked under the Lesson1a map.

► You can move the panel by dragging it from the tab and redock it by dropping it on any blue arrow.

- 8) In the Contents pane, right-click the Cities layer. On the context menu, click Zoom To Layer.

The map zooms out to the geographic extent of the layer: the entire United States. You can’t distinguish individual city polygons at this scale.

- 9) On the Map tab, in the Navigate group, click the Previous Extent button.

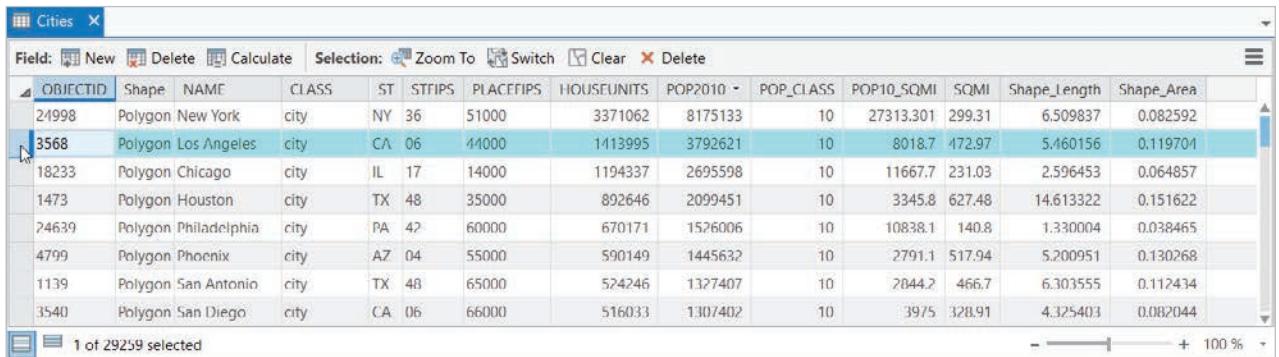
Select the record for Los Angeles

When you select a record in an attribute table, the corresponding feature is selected on the map. (Likewise, when you select a feature on the map, its record is selected in the table.) Selections are marked with a blue highlight by default.

- 1) **Scroll up to the top of the table. Make sure the table is wide enough that you can see the POP2010 field.**
 - ▶ **If necessary, widen the table by dragging its edge.**
- 2) **Right-click the POP2010 field name. On the context menu, click Sort Descending. Alternatively, double-click the column header to switch between the ascending/descending sort order.**

The records are sorted in the order of their populations, from largest to smallest. Los Angeles is now the second record in the table, after New York.

- 3) **At the left edge of the table, click the small gray box next to the Los Angeles record to select it.**

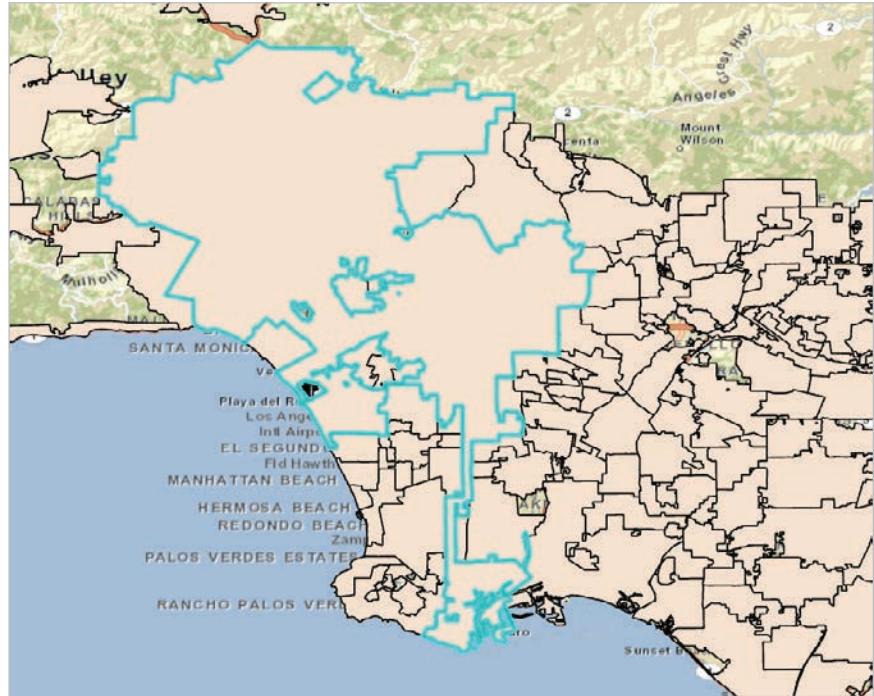


OBJECTID	Shape	NAME	CLASS	ST	STFIPS	PLACFIPS	HOUSEUNITS	POP2010	POP_CLASS	POP10_SQMI	SQMI	Shape_Length	Shape_Area
24998	Polygon	New York	city	NY	36	51000	3371062	8175133	10	27313.301	299.31	6.509837	0.082592
3568	Polygon	Los Angeles	city	CA	06	44000	1413995	3792621	10	8018.7	472.97	5.460156	0.119704
18233	Polygon	Chicago	city	IL	17	14000	1194337	2695598	10	11667.7	231.03	2.596453	0.064857
1473	Polygon	Houston	city	TX	48	35000	892646	2099451	10	3345.8	627.48	14.613322	0.151622
24639	Polygon	Philadelphia	city	PA	42	60000	670171	1526006	10	10838.1	140.8	1.330004	0.038465
4799	Polygon	Phoenix	city	AZ	04	55000	590149	1445632	10	2791.1	517.94	5.200951	0.130268
1139	Polygon	San Antonio	city	TX	48	65000	524246	1327407	10	2044.2	466.7	6.303555	0.112434
3540	Polygon	San Diego	city	CA	06	66000	516033	1307402	10	3975	328.91	4.325403	0.082044

On the map, the city of Los Angeles is outlined in blue. You may be able to see the whole city already, but now you can make sure.

- 4) **Close the attribute table by clicking the X on the right of Cities.**
- 5) **In the Contents pane, right-click Cities and click Selection > Zoom To Selection.**

The map zooms in close on the selected feature and centers it in the view. The city's odd shape is attributable to years of piecemeal expansion and incorporation. The city has internal "holes" where it surrounds other cities, such as Beverly Hills, or unincorporated areas. It also has a long, narrow southern corridor that connects it to its harbor at the Port of Los Angeles.



6) On the Map tab, in the Selection group, click the Clear button  to unselect the feature.

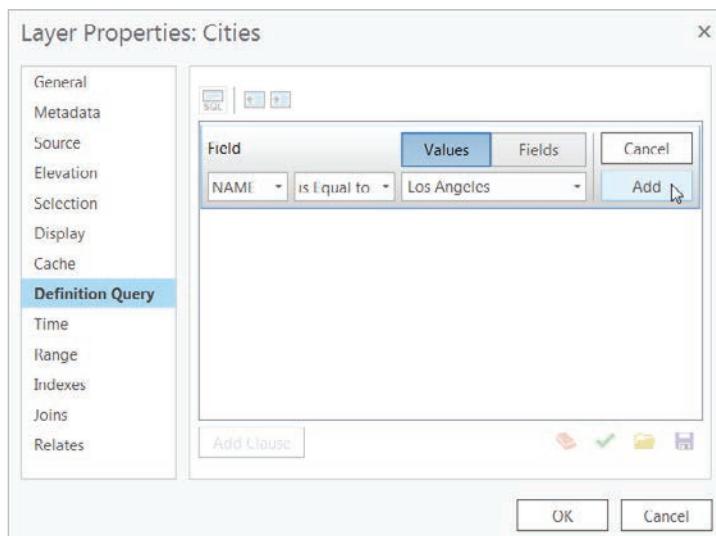
Filter the display of cities using a definition query

One of your project requirements is that the new park be inside the Los Angeles city limits. Therefore, you're more interested in Los Angeles than in other cities. A layer property called a *definition query* allows you to show only those features in a layer that interest you.

- 1) In the Contents pane, right-click the Cities layer and click Properties.
- 2) In the Layer Properties dialog box, click Definition Query.
- 3) Click Add Clause to begin building your query.

You build a query on an attribute table by specifying a field and setting a logical or arithmetic condition that values in that field must satisfy. In this case, you want to find records with the value of Los Angeles in the NAME field.

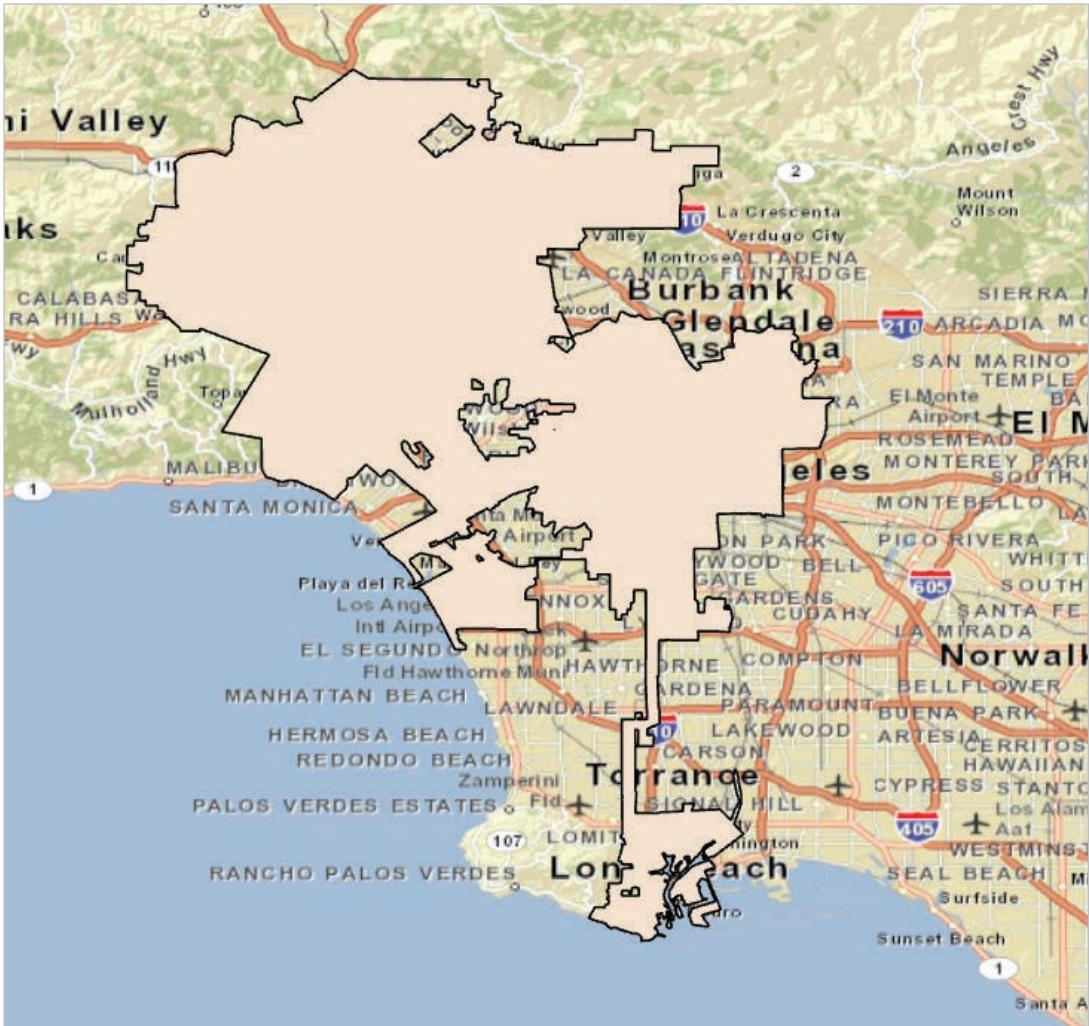
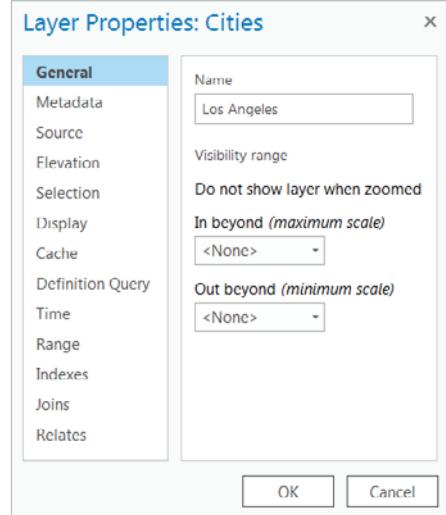
- 4) In the list of field names, use the drop-down arrow to click NAME.
- 5) Click is Equal to in the second drop-down menu.
- 6) Type Los Angeles in the third box. You can also use the menu to select the city name.
- 7) Click Add. Do not click OK yet.



