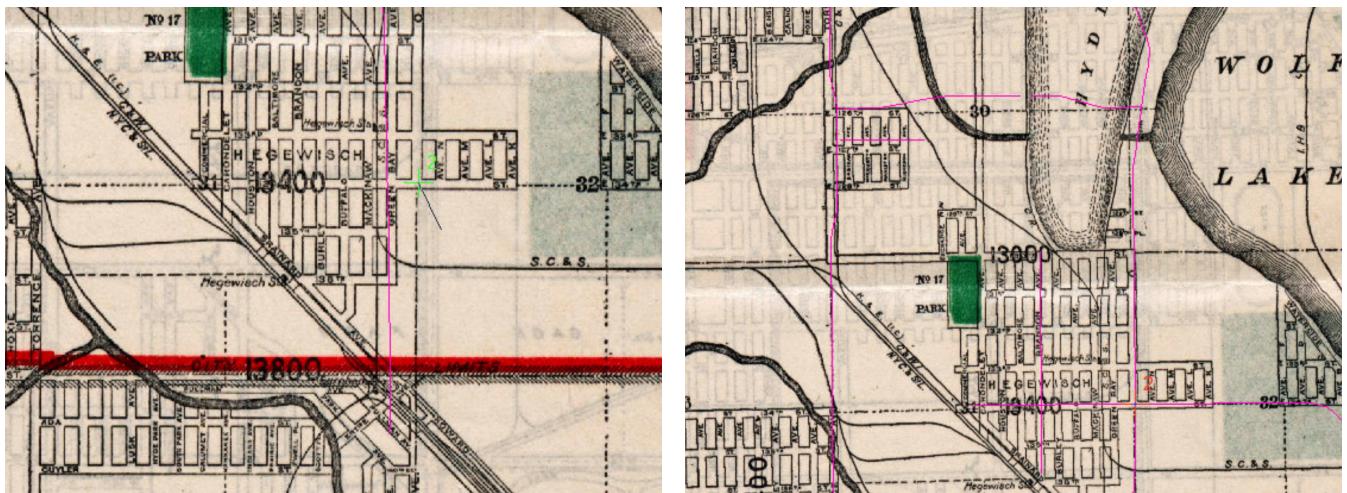


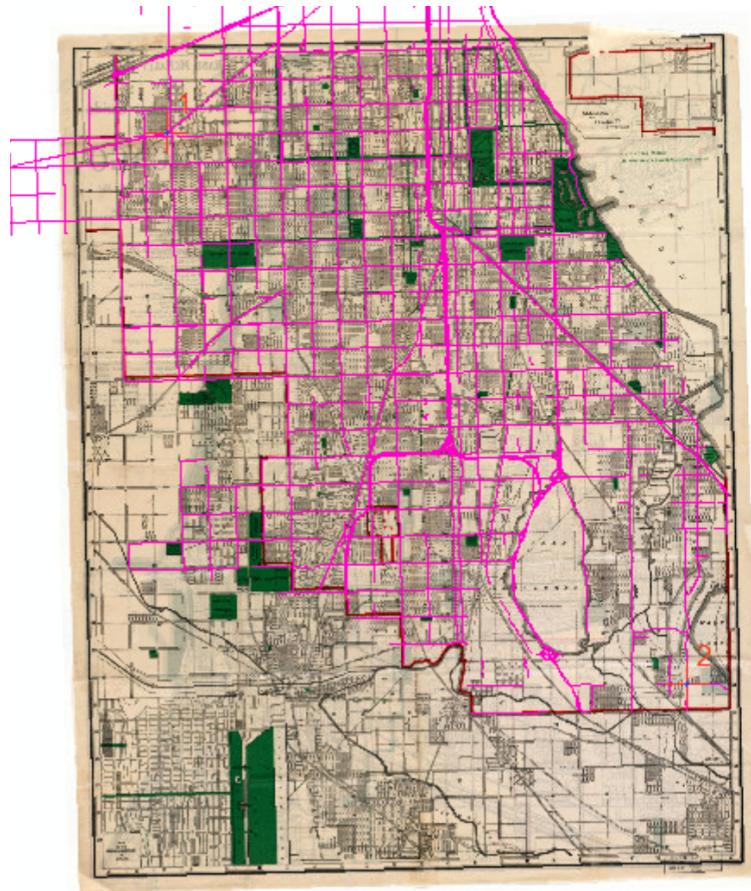
Next you will add the second Control Point. It is best if you do this on the opposite corner of the map from your first control point. In this example, I used the intersection of 134th street and Avenue O.

