Resilience Analysis and Planning Tool

User Guide

The Resilience Analysis and Planning Tool (RAPT) is a geographic information systems (GIS) tool to help emergency managers and community partners at all GIS skill levels to visualize and assess potential challenges to community resilience.

This **User Guide** provides in-depth information on RAPT functionality and step-by-step instructions on how to use all the features.

The link to RAPT as well as video tutorials are available at https://www.fema.gov/RAPT

DATA OVERVIEW

RAPT includes multiple data layers:

- **Infrastructure** information drawn from the Homeland Infrastructure Foundation-Level Data (HIFLD)[1] Subcommittee, such as fire station and hospital locations.
- **Hazards** such as real-time weather layers from the National Oceanic and Atmospheric Administration (NOAA), and historic tornado/hurricane tracks.
- **Risk information** from the National Risk Index on the estimated annualized frequency of 15 natural hazards, including coastal flooding, drought, earthquake and wildfire.
- The 20 **Community Resilience Indicators** identified in the Community Resilience Indicator Analysis: County-Level Analysis of Commonly Used Indicators from Peer-Reviewed Research: 2020 Updates (CRIA) conducted by FEMA and Argonne National Laboratory. All 20 indicators include county data; 12 also include census tract data. Tribal census data is also included in RAPT.

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[1] The HIFLD Open data portal contains national foundation-level geospatial critical infrastructure data in the public domain. You can access HIFLD Open at https://hifld-geoplatform.opendata.arcgis.com/.

GETTING STARTED

Accept the User Agreement

The initial splash page shows a user agreement on a map of the continental United States. Accept the user agreement each time to gain access to RAPT.

Left Side Display Page

When RAPT opens, the left side of the screen will be a display page with a description of RAPT and links to the following resources:

- **RAPT StoryMap** – A storymap introduction to RAPT.
- **RAPT User Guide** – A user guide providing detailed information on all elements of RAPT.
- **RAPT Data Layers and Sources** – A complete list the data layers and their sources of information. Click on and off data layers to explore potential challenges to resilience and community resources.
- **How-To Videos** – Videos highlighting various functions of RAPT.
- **Community Resilience Indicator Research Summary** – Detailed information on each community resilience indicator, including its connection to resilience, data source, national average, and binning method.
- **CRIA Correlation Analysis** – Describes how individual community resilience indicators may be related to each other. Communities can design resilience strategies that take these relationships into account.

You can close this left side display page by clicking on the arrow tab at the middle of the page.

NAVIGATING THE MAP

You can move around the map and explore areas of interest. The initial view shows the continental United States, but you can move to other areas, such as Hawaii, Alaska, or Puerto Rico. Navigate with the following:

- **Location:** Type the name of a specific county, city, or state in the search bar.
- **Zoom:** Click the +/- boxes at the top left of the map to zoom in or out on a map location.
- **Home:** Use the home button to bring the map back to the initial view.
- **My Location:** Use the circular button below home to center the map on your current location.
- **Mouse:** Use your mouse to move the whole map or click on a specific county.

At the Top: Navigation Bar Icons

These icons are along a top navigation bar. Depending on your browser and your webpage's zoom level, some of the icons may be hidden – in that case, you will see a "More" icon to reveal the additional icons.

Click the "More" icon if your browser hides some icons

Frequently Asked Questions

Provides answers to frequently asked questions about RAPT, including information on the data sources, functionality and uses of RAPT.
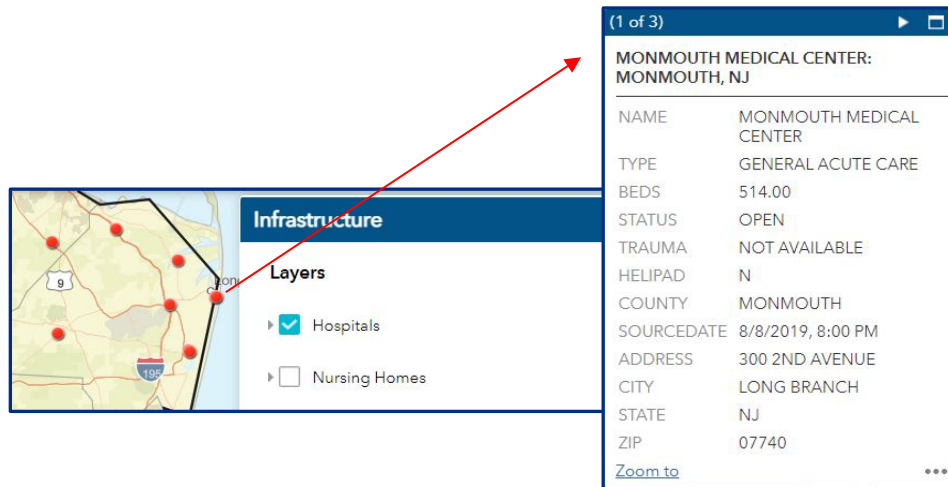
Legend

Helps you keep track of all the layers (hazard, infrastructure, county and census tract indicators) you have open.

Infrastructure

Shows community infrastructure points available through the Homeland Infrastructure Foundation-Level Data (HIFLD) Open Source page. A video tutorial of infrastructure layers can be found here.

- Click on the name of the infrastructure layer to see how that data will appear on the map (the shape and color of the datapoint).
- Click on the box next to the infrastructure layer and the datapoints will appear on the map.
- Click on a datapoint and a pop-up box will appear with the information HIFLD has available.
- Click the "x" in the top right of the pop-up box to close it.

Hazards

Shows GIS layers of flood hazard zones, historical hazard data for tornadoes and hurricane tracks; risk estimates from the National Risk Index for 15 natural hazards, including coastal flooding and earthquake; and real-time radar and watch and warning notifications from the National Weather Service, including severe weather, excessive rainfall and river flood outlooks. A video tutorial of hazard layers can be found here.

- NOTE: Because the dataset is so large, FEMA's National Flood Hazard Layer will only populate on the map when the area shown on the screen corresponds to an altitude of 10,000 feet or lower. Zoom in on the map to activate. When the layer name turns black, the data is available. Flood maps are not available for all counties.

County Indicators

Click on the County Indicators icon to see the list of all the layers available with county-level data. The top of the list shows a set of layers for different geographic boundaries: FEMA Regions, USA States, County Boundaries, Census Tract Boundaries, and Tribal Territory Boundaries. State and county boundaries are turned on by default.
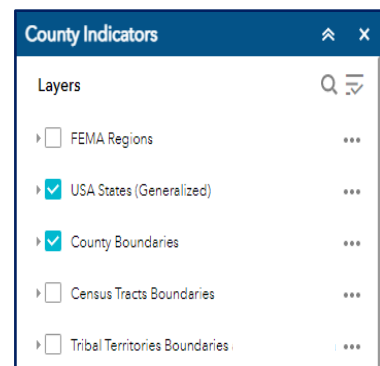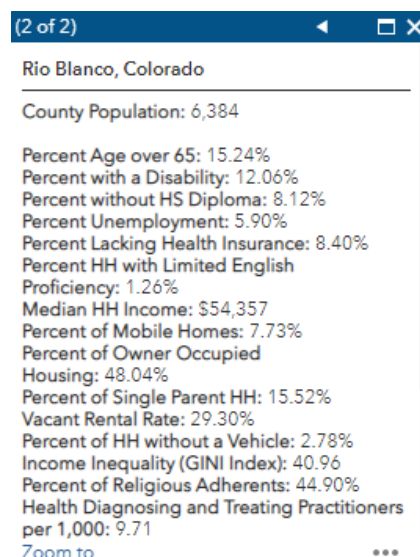
CRIA Indicators

Population-Focused Indicators	Community-Focused Indicators
CRIA Commonly Used Indicators	CRIA Commonly Used Indicators
% Population without Health Insurance[a,b]	Connection to Civic/ Social Organizations
% Population Unemployed[a,b]	Hospital Capacity
% Population without a High School Education[a,b]	Medical Professional Capacity
% Population with a Disability[a,b]	Affiliation with a Religion
% Population without Access to a Vehicle[a,b]	Presence of Mobile Homes[a,b]
% Population with Home Ownership[a,b]	Public School Capacity
% Population over 65[a,b]	Population Change
% Population Single-Parent Households[a,b]	Hotel/Motel Capacity
% Population with Limited English Proficiency[a,b]	Rental Property Capacity[a,b]
Median Household Income[a,b]	
Gini Index: Income Inequality	
CRIA Aggregate Resilience Indicator[c]	

The next set of layers are the county data for the CRIA Aggregate Resilience Indicator, all 20 individual community resilience indicator layers identified in the CRIA, and additional indicators not included in CRIA. (NOTE: 12 of the CRIA indicators are available for census tracts and 13 are available for tribal territories under those tabs). A video tutorial of community resilience indicator layers can be found here.