8) Click the General tab.
Delete the layer name
Cities and type
Los Angeles.

9) Click OK.

On the map, only the city of
Los Angeles is shown. The
other cities are hidden by
the definition query.



10) In the Contents pane, right-click the Los Angeles layer and click Attribute Table.

The table shows only the record for Los Angeles.

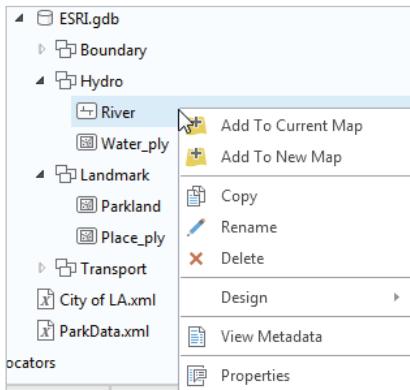
11) Close the attribute table.

The other city features haven't been deleted. Clearing the definition query would display them again. Layer properties affect the display of data in a map, not the essential properties of the data itself: the number of features, their shapes, locations, and attributes.

Add a layer of rivers

Now you can add a layer of local rivers to the map and see where the Los Angeles River fits into the picture.

1) From the Project pane, browse to the Hydro group in the ESRI.gdb and right-click the River layer. Then click Add To Current Map from the menu.



A layer of rivers is added to the map and placed at the top of the Contents pane. The layer is symbolized with a random color; if the color is difficult to identify, it may be beneficial to change its color using the color palette (if you are having trouble, refer to the task “Set layer properties,” steps 1 and 2, earlier in this section, for instructions).

2) Click on any river to identify it.

You see the name of the river (many of them don't have names) and its other attributes.

By default, the Explore tool identifies features from the topmost layer in the Contents pane. If you miss a river, you'll identify either the city of Los Angeles or nothing. That's fine—leave the Explore window open and click again on a river.

Layers and datasets

A layer points or refers to a dataset stored somewhere on disk (as specified on the Source tab of the Layer Properties dialog box). A layer is not a physical copy of the data. A layer is a representation or rendering of the data. The dataset stores the shapes, locations, and attributes of features; the layer stores display properties, including what the layer is named, which of its features are shown or selected, how those features are symbolized, and whether they are labeled. Changes to layer properties do not affect the dataset that the layer refers to. You can make as many layers as you want from the same dataset and give them different properties. These layers can co-exist in the same map document or in many different map documents.



Attribute	Value
OBJECTID	2199
NAME	Browns Canyon Wash
TYPE	Stream/River
DESCRIPTION	Intermittent
METERS	3979
FEET	13026
Shape_Length	0.036948

- 3) **Click on a few more rivers to identify them. Try to identify a segment of the Los Angeles River.**

The river runs west to east across the city, turns south near the city's eastern edge, and follows a freeway to San Pedro Bay.

- 4) **Close the pop-up window.**

Make a definition query on the LA River

Just as you're mainly interested in one city, you're also mainly interested in one river. You'll make another definition query to show just the Los Angeles River.

- 1) **In the Contents pane, right-click the River layer and click Properties.**

▶ **A shortcut is to double-click the layer name in the Contents pane.**

- 2) **In the Layer Properties: River dialog box, click Definition Query.**

- 3) **Build your query:**

Name is equal to Los Angeles River.

- 4) **Click the General tab. Change the layer name from River to Los Angeles River.**

- 5) **Click OK.**

The Contents pane reflects the new layer name.

▶ **You can also rename a layer directly in the Contents pane by clicking the name once to highlight it and then clicking it again to rename it. (Be careful not to double-click, or you'll open the layer properties.)**

Change the symbology

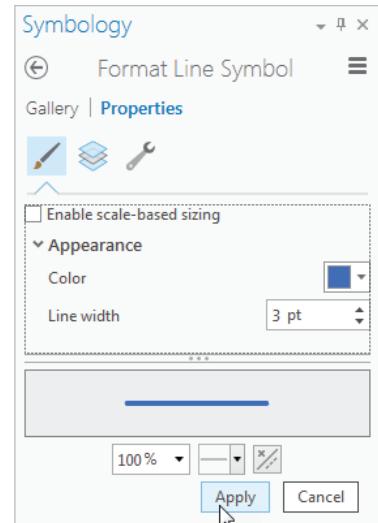
- 1) **Click the color symbol below the Los Angeles River name to modify the symbol. Clicking the symbol opens the Symbology pane on the right side of the map.**

- 2) **Click the Properties tab at the top. Under Appearance, you can change the color and width of the symbol.**

- 3) **Change the color to blue.**

- 4) Change the line width to 3 pt.
- 5) Click the Apply button and close the Symbology pane.

On the map, the river is displayed with its new symbology.



Select Los Angeles River features using a query

On the map, the river looks like a single feature (just like the city), but it's not.

- 1) In the Contents pane, right-click the Los Angeles River layer and click Attribute Table.

At the bottom of the table, you see that 0 of 17 records are selected. That means that, in this particular layer, the Los Angeles River is composed of 17 features. Why is that?

- 2) Scroll down through the table.

All the records have the same name value. Most have the same type, but one is an artificial path. There are a few description values. The need to maintain different attribute values for different parts of a geographic object is a common reason that data—especially data representing linear features such as streets and rivers—is

constructed this way, consisting of multiple features. We'll come back to this point in lesson 2.

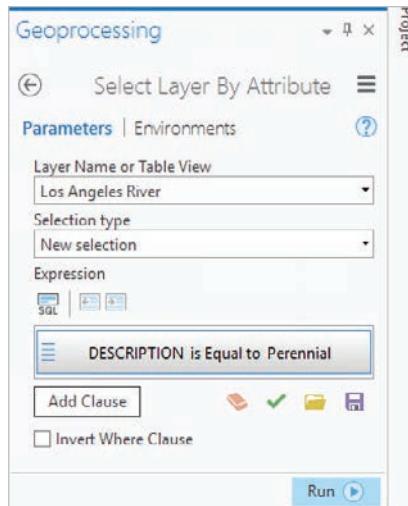
- 3) In the ribbon of tools on the Map tab, in the Selection group, click the Select By Attributes button .

Having noticed “perennial” (year-round water flow) and “intermittent” (not year-round water flow) values in the description field, you might want to know which parts of the river are which. You can find out using an attribute query. An attribute query is like a definition query in that both types of query single out features in a layer on the basis of attribute values. The difference is that an attribute query highlights (selects) features that satisfy the expression rather than hiding features that don't.

- 4) In the Layer Name or Table View box, confirm that Los Angeles River is selected.
- 5) Make sure the Selection type drop-down list is set to New selection.
- 6) Click the Add Clause button.
- 7) Create a clause for
Description is equal to perennial.

Field	Values	Fields	Cancel
DESCRIPTION	is Equal to	Perennial	Add

- 8) Click Add.



9) Click Run, in the lower-right corner of the pane.

Twelve records are selected in the table. The corresponding features are selected in the map, showing that the river is perennial for most of its length.

It's not among your guidelines to locate the new park along the river's perennial stretch, but it's interesting that fairly simple data exploration may introduce new ways of thinking about your problem.



10) Close the Select Layer By Attribute Geoprocessing pane.

Find the length of the perennial portion of the LA River

As you learned by looking at the attribute table, the perennial portion of the LA River is separated into 12 distinct records. To find the total length of this section, you must perform a summation of the FEET fields, using the Summary Statistics tool. When features are selected in the layer, the Summary Statistics tool processes only the selected records as a subset. Because you have perennial streams selected, the tool will sum up only the SUM field of these selected features.

- 1) In the attribute table of the Los Angeles River layer, right-click the DESCRIPTION field and click Summarize.
- 2) Rename the output table LARiverPerennial by clicking the Browse button and entering the name.
- 3) In the Field drop-down menu, click FEET, and in the Statistic Type menu, click SUM.

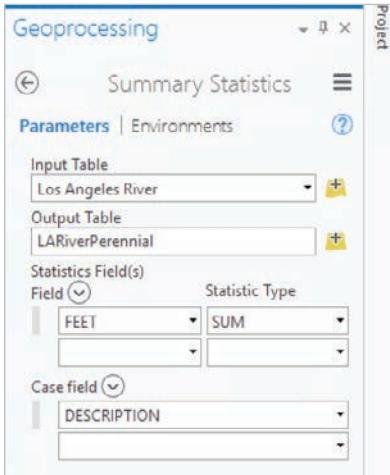
So you're using the Summary Statistics tool to find the total length (sum of each FEET record) of the perennial portion of the LA River.

- 4) In the Case field drop-down menu, click DESCRIPTION.
- 5) Compare the tool to the figure and click Run in the lower-right corner of the Geoprocessing window.
- 6) When the tool finishes processing, the resulting table is added to the bottom of the Contents pane. Right-click the table and click Open to see the results. Confirm that the total feet of perennial streams is 229,947.
- 7) At the top of the Los Angeles River attribute table panel, click the Clear Selection button .

Clearing the record selection clears the feature selection on the map and in the table.

- 8) Close the attribute tables of Los Angeles River and LARiverPerennial so that the map fills the middle of the application. You can also close the Summary Statistics pane now.
- 9) Save the project by clicking the Save button  at the top of the application.

Save your project often as you work through the workbook.



Selecting features

You make selections to work with a subset of features in a layer. You can use a selection to zoom the map to a specific area, make a new layer from the selected subset, get statistical information about the subset, or for many other things.

Selections are also used in queries. Whether you do an attribute query (to find records with a certain attribute value) or a spatial query (to find features with a certain spatial relationship to other features), the records and features that satisfy the query are returned as a selection on the layer.

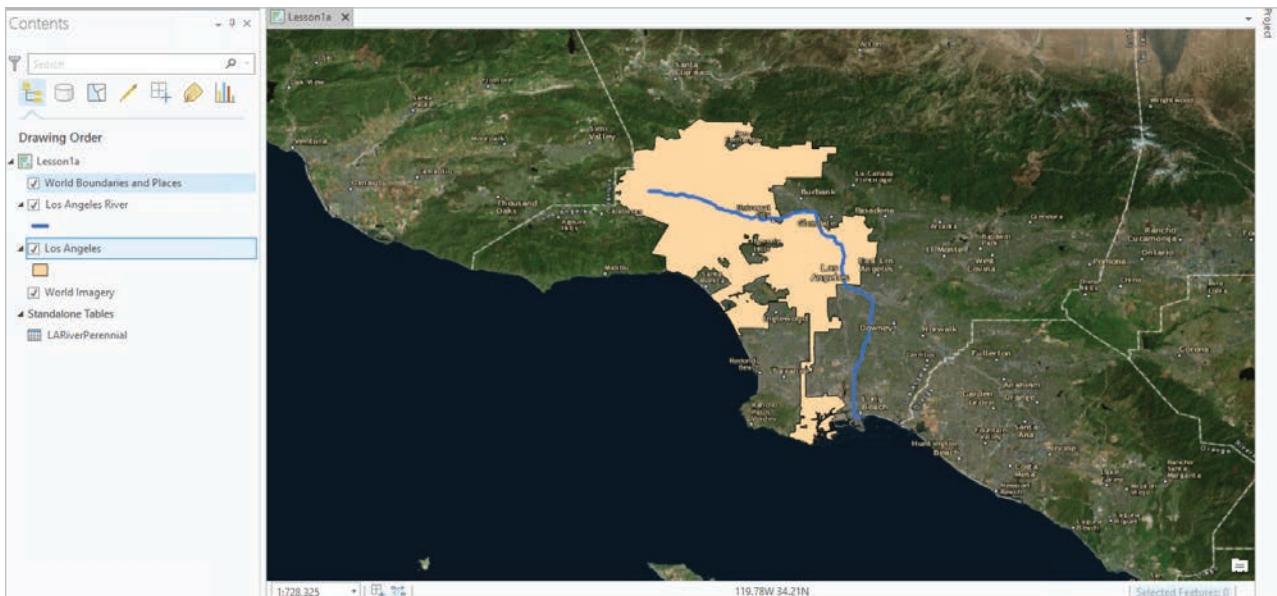
Change the basemap to Imagery with Labels

Imagery provides a detailed, photorealistic view of the ground, and you'll rely on it to explore the LA River in more detail. Imagery also has other important uses, such as providing a background against which to edit features (lesson 5) and "ground truthing" analysis results (lesson 6).

