



GEOG 473 Final Project

FINDING LOCATIONS FOR NEW BIKE PATHS IN MANKATO, MN

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Purpose

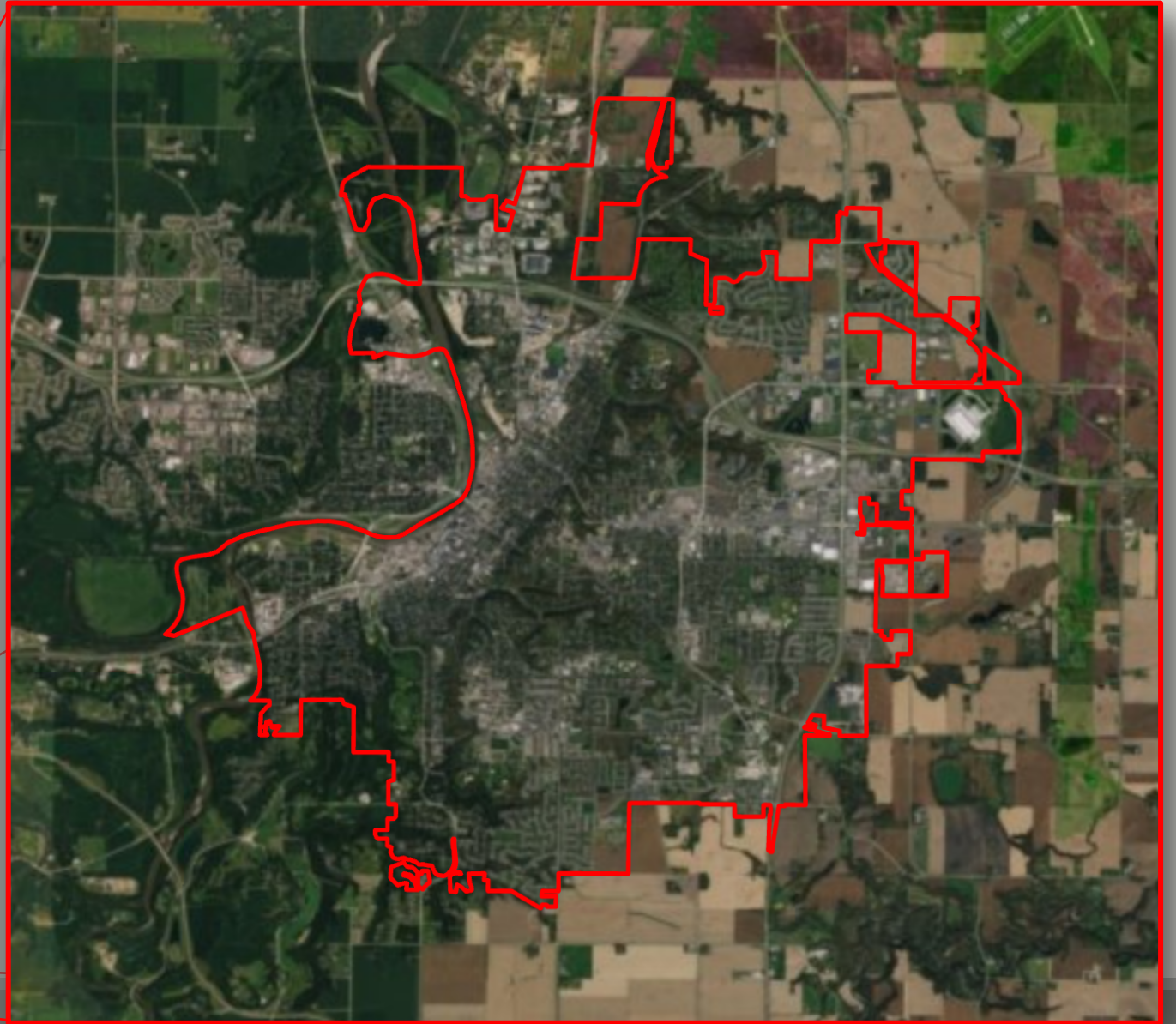
As populations grow, and cities expand, planning and types of transportation are not always considered. Vehicles are the main source of transportation, with biking and public transport not nearly as used in many locations.

With an increased amount of bike paths, and connections to centers of population and industry, it is hoped to increase usage of bike paths as a major form of transportation.

With this being said; the goal is to **propose bike routes around Mankato that would connect the centers of residential, commercial and public areas.**



Study Area



Methodology

The main tools and methods used for this project are listed below

- Use of LiDAR data for extraction of buildings
- Density Analysis done of types of buildings to find centers of individual neighborhoods
- Network Analysis to connect centers of neighborhoods with each other
- Model Builder to automate workflow (Density Analysis, Classification, etc.)
- 3D Modeling of city buildings for fly through and preview of current or proposed routes

Data

- Land Use Map, and Bike Trails (Mankato GIS Department)
- Neighborhoods KML Layer (City of Mankato Maps)
- Cities/Townships and TIGER Road Centerlines (Census Bureau)
- LiDAR Data (MnTOPO)



Use of LiDAR

LiDAR was used for two main purposes:

- Extraction of Building Footprints
- 3D Modeling with Elevation Data



Use of Models

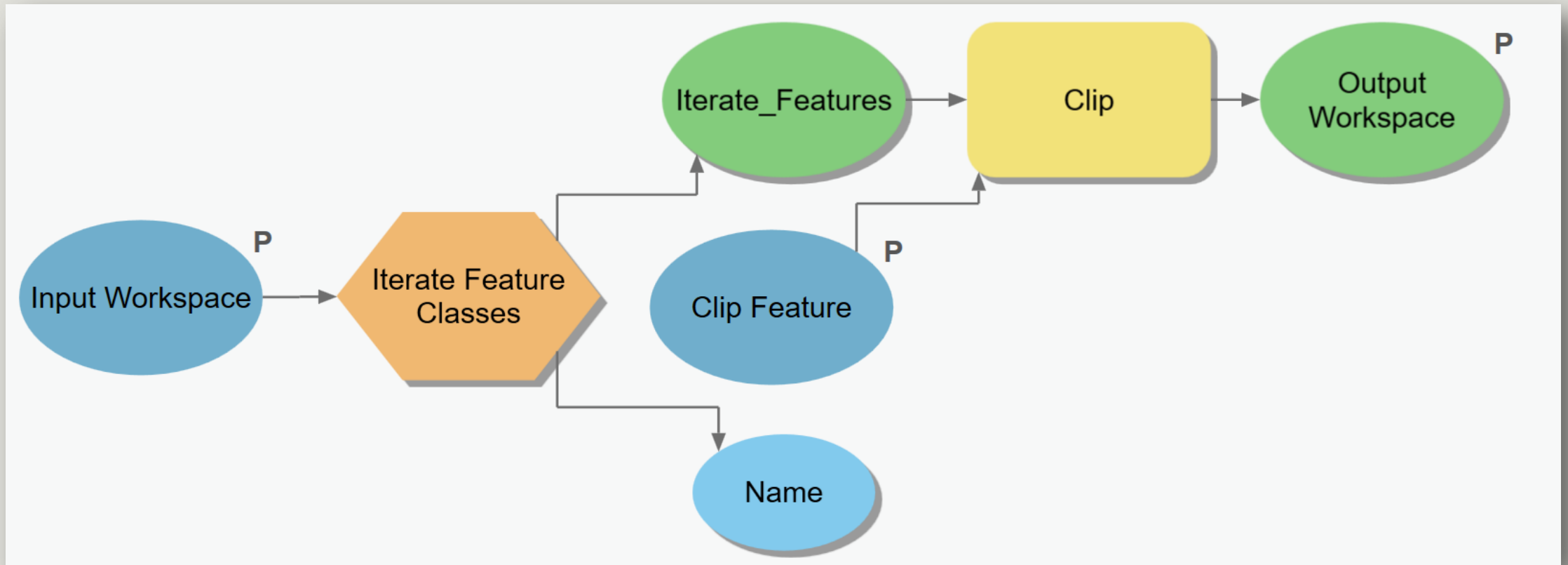
Three models were used to simplify the process, and automatic functions that would otherwise have to be done over and over; complicating and extending the project.

The use of the models include:

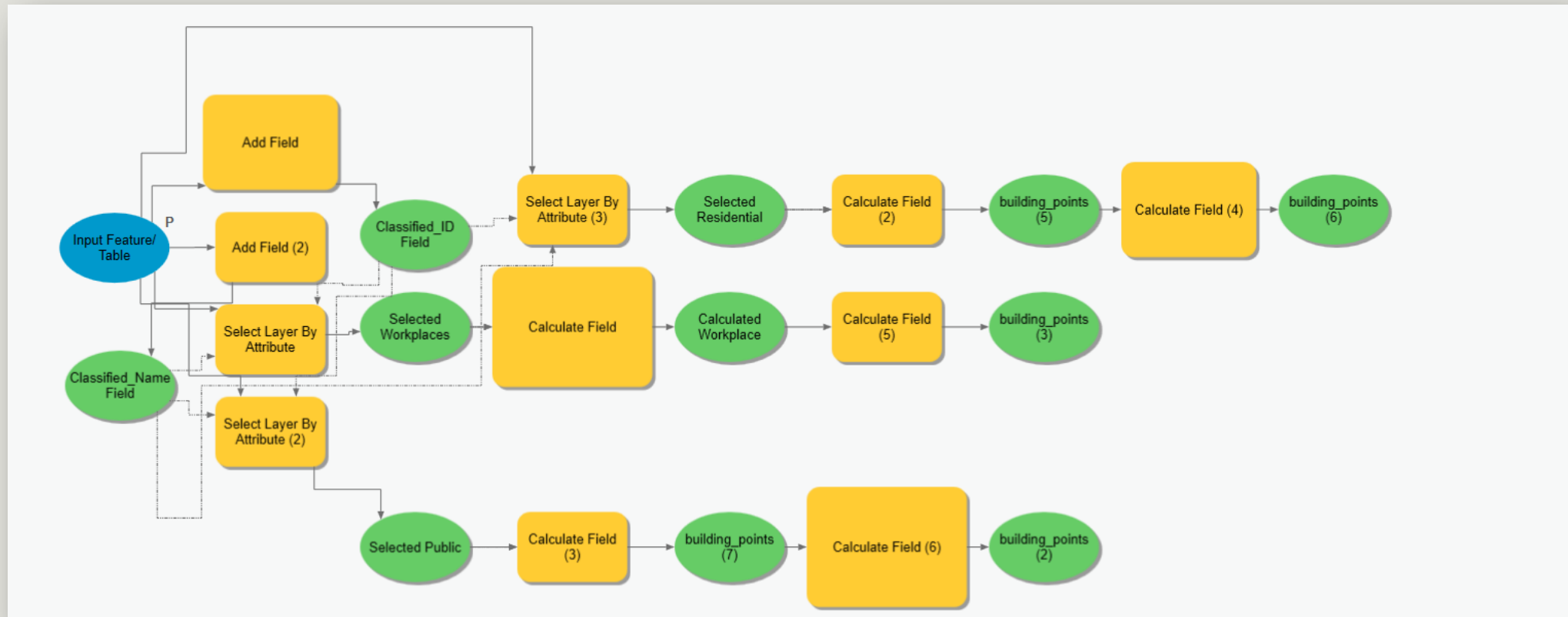
- Clipping to Study Area
- Density Analysis
- Automated Classification (ArcGIS doesn't have this tool)



