GEOG 104: Fall 2017
Practical Exercise 4: Spatial Analysis in ArcGIS Online

Due: Wednesday 11/8/17 at 9:00AM
20 points

In this exercise, you'll start to work with ArcGIS Online and use spatial analysis and geoprocessing tools. You'll be able to conduct an analysis of your design and save your maps to make them available to others.

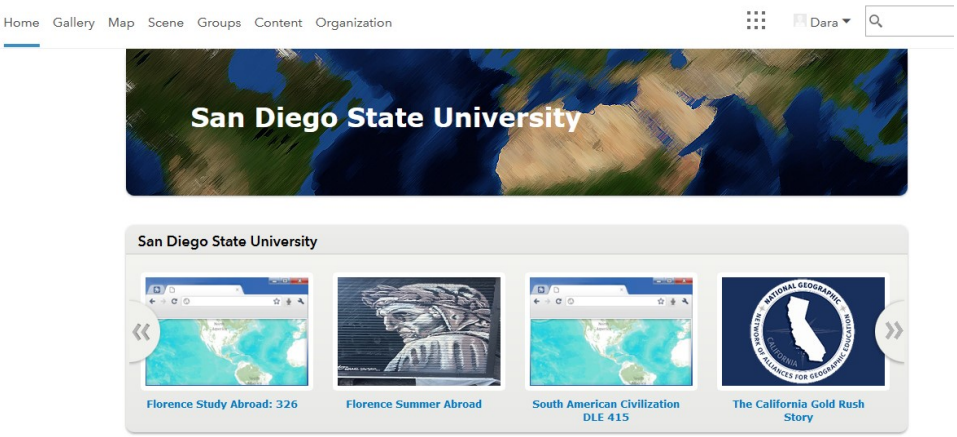
<u>This exercise will cover the following skills:</u>

Dissolve
Select by Location
Calculate Density
Buffer
Intersect

1. Before getting started, make sure you download and save the data files accompanying this lab on Blackboard. Make note of where you save them on your computer or flash drive.

Part I: Creating a Web Map in ArcGIS Online

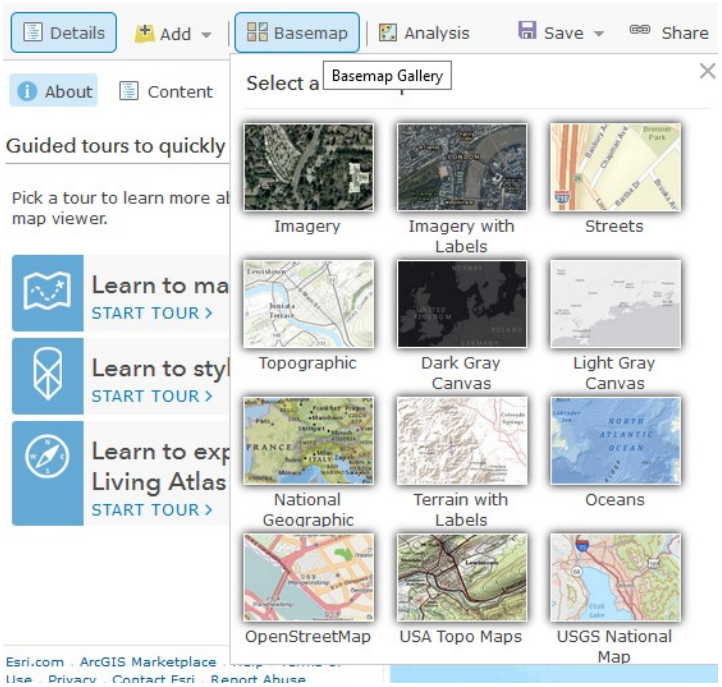
1. To get started, go to https://www.arcgis.com/home/index.html
2. Sign In with your SDSU Geo-provided Esri account.
3. You should see the following. This page shows featured projects within the SDSU Geo organization.



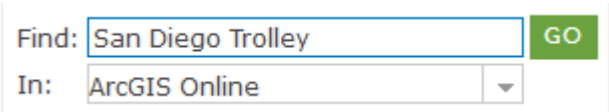
4. Click on the tab that says Map . This is where you'll immediately get to start mapping.

The first thing you'll do is explore some of the basemaps available to you. Basemaps are important for web mapping because they can provide spatial reference information as background and allow users to overlay their theme or key items on the top. Different web maps may need to adopt different basemaps, based on the symbology or theme of the other layers.

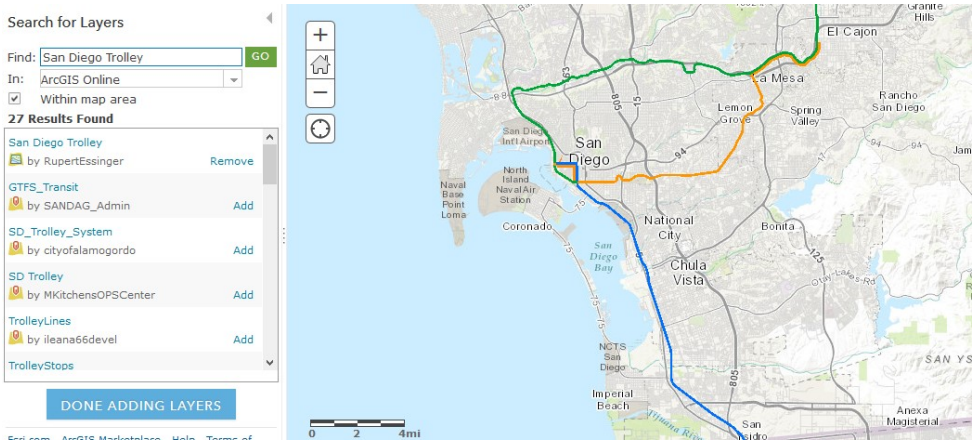
5. Click on the "Basemap" icon in the top menu and explore the options:



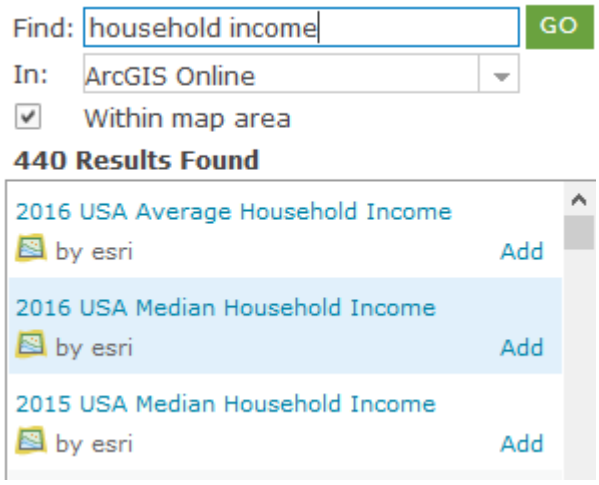
6. Next, you'll add a new layer (as the new theme in your map). Click on **Add**, then **Search for Layers.**
7. In the **Find:** text box, type in *San Diego Trolley*. Change the **In:** to *ArcGIS Online* and press **GO**.



8. One of the results is *San Diego Trolley* by RupertEssinger. Click on the "**Add**" link on the right side of the layer name. The San Diego Trolley lines should be automatically added into your map.

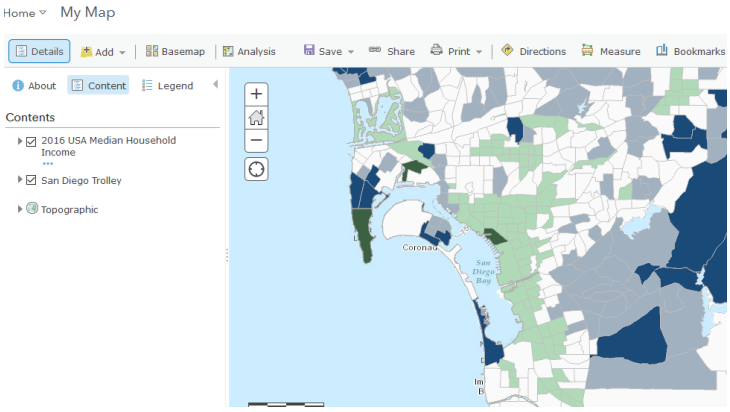


9. Next, we will overlay this map with household income data. In the **Find**: textbox, type *Household Income* and press **GO**.
10. One of the search results is *2016 USA Median Household Income* (2nd result in the screen shot below). Add this layer to your map.

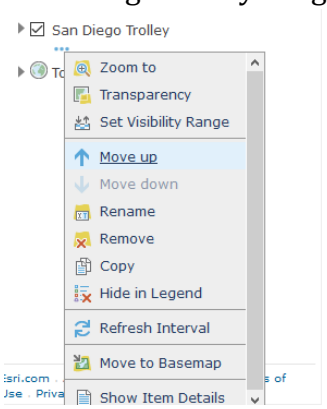


11. Then, click 

in the left panel.

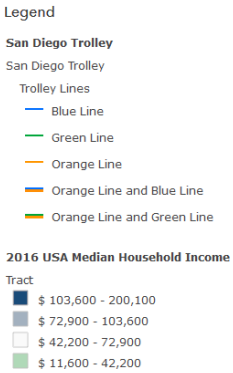


12. However, the trolley lines are now blocked by the income layer. We need to rearrange this map to show both the trolley lines and the income data. Under *Contents* in the left panel, move your cursor to San Diego Trolley, and click on the 3 dots (...) below the layer. Then select the **Move up**. This will layer the trolley lines above the income data on the map. Alternatively, you can click drag the layer names above and below each other to change the layering order.

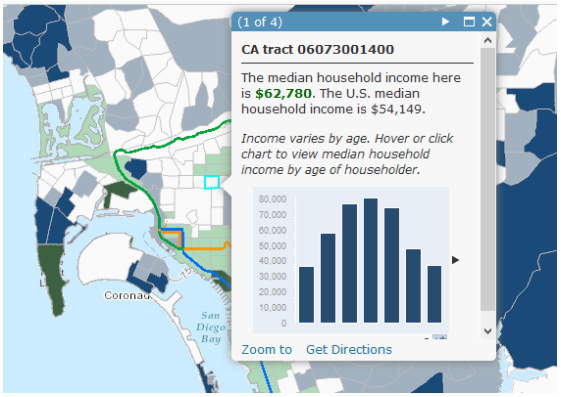


13. Next, click on the Legend tab.

14. This will list the layers in your map and provide a symbology key.

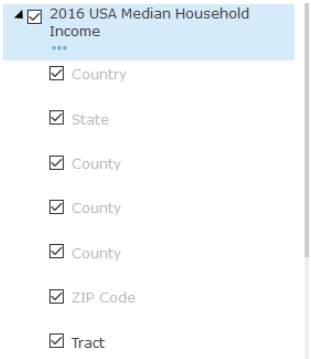


15. You can also click on each census tract in the map to see the median household income distribution in your neighborhood.