- 1) On the Map tab, click the Basemap drop-down arrow and click Imagery with Labels.

World Imagery is added to the bottom of the Contents pane and replaces streets. A layer named World Boundaries and Places has also simultaneously been added to the top of the Contents pane. This layer consists of locations, boundaries, and labels and should be

visible on the map. (You should see yellow place-names covering the city of Los Angeles feature, for instance). Your Contents pane and map should look like the figure.

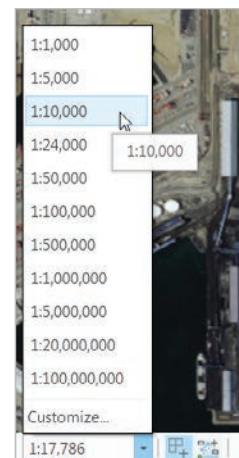


Create a bookmark

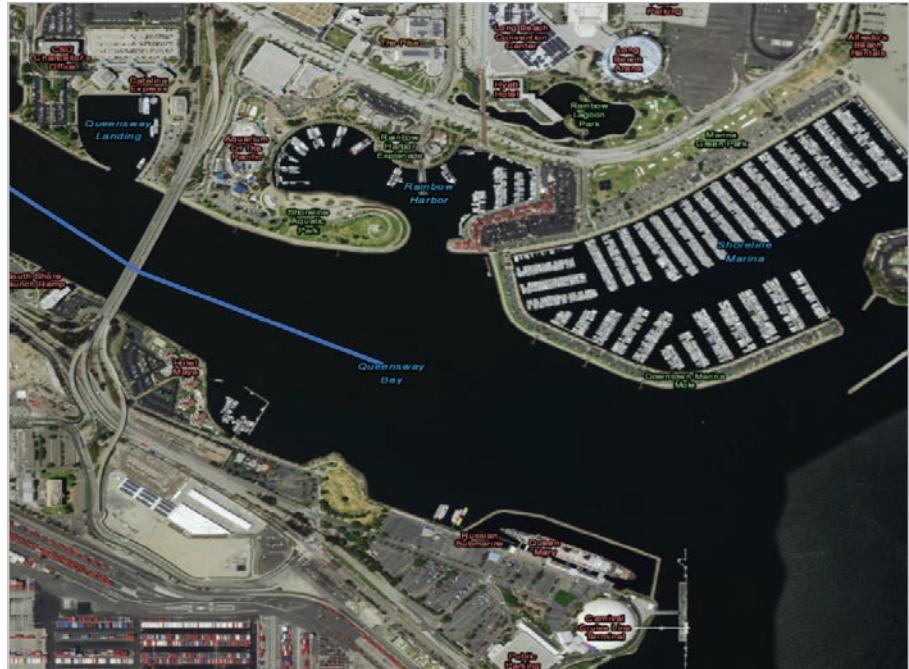
Certain views in a map are useful for orientation or reference. You can bookmark a view to make it easy to return to.

- 1) First, zoom to the Los Angeles layer by right-clicking the Los Angeles layer and clicking Zoom to Layer.
- 2) On the Map tab, click Bookmarks > New Bookmark.
- 3) In the Create Bookmark dialog box, replace the default name with City of Los Angeles. Click OK.
- 4) Zoom in on the river's mouth at the Port of Long Beach by pressing and holding the Shift key.
- 5) In the lower-left corner of the map, click the Map Scale dropdown arrow and click 1:10,000.

At this scale, one unit of measure on the map is equivalent to 10,000 of the same units on the ground. Loosely, a thing on the map is 10,000 times smaller than its actual size.



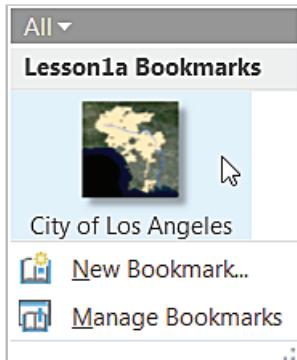
6) Use the Zoom and Pan tools to explore the harbor.



The imagery is high resolution, and you'll see more detail as you keep zooming in. Eventually, you'll reach a limit in the level of detail, and the image will become pixelated.

7) When you're ready, on the Map tab, click Bookmarks > City of Los Angeles.

The map view returns to the bookmarked extent.



Change the symbology for Los Angeles

The boundary of Los Angeles is filled in with a solid color so the imagery underneath is still covered up. Soon you're going to zoom in and follow the river's course through the city. It will serve that purpose to resymbolize the city so that you see only its outline.

1) In the Contents pane, click on the color symbol below the name Los Angeles to modify the symbol.

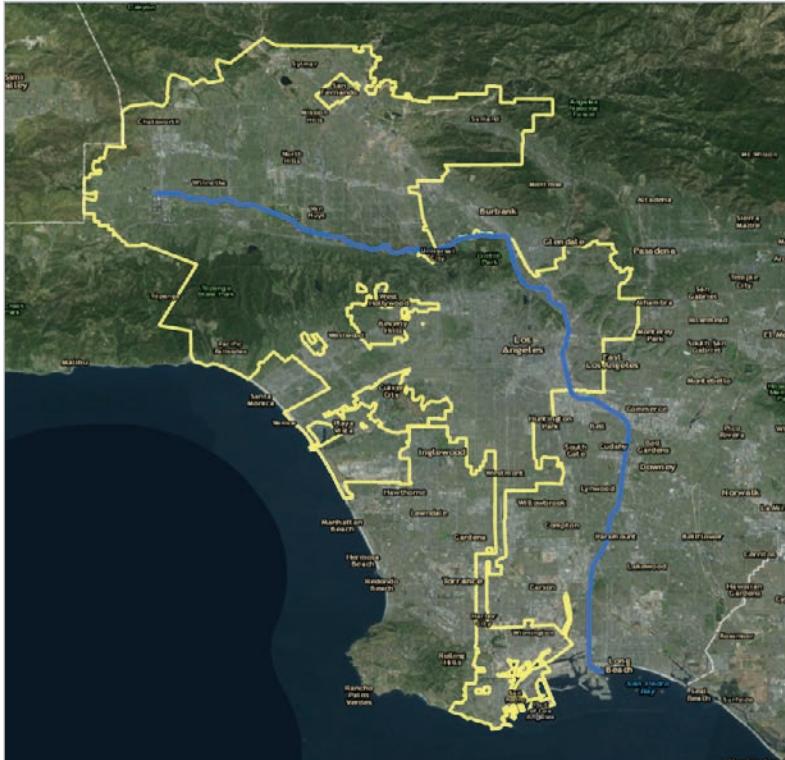
The Symbology pane opens on the right side of the map.

2) Click Properties. If necessary, expand Appearance.

3) Change the color to No Color.

- 4) Change the outline color to Autunite Yellow.
- 5) Increase the outline width to 2 pt.
- 6) Click Apply.

The new symbology is displayed on the map.



- 7) Close the Symbology pane.

Save the layer as a layer file

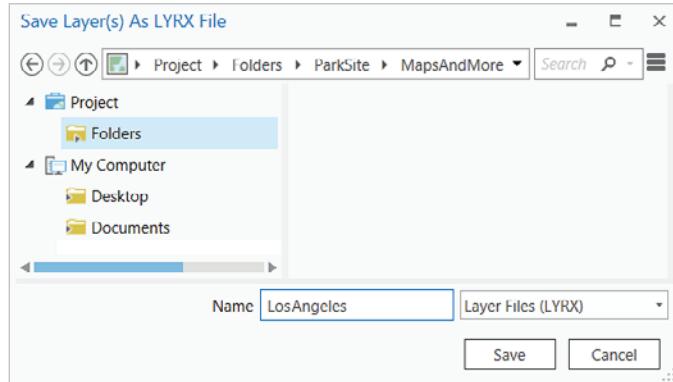
It wasn't hard to make this particular symbol, but it often takes time and effort to create good symbology. Having done so, you may want to reuse that symbology. In this book, for instance, you'll draw the outline of Los Angeles in other map documents in coming lessons.

You can save layer properties to a file called a *layer file*, which has the file extension *.lyrx*. A layer file is not a copy of the data, but you add it to a map document in the same way that you add data. The layer file stores all the properties of a layer—its name, symbology, definition query, and so on—including the path to the layer's source dataset. When you add a layer file to ArcGIS Pro, the layer draws with its properties already set.

- 1) In the Contents pane, right-click Los Angeles and click Save As Layer File (near the bottom of the context menu).

The Save Layer(s) As LYRX File dialog box opens.

- 2) Click Folders at the top of the left column and open the ParkSite\MapsAndMore folder.
- 3) Name the new file LosAngeles (no spaces) and click Save.

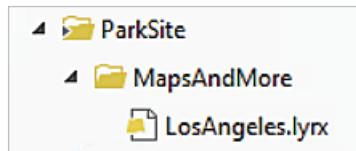


Now you'll remove the Los Angeles layer that's currently in the map, and then add the layer file to see how it works.

- 4) In the Contents pane, right-click Los Angeles and click Remove.

The layer disappears from the map and the Contents pane.

- 5) In the Project pane, browse to the MapsAndMore folder.



- 6) Drag the LosAngeles.lyrx file to your map.

The layer is added to the map with all its properties set (layer name, symbology, definition expression, and so on).

- 7) Open the layer properties of Los Angeles. In the Layer Properties dialog box, click Source.

Note that as before, the layer points to the City_ply feature class. As stated previously, layer files do not store raw data; they are a pointer to the GIS data along with the properties about how to display the data on a map.

8) Close the Layer Properties dialog box.

Anytime you add the LosAngeles.lyrx file to a map document, the layer will draw as a yellow outline with a definition query on the city of Los Angeles. Once the layer is added to the map, however, it's just the same as any other layer, and you can change its properties however you want. (Not that you want to change them.)

Follow the river

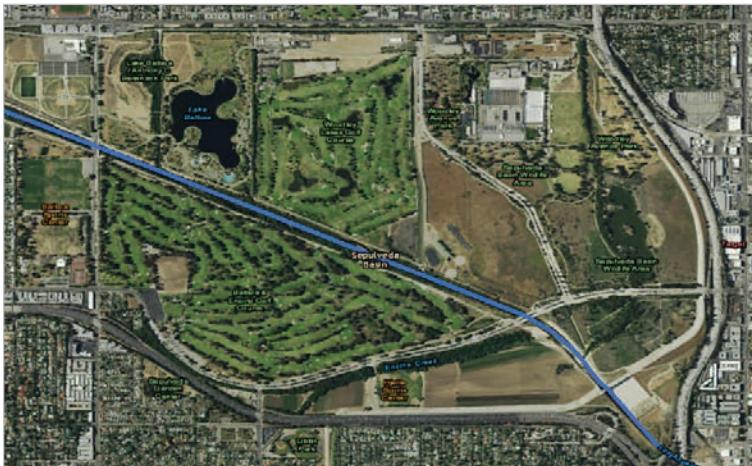
Now you can start developing a sense of the study area by following the river's course through the city.

- 1) Maximize the ArcGIS Pro window if you haven't done so already.
- 2) Open the City of Los Angeles bookmark.
- 3) Zoom in on the river's source in the community of Canoga Park in northwest Los Angeles.

The river officially starts where Bell Creek and the Arroyo Calabasas converge at Canoga Park High School.

- 4) Click the Map Scale drop-down arrow below the map and click 1:24,000.
- 5) Press and hold the left mouse button to pan slowly eastward along the river.

Densely populated residential neighborhoods line both sides of the river until you get to the Sepulveda Dam Recreation Area, a large recreational area with golf courses and a lake. The river bottom is natural here, becoming concrete again at the Sepulveda Dam in the southeastern corner of the basin.



Setting map scale

By default, map scale is displayed in the form of a representative fraction, such as 1:24,000. At this scale, for any unit of measure, one unit of distance on the map is equivalent to 24,000 units in the real world. You can set the map to any scale you want by typing a number in the scale box and pressing Enter. You can also enter a verbal expression such as "1 inch = 1 mile," and it will be converted to a representative fraction. To change the way that scale is displayed, or to change the list of predefined scales, click Customize This List at the bottom of the Map Scale drop-down list.