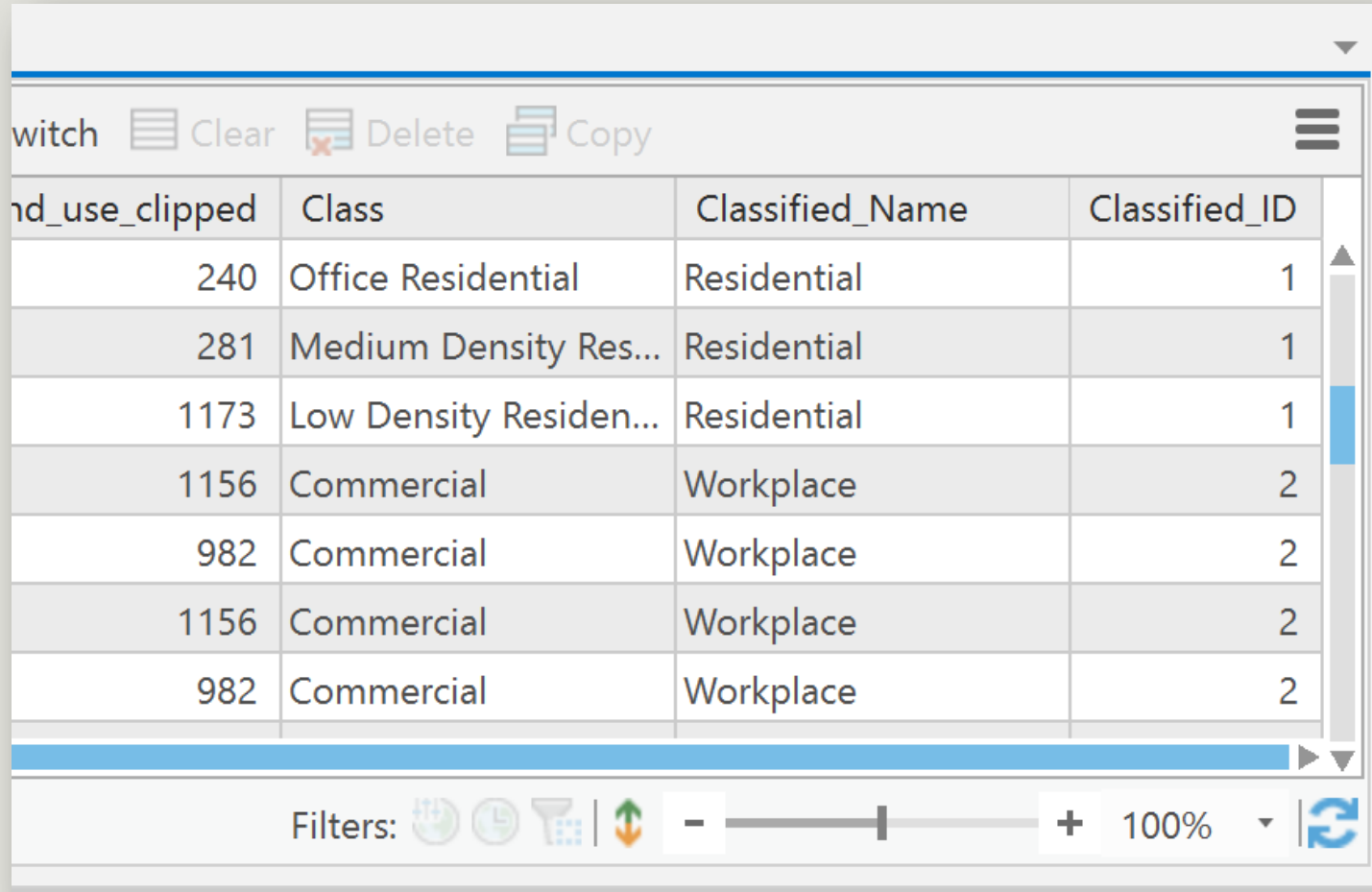
Clipping Model



Classification Model