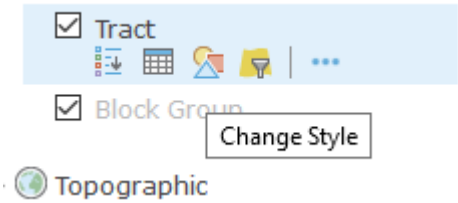


The default symbology for the income by census tracts is a diverging color scheme, with dark colors for both extremes of the color range (blue for high and green for low). This can be a little difficult to interpret. A sequential coloring scheme might be preferable in this case for exploring income patterns. Luckily, we can change the symbology of this ArcGIS Online layer!

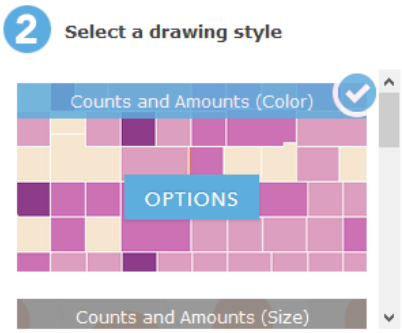
16. Switch back to the **Content** tab, then expand the income layer in the table of contents using the arrow at the left of the layer name. You should see the following:



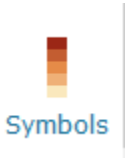
17. Scroll down to Tract (the other geographic resolutions should be grayed out at this zoom level) and hover over it, until the following appears. Click on the Change Style button. 



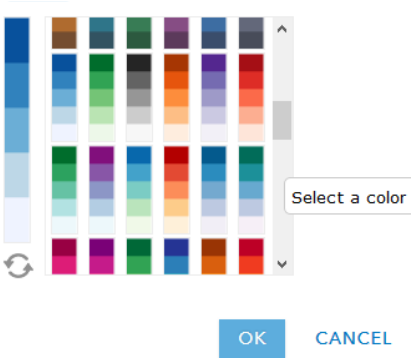
18. Under *Select a drawing style*, click OPTIONS under *Counts and Amounts (Color)*.



19. Click **Symbols** in the options that appear:



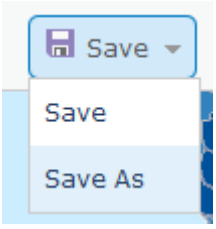
20. Choose a sequential coloring scheme (shades of a single color), where the top is darker than the bottom, such as the following. Then press **OK**.



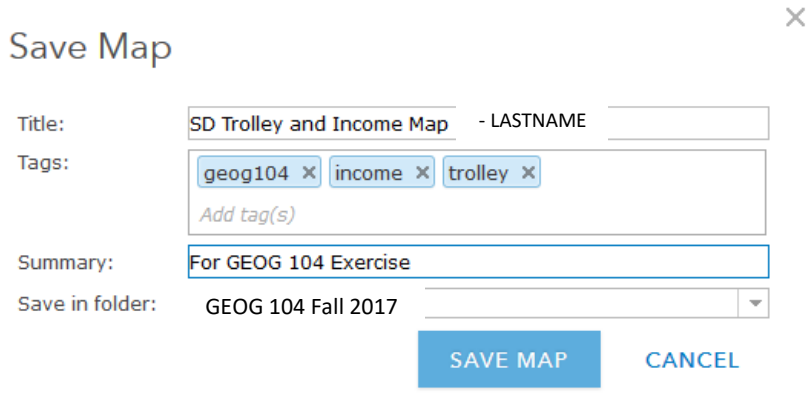
21. Press **OK** again in the left panel, and then press **DONE**. Your new symbology is now applied!

Question 1. Do you see any spatial relationship between the two layers in your map (trolley lines and median household income by census tract)? Explain any correlation you observe. [3 points]

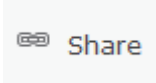
22. You will now save your map to the GEOG 104 Group folder. Select the **Save As** option, as shown below:



23. Enter a title (with your last name), content tags, and summary as shown below, then click SAVE MAP. Make sure to save your map into the **GEOG 104 Fall 2017** group folder.

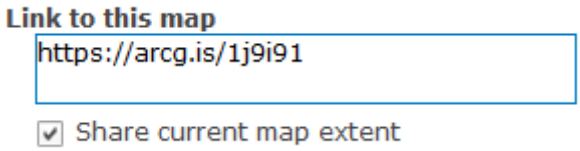


24. Once you have saved your map, its title will appear in the top left of your screen. You can also share the URL of your saved webmap with others and adjust the groups with whom it is shared.

    Click the 

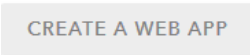
button.

25. Check the box to make sure your map is available to members of San Diego State University and members of the GEOG 104 Fall 2017 group. Make note of the URL (similar to the one shown below).



Question 2. What is the URL of your saved map? [Nothing more you need to do – grading will look for your SD Trolley and Income Map in the appropriate folder.] [3 points]

26. You can also transform your map into a "Web App." To do so, click

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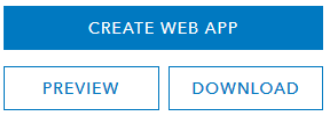
27. There will be a number of templates available. Click on and **PREVIEW** a few of them, including the *Basic Viewer* template. With the web applications, you can customize layouts and set the controls on which tools your map audience can access when viewing your map.

