

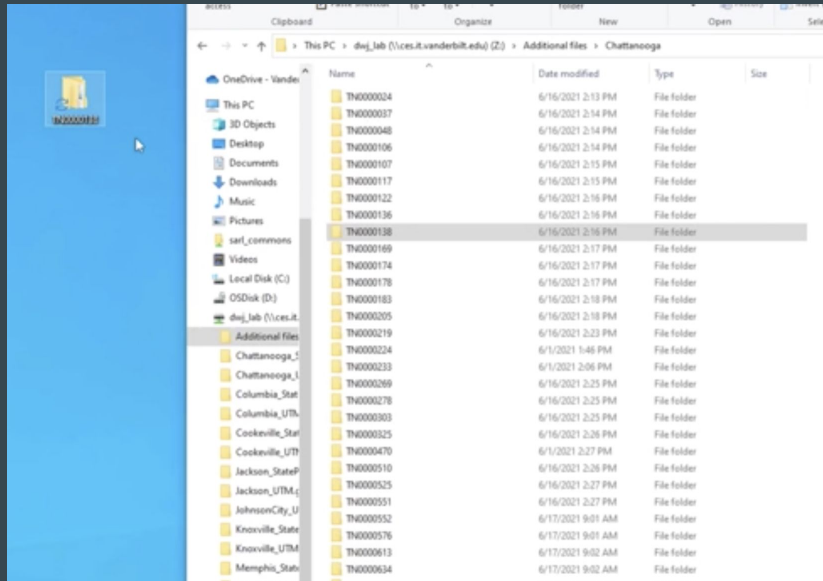
# Georeferencing in ArcMap



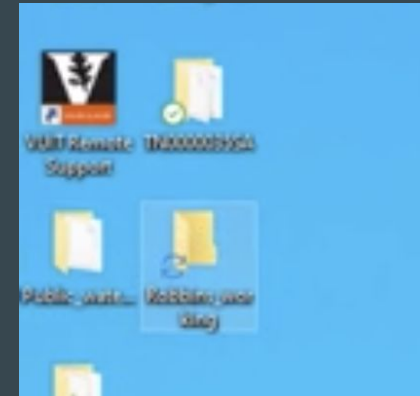
DWJ Lab

# Creating a Working Folder

- Locate the desired PWSID on the dwj\_lab server & **copy** this PWSID folder onto your Desktop

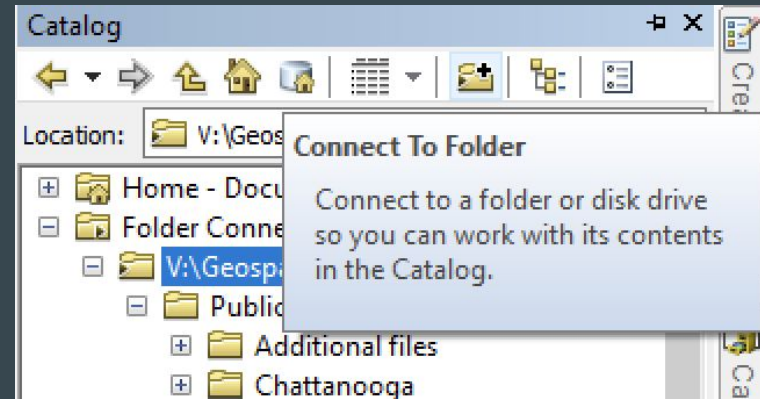
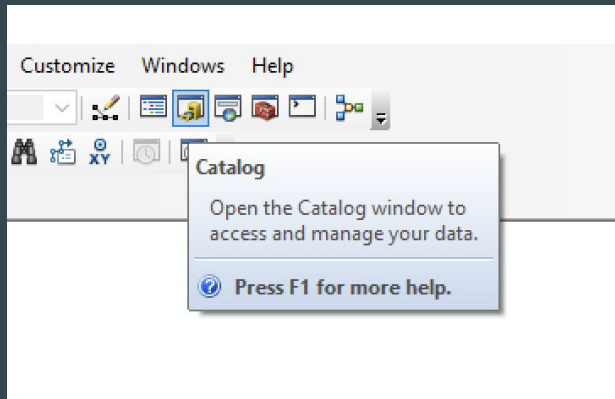


