

2021 – ArcGIS Pro

# Working with Vector Data: Selections

Warthog Information Services

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Horizontal units are in meters (UTM, 10-N, NAD-83).



## Exercise Introduction

In this exercise, we will cover various methods of selection of vector data in ArcGIS Pro. Selection of different features is often an integral step of vector analysis, allowing you to focus the analysis on data with a specific set of attributes or to simply explore and compare the attributes of your data.

In ArcGIS Pro, selection of vector data can be accomplished in one of four main ways:

- Manual selection of features in a map (using the *Select* tool)
- Manual selection of records in an attribute table
- By using *Select by Attribute* (an SQL Query based on the tabular attributes)
- By using *Select by Location* (based on proximity to some other feature)

The first two methods are manual methods, requiring the user to select a feature (or features) by hand. The second two methods are “automatic” using geoprocessing tools. With select geoprocessing tools, the user can set specific parameters or queries and then the software will select all the features based on the user input.

In this exercise, we will practice all four of the above listed selection methods using vector data in a pre-formatted ArcGIS Pro project.

## Exercise Learning Objectives

- Spatial and tabular selections:
  - Manual selection methods
  - Selections using geoprocessing tools

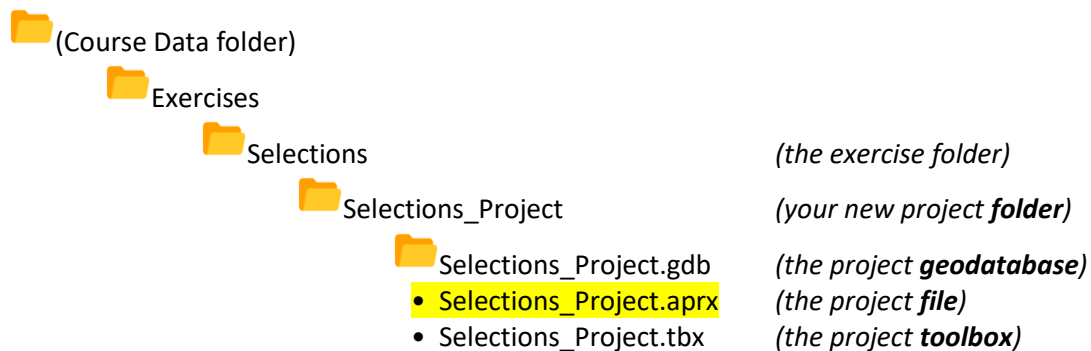
## Step 1: Open the Exercise Project

### Overview

For this exercise, a project with data and a map has already been created for you. It is stored in the **Selections** folder in the **Exercises** folder of your Course Data folder.

### Instructions

- In Windows File Explorer, navigate to the **Exercises** folder in your Course Data folder.
- Open the **Selections** folder.
- Open the **Selections\_Project** folder (a project folder).
- Locate the **Selections\_Project.aprx** ArcGIS Project file and double-click it to open the project.
  - Logging in to ArcGIS Pro if required



The project should open with the **Selections Map** view activated. If this map view is not active in the view, open it from the **Maps** folder in the Catalog pane. Depending on your software, you may have various panes open and/or available from previous work. You may close all panes except for the Catalog pane and map Contents pane.

## Step 2: Spatial Selections: the Select Tool

### Overview

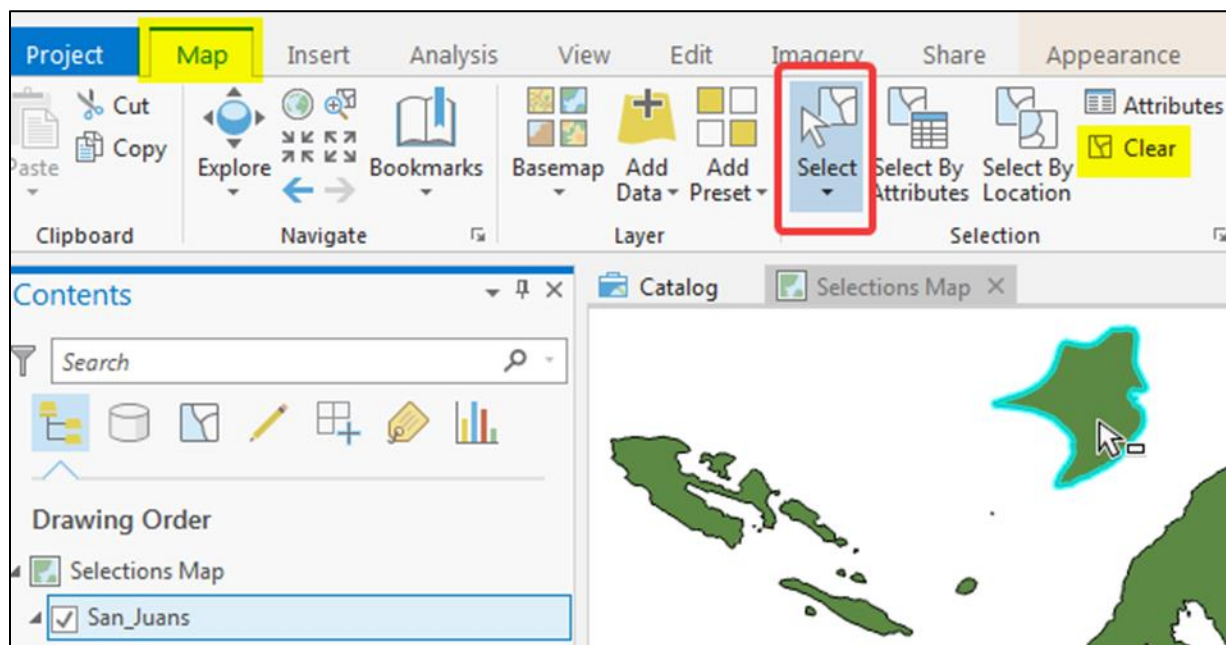
The Select tool allows you to manually select features by clicking a feature in the map view. Features can be selected by single-clicking, or by clicking and dragging over a given space. The method of selection can be specified as Rectangle, Polygon, Lasso, Circle, Line, or by Tracing another feature. The default is Select by Rectangle.

### Instructions

- From the Map tab of the ribbon, click on the *Select* tool (in the Selection group).