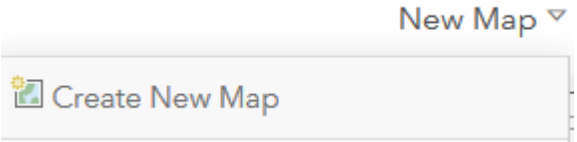


28. You do not need to follow through and create a web mapping application. Instead, close out of the previews and click on Content in the top menu. This is where any maps, applications, or layers you create are saved.

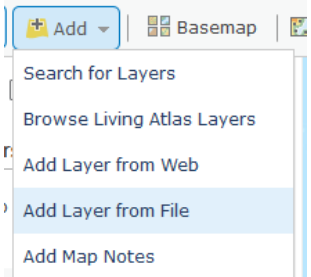
Part II: Working With Geoprocessing Tools

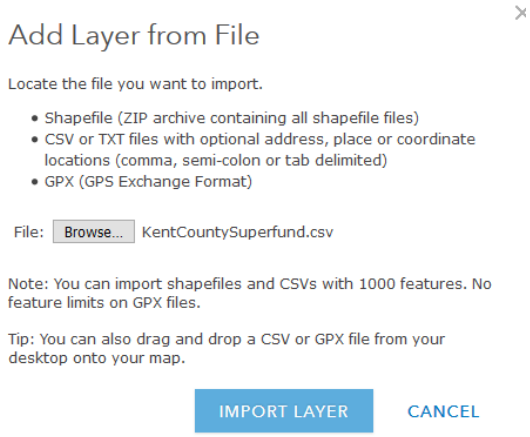
In this part of the exercise, we will work with some of the environmental data presented in the first half of the semester: Superfund sites!

1. Start a new map by going to **New Map → Create New Map** in the top right. If this is not visible, first click the *Map* tab in the top menu.

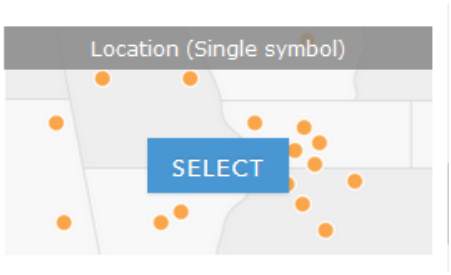


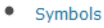
2. Instead of adding data from ArcGIS Online, you will add data provided on Blackboard. The first file to add is KentCountySuperfund.csv. These are Superfund sites in Kent County, Michigan.
3. A CSV file is essentially a table where columns are separated by a comma delimiter. You can add CSV files to ArcGIS Online (up to 1,000 records).
4. Go to **Add→ Add Layer from File**, then select **Browse…**



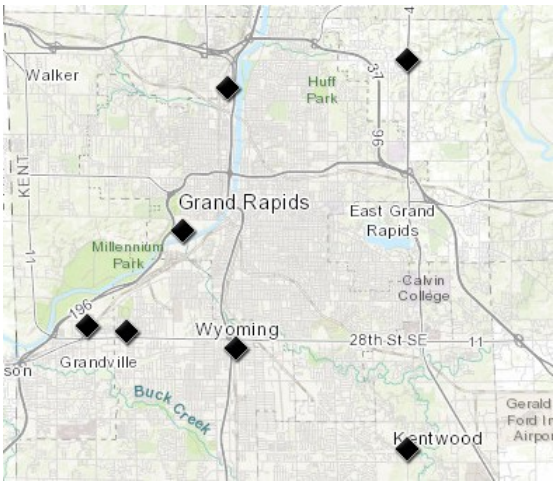


5. Add *KentCountySuperfund.csv* and press IMPORT LAYER.
6. This CSV file has latitude and longitude in the table, so the locations automatically show up on ArcGIS Online, and the map zooms to these points.
7. As a default, the points will show up in different colors. Since you will be adding more layers, you'll want to change these all to a single symbology. In the left panel, scroll down and select Location (Single symbol).