When the County, Census Tract, or Tribal Territory Boundaries layer is turned on, the list of available CRIA Indicators will be displayed as a pop-up box when you click a location on the map. Scroll down inside the pop-up box to see the full list. (For Counties, the CRIA Aggregate Resilience Indicator will be included at the bottom of the list.)

NOTE: The "County Boundaries" and "Census Tracts Boundaries" layers MUST be toggled on for some tools (e.g. Population Count, Query Tool) to function correctly.

You can display the County Indicators data by color-coded bins when you toggle on a specific indicator layer.

- Click on the title of the desired layer, and a legend will appear below the layer name. The county indicators are organized into five bins, with the darker colors indicating potential greater challenges to resilience.
- NOTE: The data ranges for each color bin is different for each indicator. Refer to the legend for each indicator to see the data ranges for each bin/color. Review the Community Resilience Indicator Research Summary for more information on the binning methodology.
- Toggle indicator layers on, and the bins will populate the map.
- Click on a county on the map for a pop-up box of that county's data and the national average for that indicator.
- If multiple indicator layers are toggled on, the map will only display the colored bins for the indicator that is highest on the drop-down list. The pop-up box will, however, include the county datapoints and the national average for all data layers that are turned on.
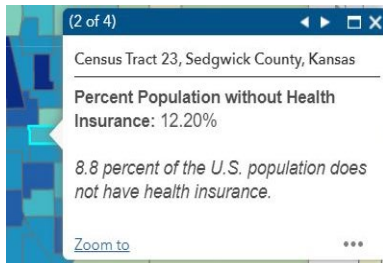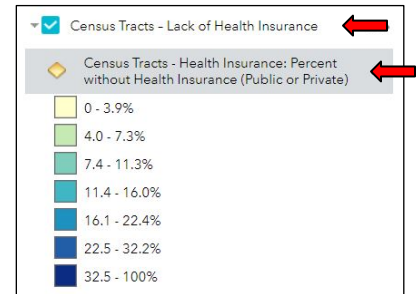
Census Tract Indicators

Click on the Census Tract Indicators icon to see the list of all the layers available with census tract data. The top of the list shows a set of layers for different geographic boundaries: FEMA Regions, USA States, County Boundaries, Census Tract Boundaries, and Tribal Territory Boundaries. State and county boundaries are turned on by default. When the County, Census Tract, or Tribal Territory Boundaries layer is turned on, the list of available CRIA Indicators will be displayed as a pop-up box.

There are 12 CRIA community resilience indicators available with census tract data.

- To view the legend and data bins for each census tract layer, click the name of the indicator, *and then also* click on the detailed name of the indicator. Darker colors denote greater challenges to resilience. Census tract data is grouped into 7 bins to allow greater differentiation across this much larger dataset.

- Click on a census tract on the map for a pop-up box with information on the selected indicator data.
- If multiple layers are toggled on, the map will only display the colored bins for the indicator that is highest on the drop-down list. The pop-up box will, however, include the census tract datapoints for all data layers that are turned on.

Tribal Territories Indicators

Click on the Tribal Territories Indicators icon to see the list of all the layers available with tribal census data. The top of the list shows a set of layers for different geographic boundaries: FEMA Regions, USA States, County Boundaries, Census Tract Boundaries, and Tribal Territory Boundaries. State and county boundaries are turned on by default. When the County, Census Tract, or Tribal Territory Boundaries layer is turned on, the list of available CRIA Indicators will be displayed as a pop-up box.

There are 13 CRIA community resilience indicators available with tribal census data.

- Similar to the County Indicators tab, click the name of the indicator to see the legend showing its data bins. Darker colors denote greater challenges to resilience. Tribal territory data is grouped into 5 bins.
- Click on a tribal area on the map for a pop-up box with information on the selected indicator data.
- If multiple layers are toggled on, the map will only display the colored bins for the indicator that is highest on the drop-down list. The pop-up box will, however, include the tribal datapoints for all data layers that are turned on.
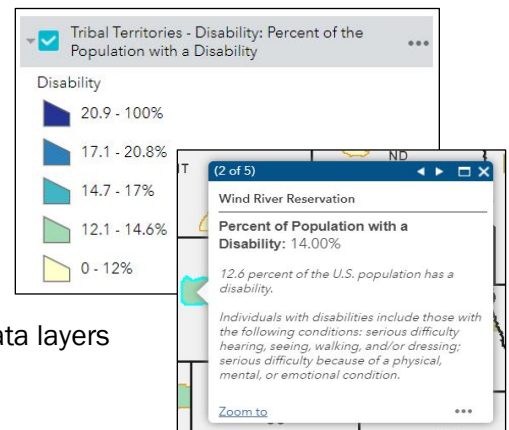
Basemap Gallery

The Basemap Gallery allows you to change the display of the base map. The default map is the Streets Map; other options include satellite imagery, grey canvas, and terrain views. The street map view is

especially helpful to assess evacuation routes, and the terrain views are useful when looking at hazards such as flood or wildfire. A video tutorial for the basemap gallery can be found here.

Toolbox

When you open the Toolbox icon, in the upper-right corner of the screen, you will see three tools to help visualize areas on the map: Draw, Print, and Measurement. A video tutorial for the toolbox can be found here.

- **Draw:** The Draw tool lets you create graphics that display on the map (single points, lines, polygons, etc.). It can also display measurements for drawn features, such as length, area, and perimeter.