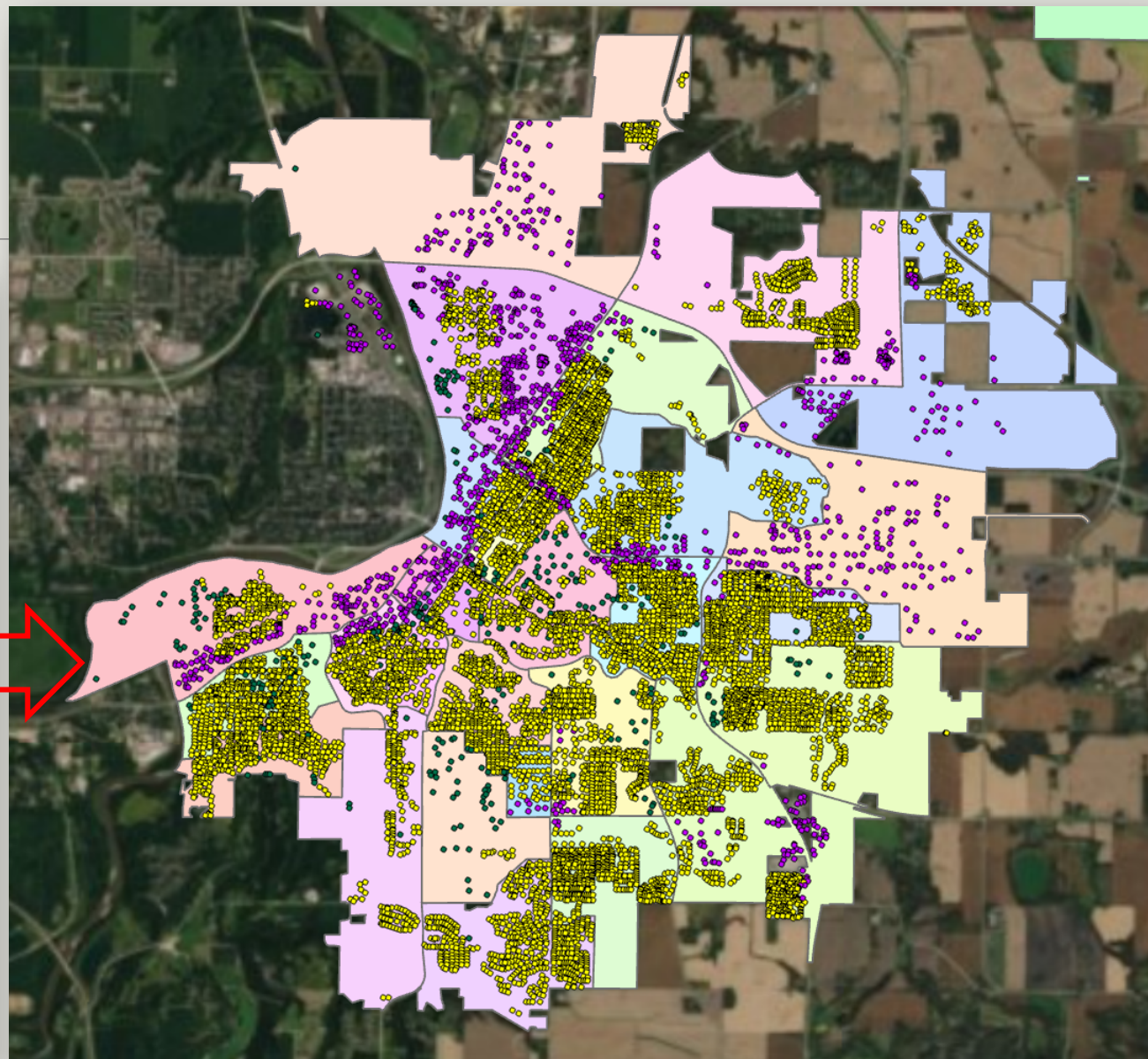
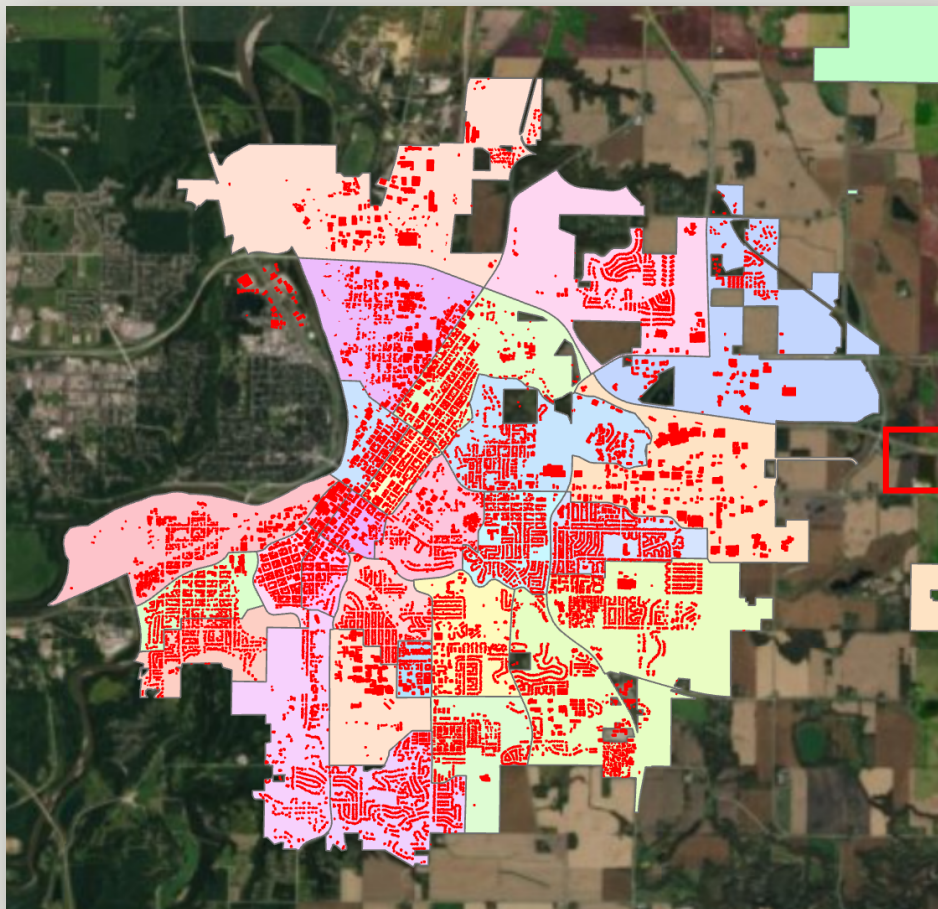
Classified Table