*Note that the Select tool is actually a drop-down menu of tools: the default is Select by Rectangle. Alternatively, you can select features by drawing a Polygon, a Lasso, a Circle a Line or by Tracing another feature.*

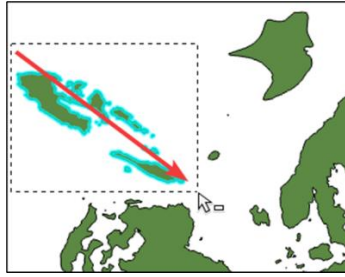
- Click on a feature in the map using the Select tool (with the default, Rectangle).



- With this feature still selected, hold the *Shift* key to select additional features.
- Unselect, or clear the selection by clicking the *Clear* button in the ribbon.

*You can also right-click in the map view and click Clear, or right-click on the layer in the Contents pane and choose Selection and then Clear Selection.*

- Next, click and drag a box in the map to select multiple features.

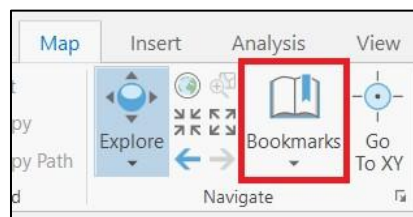


*Note that when you click and drag, the shape is a box. This is because we are using Select with the default as Rectangle. If we were to use Circle instead, the shape would be a circle.*

- Clear your selection.

Sometimes, when you have multiple layers in a map you will select multiple overlapping features when using Select.

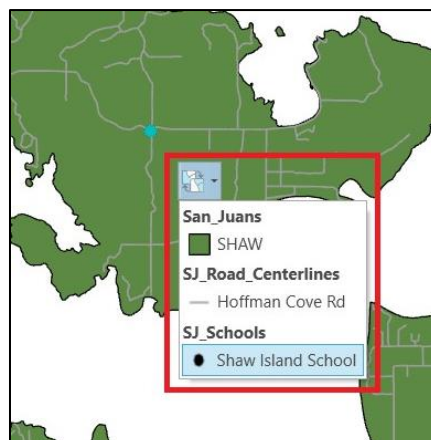
- Turn On the **SJ\_Road\_Centerlines** and the **SJ\_Schools** layers in the map Contents pane.
- Click the *Spatial Bookmarks* button in the Map tab of the ribbon and select the *Shaw Island* bookmark to zoom to Shaw Island.



- Using the Select by Rectangle tool, click on the Shaw Island school point.

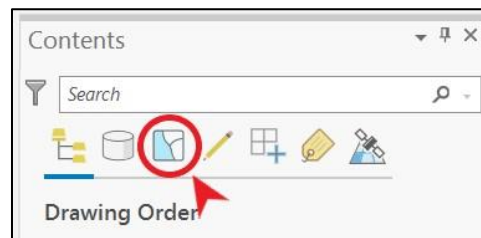
The top feature (of the layers that are turned On) is selected (a school point).

In addition, a small drop-down list appears beside the selected feature. This drop-down menu lists the features in overlapping layers. If you wish to select one of the features from a "lower" layer, click it in the list. So, for example, click on *SHAW* Island (from the **San\_Juans** layer) and watch the selection update.

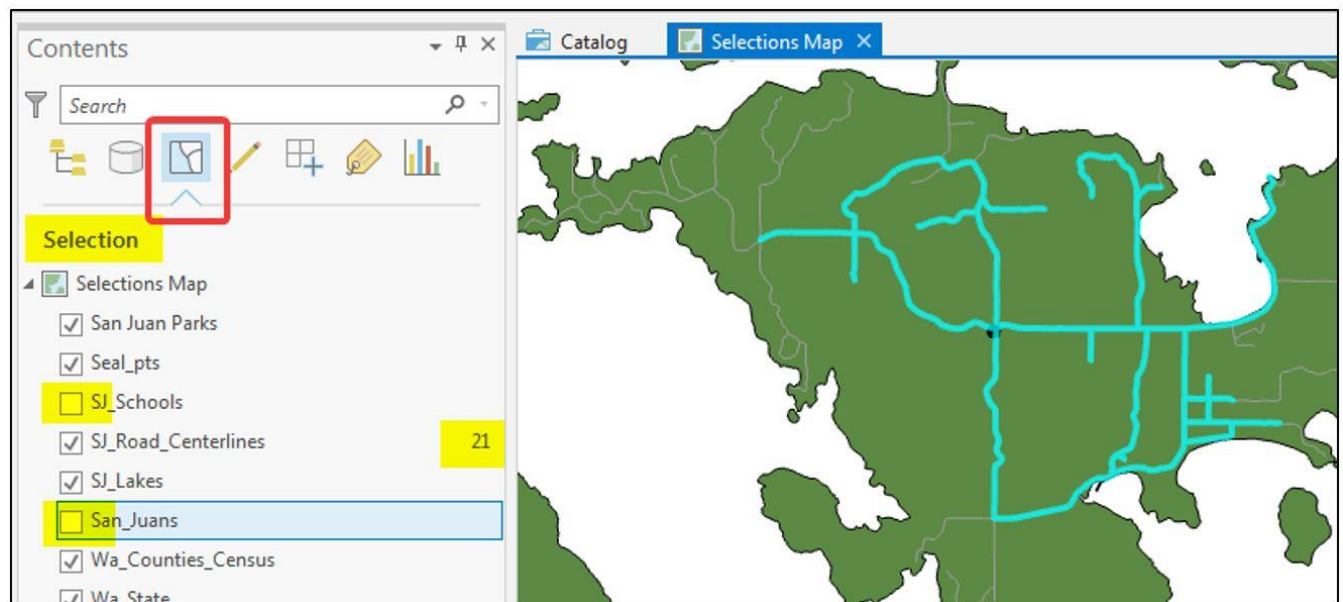


Now let's explore selections in the Contents pane. If you drag a selection rectangle across an island with roads and/or schools, you will select the island and all of the roads and/or schools within the selection rectangle (i.e., all of the features of all layers within the box).

- Click and drag a selection rectangle across the main section of Shaw Island. The school, some roads and the island should all be selected.
- At the top of the map Contents pane, click *List by Selection*. This will switch the Contents display from *List by Drawing Order* (the default) to *List by Selection*.



The number of selected features in each layer is displayed by the layer's name.