   – To draw an object, select the shape of the object you wish to draw.
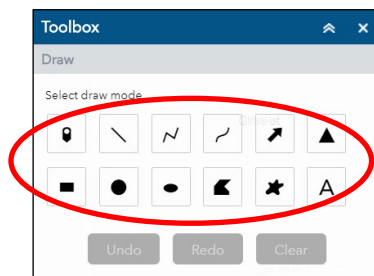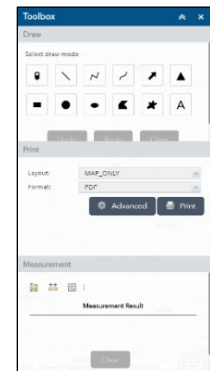
    – Once you select the shape you want, formatting options will appear below that allow you to adjust the color and transparency of the figure and include measurements (depending on the type of image).
    – Use the drop-down for "Show area/length measurement" to select the unit of measurement.
   – Change the font size depending on preference.
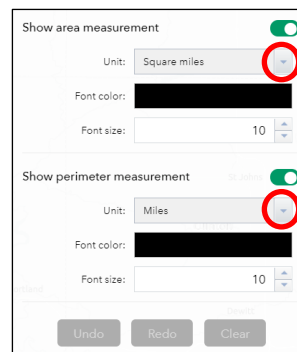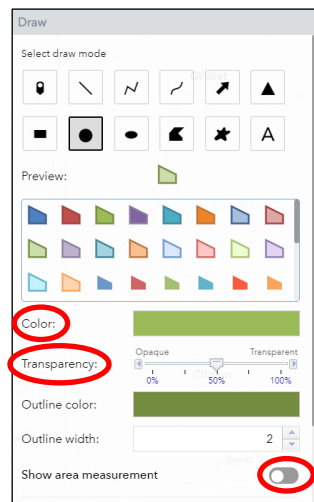
- After you select the shape and choose the formatting, move your cursor to the map. A pop-up box will appear with instructions on how to draw the shape.
- You can have multiple shapes on the map. To draw additional shapes after your first, go back to the Select Draw Mode, select your next shape and follow the previous steps.
- You can undo the most recent drawing and clear all drawings by clicking the "Undo" or "Clear" buttons at the bottom of the formatting box.
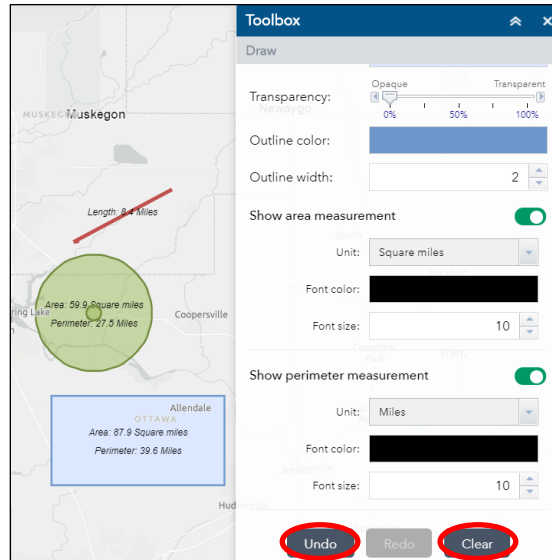

- NOTE: Drawings are not saved when you exit the application. They remain on the map until you click "Clear" or refresh your browser.

- **Print**: The Print function lets you save a PDF of the map on your screen.

  - NOTE: The PDF will only show the extent of the map that is visible on your display.
  - Click the "Print" bar in the Toolbox (the Print function may take some time to load) and select layout and format preferences from the drop-downs.
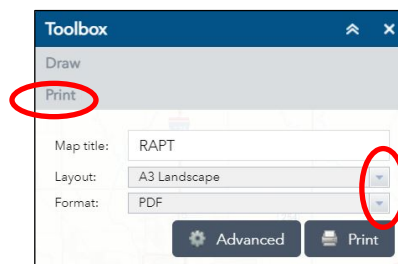
– Click the "Advanced" button to modify various aspects of your map, including labels, map size, and print quality.

▪ In the Advanced Options, the "include attributes" box needs to remain toggled off for the map to print.

– Click "Print" and your map will save as a PDF.
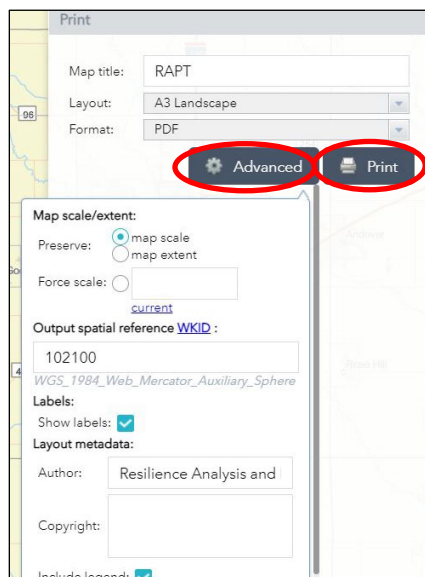
- **Measurement**: The Measurement tool lets you create polygonal shapes and straight lines while providing the square miles or distance as you draw your shapes. It can also provide latitude and longitude values for a specific point on the map.

– NOTE: The Measurement tool differs from the Draw tool in that it allows you to see the area of a polygon or the length of a line you are drawing while you're using the tool. This is useful for potentially determining the distance between events and infrastructure, geographical landmarks, or the affected radius of an event.

– Click on the "Measurement" bar located below the "Print" option in the Toolbox.
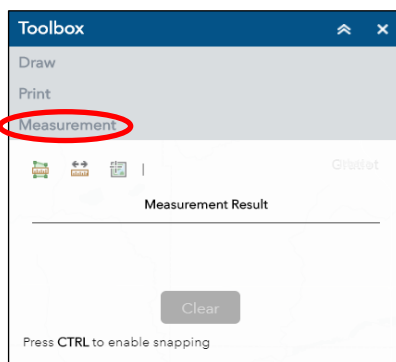
- To draw a polygon and measure the area within the polygon, click the "Area" icon.
- Click on points on the map to determine the corners of your polygon.
- Double-click the final corner of your polygon and the shape and area will appear.
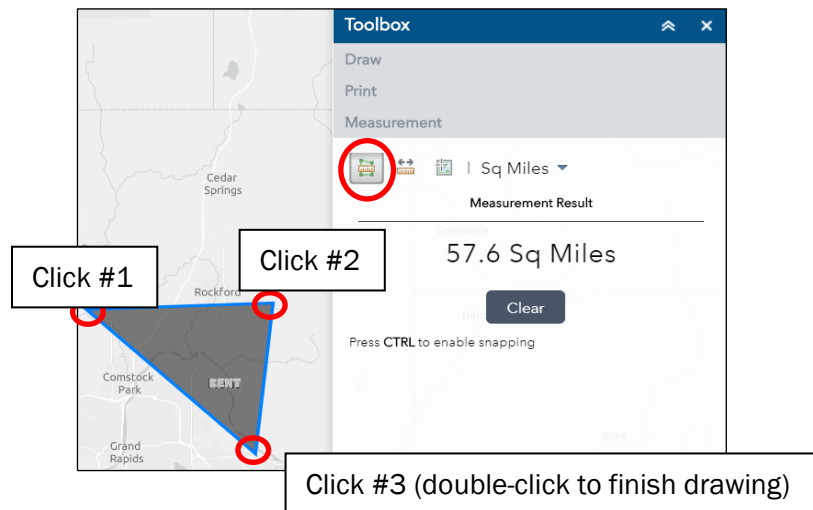

- To draw a line and measure the distance of the line as you draw, click on the "Distance" icon.
- Click a point on the map as the start point of your line. As you move your mouse from that point, the distance will display under the "Measurement Result" section.
- Double-click the final point of your line and the total distance will appear.
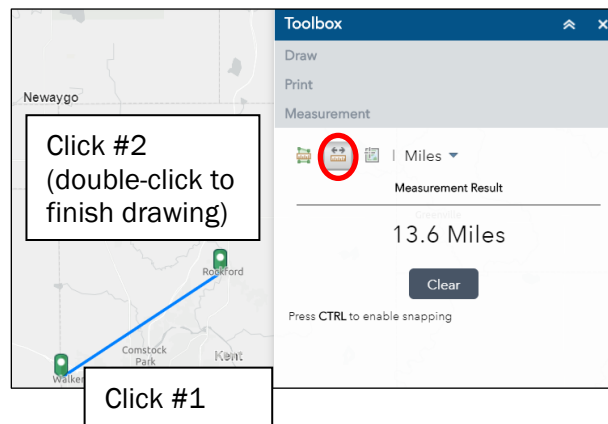
- To see the latitude and longitude values of a specific point on the map, click on the "Location" icon.
- Click the map at the desired location and the latitude and longitude values will display under "Measurement Result" section.

As you move your mouse, the latitude and longitude values for your mouse location will display next to the mouse icon.