- Locate the intersection of 134th street and Avenue O on both the Chicago map and the Major_Streets dataset. Use the Identify tool to help find the streets.
- With the Control Points button selected, click on the reference point (the intersection of 134th street and Avenue O) **on the Chicago Map**. You will see a green cross with a number 2 at that point.
- Next click on the intersection of 134th street and Avenue O **on the Major_Streets dataset**. The map will shift again so that the two points are approximately in the same place and the streets in the area should line up.



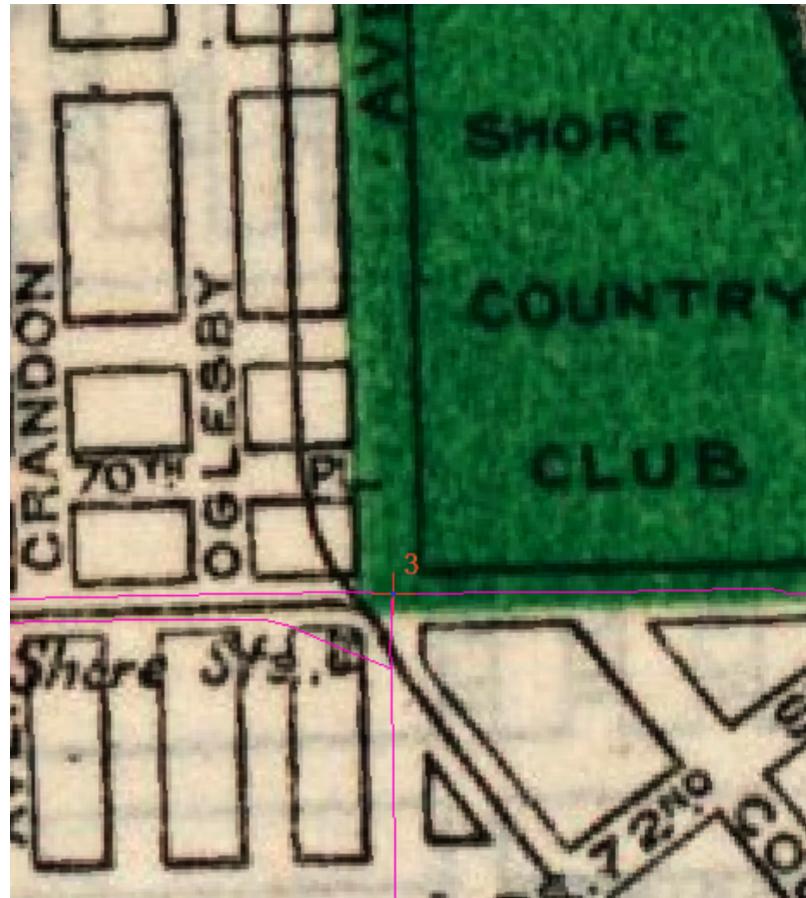
Checking the Full Map

After you have added two Control Points in opposite corners of the Chicago map, zoom to the full map (right click on the map and select Zoom to Layer) and see how well it is currently lined up with the Major_Streets dataset. It should match pretty well at this point.