- Create a new folder on the Desktop with the following label: “LastName\_DWJ\_Working”  
example: Caiola\_DWJ\_Working
- Copy the contents of the PWSID folder into this new folder



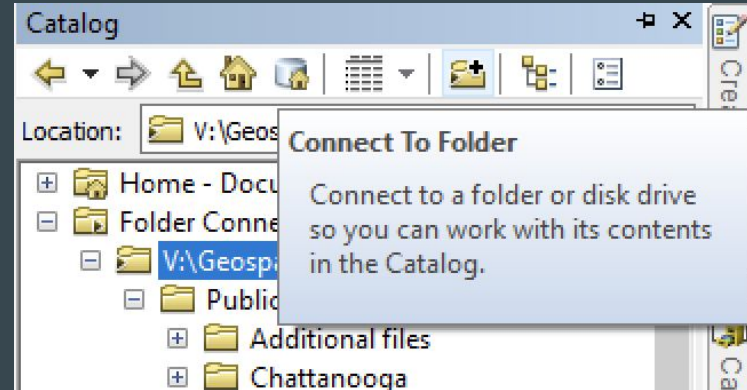
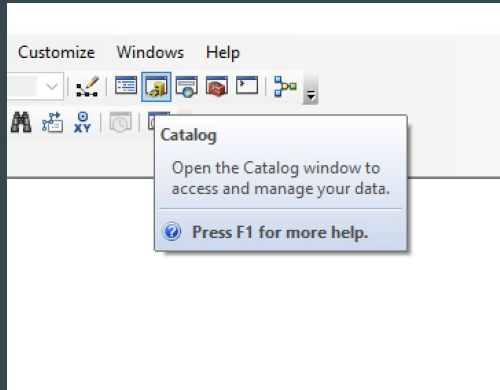
# Creating a Personal Folder Connection

- Now, we are going to open our map and if this your first time georeferencing for the DWJ Lab, go to “Catalog” → “Connect Folder” → locate the newly created “LastName\_working” folder from your Desktop



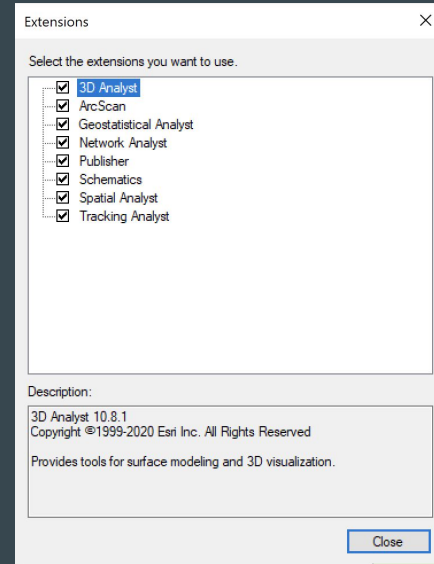
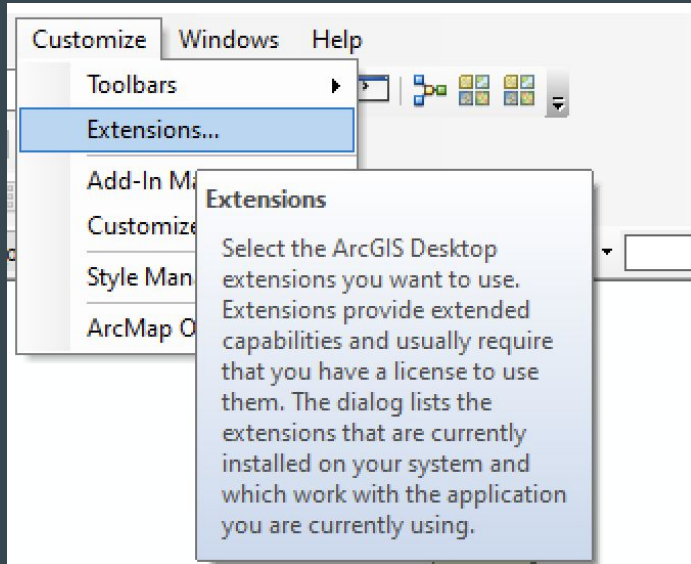
# Creating a Folder Connection to Server