East of the Sepulveda Basin, the river follows a freeway for a while and is again surrounded by fairly dense residential and commercial areas.

6) On the keyboard, press and hold the Q key.

Now you roam continuously across the display in whichever direction you point the mouse. To control your speed, make small brushing movements with the mouse either with or against the direction of movement. As you roam, the imagery should draw smoothly and continuously, although your experience may vary. Other layers, such as the Los Angeles River layer, suspend drawing and catch up when you stop.

7) Release the Q key to stop roaming.

▶ You can also use the four arrow keys on the keyboard to roam.

8) Continue to pan (or roam) along the river.

The river flows generally southeast for a while, and then follows the northern edge of unincorporated Universal Studios. It continues east, and then bends sharply south as it curves around Griffith Park (at 4,218 acres, one of the largest city parks in the United States). To the north of Griffith Park lies the city of Burbank; to the east is Glendale.

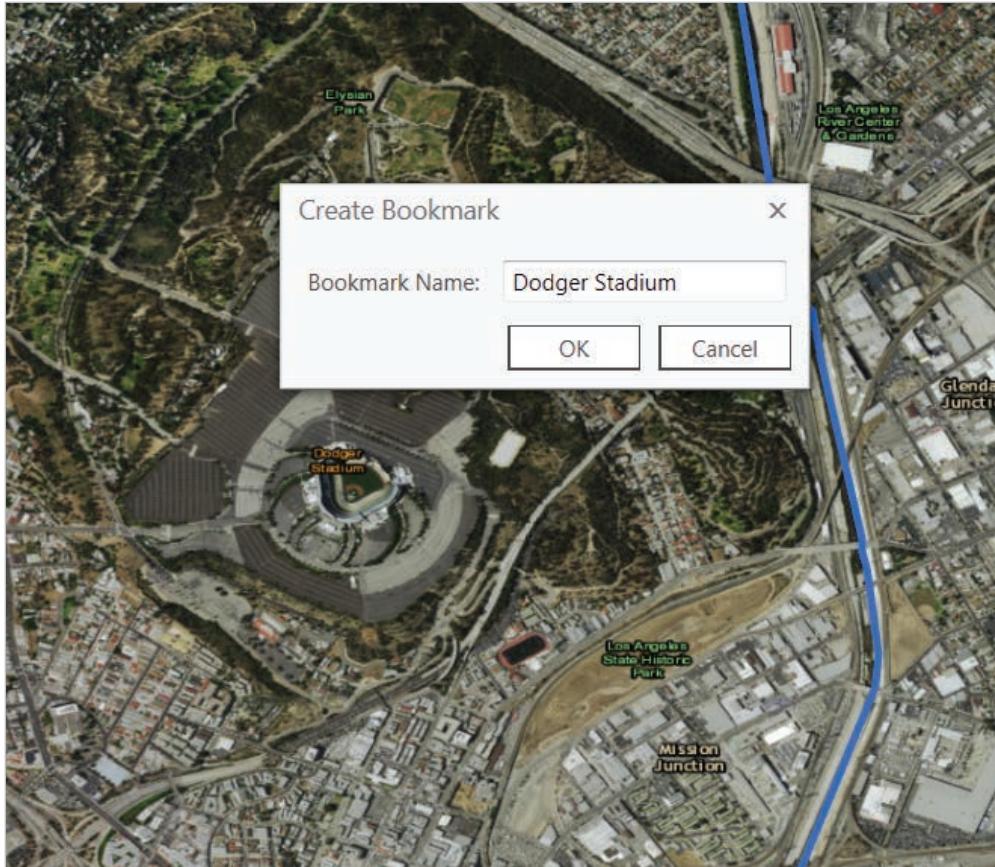
As it flows south, the river runs parallel to another major freeway. You'll see the Silver Lake Reservoir and then Elysian Park, where the Los Angeles Dodgers play Major League Baseball.



Save your bookmarks

Dodger Stadium is a landmark that you may want to return to so you can save the map location (or “extent”) as a bookmark.

- 1) **Center your view on Dodger Stadium, more or less as shown in the figure.**
- 2) **On the Map tab, click Bookmarks > New Bookmark.**
- 3) **In the Create Bookmark dialog box, name the bookmark Dodger Stadium and click OK.**



Pan to the city limits

You'll follow the river until it crosses the LA city limits, which marks the boundary of your study area.

- 1) **Pan along the river as it runs south.**

This last section of river passes through an industrial landscape and leaves the city at the Redondo Junction train yards.

- 2) **Close the Lesson1a map view (not the entire project) and any open tables.**
- 3) **Save your project.**
- 4) **Continue to the next lesson or close ArcGIS Pro. Save your changes if prompted.**

Results for the book's exercises can be found online on the book's resource web page. For information on how to download and use the Results data, go to esri.com/Understanding-GIS-3.

Exercise 1b: Do exploratory data analysis

In this exercise, you'll add park data and census data (containing demographic and socioeconomic information) to your map. The goal is to pay attention to patterns in the data and thereby build an intuitive sense of likely and unlikely locations for the park. This intuition should give you confidence that the analysis results you get in lesson 6 are plausible. Conversely, if the results contradict your gut feeling, you may be alerted to possible mistakes in the analysis.

Get started

You'll start ArcGIS Pro, if necessary, and continue working with your project document from the last lesson.

1) Start ArcGIS Pro.

From the Project pane, you'll make a copy of your Lesson1a map and name it Lesson1b. You can easily copy and paste maps in the Maps section of the Project pane similar to how you copy and paste files on your computer.

- 2) **If necessary, expand the Maps item in the Project pane.**
- 3) **Right-click the Lesson1a map and click Copy.**
- 4) **Right-click the Maps item (the folder above Lesson1a) and click Paste.**
- 5) **Rename the copy of Lesson1a as Lesson1b.**
- 6) **Open the lesson1b map by double-clicking the map in the Project pane.**

Add a layer of parks

The Parkland feature class can be found in ParkSite > SourceData > ESRI.gdb > Landmark > Parkland.

1) Add the Parkland layer by dragging it to the map.

One of your geographic constraints is that the new park not be located too close to existing parks. You know from your exploration so far that there are a couple of big parks along the river, but now you can look at the whole scenario.

Symbolize the layer

A shade of green is usually the right cartographic choice for parks. ArcGIS Pro may have chosen one by a stroke of luck, but probably not. You'll symbolize the layer after taking a look at its extent.

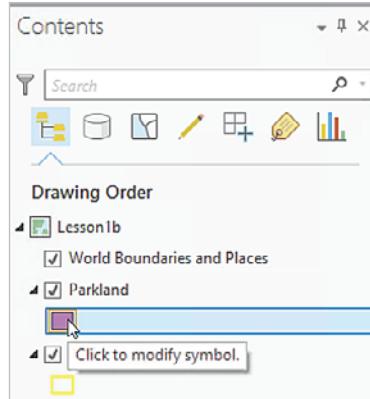
1) In the Contents pane, right-click the Parkland layer and click Zoom To Layer.



2) In the Contents pane, turn Parkland off and on a few times by clicking its check box. Leave it turned on.

The data extends well beyond Los Angeles, and the basemap shows that those big polygons to the north correspond to mountains. They're probably national forests.

- 3) In the Contents pane, click the color patch under the Parkland layer name to open the Symbology pane.



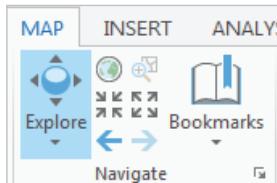
- 4) Switch from the Gallery tab to the Properties tab and click the Color button to open the color palette. Click Apple Dust, a shade of green.
- 5) Click the Outline color button to open the color palette again.
- 6) Click Moss Green.
- 7) Click Apply in the Symbology pane.

The layer symbology is updated on the map.

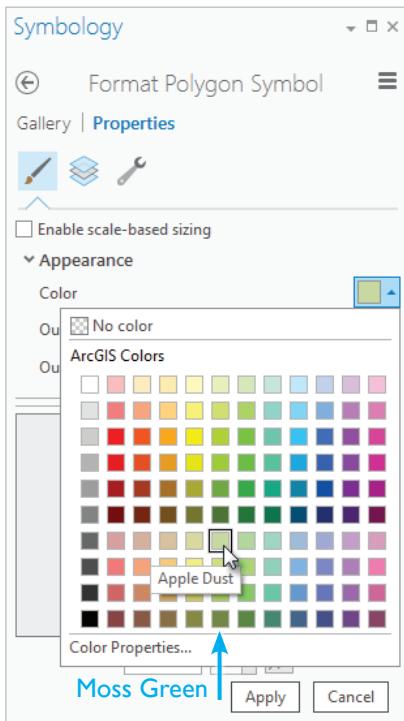
Identify features

Now you can find out what attributes this layer has in the table.

- 1) On the Map tab, verify that the Explore tool is active by clicking on it.



- 2) Click on one of the big park features in the mountains to identify it.



Among the attributes are the park's name, its type, and its acreage.

- 3) Leave the pop-up window open. On the Map tab, in the Navigate group, click Bookmarks > City of Los Angeles.

At this scale, you can make out the larger parks within the city.

- 4) Try to locate the parks mentioned earlier: the Sepulveda Dam Recreation Area, Griffith Park, and Elysian Park. Click on each one to see its attributes.
- 5) When you're done, leave the Identify window open and zoom to the Dodger Stadium bookmark.
- 6) Identify some of the neighborhood-size parks in the view.
- 7) Close the pop-up window.

Your list of park requirements doesn't have an upper size limit, but you can expect your candidates to be under 10 acres. Your trip down the river in the previous exercise didn't reveal any great big tracts of open land that weren't already parks.



ATTRIBUTE	VALUE
OBJECTID	1
NAME	Angeles National Forest
TYPE	National Park Service land
ACRES	448652.3
Shape_Length	2.709836
Shape_Area	0.177936



Label the parks layer

Some of the larger parks are already labeled in the World Boundaries and Places layer, but many of the smaller ones are not.

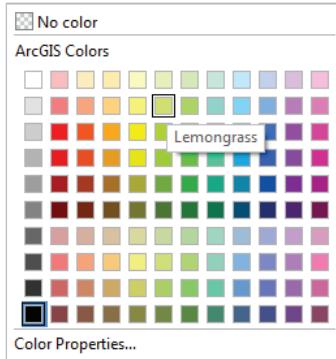
- 1) With the Parkland layer selected in the Contents pane, click the Labeling tab above the map and, in the Layer group, click the Label button  on the far left of the ribbon.

The parks are labeled with their names in simple black text. The information is being taken from the NAME attribute in the Parkland attribute table.

The default labels aren't ideal for this map. The black text disappears into the imagery wherever the label doesn't fit inside the park. In addition, the labels appear on one line, no matter how long they are.

2) On the Labeling ribbon, in the Text Symbol group, change the font to Arial (near the top).

3) Click the Color button. On the color palette, change the text color to Lemongrass.



Light-green text will show up better than black, but to be legible it still needs an outline, or *halo*.

4) Click the launcher button  in the Text Symbol group to open the Label Class pane.

5) On the Symbol tab, expand the Halo group.

6) Click the selector arrow next to the Halo symbol, click White fill under Polygon symbols, and click Apply (at the bottom of the pane). The default halo color is white, but you're going to use something darker.

7) Click the Color selector under Halo and click Moss Green.

8) Click Apply to see the result on the map.

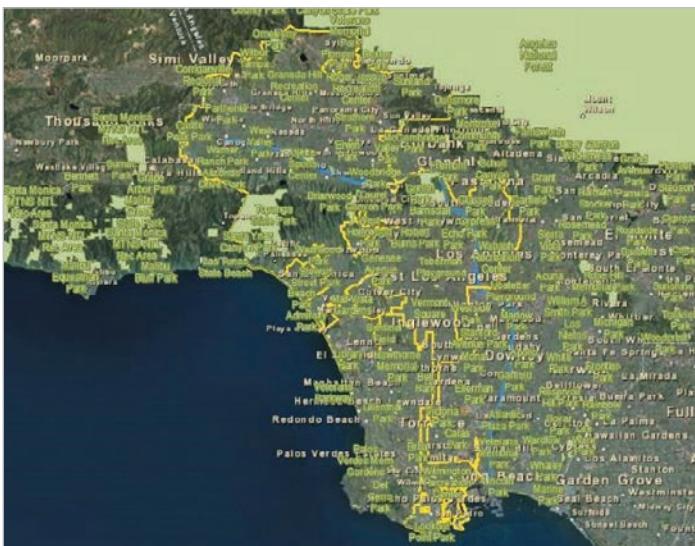
On the map, the park labels are visible against the basemap.