- If you click on a new location in the map, the latitude and longitude values will change to display the new location.
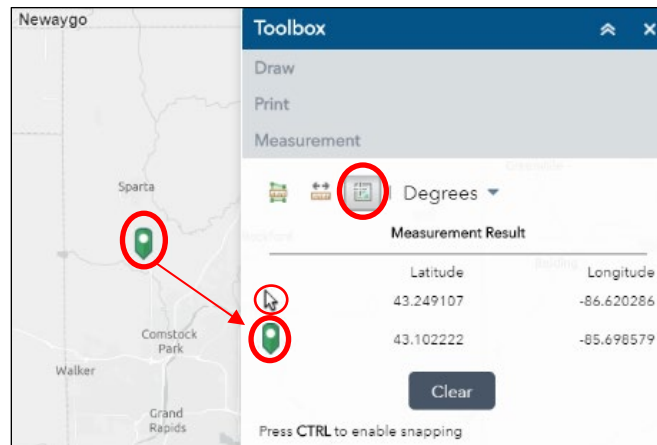
Add Data

The Add Data tool allows you to add data to the map by searching for layers hosted on ArcGIS Online or on a Portal for ArcGIS, entering URLs to data sources, or uploading local files (appropriate data types include a zipped shapefile, KML, CSV, GPX, or GeoJSON). You can temporarily add layers to and remove layers from the map, but **these layers cannot be saved to the map** to be retained for future review.

Not all layers are available for free; some require a subscription to Esri. When scrolling down the available layers, click on the details link to the right to see if that layer requires a subscription (a shield will appear). If you would like to access to the subscriber data layers, please contact your organization's lead GIS analyst to obtain the requisite login information. You can also upload your own GIS layers by zipping a shapefile and dragging and dropping the zipped folder into the Add Data Tool.

While you can upload additional layers for analysis, and you can print with a screenshot with these layers (see the print function in the Toolbox) **you will not be able to save these layers into RAPT**. Because RAPT is a publicly-available tool that does not require a username or password, local layers cannot be permanently saved or embedded. A video tutorial for the add data tool can be found here.

Incident Analysis Tool

The Incident Analysis Tool allows you to create a buffer zone around an incident or area of interest (single point, linear, and polygonal) and identify and visualize infrastructure entities within this zone. This tool can provide a comprehensive list and visuals of the locations of infrastructure entities within the buffer zone. A video tutorial for the incident analysis tool can be found here.

- Click on the Incident Analysis Tool icon ⚠ (you may need to click the "more" icon in the upper right ⊟ to find the tool) and the tool will open at the bottom of the page.
- Set the buffer distance by moving the scale to the desired distance or clicking inside the box, typing the desired value, and hitting "Enter."
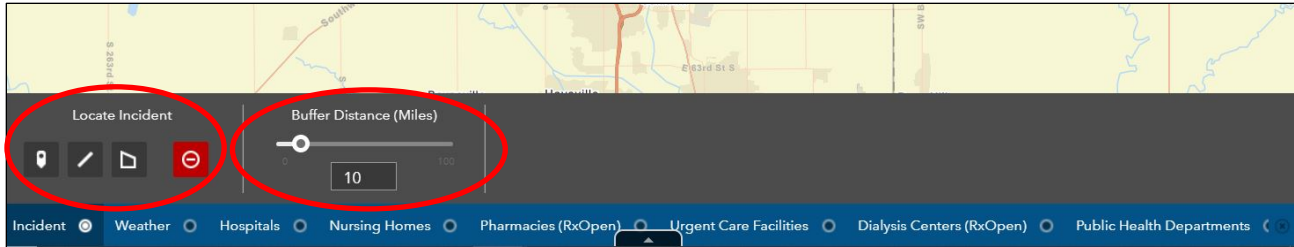
- Select the desired type of buffer (single point, linear, or polygonal). In this example, single point is used.
- Click on the map to draw the buffer zone. The map will zoom to the affected area.
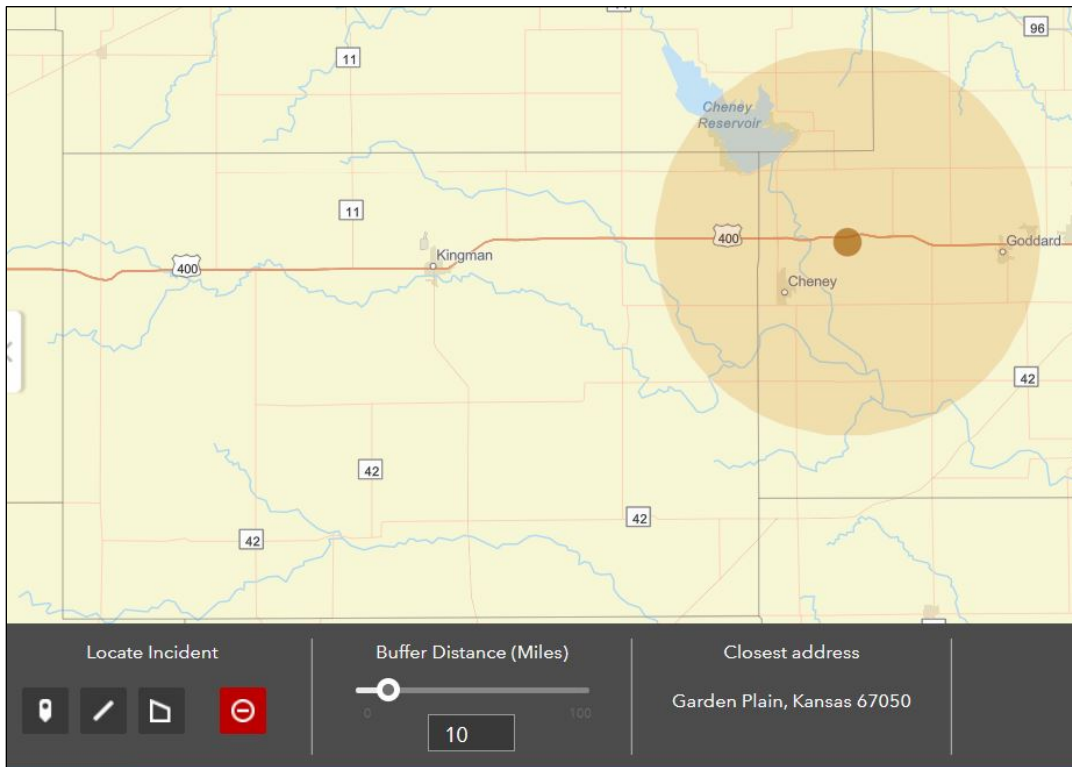
- Once the buffer zone is drawn, select infrastructure entities by clicking on the infrastructure name.

  - NOTE: Infrastructure entities are listed in order of closest to furthest from the center of the buffer zone. Only the infrastructure entities in the buffer zone will be listed, although the map will show all infrastructure entities outside the buffer zone as well.
  - NOTE: You can only select one infrastructure layer at a time, but the buffer zone will not disappear as you toggle between layers.
  - NOTE: You can only create one buffer zone at a time.
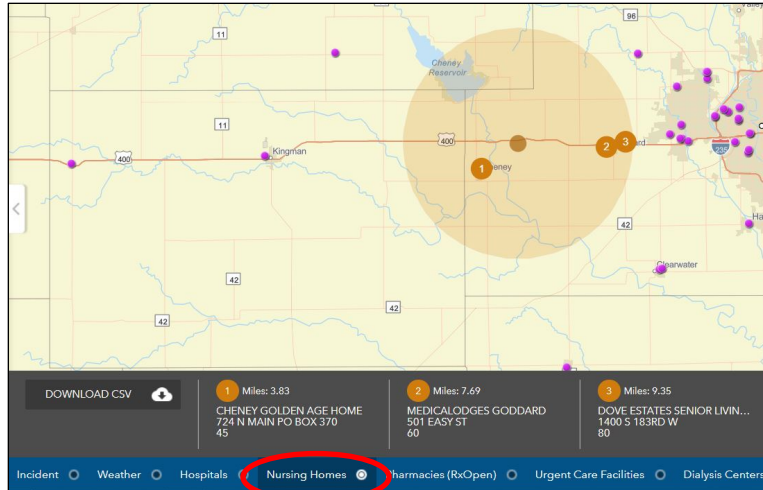
- To export the list of entities, click on "DOWNLOAD CSV" and the list will open in Excel.
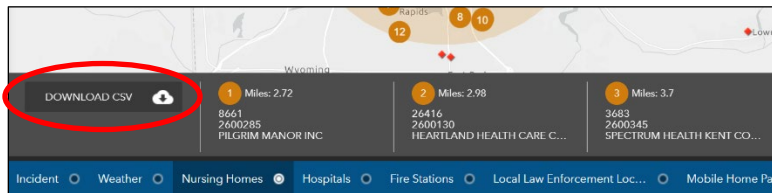