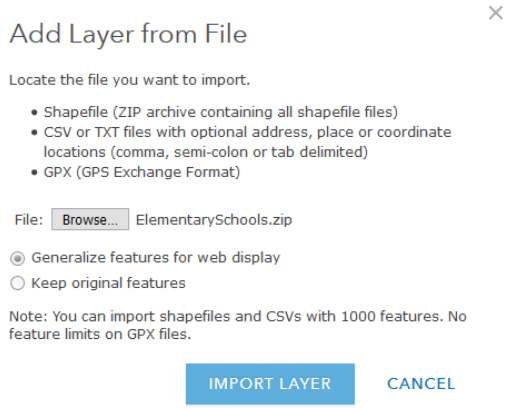


8. Next, press OPTIONS to make these a bit bigger. Then press 

9. Change the shape to diamond and the pixel size to 30. Then press OK.

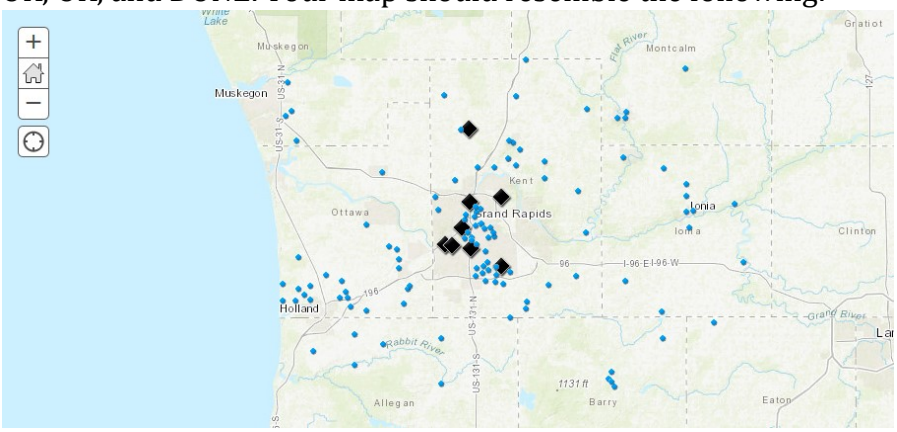


10. Press OK in the left panel and observe your map. Then press DONE.
11. Suppose you are interested in seeing which elementary schools are close to Superfund sites in Kent County. You will now add a layer of elementary schools in the region.
12. Go to **Add→ Add Layer from File**. Browse to your data directory. This time you will add ElementarySchools.zip. This is a zipped shapefile. Press **Import Layer**.

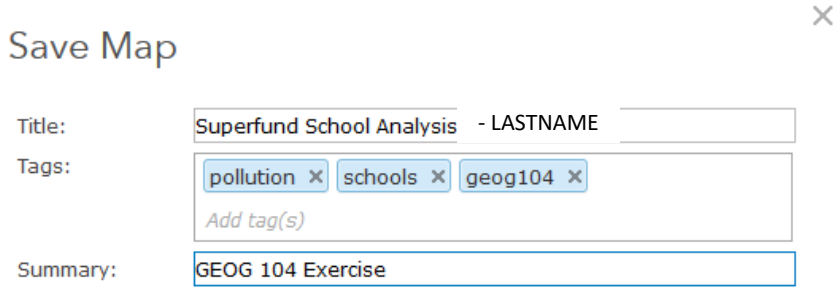


13. This will show the locations of regional elementary schools on the map.
14. Under *Select a Drawing Style,* scroll down and select **Location (Single Symbol)**.
15. Go to **Options→ Symbols**. Change the color to blue and the pixel size to 12:

16. Press OK, OK, and DONE. Your map should resemble the following:

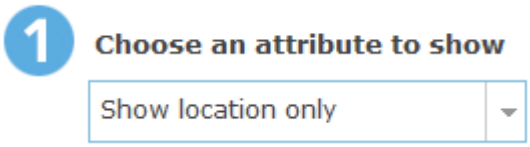


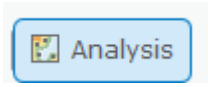
17. At this point, make sure to SAVE YOUR MAP into the **GEOG 104 Fall 2017** folder. Go to **Save ->Save As** and type the following:



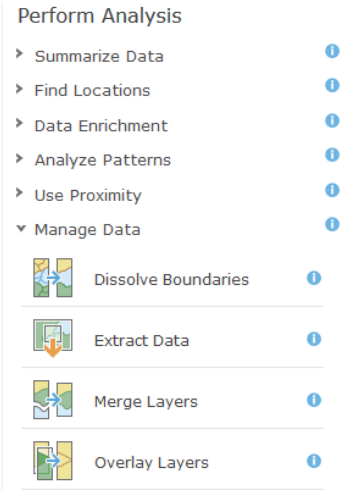
The map you just made shows elementary schools in the region, and we only want to show schools in Kent County. What resources do we have?

18. The last remaining geodata file from Blackboard is KentCountyTracts.zip. Add this file to your map (**Add→Add Layer from File**, and Browse to KentCountyTracts.zip).
19. Under *Choose an Attribute to show*, choose the following, and then press DONE.

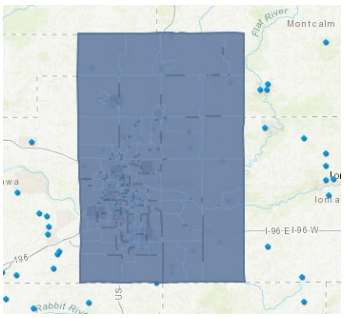


20. We are actually only interested in the boundary of Kent County. This will help us pick out which schools are in Kent County and reduce clutter in our map. Luckily, we can derive this from our layer of Kent County Census tracts! You're about to run your first geoprocessing tool: **Dissolve**.
21. Go to 

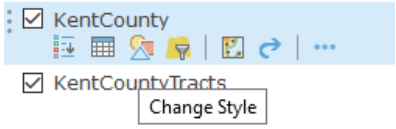
and observe the left panel. Expand the **Manage Data** category:



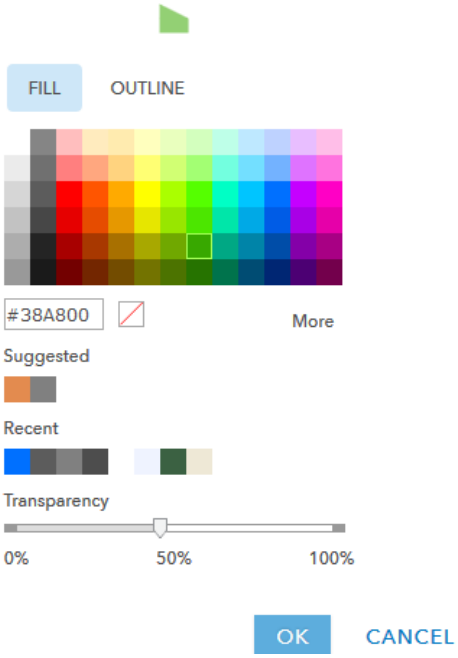
22. Click on **Dissolve Boundaries**.
23. For 1, select KentCountyTracts, for 2, *Areas that overlap or are adjacent*, skip #3, and for 4, name the layer KentCounty. Uncheck the box that says "Use current map extent."
24. Then hit Run Analysis. When it is all done, you should see this:



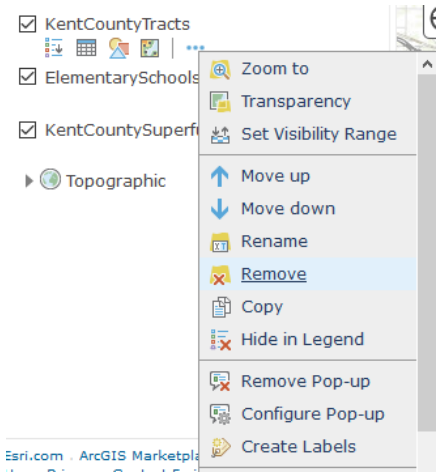
25. All the Census tract boundaries have been dissolved into a single county boundary!
26. You will now change the style of this layer. Under this layer in the Contents, go to **Change Style**  .



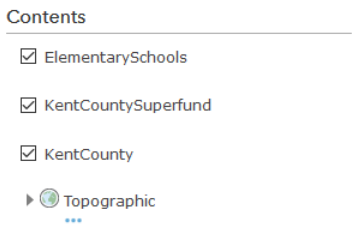
27. Go to Options → Symbols. Under the **Fill** tab, match the following green:



28. Under the **Outline** tab, hit  to make the outline transparent.
29. Press OK, OK, Done.
30. Observe your map. The tracts are still visible underneath your county layer. <u>Remove</u> the tracts layer using the following guide [press …(next to the tract layer) → Remove]:



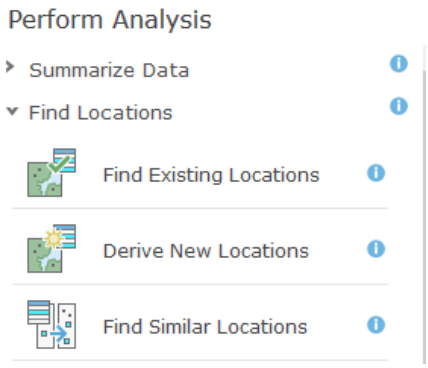
31. With the Content tab still activated, drag the KentCounty layer under the rest of your layers, as shown below:



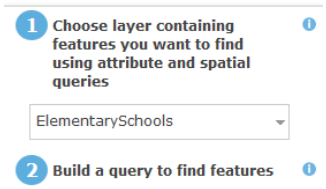
32. Save your map!

Next, we are interested in limiting the schools in our analysis to *just* the schools in Kent County.

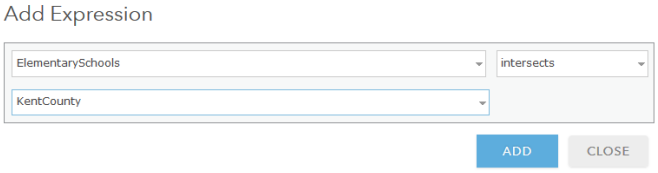
1. Click on the **Analysis** tab.
2. Expand **Find Locations** and click **Find Existing Locations**.



3. Make sure Box 1 matches the following:



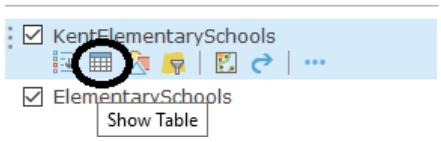
4. Now click **Add Expression**.
5. We want to select elementary schools in Kern County. To do this, match the following expression and press **ADD**:



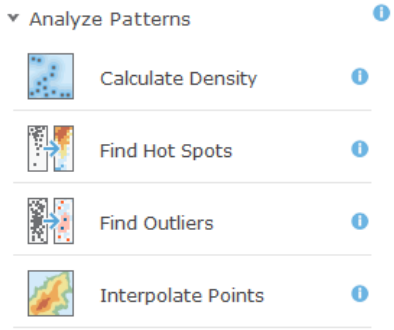
6. Change the result layer name to *KentElementarySchools*.
7. Uncheck use current map extent, then click **Run Analysis**.