List by Selection also allows you to control which layers are selectable.

- Still in List by Selection, uncheck the boxes for the **SJ\_Schools** and the **San\_Juans** layers.
- Next, clear the current selection (using the Clear button/command from the ribbon).
- Use the Select tool to drag a selection rectangle across Shaw Island again.

This time, only the roads should be selected. Layers that are unchecked in the List by Selection menu will become un-selectable. The number of selected roads should also be displayed.

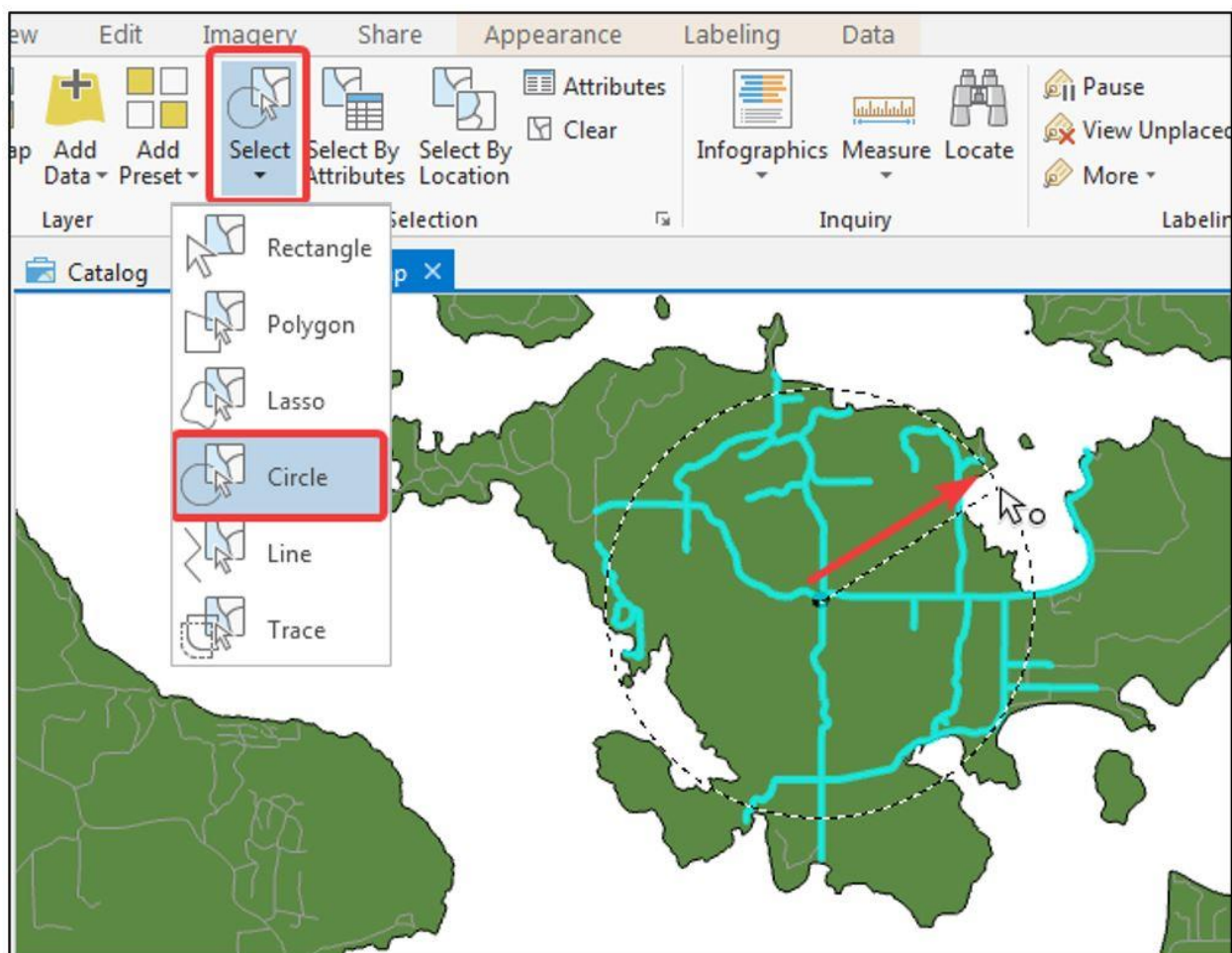
*Note that checking/unchecking the boxes in the List by Selection option of the map Contents pane does not have any effect on whether or not the layers are turned On or Off in the map. On/Off visibility of a layer is controlled by the checkboxes in the List by Drawing Order section of the map Contents pane.*

Next, we will use the Circle option for the Select tool.

- From the Select tool drop-down menu in the ribbon, choose *Circle*.
- Click approximately on the Shaw Island School point and drag a selection circle outward.

Any feature that overlaps with the extent of the circle should become selected/highlighted. Remember that you "unchecked" the **SJ\_Schools** and **San\_Juans** layers in List by Selection. You can turn their selectability back On/Off if you'd like to experiment.

The Select by Circle tool can be useful for selecting features based on proximity (i.e., all houses within a certain distance of a school or park). Experiment with the other selection tool options (Select by Lasso, Select by Line, etc.).