- To erase the current buffer zone and create a new one, select "Incident" and click the red box.
- Once you erase a buffer zone, the entities on the map and the list will disappear.
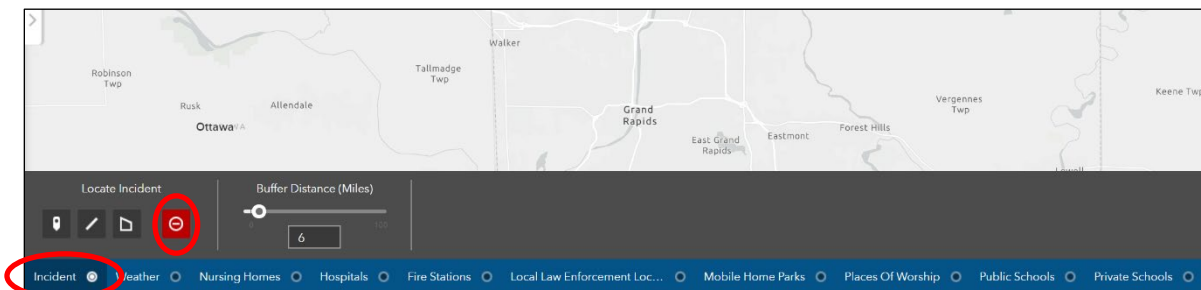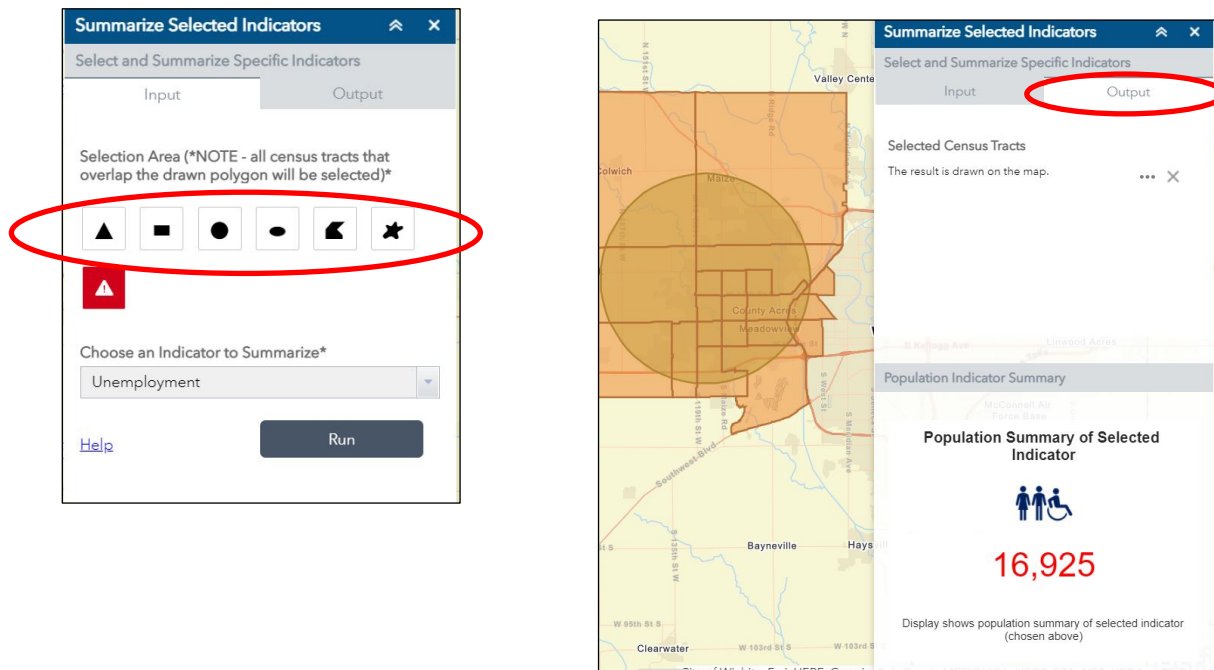

Summarize Selected Indicators Tool

The Summarize Selected Indicators Tool allows you to draw a specific shape on the map (circle, rectangle, polygon etc.), select all the census tracts within or touching that shape, and calculate the population of individuals with specific resilience indicator characteristics (age over 65, disability, unemployment, etc.) in those selected census tracts. This tool can provide a visual and comprehensive list of census tracts located in the shape, as well as the total number of individuals with your desired indicator characteristic. A video tutorial for the summarize selected indicators tool can be found here.

- Click on the Summarize Selected Indicators icon 🗒 in the upper-right corner (you may need to click the "more" icon in the upper right 🗒 to find the tool).
  The Summarize Selected Indicators tool opens on the right side of the screen. Click the desired shape you want to draw on the map (triangle, rectangle, circle, etc.).


- Place your mouse over the map after selecting the shape, and a box appears with instructions on how to draw the shape.
- After drawing the shape, select the indicator characteristic you wish to summarize from the drop-down list and click "Run."
- NOTE**:** You may have to scroll down slightly to see the "Run" button, depending on your browser display settings.
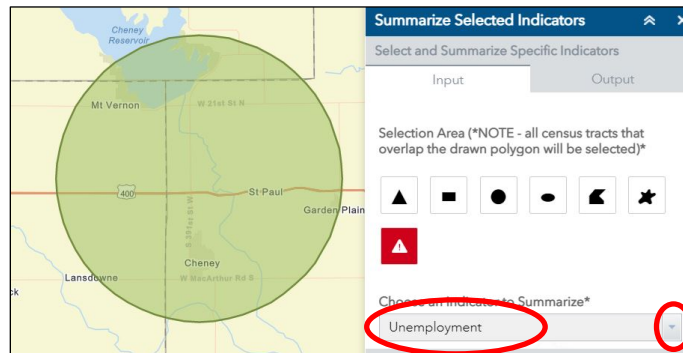

- The tool will take you to the "Output" tab, produce a visualization of the all the census tracts within or touching the shape, and show the number of individuals with the selected resilience indicator characteristic in the "Population Indicator Summary" section.
- In the example below, the number of unemployed individuals within the selected census tracts is 16,925, displayed in the "Population Summary of Selected Indicator" section.