8. A new layer should appear in your map.

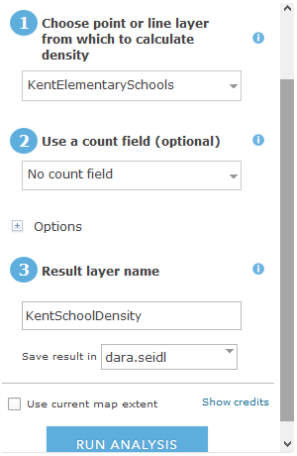
Question 3. How many of the elementary schools are within Kent County? [3 points] To find the answer, open the attribute table of your new layer:



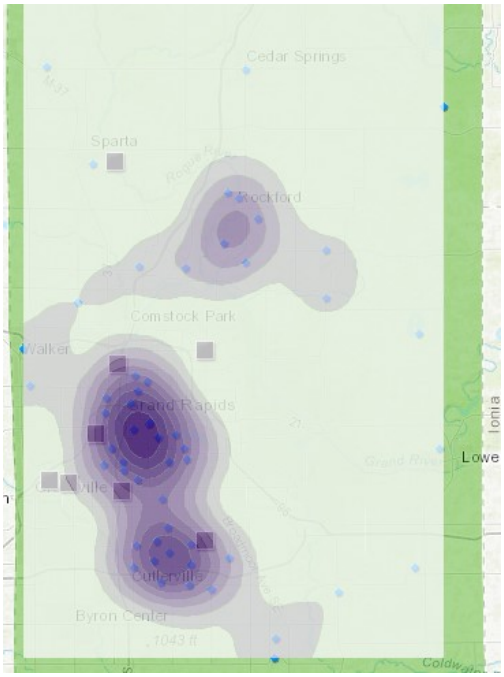
1. Remove the ElementarySchools layer from the map. You will not need it anymore (Keep the KentElementarySchools).
2. Notice that mapping point locations makes the map look quite cluttered. If we are interested in looking at concentrations of schools in Kent County, we can make a density map to better visualize patterns.
3. Click on **Analysis** and expand **Analyze Patterns**:



4. Now click on **Calculate Density**.
5. Match the tool parameters to the following (using your own folder):

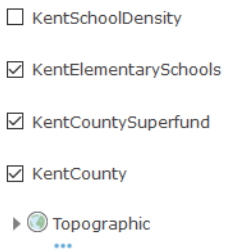


6. Click **Run Analysis**. Your map should resemble the following:



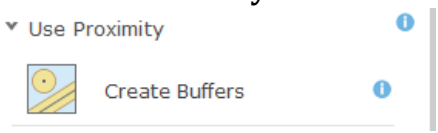
Note that this is just one way to look at densities of point concentrations. Another (perhaps simpler way) is to change the Style of the point layer to Heat Map. This would result in a density layer that dynamically changes depending on your zoom level (and looks a lot nicer than this density layer).

1. From the density map, we can see that there are Superfund sites generally near the higher densities of schools. But how meaningful is this?
2. For now, <u>click off</u> the density layer, so that your map contents match the following:

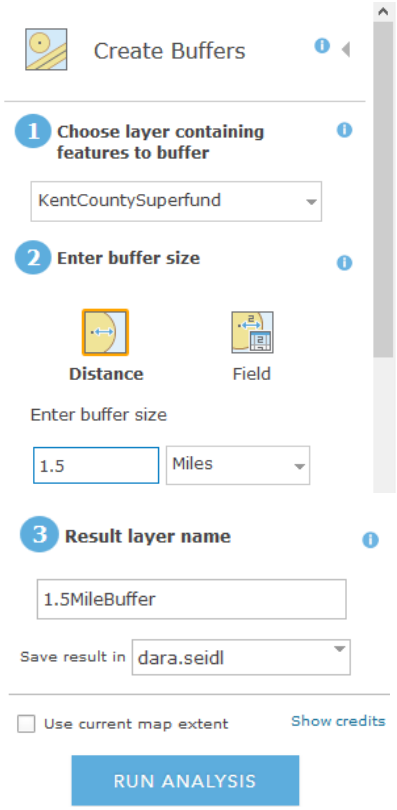


Let's assume that Kent County is considering implementing a rule that no elementary schools can be open less than 1.5 miles from a Superfund site. Our job is to identify how many and which elementary schools would be impacted by this rule.

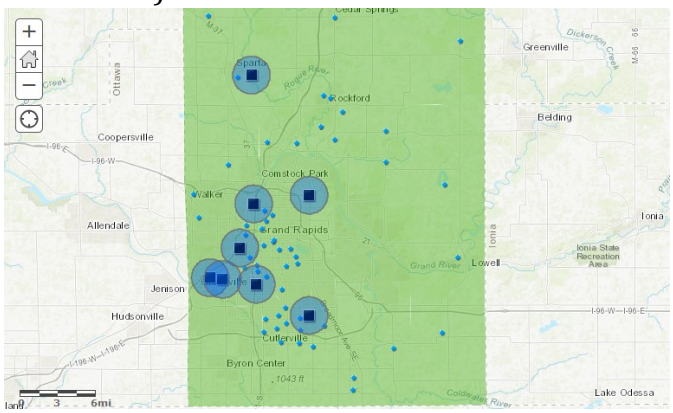
1. Click on **Analysis**, then choose **Use Proximity**. Select **Create Buffers**.