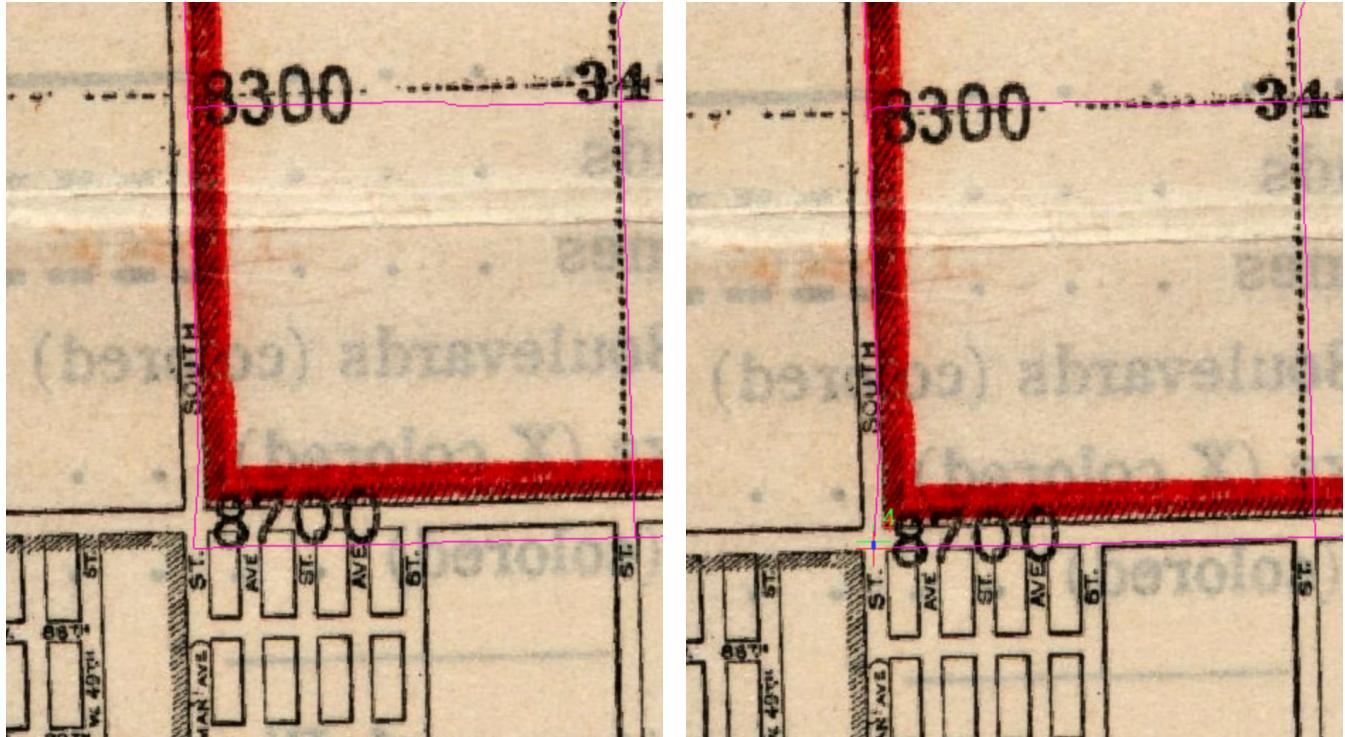
Adding the Third Control Point

Now it is good to add a third Control Point in another corner of the Chicago map. For this example, I choose the intersection of 71st and Yates. The Major_Streets road and the Chicago map were well lined up at this location, so I simply clicked twice to add a Control Point in the same spot in both. Even if the map lines up well already in this corner it is good to add a Control Point as ArcMap will continue making adjustments to the map as you add more Control Points .