- To export, save, or view this information in the Attribute Table, click the three dots under "Selected Census Tracts" and select the desired action.
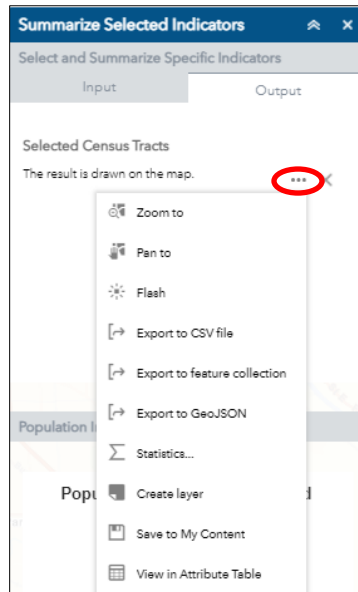
- To maintain the same area of analysis but summarize a different indicator characteristic, click on the "Input" tab in the tool, select the new indicator characteristic from the drop-down list, and click "Run."
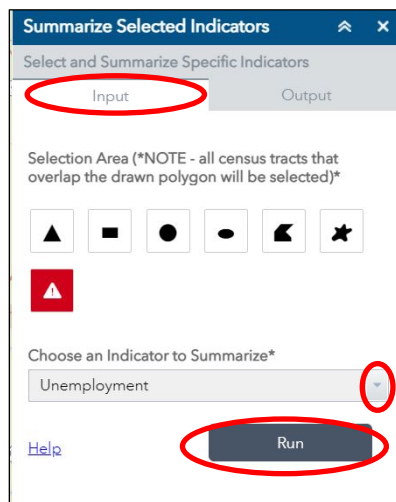
- To select a different area for summary, click on the "X" to clear the results in the "Output" tab. Then, go to the "Input" tab, and click on the red box to start the tool with a new area.
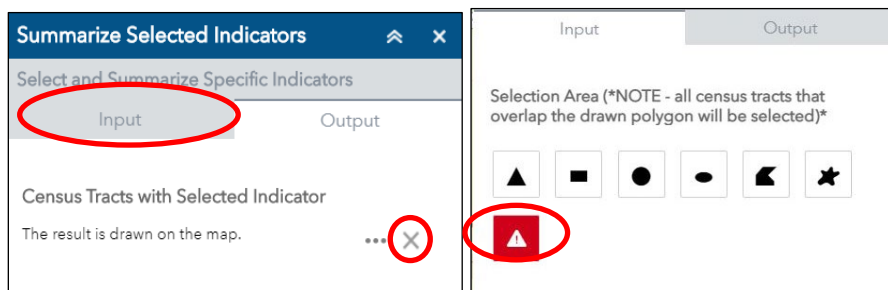
At the Bottom: The Attribute Table

You have the option to "View in Attribute Table" for all infrastructure, hazard, and indicator features in RAPT.

- Click the dark grey tab at the bottom of each web page to open the Attribute Table for all the indicators currently selected. A window will pop up showing data in a table format.

- Initially, the table will include only the counties and census tracts displayed on the screen (within the extent of the map on the screen). To include all counties and census tracts in the database, deselect "Filter by Map Extent."
- Select one or more counties or census tracts of interest by clicking on the grey "Selection Handle" box to the left of the row.
- Use CTRL-click to select additional counties or census tracts.

The table has columns for all of the CRIA resilience indicators (all 20 with the county data, as well as 12 indicators with census tract data).

OBJECTID	AFFGEOID	County	State Name	FEMA Region	Age: Population Age 65 and Older	Disability: Percent of the Population with a Disability	Educational Attainment: Lack of High School Diploma in Adults over Age 25	Unemployment Rate: Percent of the Labor Force That Is Unemployed
04	0500000US26133	Osceola	Michigan	Region V	20.62	19.57	11.31	6.90
15	0500000US55135	Waupaca	Wisconsin	Region V	20.39	14.59	8.16	2.60
19	0500000US26085	Lake	Michigan	Region V	27.74	25.67	17.56	8.90
177	0500000US26165	Wexford	Michigan	Region V	18.63	16.11	10.40	6.20
178	0500000US26113	Missaukee	Michigan	Region V	20.34	18.50	10.49	6.40

52 features 3 selected

The bar at the bottom of the screen shows how many counties or census tracts (labeled as features) are included in the dataset on the screen.

From the Attribute Table, you can download data into an Excel document, sort by name/title, and filter by state or county.

- Click on the Options tab to export the data to a csv file, which can be easily saved as an Excel file. The options table also allows you to filter the data by specific properties (by state or county, for example) and show or hide specific columns.
- Sort by state or county to make it easier to look at specific areas within the map.

  - NOTE: The list of counties within a state is not in alphabetical order.

At the Top Left: RAPT Tools

There are three additional RAPT tool at the top left: Query Tool, the Selection Tool, and the Population by Census Tracts Tool.

 ### Query Tool

The Query Tool can be found in the upper left underneath the search bar and includes two different queries:

- The first allows you to zoom in and see all the census tracts in a specific county or state.
- The second provides specific information on the hospitals in a county or state, such as the trauma level.

Each tool provides a list of all desired entities with their census tract or hospital information and allows you to export the information to an Excel file, see averages/statistics across the selected entities, and view the results in the Attribute Table. A video tutorial for the query tool can be found [here](#).

- Click on the Query icon in the upper left of the map and choose whether you want to select census tracts or hospitals.

- If you select "Query Census Tracts" (left image below), select the state and county from the drop-down boxes and click the Apply bar at the bottom. If you select "Query Hospitals" (right image below), select the state, county, and trauma level from the drop-down boxes and click Apply.
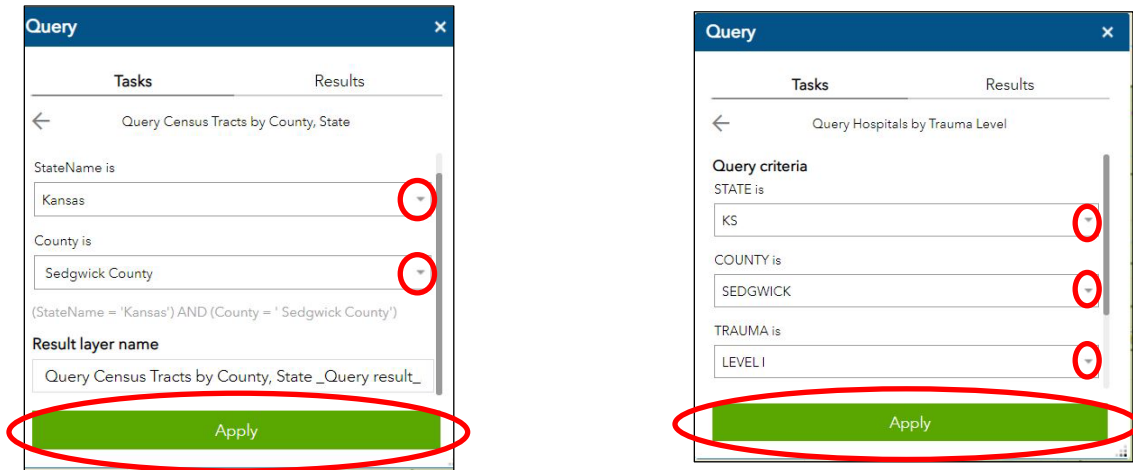
- The map will zoom to that area and the list of selected features appears in the tool pop-up.
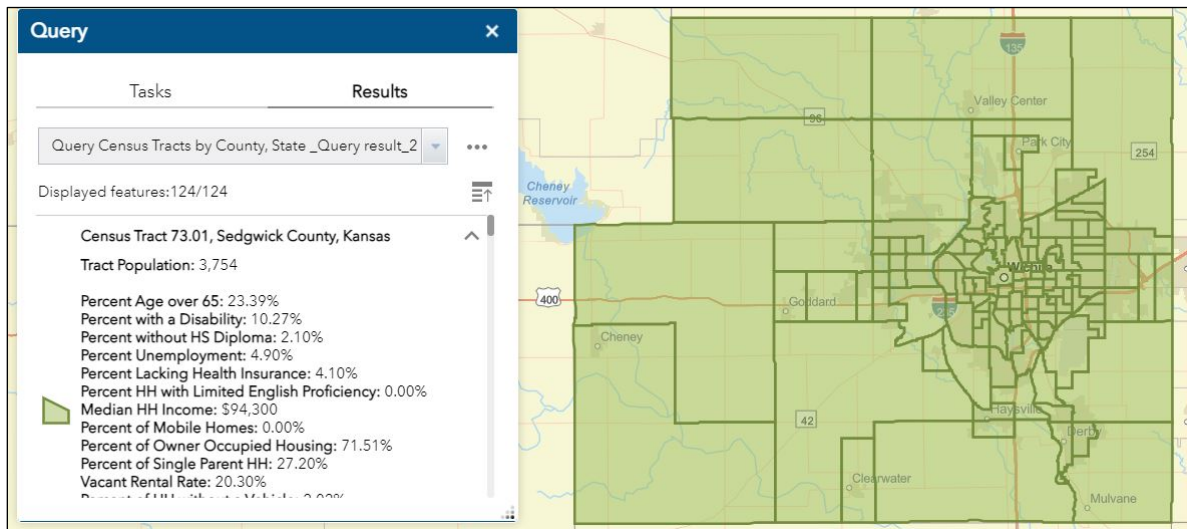
- To export, save or view this information in the Attribute Table, click the three dots at the top of the sidebar and select the desired action.
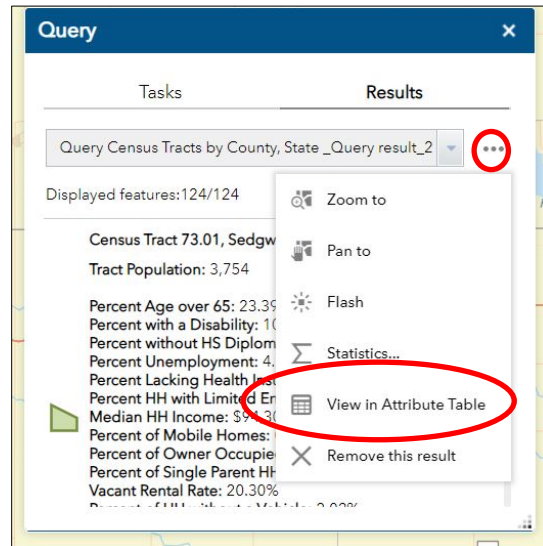