Set a scale range for the labels

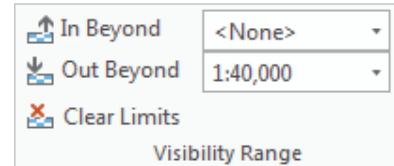
The park labels look good at this fairly large scale, where there's room to accommodate them. Now you can see what happens when you zoom out.

1) Zoom to the City of Los Angeles bookmark, located on the Map tab.



At this smaller (zoomed-out) scale, the labels overwhelm the map. You could just turn them off, of course, whenever they seem too crowded. A better solution is to make their visibility depend on the map scale.

- 2) With the Parkland layer selected, open the Labeling (not Appearance) ribbon.
- 3) In the Visibility Range group, click in the Out Beyond box and type 40,000 (not 1:40,000). Then press Enter. The park labels turn off instantly because you are zoomed out beyond 1:40,000. Whenever the map scale crosses the 1:40,000 threshold, the park labels will turn off automatically.
- 4) Zoom to the Dodger Stadium bookmark.



As long as the map scale is larger than 1:40,000 (which means it is zoomed in closer than 1:40,000), the labels show up again.



You've probably noticed that some parks, such as Elysian Park and Echo Park, are labeled in both the World Boundaries and Places and Parkland layers. You can set the scale range of the World Boundaries and Places layer reciprocally to the Parkland labels.

- 5) With the top World Boundaries and Places layer selected, open the Appearance ribbon (there should be no Labeling or Data options).

Scale ranges

As you've just seen, scale ranges can be set both for a layer's labels and for the layer itself. In this case, the distinction was blurred because the Reference layer is composed of labels. But layers that are composed of features, such as parks or rivers, can have their scale ranges set in exactly the same way. When you design maps to be viewed at multiple scales, you normally want layers representing detailed data, such as buildings or utility lines, to be visible only at large (close-up) scales. You may want your map to include multiple copies of a layer, each with a different scale range and unique symbology. For example, one layer might represent trees with a generic point symbol at medium scales. A second layer might represent the same trees with a more detailed and realistic symbol at large scales.

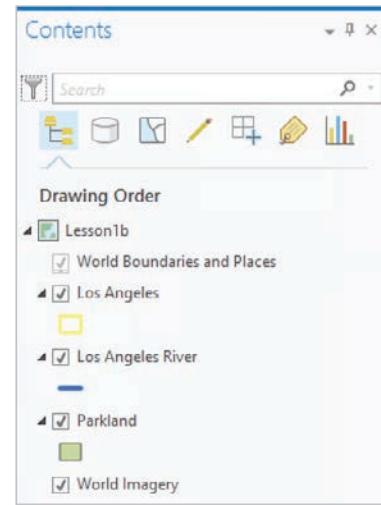
6) In the Visibility Range group, click in the In Beyond box and type 40,001.

Notice that some default options were already set here. These are defaults that are set for this hosted basemap.

By setting this option, the entire top World Boundaries and Places layer turns off when zoomed in at a larger scale than 1:40,001. Most of these labels are actually for places other than parks, but you can accept their loss at large scales.

7) Zoom back and forth across the 1:40,000 scale threshold to test your settings.

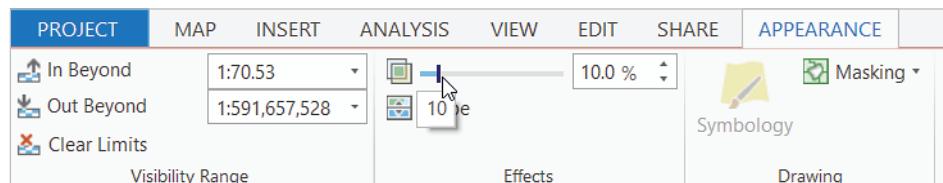
At scales of 1:40,000 or larger, the World Boundaries and Places layer appears with a dimmed check box in the Contents pane. This dimmed check box tells you that the layer is turned on but is set not to show at the current map scale.



Dim the basemap

Without doing anything further to the labels, you can emphasize them a little more by dimming the imagery basemap. To do that, you'll adjust its transparency.

- 1) With the bottom World Imagery layer selected, open the Appearance ribbon.
- 2) From the Effects group, adjust the transparency slider to 10%. You can do so by dragging the slider to 10%, or by typing 10 in the box. On the map, notice that the basemap fades slightly.



Add a layer of census tracts

The US Census Bureau gathers socioeconomic data about households and aggregates it by various geographic units. One of these units is a *census tract*, which is a relatively small subdivision of a county.

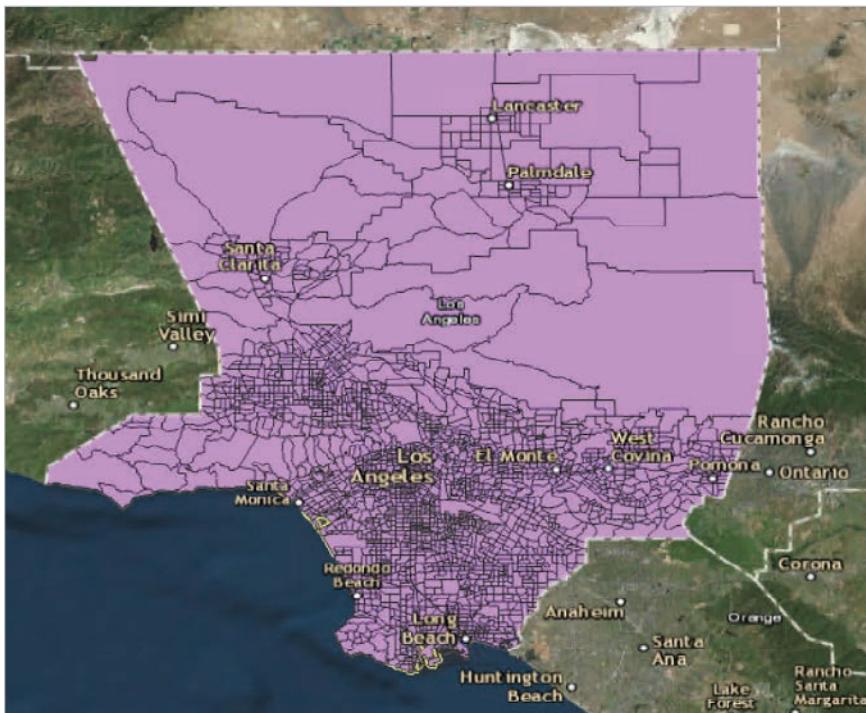
- 1) Open the Project pane and browse to ParkSite > SourceData > census.
- 2) Drag the tracts shapefile to the map.

The tracts layer is added to the Contents pane. The tracts cover everything except the labels.

- 3) In the Contents pane, right-click the tracts layer and click Zoom To Layer.

The census tract data covers Los Angeles County, including the islands of Catalina and San Clemente.

- 4) Zoom to the City of Los Angeles bookmark.

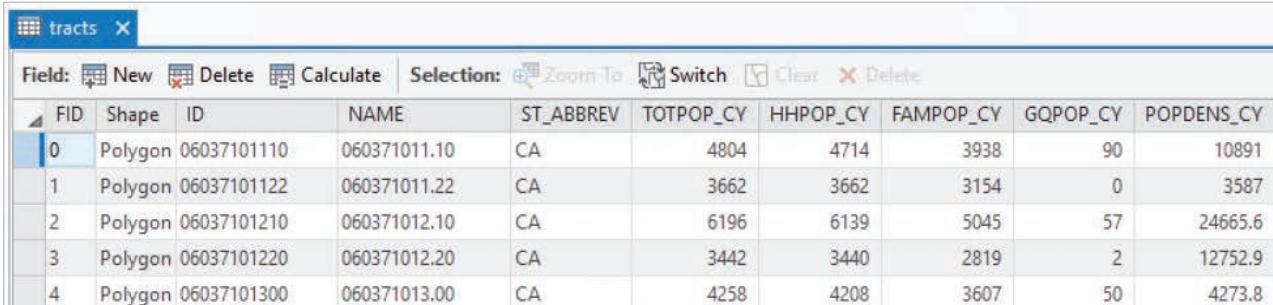


The tracts layer is made up of contiguous polygons that are reminiscent of a jigsaw puzzle. Because each piece of the puzzle represents a different set of living, breathing human beings, it's natural that each tract's attribute values for population, income, age, and so on would be different.

Open the attribute table

Now you can see what attributes the table contains.

- 1) In the Contents pane, right-click the tracts layer and click **Attribute Table**.
- 2) Scroll across the table and look at the field names.



FID	Shape	ID	NAME	ST_ABBREV	TOTPOP_CY	HHPOP_CY	FAMPOP_CY	GQPOP_CY	POPDENS_CY
0	Polygon	06037101110	060371011.10	CA	4804	4714	3938	90	10891
1	Polygon	06037101122	060371011.22	CA	3662	3662	3154	0	3587
2	Polygon	06037101210	060371012.10	CA	6196	6139	5045	57	24665.6
3	Polygon	06037101220	060371012.20	CA	3442	3440	2819	2	12752.9
4	Polygon	06037101300	060371013.00	CA	4258	4208	3607	50	4273.8

The table has some identification codes, followed by selected population and housing attributes. Some of the field names are fairly easy to interpret, others less so. In lesson 2, you'll see how to get more information about your information by accessing the metadata.

- 3) Locate the **POPDENS_CY** field. **CY** stands for current year, which for this census data is 2015.

This attribute stores population density (people per square mile) for the year 2015. Because one of your criteria is to locate the park in a densely populated area, this is relevant information. The attribute doesn't tell you what value should be a threshold for "high density," but it gives you a way to start making patterns on a map. Close the table when you are finished looking at it.

Symbolize census tracts by population density

Symbolizing a layer by an attribute, also called *thematic mapping*, allows you to see how values are spatially distributed.

- 1) With the tracts layer selected in the Contents pane, open the Symbology pane by clicking **Symbology** on the Appearance ribbon.

By default, all features in a layer have a single symbol. That's why all your census tracts are purple, or whatever color they happen to be.

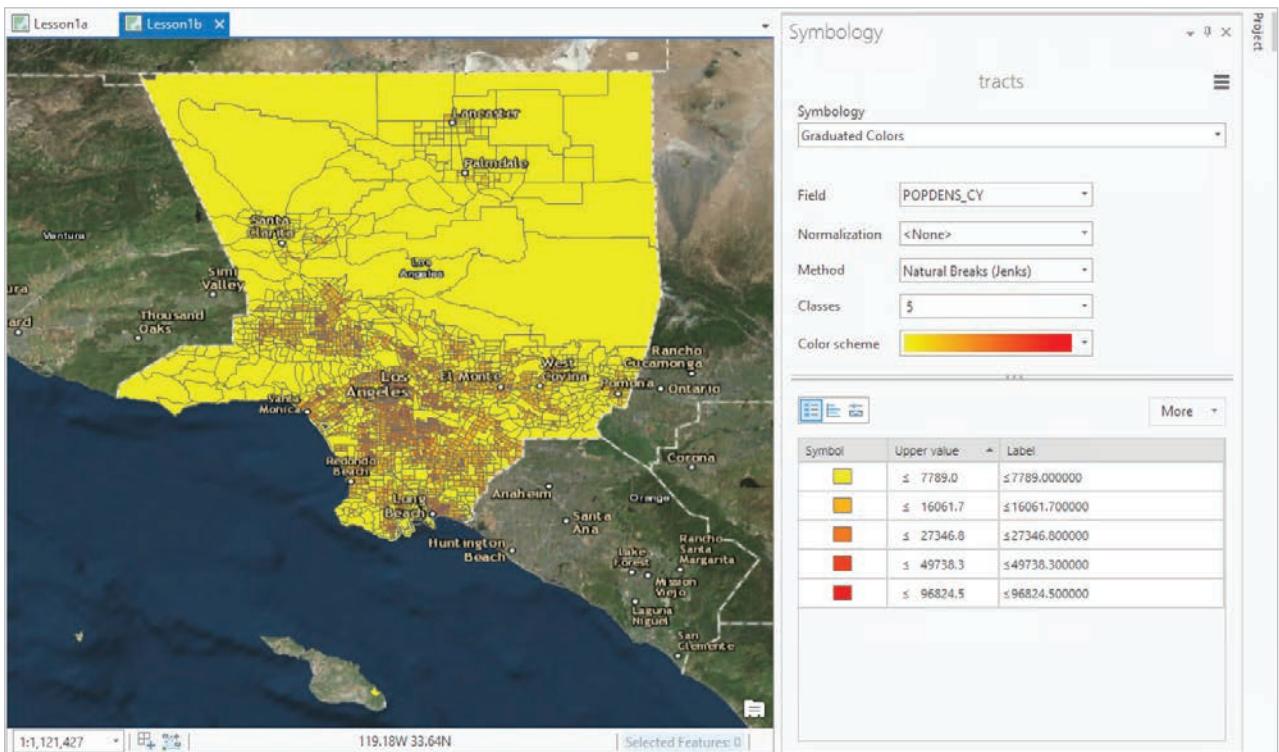
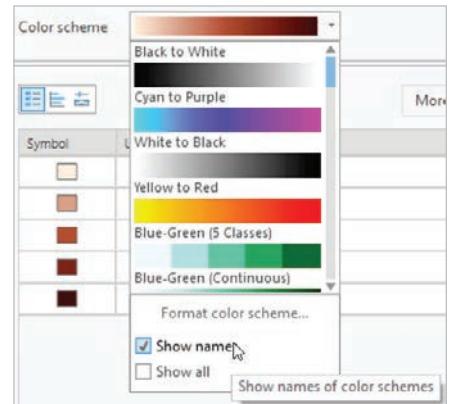
- 2) In the Symbology drop-down list, click **Graduated Colors**. The map updates automatically on the basis of some default values.