- Go to “Catalog” → “Connect Folder” → follow this pathway:
  - “Geospatial Water Sanitation”/“WaterDatabase\_United\_States”/“Tennessee”/“-QA\_Restructure”/“Public\_water\_systems”
    - **IMPORTANT:** not “Public\_water\_systems\_test” OR “TN\_public\_water\_systems\_shared”



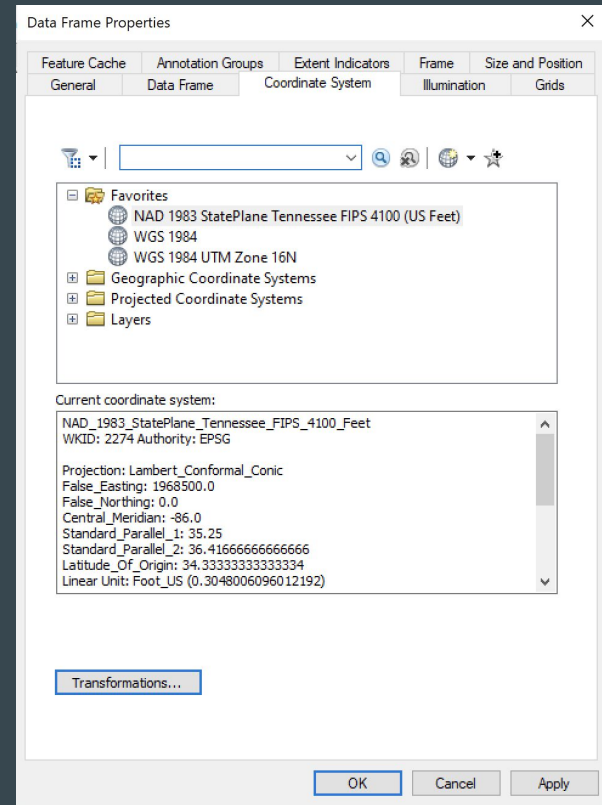
# Ensure Extensions are Selected

- Go to “Customize” → “Extensions” → ensure all extensions (3D Analyst, Geostatistical Analyst, Network Analyst, Publisher, Schematics, Spatial Analyst, & Tracking Analyst) are selected.



# Add Projections to Favorites

- Right-click → select “Data Frame Properties” → a pop-up box will appear → search for the three projections we use as a lab (UTM, StatePlane, WGS):
  - **Search by EPSG Codes:**
    - WGS 1984 - 4326
    - UTM 16N - 32616
    - State Plane - 102736

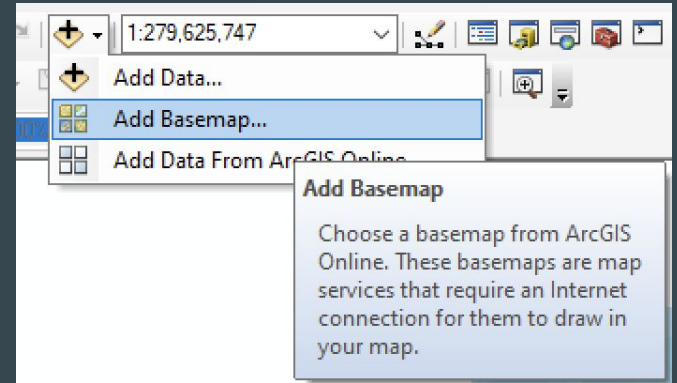


# Georeferencing Coordinate Settings

- When you begin to georeference, keep the map in the WGS 1984 (EPSG 4326) projection, to avoid complications
  - Be prepared to convert the output into both UTM\_Zone\_16N (for lab purposes) and NAD 1983 (for stakeholder purposes) during the digitization stage