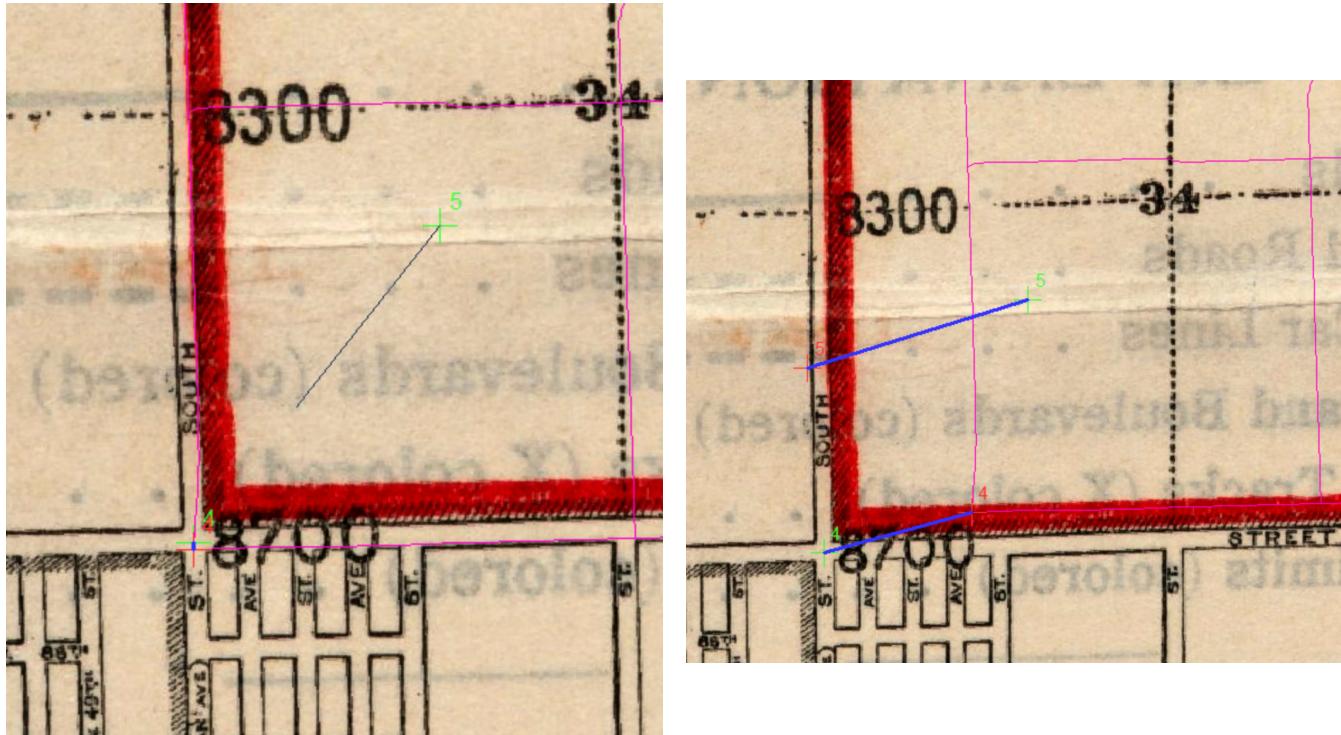
Adding the Fourth Control Point

Finally I added a fourth Control Point near the last corner of the map. As the map and Major_Streets were slightly off here I first clicked on the intersection of Cicero and 87th on the Chicago map then on the Major_Streets intersection.

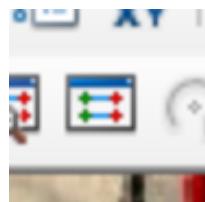


Fixing a Bad Control Point

Finally, what happens if you add a bad Control Point ? In this example I added a bad fifth control point where I clicked in the center of the block and matched it with a section of Cicero Avenue. This shifted the Chicago map again, and now you can see large blue lines between my two fourth Control Points , which had been in the correct location, and my two bad fifth Control Points . Large blue lines between Control Points is a sign that the map and the data layer is not well aligned.



To fix this I first opened the Link table by pressing the Link table button in the Georeferencing toolbar.



There are very large numbers in the Residual column in the Link table, which is a bad sign. The values for the bad fifth Control Point are the largest.

Link	X Source	Y Source	X Map	Y Map	Residual_x	Residual_y	Residual
1	1044.51592662	-998.33032734	1150090.8300...	1870820.3900...	604.51660089	241.08725156	650.81747334
2	5707.50104548	-6165.87065211	1201091.9341...	1816722.6275...	260.98629050	109.43483188	283.00145981
3	5077.41626342	-2252.26711550	1193450.9107...	1858369.5504...	-301.71064314	-131.27937953	329.03432598
4	604.03311927	-3259.66873724	1145903.1906...	1846407.7813...	1147.02766801	313.72300210	1189.15709359
5	749.31259865	-3081.62898114	1144630.2273...	1847527.6233...	-1710.81991...	-532.96570600	1791.91440354

Auto Adjust Transformation: 1st Order Polynomial (Affine) Degrees Minutes Seconds Forward Residual Unit : Unknown

To fix this I simply clicked on the row for the fifth Control Point and selected the Delete Control Point button at the top of the toolbar in the Link dialog box. Afterwards you can see that the values in the Residual columns are much smaller. It will be impossible for each of the values to be zero as some error in this process is expected.