## Step 3: Tabular Selections: Attribute Tables

### Overview

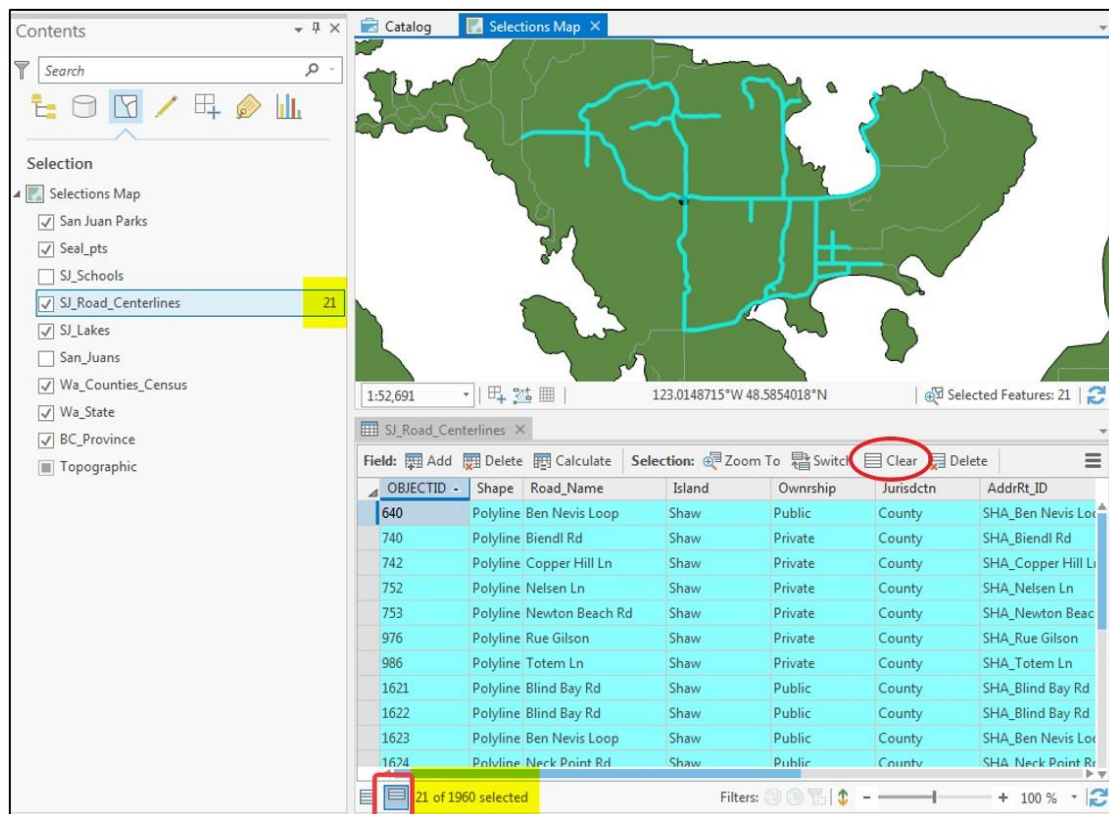
Recall that each vector data layer has an associated attribute table. Attribute tables contain multiple fields, or columns, for the different attributes related to the data layer. Each spatial feature has a record (or row) in the table and data for each feature is stored in the feature's record. Records in the table can be selected by clicking the gray box to the left of the record. Selecting a record in the table simultaneously selects the corresponding feature in the map. Likewise, selecting a feature in the map simultaneously selects the corresponding record in the table.

### Instructions

- Make sure that the **SJ\_Road\_Centerlines** layer is selectable (from the Contents pane/List by Selection).
- Use one of the Select tools from the ribbon to select some road features in the map.
- Right-click on the **SJ\_Road\_Centerlines** layer in the map Contents pane and click *Attribute Table*. This will open the **SJ\_Road\_Centerlines** attribute table in a table view.

*You can also access the Attribute Table from the Data tab of the ribbon.*

- In the **SJ\_Road\_Centerlines** attribute table view, the records of the selected roads should be highlighted in blue. There are a lot of road features, so you may need to scroll down to find a selected record.





When features are selected, the corresponding records in the attribute table are also selected. The number of selected features, or records, is shown at the bottom of the table view. This is the same number that is displayed in the map Contents/List by Selection.

- Click the *Show Selected Records* icon at the bottom of the table to show just the selected features in the table (circled in the bottom left in the image below).

*Remember that you can hover over icons and buttons to display their name or the screen hint.*

- Clear the selected records using the *Clear* command at the top of the table view.
- Click the *Show All Records* icon at the bottom of the table view to display the full table (this button is located just beside the Show Selected Records button).
- Keep this table open.

In addition to manually selecting features by spatial selection (with the Select tool via the ribbon), features can also be manually selected by selecting records in an attribute table.

- In the attribute table for **SJ\_Road\_Centerlines**, click on the gray box to the left of a record to select it.

If you double-click the gray box, the map view will zoom to the selected feature. You can also right-click on the gray box beside a record to choose *Zoom To*, or *Pan To*, etc.

- Use the *Shift* or *Ctrl* key to select multiple records (Shift will select all of the records between the two that were manually selected; Ctrl will just select another record.)
- Clear your selection.

OBJECTID	Shape	Road_Name	Island	Ownrship	Jurisdctn	AddrRt_ID
748	Polyline	Indian Cove Rd	Shaw	Private	County	SHA_Indian Cove F
749	Polyline	Lou's Ln	Shaw	Private	County	SHA_Lous Ln
750	Polyline	Lyckebo Ln	Shaw	Private	County	SHA_Lyckebo Ln
751	Polyline	Midway Rd	Shaw	Private	County	SHA_Midway Rd
752	Polyline	Nelsen Ln	Shaw	Private	County	SHA_Nelsen Ln
753	Polyline	Newton Beach Rd	Shaw	Private	County	SHA_Newton Beac
754	Polyline	Old Mcdonald Ln	Shaw	Private	County	SHA_Old Mcdonal
755	Polyline	McMillin Dr	San Juan	Private	County	SAN_McMillin Dr

3 of 1960 selected

## Step 4: Select by Attribute (SQL)

### Overview

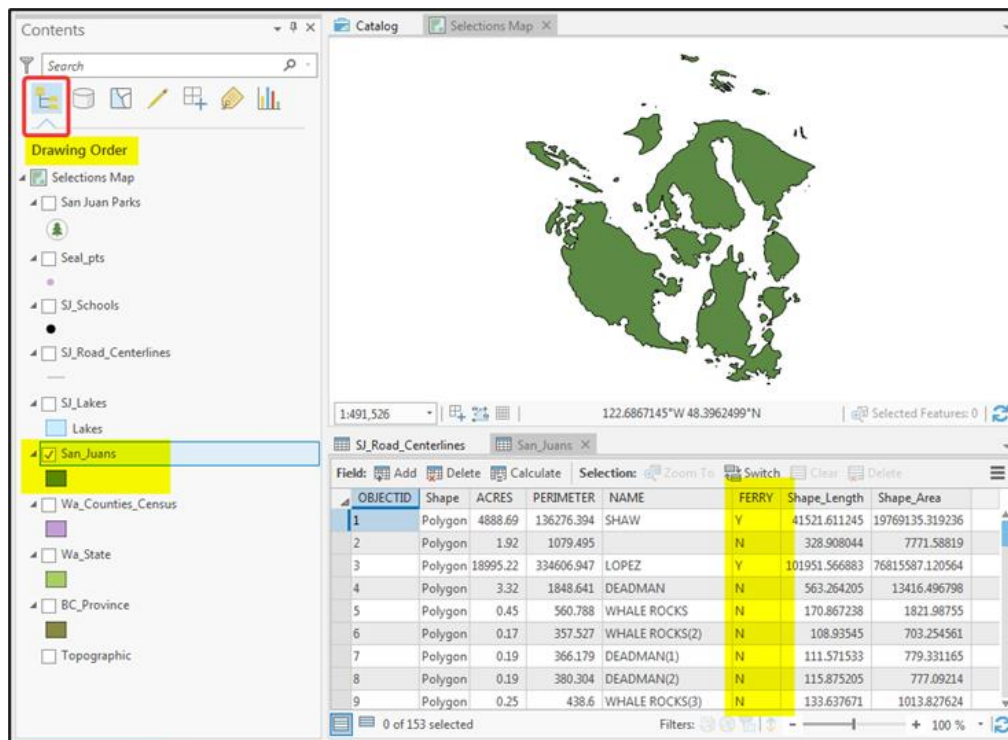
Attribute queries are an automated way of selecting features based on the attribute values.