# Getting Reading to Georeference Pt. 1

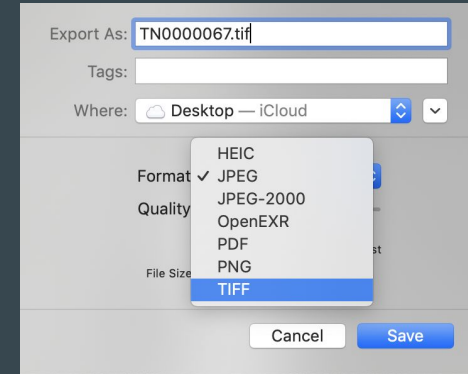
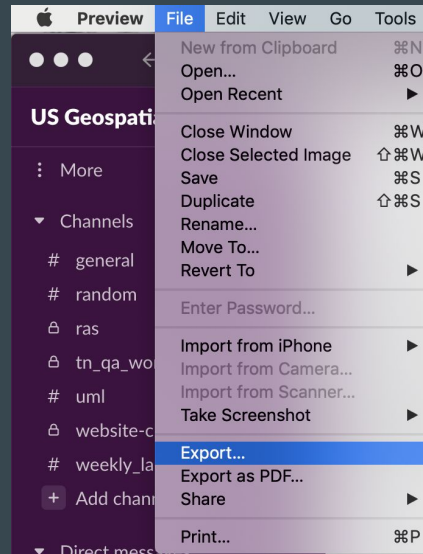
- Use the “Add Data” Icon, which prompts a pop-up box and select “Add Basemap” → select “OpenStreetMaps” (OSM)
  - Utilize for georeferencing WGs and associated characteristics)
- Selecting this basemap, might prompt a “Geographic Coordinate Systems Warning”. To fix the misaligning GCSs click “Transformation”, which will prompt a new window
- Ensure the map is in “WGS\_1984” - EPSG 4326





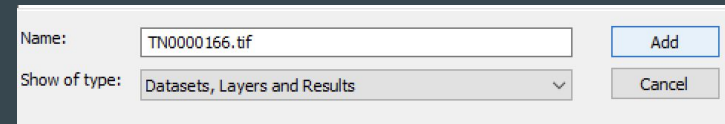
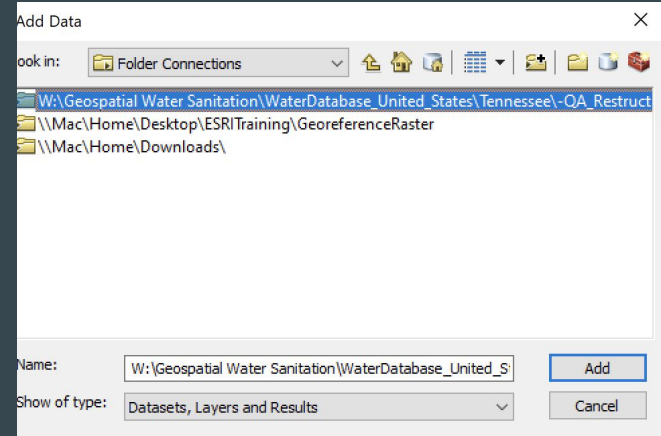
# Getting Reading to Georeference Pt. 2

- Use the “Add Data” Icon from the previous slide, which prompts a pop-up box and select “Add Data”. Locate the DWJ Lab folder connection and open the desired Field Office → PWSID → .tif file
  - If the map is not in a TIFF format, open the file on your computer → navigate the toolbar on your desktop → select “File” → scroll down to “Export...” → select the option “TIFF” option