Delete Link
Delete the selected link.

Link	Source	X Map	Y Map	Residual_x	Residual_y	Residual
1	32734	1150090.8300...	1870820.3900...	604.51660089	241.08725156	650.81747334
2	5707.50104548	-6165.87065211	1201091.9341...	1816722.6275...	260.98629050	109.43483188
3	5077.41626342	-2252.26711550	1193450.9107...	1858369.5504...	-301.71064314	-131.27937953
4	604.03311927	-3259.66873724	1145903.1906...	1846407.7813...	1147.02766801	313.72300210
5	749.31259865	-3081.62898114	1144630.2273...	1847527.6233...	-1710.81991...	-532.96570600

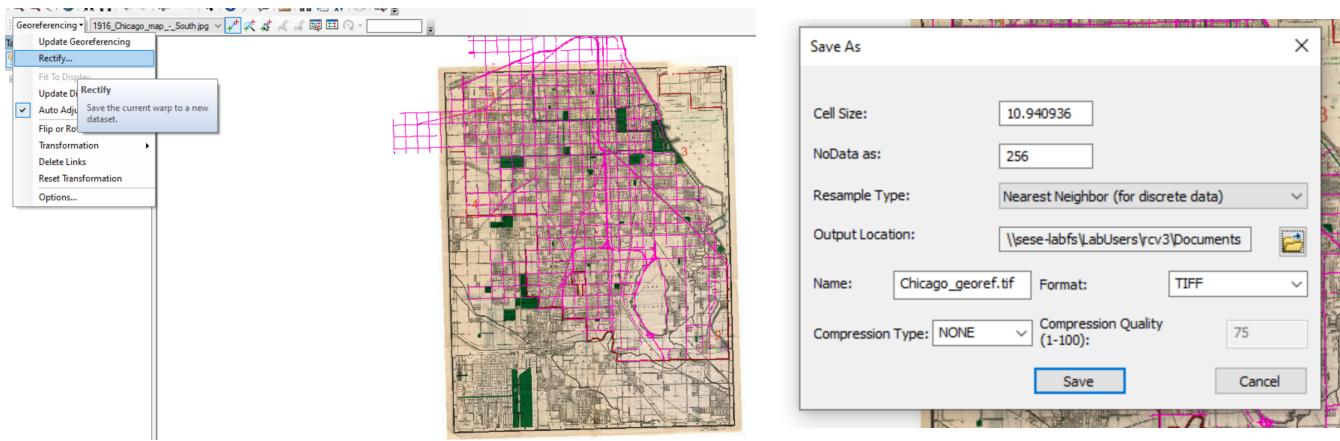
Auto Adjust Transformation: 1st Order Polynomial (Affine) Degrees Minutes Seconds Forward Residual Unit : Unknown

Link	X Source	Y Source	X Map	Y Map	Residual_x	Residual_y	Residual
1	1044.51592662	-998.33032734	1150090.8300...	1870820.3900...	3.61984245	53.89199971	54.01343252
2	5707.50104548	-6165.87065211	1201091.9341...	1816722.6275...	1.92987734	28.73189943	28.79663993
3	5077.41626342	-2252.26711550	1193450.9107...	1858369.5504...	-2.55814115	-38.08545368	38.17127019
4	604.03311927	-3259.66873724	1145903.1906...	1846407.7813...	-2.99157865	-44.53844546	44.63880226

Auto Adjust Transformation: 1st Order Polynomial (Affine) Degrees Minutes Seconds Forward Residual Unit : Unknown