- To start another query, click the three dots and select "remove this result."
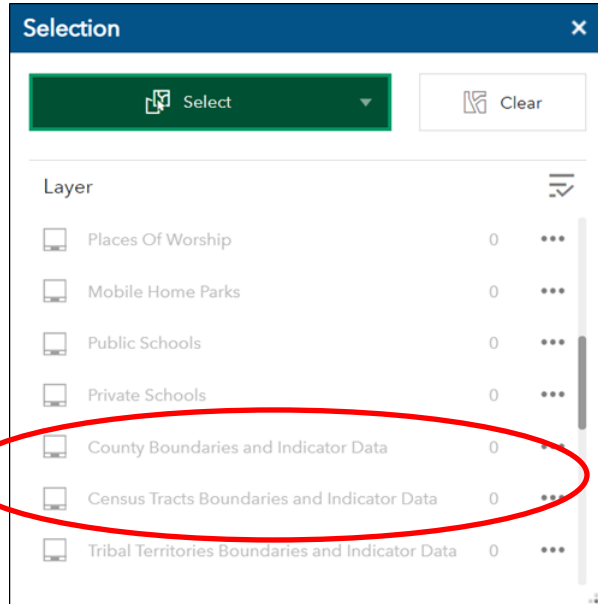
Selection Tool

The Selection tool can be found in the upper left of the map and allows you to select multiple infrastructure, hazard, county, or census tract datasets in a specified region (rectangle, polygon, circle etc.). The output provides a number, visual, and comprehensive list of those multiple datasets. You may export, save, or view these datasets in the Attribute Table. A video tutorial for the selection tool can be found here.

- Before using the Selection tool, turn on the infrastructure and hazard layers to be included in the output.
  - NOTE: Refer to the Infrastructure and Hazards sections on how to toggle on/off these layers.
- Click the Selection icon and the tool pop-up box appears. Select the infrastructure layers you wish to analyze by clicking on the boxes next to their names.

  - NOTE: Only the infrastructure layers you have turned before opening the tool can be selected and summarized. All other layers will be greyed-out as shown below and will not be included in the summary of entities.
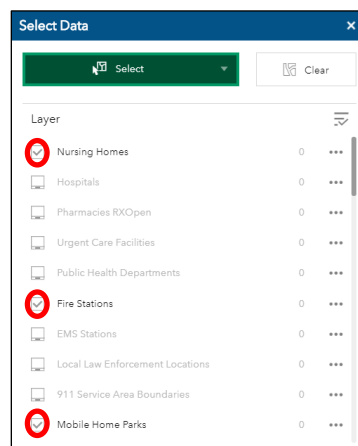

- If you have the "County Boundaries" or "Census Tracts Boundaries" layers toggled on, they will also appear in the results of the Selection Tool. If you do not want to look at the counties or census tracts, and instead want to focus on infrastructure or hazard layers, turn off the "County Boundaries" and "Census Tracts Boundaries" layers listed in the layer list. Sometimes it is easier to see individual infrastructure entities with the county or census tract layers turned off.


- Click the arrow in the green "Select" box and select your desired shape from the drop-down list.

  – NOTE: When you place your mouse over the map after selecting the shape, a box will appear with instructions on how to draw the shape.
  – The Legend includes information about which infrastructure layers are turned on; the legend for this example is below.
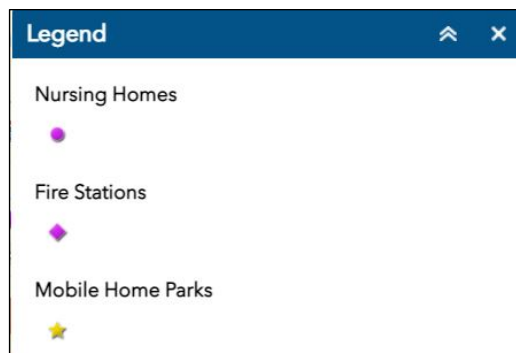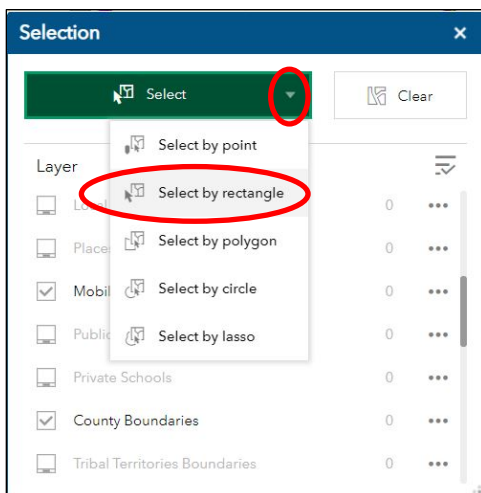
- After drawing the shape, you will see the infrastructure, hazard, county, and census tract entities selected within the shape.
- The image on the left shows the results of a rectangular drawing when census tracts are on. The image on the right shows the same drawing results when census tracts are off. The purple circles identify the various infrastructure entities within the selected area.
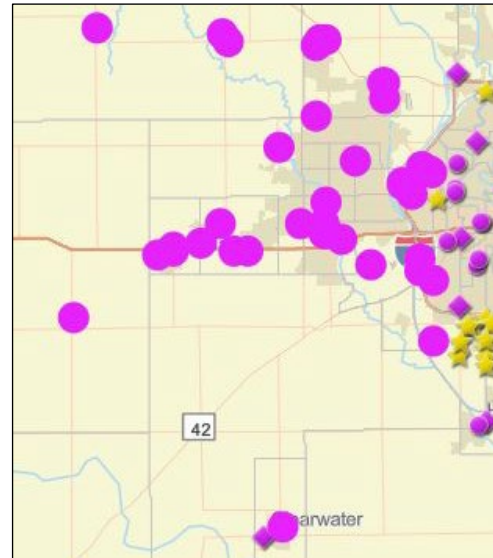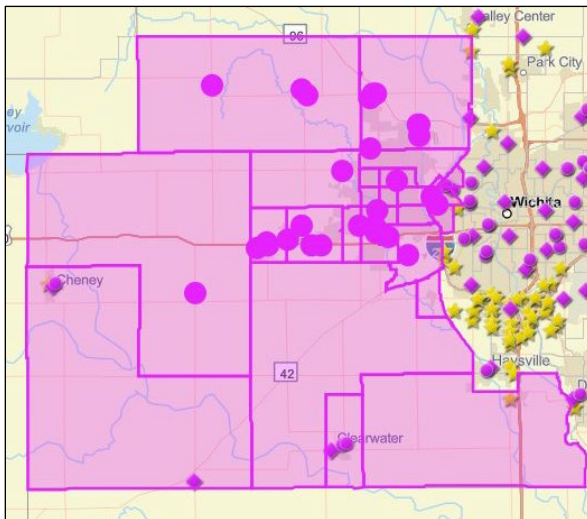

- The layer list displays the number of infrastructure entities and the number of counties and census tracts in the selected area.