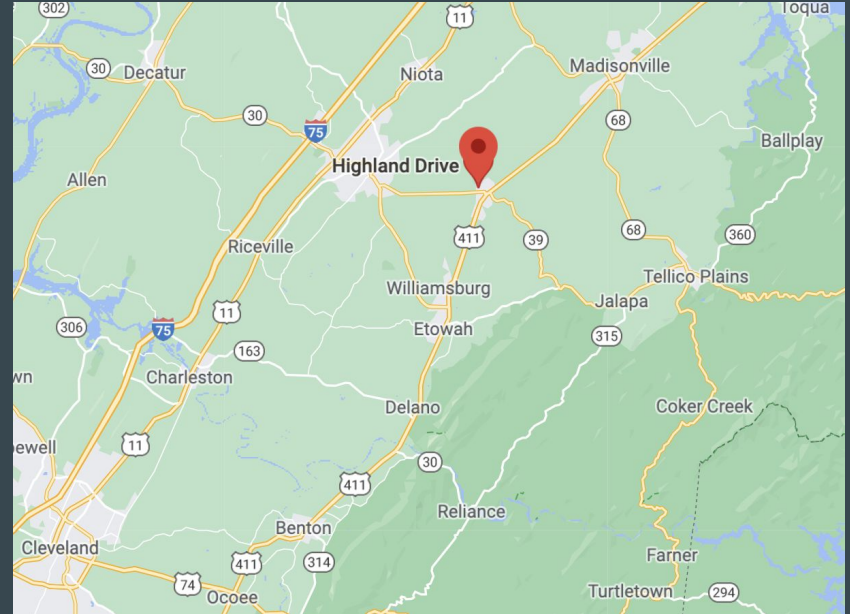
# Getting Reading to Georeference Pt. 3

- Add the .tif map, which will prompt a window that asks if you wish to build pyramids, select “No”
- This might prompt a “Geographic Coordinate Systems Warning”. If so, fix the misaligning GCSs by clicking “Transformation”, which will prompt a new window (follow the same steps from the previous slide)



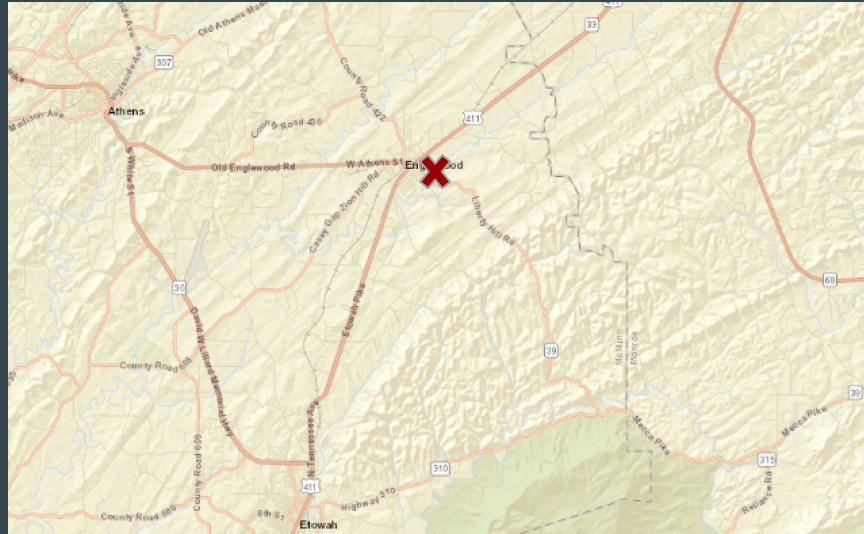
# Locating this Map Spatially Pt. 1

- Locate a main road or feature on this .tif map and determine the town this CWS is located in
- Go to Google Maps & enter this information to locate this CWS
- Once you have located it, zoom out from this CWS on Google Maps and locate where it is in relation to other large cities/towns in TN (this will help you locate the CWS in ArcMap)



## Locating this Map Spatially Pt. 2

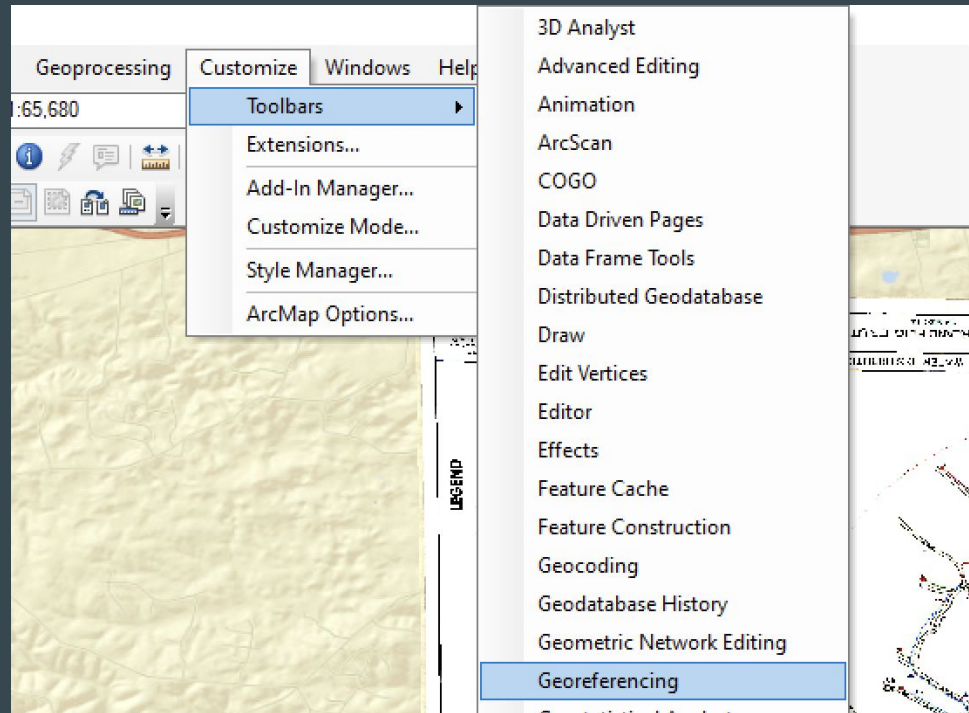
- Open your basemap and zoom in on Tennessee and begin to locate the CWS (continue to reference Google Maps for assistance)