For example, if you wanted to know which islands were served by the Washington State Ferry system, you could open the attribute table and manually search and select records where the value of the FERRY field is "Y" (for Yes). Or you can automate this search and selection process using the Select by Attribute tool.

This is done by using the "Structured Query Language" (or SQL) to write a query expression. The *Select Layer by Attribute* tool makes writing an SQL expression simple.

### Instructions

- First, clear any current selections.
- In the map Contents pane, click the *List by Selection* button at the top.
- Ensure the boxes beside the **SJ\_Schools** and **San\_Juans** layers are checked, so that both layers are selectable.
- In the Contents pane, go back to the List by Drawing order option.
- Right-click on the **San\_Juans** layer in the map Contents pane and click *Zoom to Layer*.
- Turn the **SJ\_Schools** and **SJ\_Road\_Centerlines** layers Off.
- Right-click on the **San\_Juans** layer from the Contents pane and click *Attribute Table* to open the layer's attribute table.



*Note that if you have multiple tables open they are shown as tabs at the top of the table view.*

Note that one of the attribute fields in the **San\_Juans** layer is FERRY. This field contains Y or N values (Yes or No) indicating whether the island is served by a Washington State Ferry.

If we wanted to select just those islands that have ferry service, we could scroll through the entire attribute table looking for islands with a value of "Y" and select them one-by-one, but that would be a lot of work.

Alternatively, we could double click on the FERRY field column header to sort the field alphabetically (or via right-click and choose *Sort Ascending*). If you double-click on the FERRY field a second time it should reverse-sort the field, putting all of the Y values at the top. You could now use the Shift or the Ctrl key to select all of the records for islands with a ferry.

However, the *Select by Attributes* tool will do a similar process for you. We will practice using it now.

- At the top of the table view, click the *Select by Attributes* button.

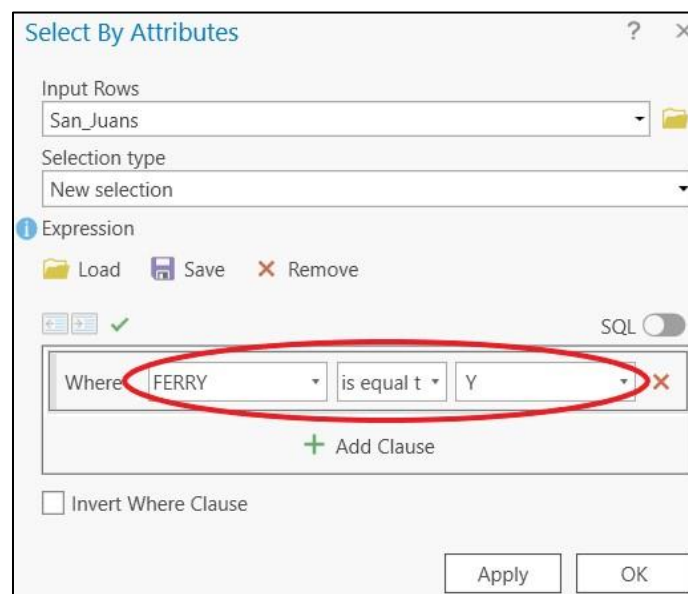
*Note that you can also open the Select by Attributes tool from the Map tab of the ribbon. You could also open the Geoprocessing pane (from the Analysis tab of the ribbon click Tools) and search for "Select" to open the Select by Attribute tool. All of these methods open the same tool.*

- In the Select by Attributes dialog box/pane, specify:

<u>Input Rows:</u>	<b>San_Juans</b> (from the drop-down list)
<u>Selection Type:</u>	<b>New Selection</b> (from the drop-down list)
Click:	<b>+ New expression</b>

Now you can create a query expression by building a clause. Using clauses allows you to select fields, Boolean operators, and values from dropdown lists to easily make a query expression. Use the drop-down lists to create the clause:

Where **FERRY** is equal to Y

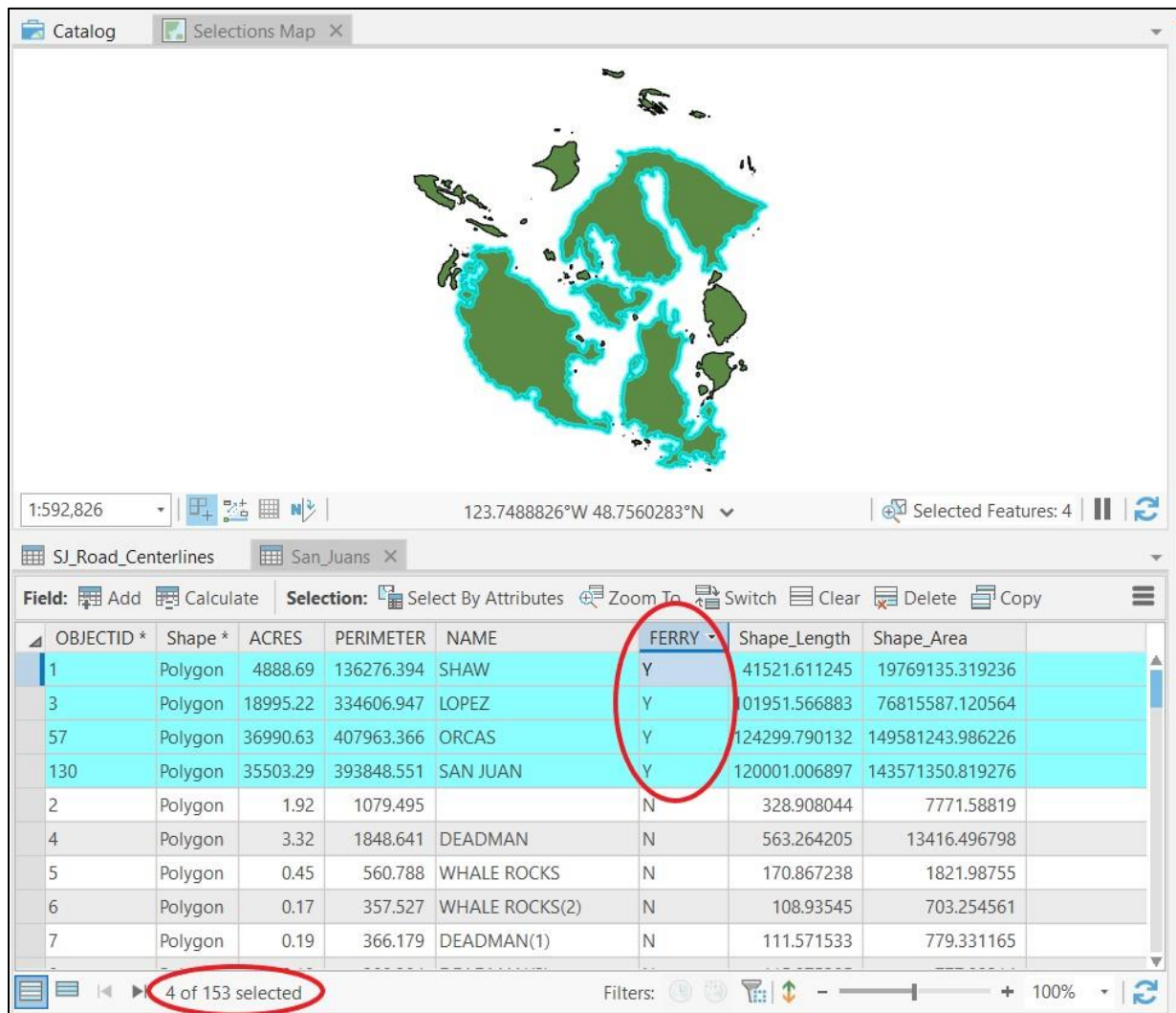


Note that this clause has three parts:

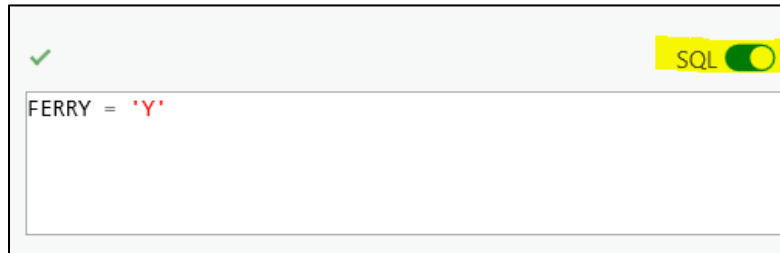
- A Field (FERRY)
- An Operator (is equal to)
- A Value (Y)

- Click OK to run the tool.  
This should select the islands that are served by a Ferry.

The number of selected features/records is shown at the bottom of the table view.



- Open the Select by Attribute tool again and build the same clause.
- Instead of running the tool, click the *SQL toggle* above the clause.



This will show you the same query using SQL (Structured Query Language). You can create expressions by manually typing an SQL expression, but using clauses is generally much easier.

- Click the SQL toggle again to return to Clause mode.
- Change the Operator to "is not equal to" and run the tool a second time to select islands that do NOT have ferry service.

We can make the SQL query a little more complicated as well.

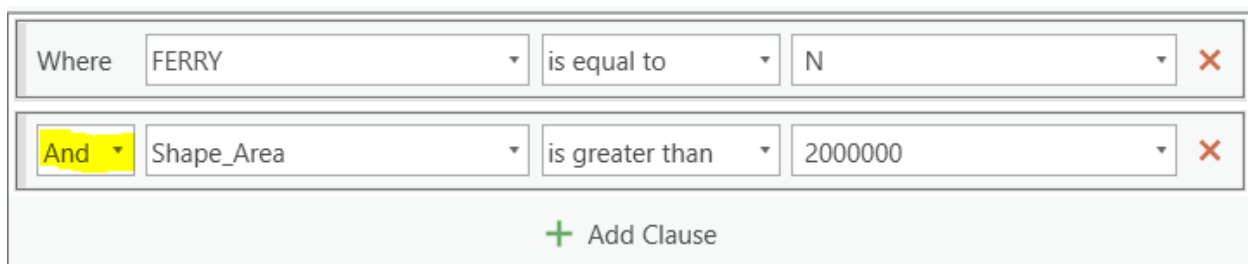
- Re-open *Select by Attributes*.
- Click **+ New expression**.
- Create the query:

Where **FERRY** is equal to **N**

- Click **+ Add Clause** to continue adding on to the query.
- Create a second clause:

And **Shape\_Area** is greater than 2000000

Manually type 2,000,000 into the box. But do not use commas.



Note that the second clause has an added part, the “And” Boolean operator. The other option from the drop-down would have been “Or”. The “Or” operator would select island that *either* do not have ferry service *or* have a shape area greater than 2,000,000 units, not both. On the other hand, the “And” operator selects islands that meet *both* criteria – so only the islands that have *both* no ferry service and have a shape area greater than 2,000,000 units are selected.

Which operator produces the more limited selection?

## Step 7: Select by Location

### Overview

Another method for selecting features is to use the location of one layer to select features in another layer based on spatial relationships between the two layers (proximity, overlap, etc.).

For this example, we will select the parks that are located on Orcas Island.

### Instructions

- In the map Contents pane, turn the **San Juan Parks** layer On.
- Manually select Orcas Island using the Select tool via the ribbon.