The image shows a screenshot of a data table interface. At the top, there is a toolbar with icons for 'Switch', 'Clear', 'Delete', and 'Copy'. Below the toolbar is a table with four columns: 'nd_use_clipped', 'Class', 'Classified_Name', and 'Classified_ID'. The table contains eight rows of data. Below the table is a filter bar with icons for filters, a zoom slider set to 100%, and a refresh icon.

nd_use_clipped	Class	Classified_Name	Classified_ID
240	Office Residential	Residential	1
281	Medium Density Res...	Residential	1
1173	Low Density Residen...	Residential	1
1156	Commercial	Workplace	2
982	Commercial	Workplace	2
1156	Commercial	Workplace	2
982	Commercial	Workplace	2

Density Analysis

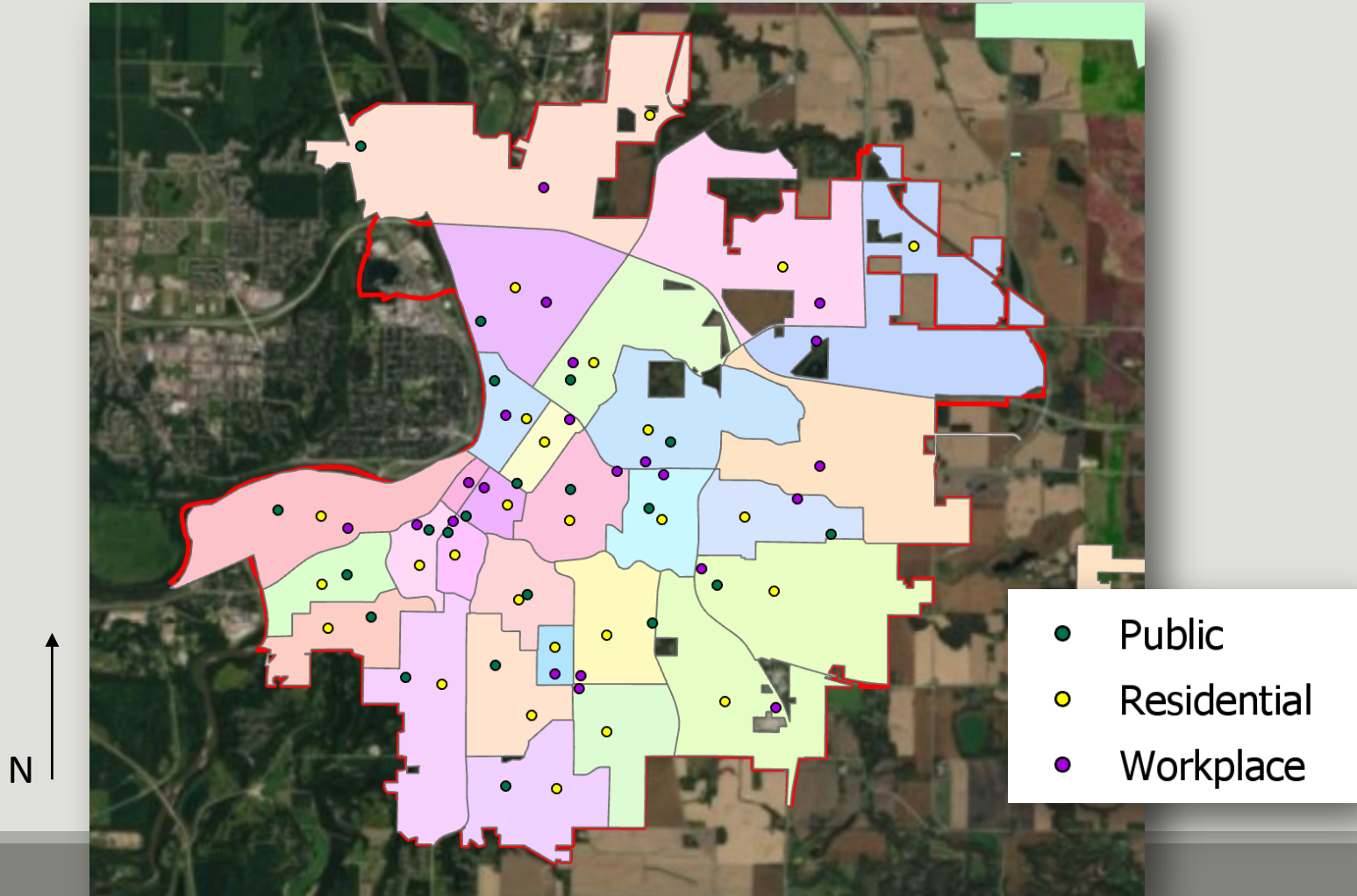


POLYGON TO POINTS

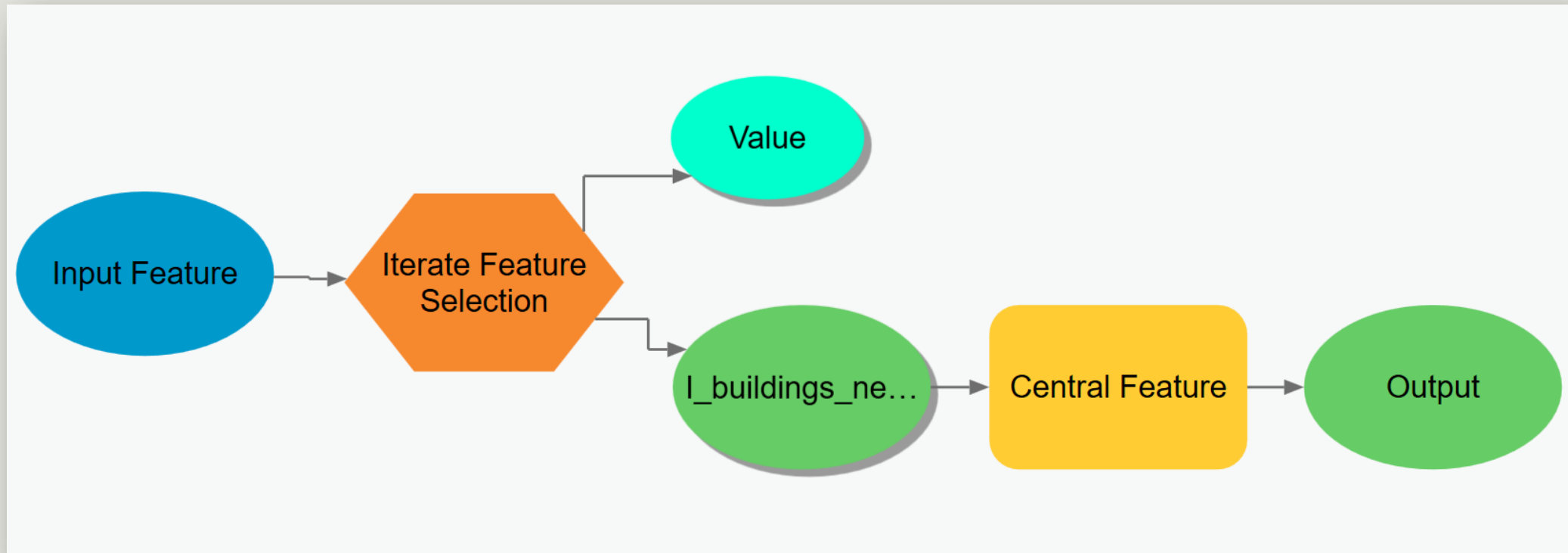
Density Analysis (Central Feature)

With the use of the extracted buildings, as well as a Land Use map of Mankato, 3 density analysis's were done of each neighborhood.

Model was used to automate Density Analysis of each Neighborhood. Case Field was used for density done of each category (Residential, Public, and Commercial).