- Continue to zoom into the map on ArcMap, until you can find the CWS

# Prepping to Georeference Pt. 1

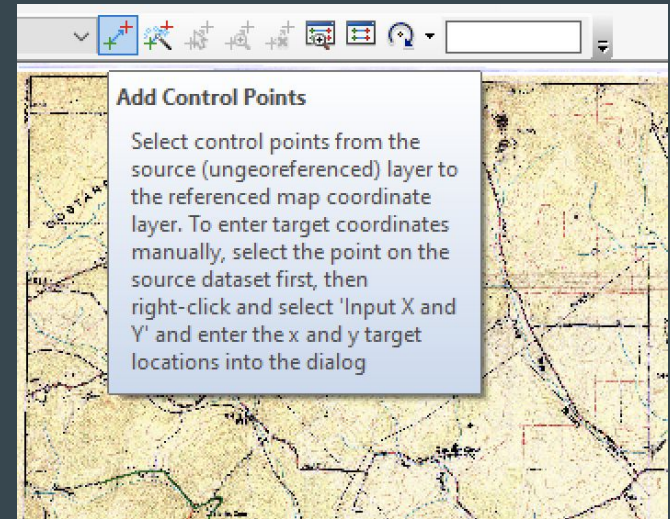
- To begin to georeference, go to “Customize” → “Toolbars” → select “Georeferencing”



The content of this slide deck supports a manuscript in process, therefore, do not circulate further. This slide deck is not to be used for publication or any other research purposes. This research should be cited by as Caiola, Wyman, Crone, Robbins, and McDonald on behalf of the Vanderbilt University Drinking Water Justice Lab (2023).

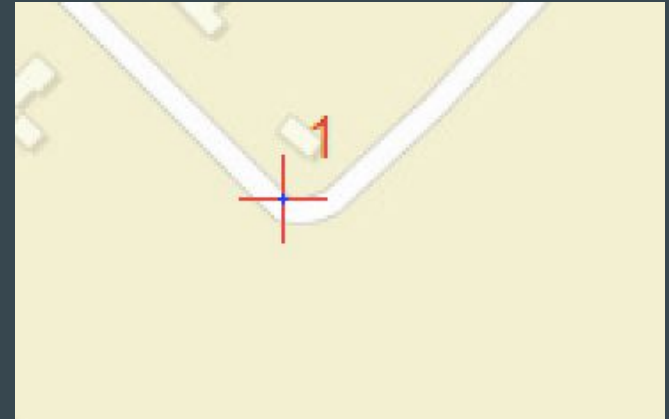
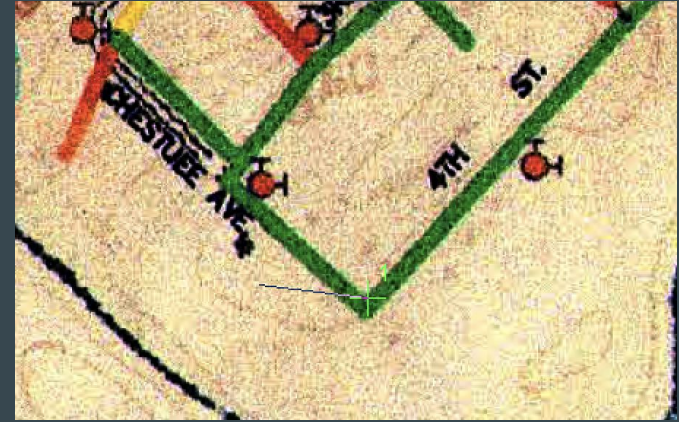
# Prepping to Georeference Pt. 2