  – In the example below, the area has 19 nursing homes, 10 fire stations, and 10 mobile home parks.
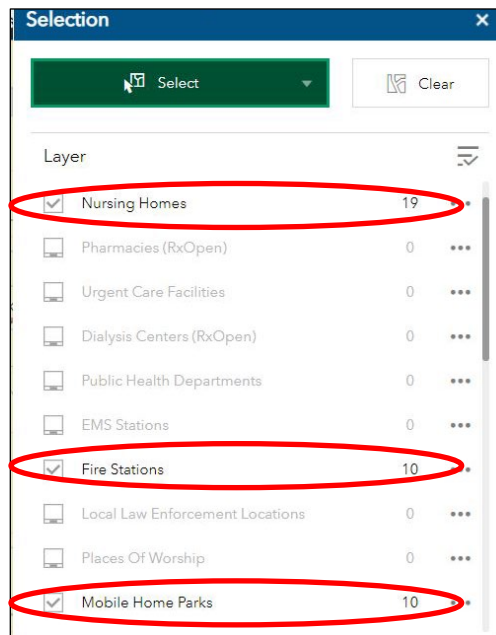
- Click on a specific layer to see a list of those entities within the area.

  – The image below shows the 19 nursing homes from the example above.

- Click on one of the nursing homes in the list to display a pop-up on the map with that nursing home's information.

- To go back to the layer list and view other infrastructure entities, click on the arrow in the top left of the tool.
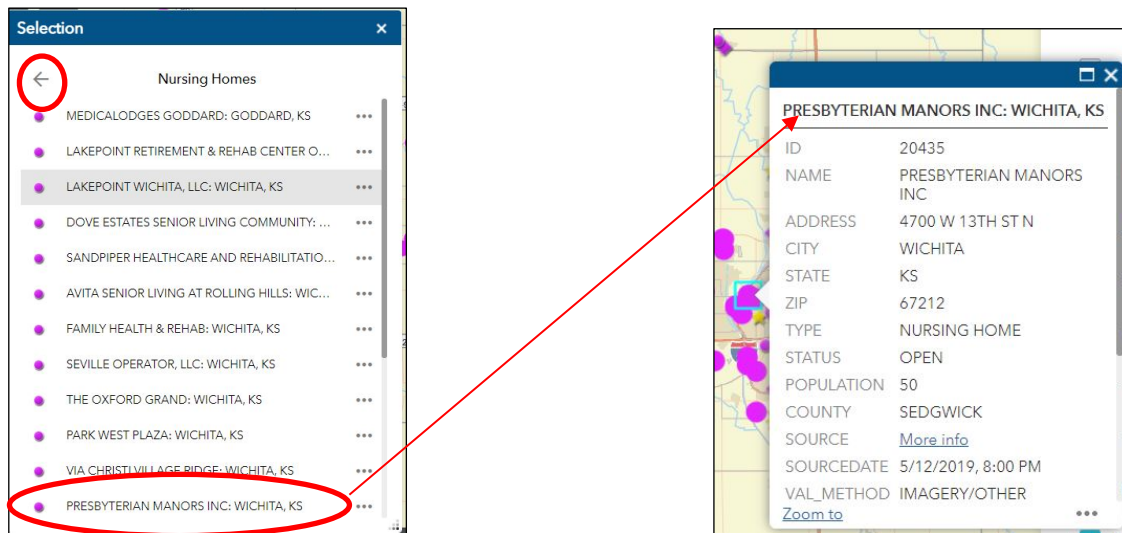
- To export, save, or view this information in the Attribute Table, click the three dots to the right of the specific layer you want to focus on and select the desired action.
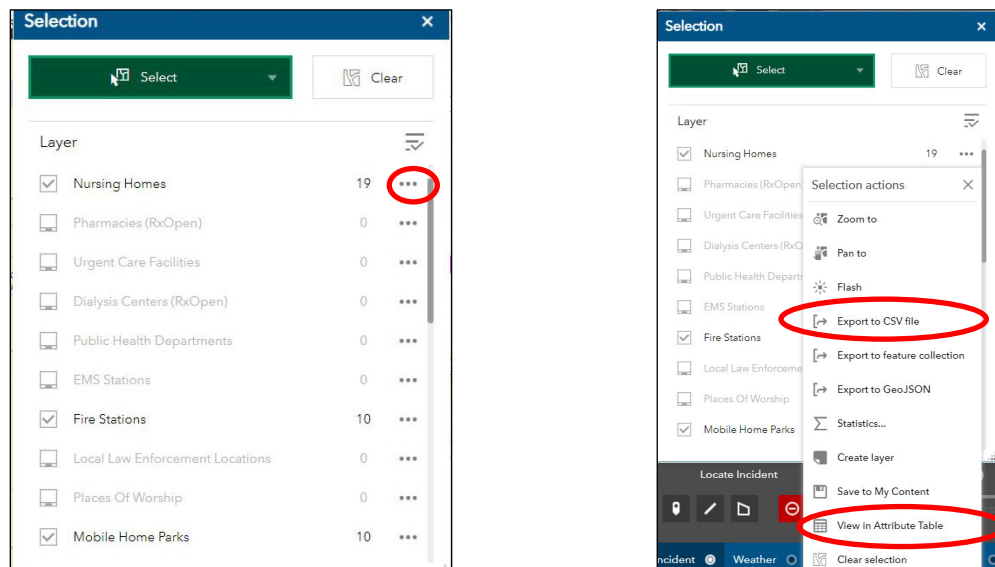

- To clear the results and select different entities or a different area, click the "Clear" button at the top of the Select Data tool.

- NOTE**:** If you wish to use the Population Count tool to calculate the total population within the selected census tracts as described below, do not click the "Clear" button.

Population by Census Tracts Tool

The Population by Census Tracts, or Population Count, tool is located at the top left of the map and calculates the total population of the census tracts that are selected by the Selection tool. A video tutorial for the population count tool can be found [here](#).

- NOTE: For this tool to work, you must have turned on the "Census Tract Boundaries" layer within the Census Tract Indicators list when using the Select Data tool. If this layer was turned off, you will need to clear your results in the Select Data tool, turn on the "All Census Tracts" layer, and re-select the census tracts.
- After selecting several census tracts with the Selection tool, click the Population Count icon.
- The total population of the selected census tracts appears.
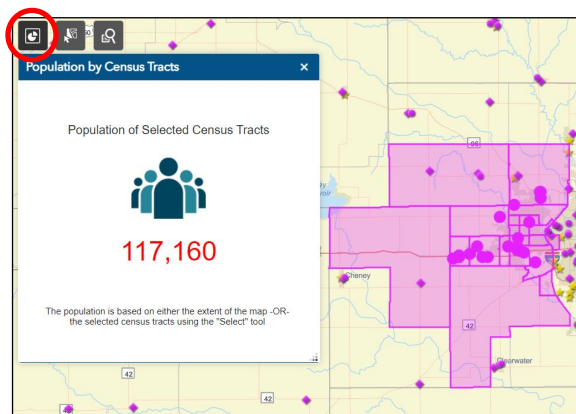
ANY QUESTIONS?

If you have questions or would like additional support in using the Resilience Analysis and Planning Tool, please email FEMA-TARequest@fema.dhs.gov.

Please send us examples of how you are using RAPT, as well as recommendations for future improvements.