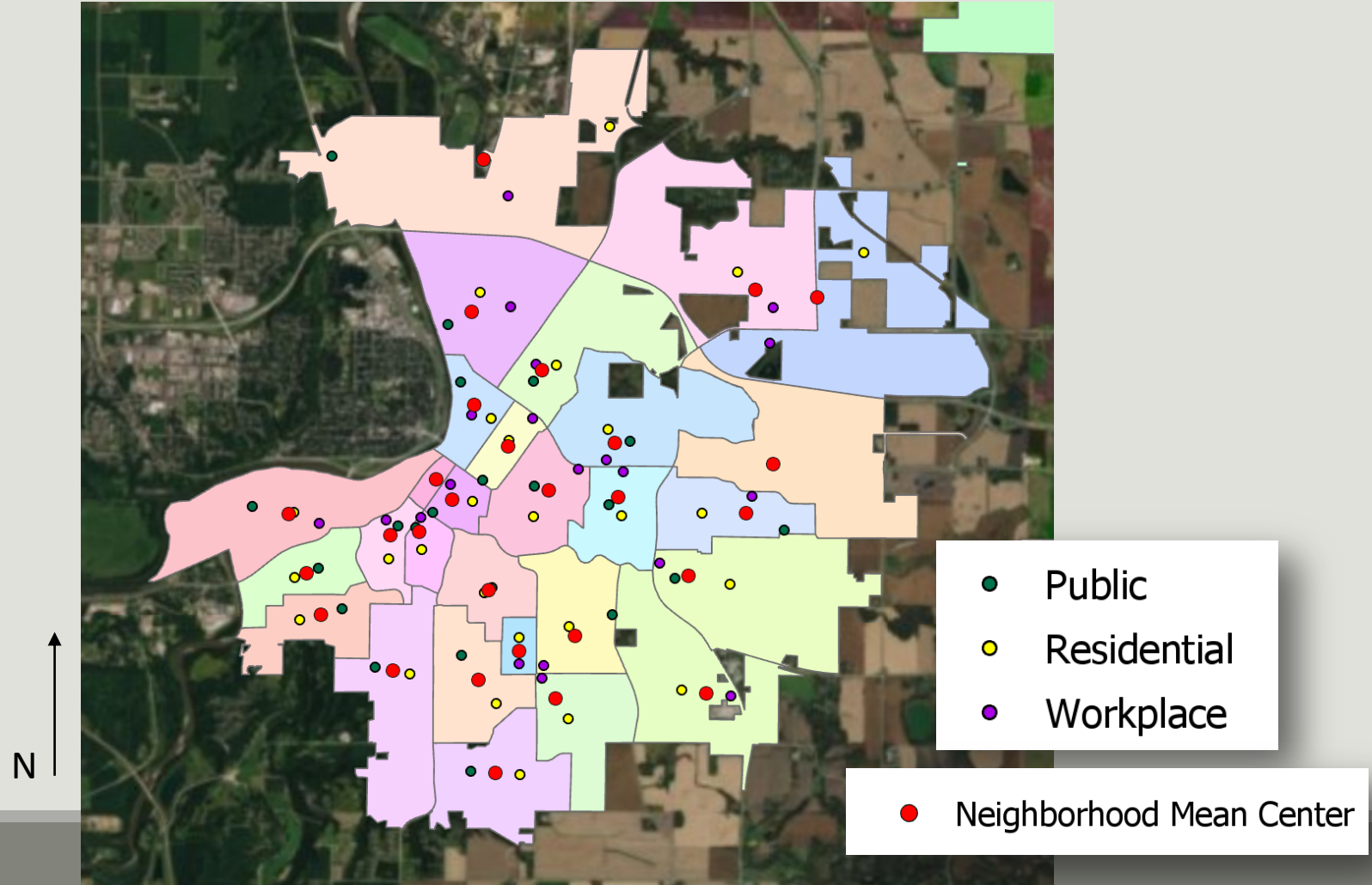


Density Analysis Model (CF)

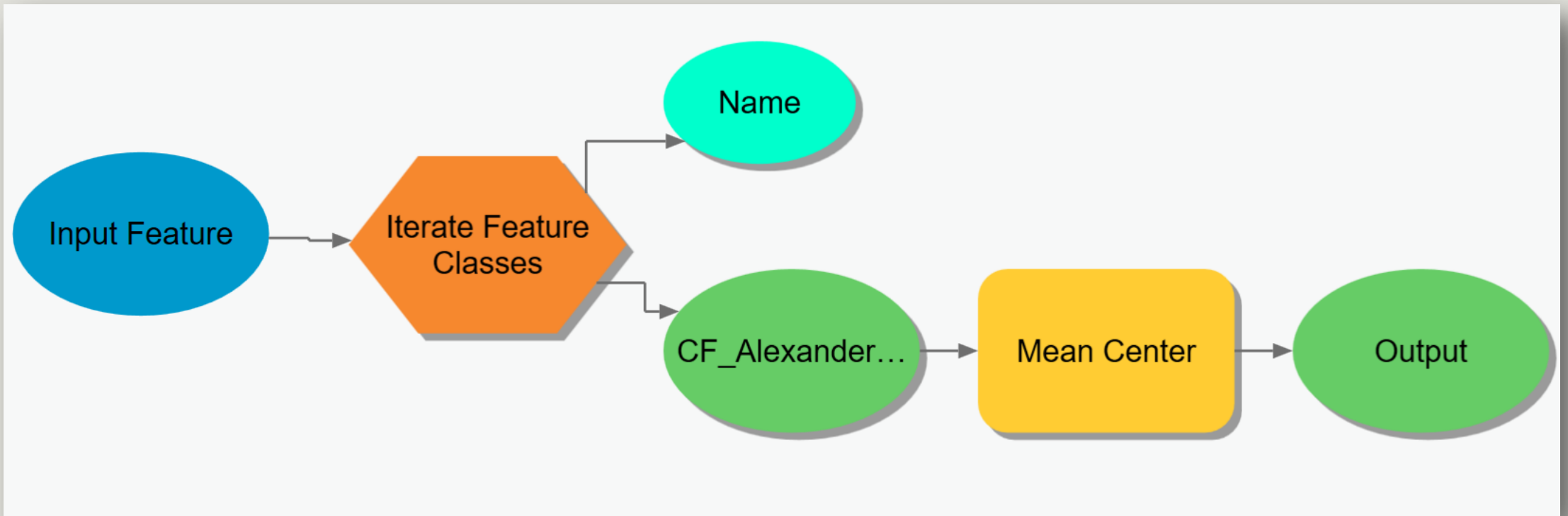


Density Analysis (Mean Center)

The Mean Center was found from the 3 (or less) Central Features of each Neighborhood. These act as the center of the neighbor, and the linkages of neighborhoods to the bike networks.