- Once the “Georeferencing” bar has appeared, ensure your .tif map is selected and click on the drop-down arrow to select “Fit to Display”
- Now, we are going to start adding “Control Points”, which will help us geospatially place our map
  - Click on the “Add Control Points” Icon and Zoom in on your .tif map



# Georeferencing Pt. 1

- Locate a distinctive feature (an intersection of two roads, etc.) on the .tif map and place a “Control Point” here by clicking
- Once you have clicked on this point, an attached string will appear from the point you just selected → drag this string and click whenever you find the corresponding point on the basemap (you can see the basemap by un-selecting the .tif map in the Table of Contents)
  - Look at pictures for reference



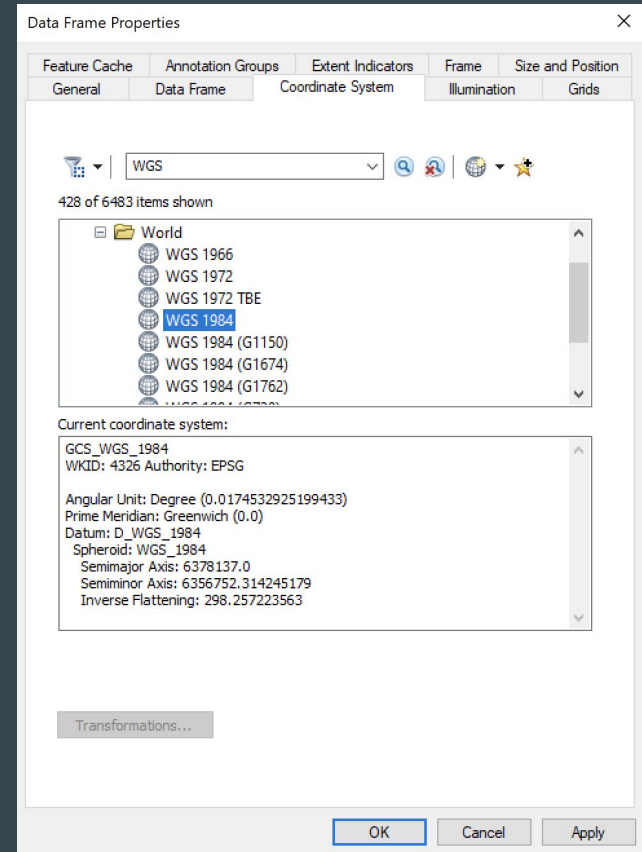
# Georeferencing Pt. 2

- Continue adding “Control Points” around the map
  - Make sure these points are equally distributed around the map
  - Select a minimum of 8 “Control Points” (some maps may need more depending on the complexity)
- Each time you add a “Control Point”, the .tif map moves closer to its actual geospatial location
- **IMPORTANT STEP:** On the georeferencing bar, go to the “View Link Table” and scroll to the very right and check the “Residual” Column
  - Make sure the residuals are extremely close to 0 (this means your “Control Points” are geospatially close to the actual set X & Y coordinates)
  - The residuals should get closer to 0, the more control points you add



# Double-Checking the GCS

- After you are satisfied with your “Control Points” and Residual Value (less than 0.5), right-click on “Layers”, which will prompt a pop-up box, and scroll down & select “Properties”
- This will prompt a pop-up window (“Data Frame Properties”), and go to the “Coordinate System” Tab.
  - Ensure the projection is: WGS\_1984 - EPSG 4326
- No need to set GCS for stakeholder and lab use until after digitization is complete



# Finishing & Saving Your Work

- If you are satisfied with your georeferencing (residuals are close to 0, if not 0), then go to the “Georeferencing” toolbar
- From the Georeferencing box, click the drop-down arrow and select “Rectify”
  - Save the newly georeferenced .tif map (ensure the “Output” is the RawData folder of the PWSID you just georeferenced)
  - Use this nomenclature: TNXXXXXXXXX.modified.tif