3) In the Field drop-down list, click POPDENS_CY. On the map, the tracts are symbolized by population density.

4) Change the Color scheme to Yellow to Red.

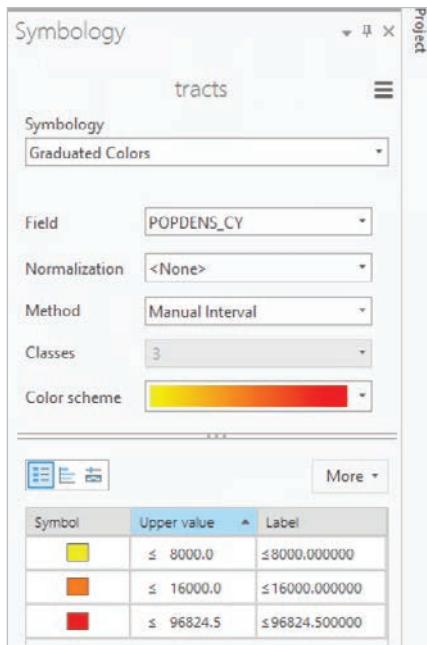
You can view the names of the schemes by clicking the Show names check box at the bottom of the list. Additional color schemes are available by clicking the Show all check box.

A lot is going on here if you expand the Symbol chart. (The same information is also available in the Contents pane.) The values for the POPDENS_CY attribute, which range from 0 to 96,824.5, are divided into five classes. The starting and ending values for each class are calculated by a “natural breaks” algorithm that separates clumps in the data. That’s why the range of values is different from class to class and why classes break at seemingly arbitrary numbers. Each class is associated with a symbol in a color ramp and is displayed on the map.



Change the classification

Quantitative symbology is flexible, and you can present data in many ways. Because all you want right now is a general sense of viable areas for your project, and because you’re going to look at a couple of variables together, you should keep your presentation simple.



- 1) Change the Classes drop-down box to 3.
- 2) Set the classification method to Quantile.

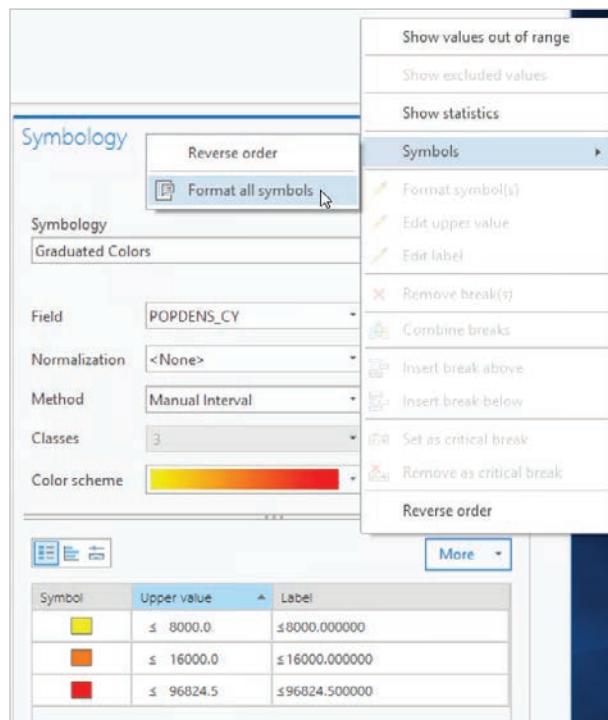
Using three classes, you'll easily be able to see high, medium, and low values. The quantile method guarantees that an equal number of tracts will fall into each class. It should be noted that there are no inherently good or bad ways to classify data—different classifications may be more or less appropriate to the purpose of your map and the background knowledge of your audience.

- 3) Change the first upper value to 8000 by double clicking the label, typing the value into the Upper value cell, and pressing Enter. The second class break point is selected and editable.
- 4) Change the second upper value to 16000.

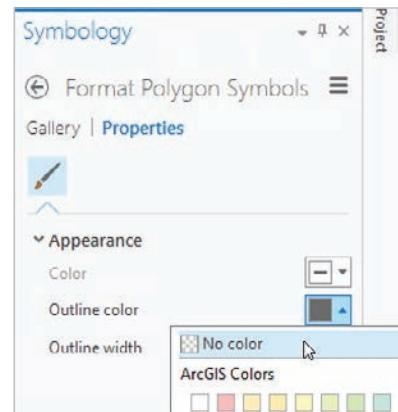
Notice that the classification method has been reset to Manual Interval because you've changed the class breaks. The histogram is updated, too. You no longer have a pure quantile classification, but having your classes break at round numbers makes intuitive sense.

The outlines of the polygons are currently overwhelming the map in some of the areas with the highest densities, making it difficult to interpret the classifications.

- 5) Click the More button in the Class breaks area of the histogram, and then browse to Symbols > Format all symbols. Any changes made here will apply to all the classifications.



- 6) If necessary, change to the Properties tab (near the top of the pane). Change the Outline color to No Color.
- 7) Click Apply at the bottom of the pane, and then click the back arrow at the top of the Symbology pane to return to the classification settings.



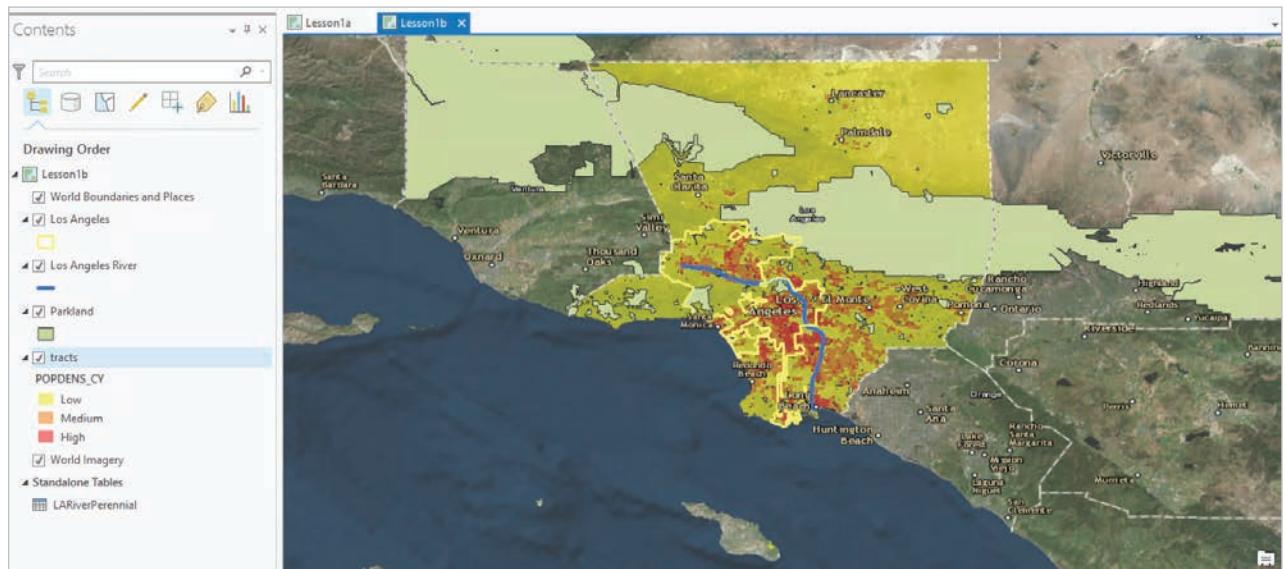
You're removing the outlines because you don't need to see the tract boundaries on the map. For now, you're interested in them as areas, not specifically as tracts.

- 8) In the Label column, double-click on the first label (< 8000) to make it editable. Type Low and press Enter.
 - ▶ If you start typing in the wrong box (in this case, Upper value), change the classification method to Natural breaks to reset the upper value, and then begin typing in the correct box, Label.

Symbol	Upper value	Label
	≤ 8000.0	Low
	≤ 16000.0	Medium
	≤ 96824.5	High

- 9) Replace the second label with Medium. Press Enter.
- 10) Change the third label to High. Click outside the edit box to commit the edit.
- 11) Change the transparency of the tracts layer to 50% (from the Appearance ribbon).
- 12) In the Contents pane, drag the tracts layer under the Parkland layer.

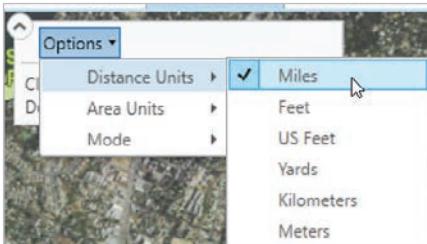
On the map, you can now see where population is concentrated along the river, and you can see it in relation to existing parks.



Measure distance from the river to parks

Making a few measurements will improve your ability to estimate distance on the map and give you a better intuitive sense of how close to the river the new park should be.

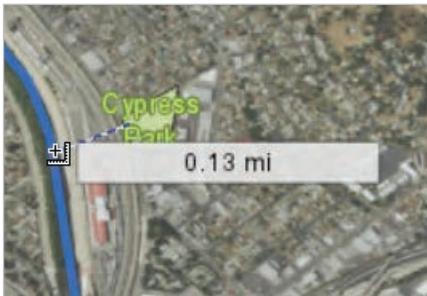
- 1) Select the **Dodger Stadium** bookmark (if necessary, turn off the tracts layer).
- 2) Pan the map so that a number of parks are in the view. Feel free to zoom in or out.
- 3) On the **Map** tab, in the **Inquiry** group, click the **Measure > Measure Distance** button to open the **Measure Options**.



- 4) Click the **Options** drop-down arrow. Set the **Distance units** to **Miles** and turn off **Feet**.

On the map, the pointer changes to a ruler with inscribed cross hairs.

- 5) Move the pointer over a park, such as **Cypress Park** (northeast of **Dodger Stadium** on the east side of the river).



- 6) Click to start a measurement.
- 7) Move the pointer (you don't have to drag it) to the river. The measurement result is displayed along the line and in the **Measure** dialog box.
- 8) Double-click to end the measurement.
- 9) Click on another park and measure its distance to the river.

The new result replaces the previous one in the **Measure** dialog box.

- 10) Measure the distances from a few more parks.

Cypress Park, Elysian Valley Recreation Center Park, and Downey Playground are close to the river. Elyria Canyon Park, a little over three quarters of a mile away (at its nearest edge), stretches the notion of proximity. Bear in mind that these measurements are straight-line distances, not the distance along streets.

- 11) Switch back to the **Explore** tool . The **Measure** tool stays active until another tool is selected.

- 12) Zoom to the **City of Los Angeles** bookmark.