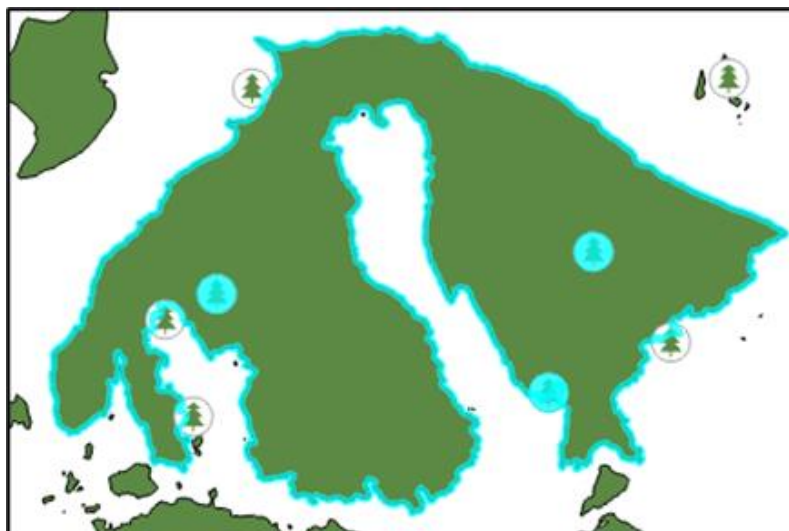
*Alternatively, you can use the Select by Attribute tool and query where NAME is equal to ORCAS.*

*(If you are unable to select an island feature, check that the **San\_Juans** layer is selectable via Contents/List by Selection).*

- From the Map tab of the ribbon, click *Select by Location*.
- In the Select by Location tool pane use the dropdowns to set the following parameters:

<u>Input Features:</u>	<b>San Juan Parks</b>
<u>Relationship:</u>	<b>Intersect</b>
<u>Selecting Feature:</u>	<b>San_Juans</b>
<u>Search Distance:</u>	<b>(leave blank)</b>
<u>Selection type:</u>	<b>New selection</b>

- Click *OK*.
- The parks on Orcas Island should now be selected.





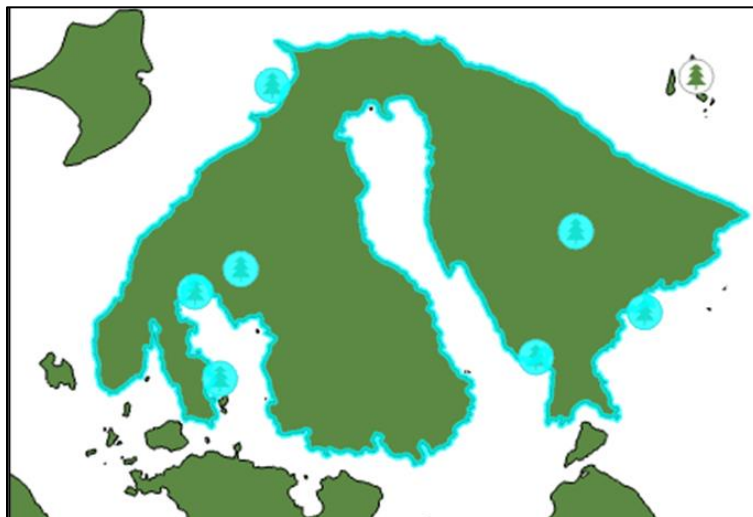
*Note that if you check the box for **Invert Spatial Relationship** and run the tool again you will select all of the parks that are not on Orcas Island.*

Do you notice that there are some parks that are quite close, but not actually on Orcas Island? These are parks located on small adjacent islands. If we want to select these nearby parks as well, we can add a *Search Distance* to the tool parameters.

- Open the Select by Location tool again:

<u>Input Features:</u>	<b>San Juan Parks</b>
<u>Relationship:</u>	<b>Intersect</b>
<u>Selecting Feature:</u>	<b>San_Juans</b>
<u>Search Distance:</u>	<b>500 Meters (Manually type "500")</b>
<u>Selection type:</u>	<b>New selection</b>

The parks located on or within 500 meters of Orcas Island should be now also selected.



- Clear your selection.
- Run the Select by Location again, but this time without selecting one of the Island features first:

<u>Input Features:</u>	<b>San Juan Parks</b>
<u>Relationship:</u>	<b>Intersect</b>
<u>Selecting Feature:</u>	<b>San_Juans</b>
<u>Search Distance:</u>	<b>(leave blank)</b>
<u>Selection type:</u>	<b>New selection</b>

If you don't select an island beforehand, almost all of the San Juan Parks will be selected, since most parks are on islands and thus spatially intersect with the **San\_Juans** layer. If there are pre-selected features in the Selecting Features layer, then the location selection is made using only the pre-selected features. If there are no pre-selected features, then the entire Selection Features layer is used for the location selection.