2. Select the following options to create a 1.5-mile buffer around the Kent County Superfund sites (save the result to your folder):



3. Click **Run Analysis**. Your map should resemble the following (but your Superfund sites should be diamonds):

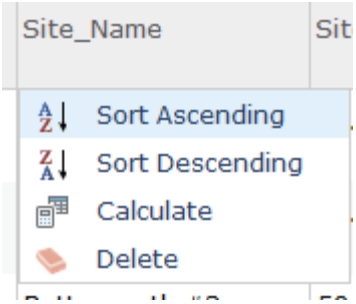


4. Our main question now is to determine which schools are within 1.5 miles of the Superfund sites. It would also be nice to know the identity of the Superfund site the schools are close to. We can accomplish this with an intersect operation.
5. Click on **Analysis → Manage Data → Overlay Layers**.
6. Your input layer will be KentElementarySchools.
7. Overlay Layer: 1.5MileBuffer

8. Overlay Method: Intersect (Notice that your output will be a point layer).
9. Result Layer Name: SchoolBufferIntersect
10. Uncheck use current map extent.
11. Click **Run Analysis**.

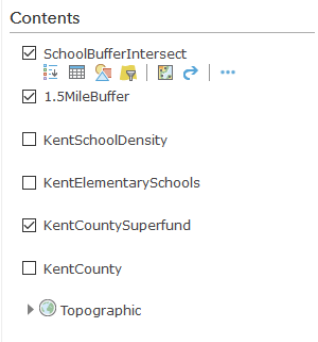
Question 4. How many elementary schools are within 1.5 miles of a Superfund site in Kent County (open up the attribute table of your SchoolBufferIntersect layer)? [3 points]

1. With the attribute table of SchoolBufferIntersect open, take a look at the field names. As you scroll to the right of the table, you will notice not only school information, but the Superfund site data as well. The Superfund data was appended to your school data when you performed the Intersect operation.
2. Scroll to the field called "Site_Name."
3. Click on the field name and choose Sort Ascending.

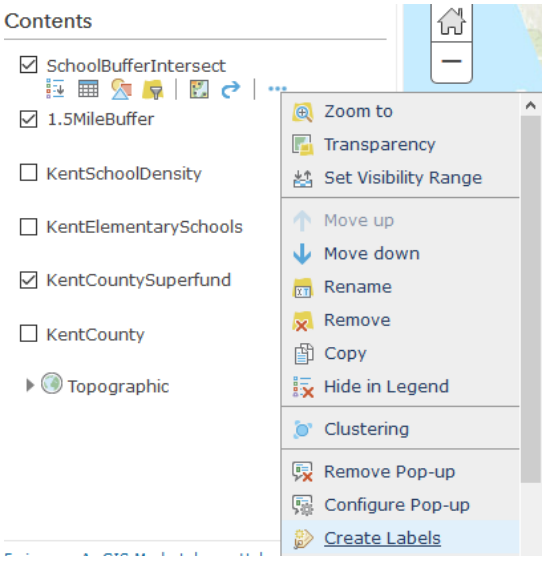


Question 5. How many elementary schools are within 1.5 miles of the Butterworth #2 Landfill? [3 points]

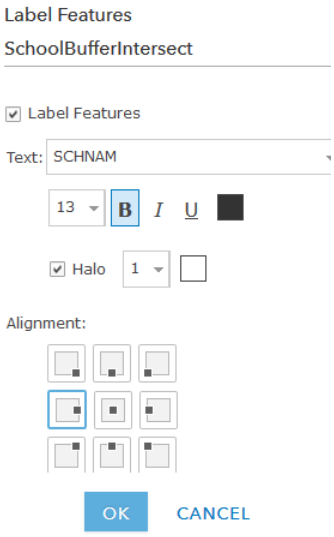
1. Close out the attribute table for your intersect layer.
2. Turn off all layers except the following:



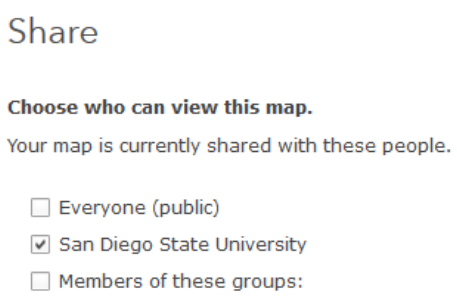
3. Change the symbology of your 3 visible layers so they are *not all blue*.
4. You will now label the schools within the buffers. On the SchoolBufferIntersect, click the … and then choose **Create Labels**.



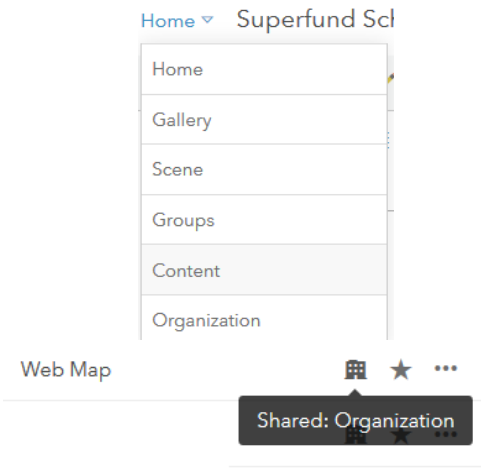
5. Match your settings to the following to label the schools with the school name.



6. Press OK, and **Save** your map.
7. You will now make your map available to the organization. Click Share, and then check the box for San Diego State University. You will also receive a popup that you'll need to share each of your layers with the organization. Accept this popup and click Update Sharing. Copy the link of your map.



Question 6. What is the URL of your Superfund School Analysis map? Maps will be graded on whether the correct layers and names appear, and how well symbology directions have been followed. Make sure your map is available to the SDSU organization by going to Home→ Content and checking that the building icon is listed next to your webmap. Your map should also be located in the GEOG 104 Fall 2017 folder [5 points]



You did it!