Add a layer of census block groups

Another requirement for the new park is that it be located in a lower-income neighborhood. To symbolize an income attribute, you must add another layer to the map. (It's not that income data isn't reported at the census tract level, it's just that your particular tracts layer doesn't happen to include it.)

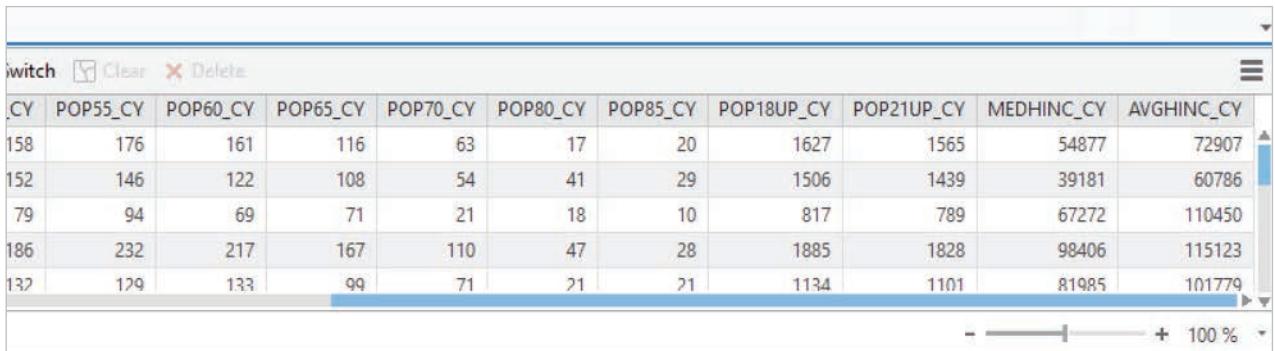
The same census folder that contains tracts.shp also has a shapefile dataset named block_groups.shp.

1) Open the Project pane and add the block_groups shapefile to the map from ParkSite > SourceData > census.

The new layer is added above the other layers. Like the tracts layer, the block_groups layer covers Los Angeles County. And like the census tracts, the block group polygons resemble a jigsaw puzzle. Block groups are another Census Bureau statistical unit: they're smaller than tracts and nest inside them. We'll talk more about census geography in lesson 2.

2) Open the attribute table of the block_groups layer and scroll across the attributes.

Most of these attribute names are cryptic. One of the last fields in the table is called MEDHINC_CY. For now, take it on faith that this acronym stands for median household income.



CY	POP55_CY	POP60_CY	POP65_CY	POP70_CY	POP80_CY	POP85_CY	POP18UP_CY	POP21UP_CY	MEDHINC_CY	AVGHINC_CY
158	176	161	116	63	17	20	1627	1565	54877	72907
152	146	122	108	54	41	29	1506	1439	39181	60786
79	94	69	71	21	18	10	817	789	67272	110450
186	232	217	167	110	47	28	1885	1828	98406	115123
132	129	133	99	71	21	21	1134	1101	81985	101779

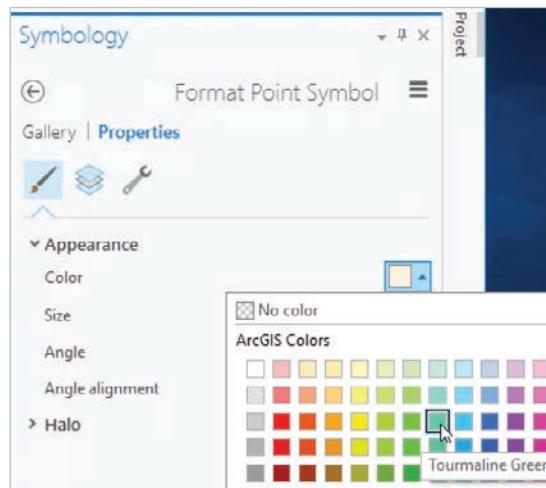
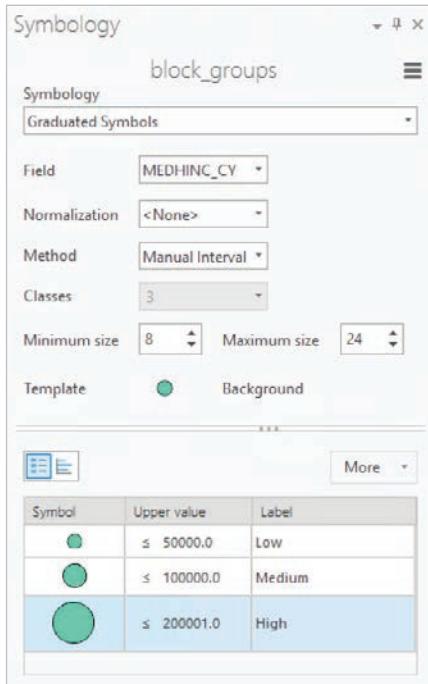
3) Close the attribute table.

Symbolize census block groups by median household income

If you symbolize the block_groups layer with graduated colors, you won't be able to evaluate income and population density at the same time. Instead, you'll represent each block group's median household

income as a point drawn inside the block group polygon. The point sizes will be graduated according to the income value.

- 1) Using the Appearance tab, open the Symbology pane for the block_groups layer.
- 2) In the Symbology drop-down list, click Graduated Symbols.
- 3) In the Field drop-down list, click MEDHINC_CY.
- 4) Click the Classes drop-down arrow and click 3.
- 5) Replace the first value with 50000 and the middle value with 100000 and press Enter.
- 6) Click the Template symbol (underneath the Minimum size drop-down box) to open the Format Point Symbol pane.
- 7) Under Properties, click the Color button and change its color to Tourmaline Green.



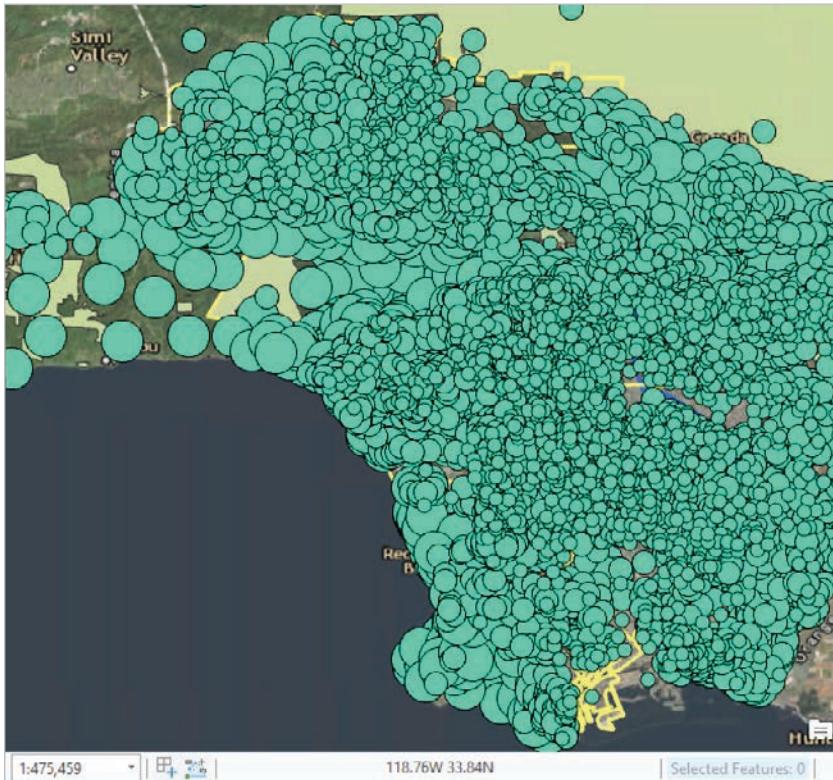
- 8) Click Apply and then the back button at the top of the pane. This symbology sets the color and shape of the symbols that will be used to represent income values.
- 9) Click Background (on the right of Template) to open the Format Point Symbol pane again.
- 10) Change Color to No Color, if necessary, and then change the Outline color to No Color.
- 11) Click Apply and then the back button at the top of the pane.

This symbology makes the block group polygons themselves invisible. All you'll see are the income dots spread around the map.

- 12) Change the Minimum size to 8.

- 13) Change the Maximum size to 24.
- 14) In the Label column, double-click on the first label (< 50000) to make it editable. Type Low and press Enter.
- 15) Replace the second label with Medium. Press Enter.
- 16) Change the third label to High. Press Enter.

At the present scale, the symbols overwhelm the map.



Set a scale range for the block_groups layer

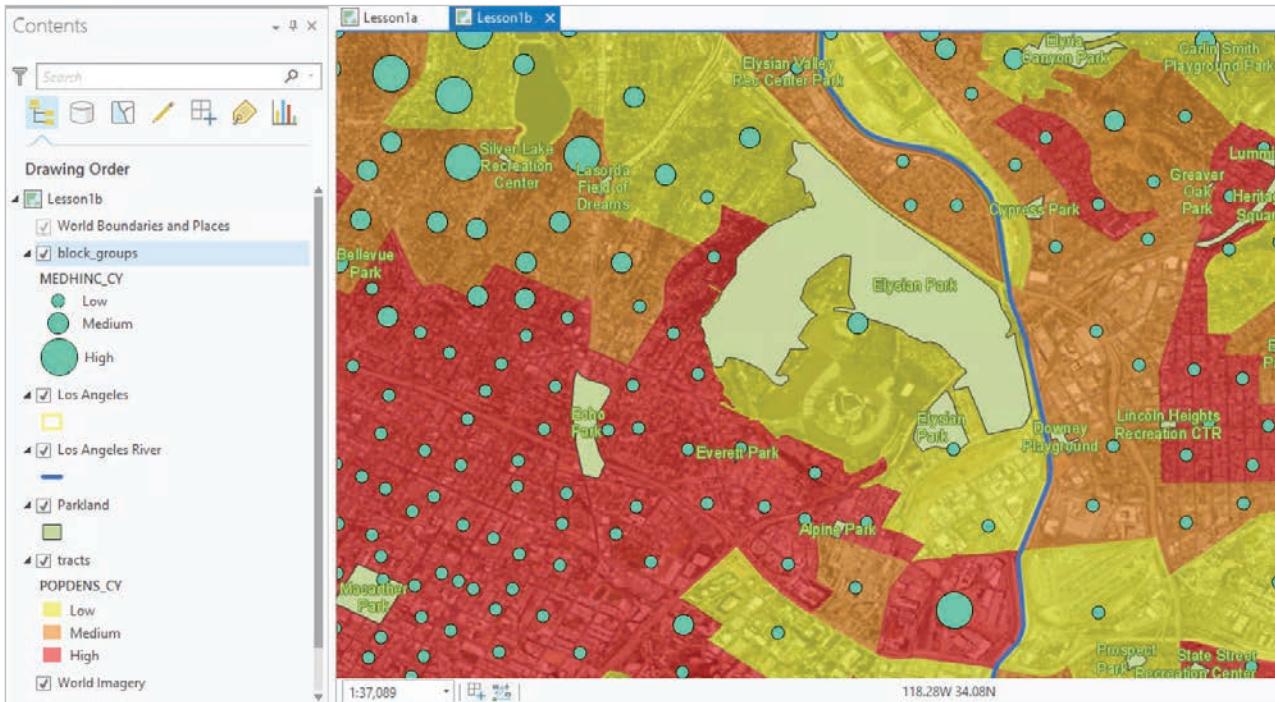
Earlier, you set a maximum scale value for the World Boundaries and Places layer. Here, you'll set a minimum value for the block_groups layer.

- 1) With the block_groups layer selected in the Contents pane, open the Appearance ribbon.
- 2) Click in the Out Beyond box and type 100000. Press Enter.

The symbols disappear from the map. In the Contents pane, the layer's dimmed check box indicates that the layer is turned on but is not visible at the current map scale.

- 3) Zoom to the Dodger Stadium bookmark.
- 4) Click the Fixed Zoom Out button a couple of times until some of the Medium and High symbols begin to appear.
- 5) Turn the tracts layer back on, if necessary.

Now you can start to get a general sense of household income and population density along the river, and look at these variables in relation to park locations.