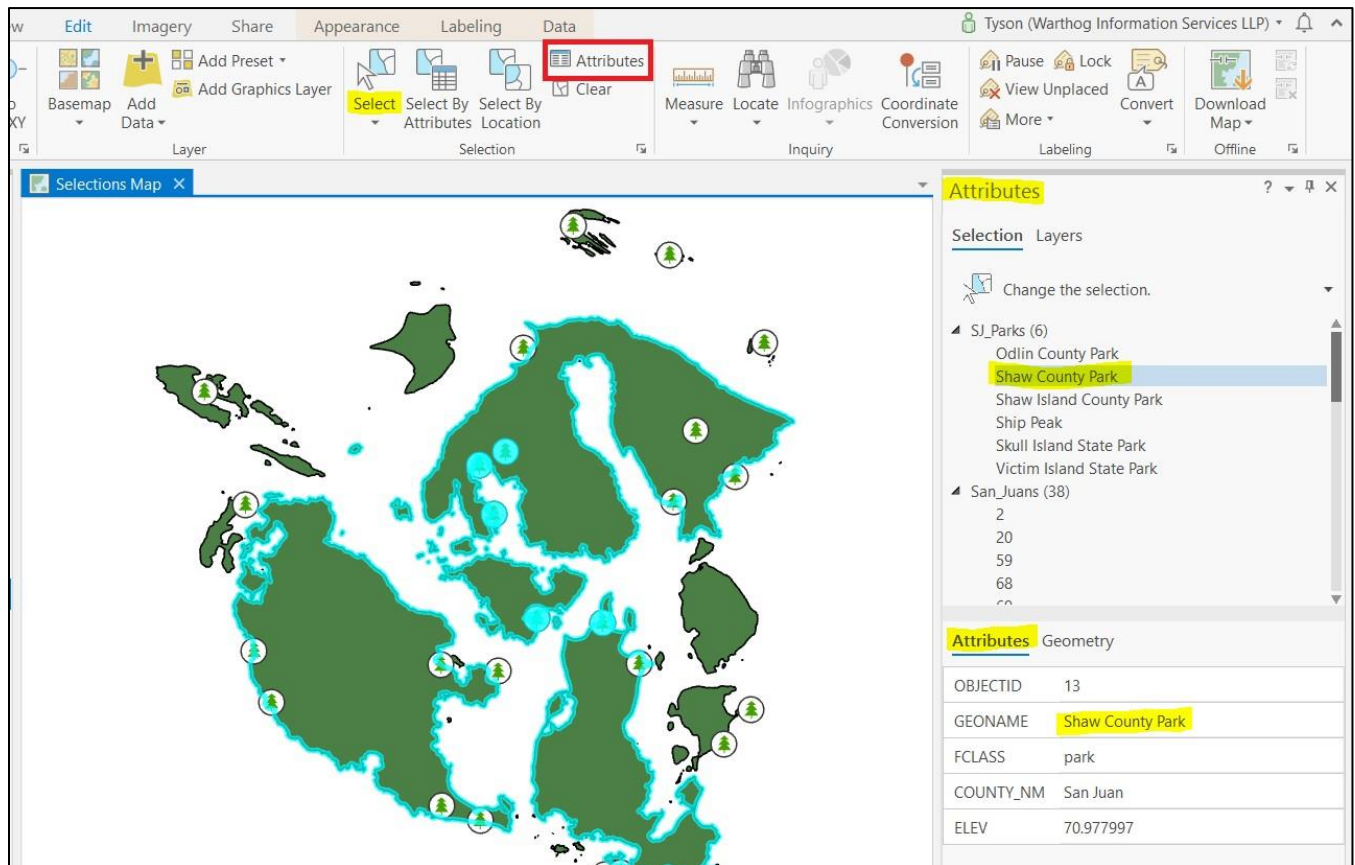
## Step 8: Working with Selections

### Overview

In this step we will go over more ways to manage selections.

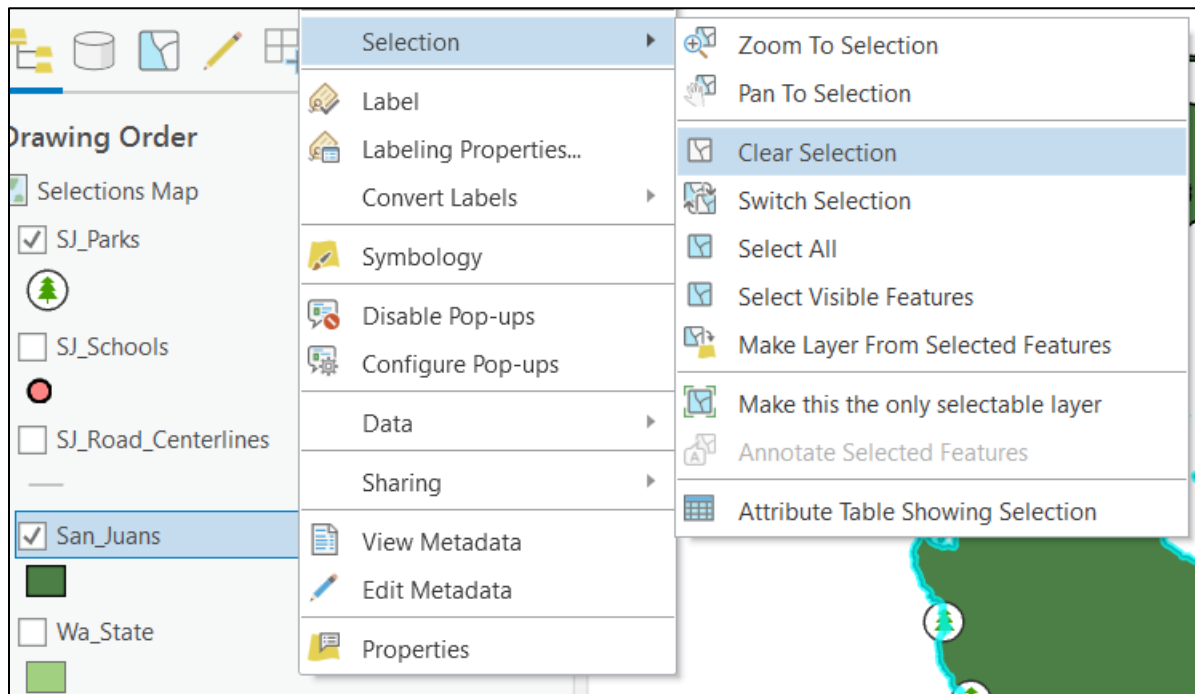
### Instructions

- Clear any previous selections.
- Using the Select tool, click and drag across the map view to select some of the San Juan Parks (as well as some of the islands).
- From the Map tab of the ribbon click the *Attributes* command. An Attributes pane should appear listing the selected features.



- Click on a feature in the Attributes pane to display the attributes for that feature.

- In the Contents pane, right-click on the **San\_Juans** layer to choose Selection and then *Clear Selection* (from the Selection sub-menu). This should unselect the islands, leaving just the parks selected.



- In the Contents pane, right-click on the **SJ\_Parks** layer to choose Selection and then *Zoom to Selection*.  
This will zoom the map display to the spatial extent of the selected features.
- In the Contents pane, right-click on the **SJ\_Parks** layer to choose Selection and then *Attribute Table Showing Selection* (from the Selection sub-menu)  
This should open the attribute table with the option to Show Selected Records
- In the map view Contents, right-click on the **SJ\_Parks** layer to choose Selection and then *Make Layer From Selected Features*.  
A copy of the San Juan Parks layer should be added to the map view and the Contents pane. This new layer will contain *only* those features (parks) that were selected.  
*Note that no new data was created, nor was any data deleted. The new 'selection layer' is a virtual subset of the original data layer.*

End of Exercise

# Working with Vector Data: Selections

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