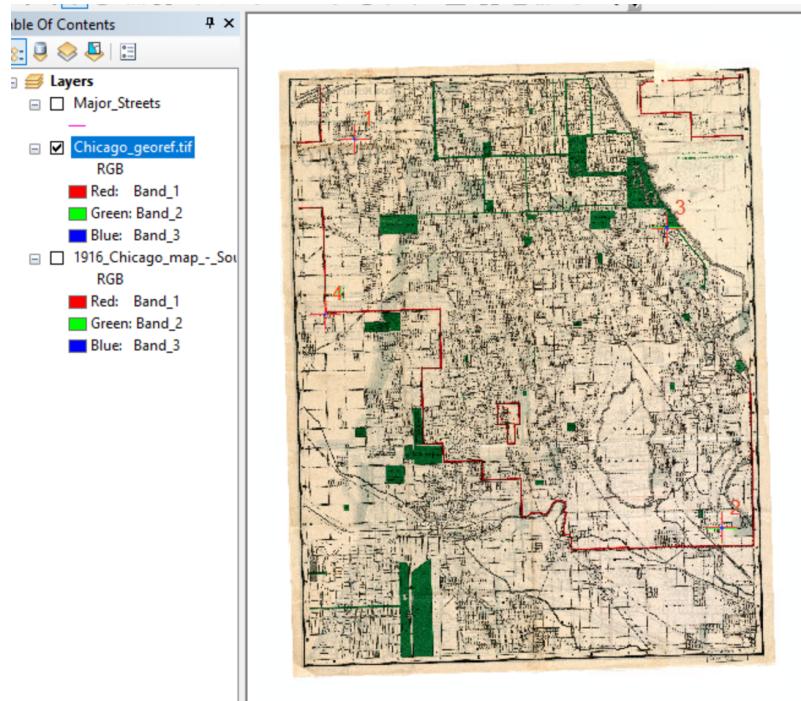
Completing the Georeferencing Process: Rectifying

Once you are satisfied with the control points, you will need to complete the georeferencing process and save the final image. In the Georeferencing toolbar select Rectify.... This will open the Save As dialogue box as you will be saving a copy of the image that includes spatial information. A common format is a GeoTIFF file, which is a TIFF image file that includes spatial information (it will just appear as TIFF in this box). Click on the folder icon to change the output location to the folder that you want to save the image in. You can also change the name of the final image if you would like.

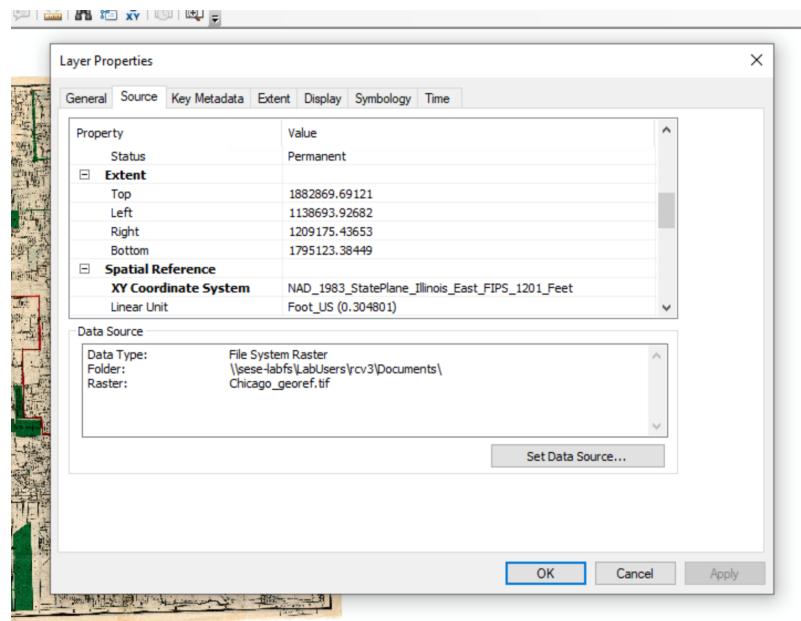


Loading the Rectified Image

Now you can open the final rectified image in ArcMap using the **Add Data** button. It will show up in the **Table of Contents** and will be displayed on the screen.



Right click on the final image in the **Table of Contents** pane and select **Properties...** and click on the **Source** tab. You can now see that the image has spatial reference information which is the same as the **Major_Streets** dataset.



Large Image Size

The rectified image will be larger than the starting image. It could easily be too big to transfer in and out of a remote desktop. If this is the case, using a cloud based data storage system, such as Illinois Box, could be helpful in transferring the file.