Search for likely park areas

Clearly, you're taking an incomplete initial look at a complex problem. You haven't considered all the requirements (for example, the presence of children). You're not making any exact measurements of distance. Your data classifications are casual: you don't yet have a good reason to say what values should count as high population density or low median household income in the context of your project. Nevertheless, you can form some meaningful impressions. You won't be able to say of an area that a park should definitely go there, but you might be able to identify likely and unlikely areas. Later, it will be interesting to see how well these impressions are borne out by analysis.

- 1) In the Map Scale box at the bottom of the map pane, highlight the current value. Type 40000 and press Enter.
- 2) Pan south to where the river crosses the city boundary.
- 3) In the Contents pane, drag the Los Angeles River layer to the position just below the World Boundaries and Places layer (it may already be there).

You'll follow the river to its source, marking good areas for a park along the way. A really good area would have these properties:

- high population density (dark red),
- low median household income (small green dot),
- no existing park nearby, and
- close to the river.

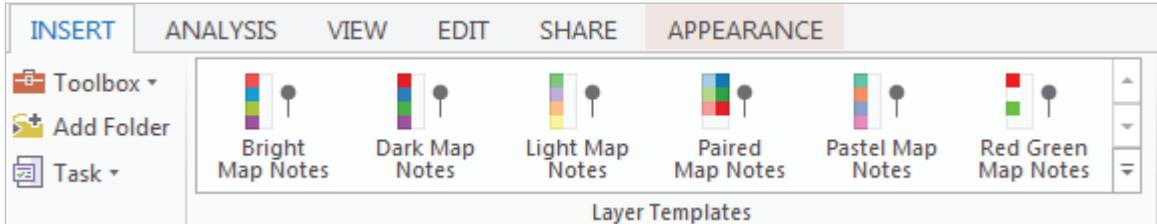
4) Pan slowly north.

Less than a mile north of the city limits, on the east side of the river, are a couple of tracts—one dark red and one medium red—with small green dots. They're pretty close to the river, and even though there are some parks in the general vicinity, it's probably worth marking the area as a potential park.



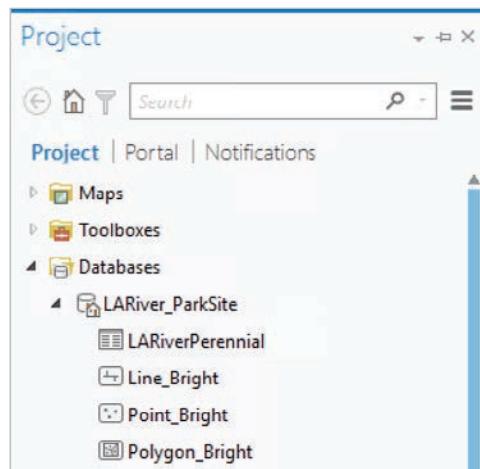
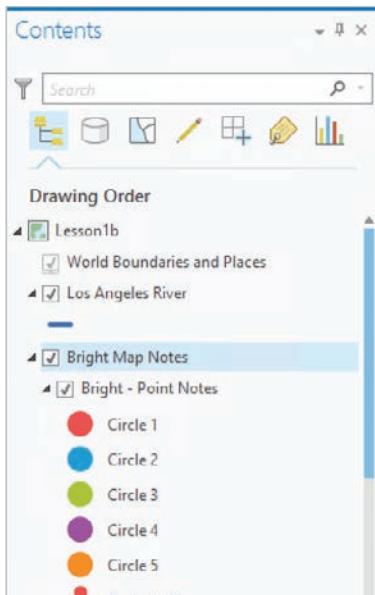
To mark the area, you'll use a feature of ArcGIS Pro called Map Notes. Map Notes are layer templates that create point, line, and polygon feature classes in your Home database with predefined symbols for feature creation and editing.

- 5) On the Insert tab, in the Layer Templates group, click the Bright Map Notes button.



Clicking the button adds a new group layer to your Contents pane named Bright Map Notes.

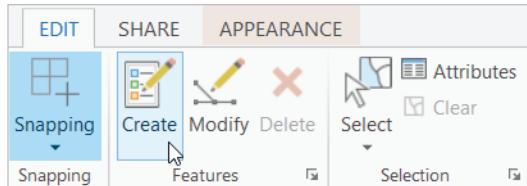
- 6) Expand the Bright Map Notes layer to see that it contains point, line, and polygon layers.
- 7) Expand the three layers to see their predefined symbols.
- 8) Collapse the Bright Map Notes group by clicking the little arrow on the left of the check box.
- 9) In the Project pane, browse and expand your home database in the Databases group. Notice that three new feature classes have been added to the geodatabase. These classes are the data sources for the Map Notes layers that were added to the map.



Create a new feature

You will now create a new feature in the feature class.

- 1) Go to the Edit tab.
- 2) In the Features group, click the Create button .



This button opens the Create Features pane on the right of the map. This pane allows you to draw new features in any of the layers marked as editable in the map. By default, all layers are editable so you will change that so that you don't accidentally add new rivers, parks, census tracts, and so on.

- 3) In the Contents pane, click the List By Editing button  above the layer list.

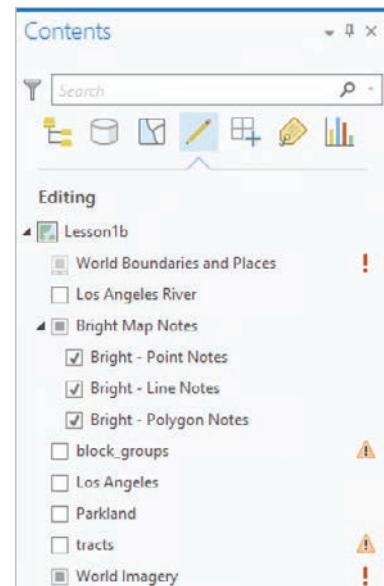
This list now displays all the layers with a check box next to each one to define whether they are editable or not.

- 4) Click to clear all but the Bright Map Notes layers (you will probably have to expand the group layer to confirm that they are checked).

Notice that as you click to clear the other layers, the Create Features pane on the right of the map changes to show only those features that are editable.

- 5) Switch back to the List by Drawing Order view by clicking the  button at the top of the Contents pane.
- 6) Add a purple star point near the areas of interest by clicking the Star  icon from the Create Feature pane on the right side of the application and then clicking the spot on the map.

- ▶ To stop adding stars, click the Explore button. To delete unwanted stars, click the Undo button.

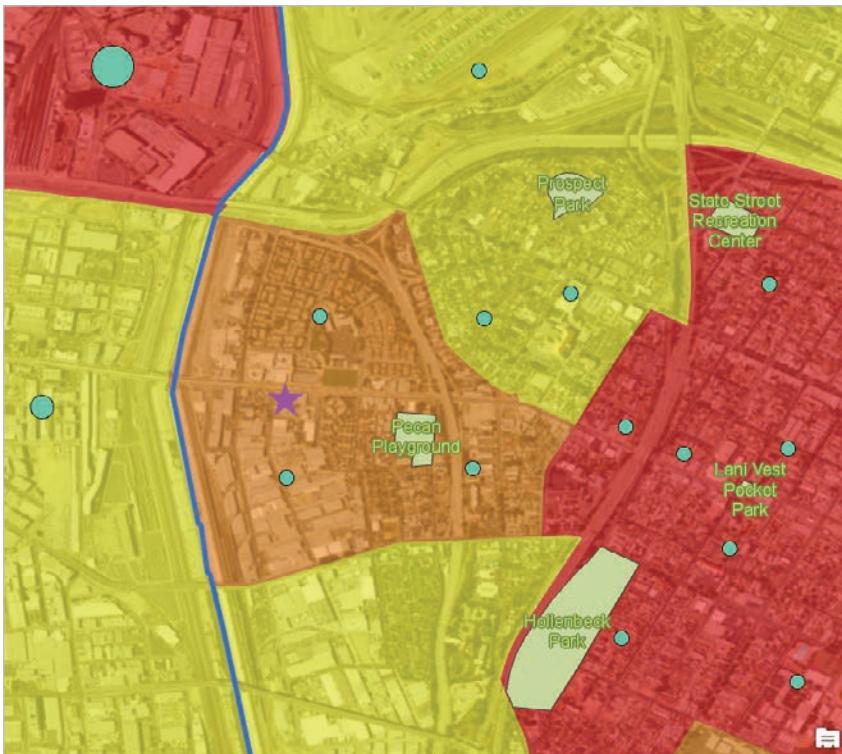


Continue searching for park areas

You'll keep following the river and looking for likely places for a park.



1) Click the Explore button on the Map tab and pan north.

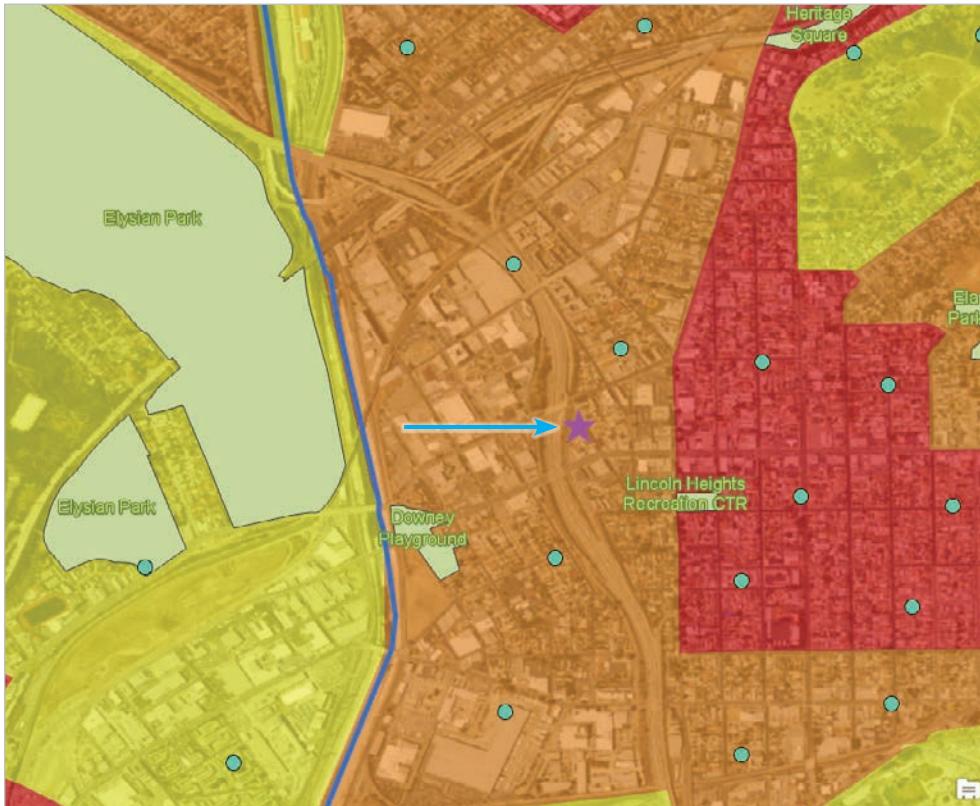


A little farther north, again on the east side of the river, is a medium-density, lower-income area with just one park (Pecan Playground) in the general vicinity. You'd prefer a high-density neighborhood, but since you don't yet have specific criteria for your analysis, you want to be inclusive rather than exclusive in your assessments. It's up to you whether to mark this area or not—all that really matters is that you start to gain a sense of the study area.

- 2) Add another purple star in this area by going back to the Edit tab and clicking the Star 4 icon.

The area opposite Dodger Stadium, on the east side of the river, is medium density, lower income, and park poor, which makes it rich with possibility for a new park site.

- 3) Add another purple star in this area.



- 4) Mark any other areas that seem promising to you.

As you navigate around Griffith Park, remember that the yellow line marks the city limits. The areas north and east of the park aren't part of Los Angeles and shouldn't be considered. Once you get around this park, you may find fewer likely areas. But remember, there's no right or wrong answer for this exercise.

- 5) When you're finished marking promising locations, zoom to the layer Bright – Point Notes.
- 6) Save your edits by clicking the Save button  in the Manage Edits group.
- 7) When prompted to save all Edits, click Yes.

- 8) Close the Create Features pane.
- 9) Close the Lesson1b map and any open tables.
- 10) Save your project.
- 11) Continue to the next lesson or close ArcGIS Pro. Save your changes if prompted.

Now that you've explored the study area around the Los Angeles River, you will begin to list the data requirements for the project and begin previewing the data that meets your project needs. This data can also help you reframe your problem and park criteria in more detail by replacing general guidelines with hard numbers and thresholds.