Density Analysis Model (MC)

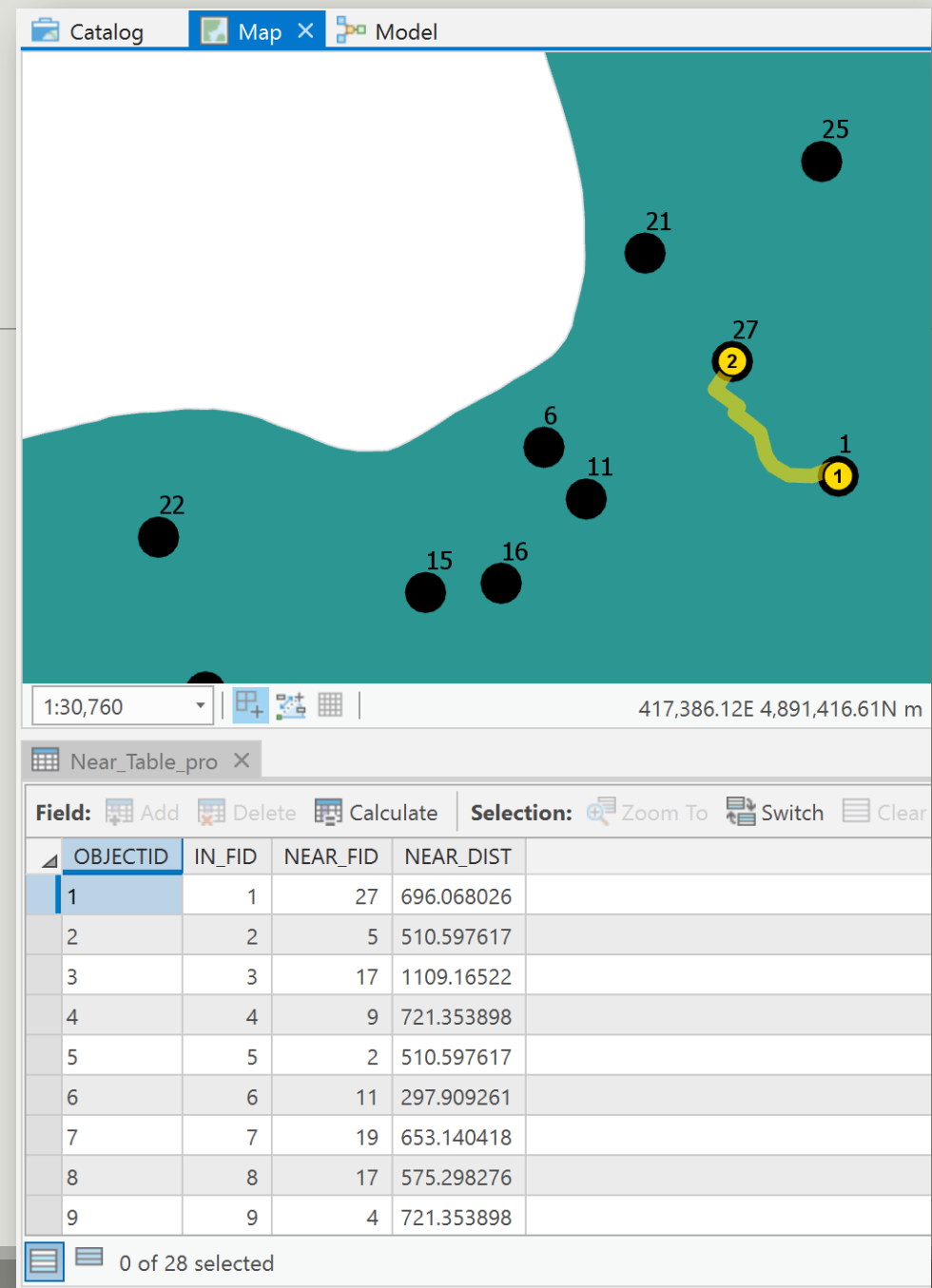


Network Analysis

Find Route tool was used to make connections between density points.

Originally meant to use OD Cost Matrix, but has issues with origin and destination not being one to one; making it unable to be used in this function.

Used **Generate Near Table** along with Find Route to connect and export all points.



The screenshot displays the ArcGIS interface with three tabs: Catalog, Map, and Model. The Map view shows a teal-colored area with several black circular points labeled with numbers: 1, 2, 6, 11, 15, 16, 21, 22, 25, and 27. A yellow line connects point 1 to point 2, and another yellow line connects point 2 to point 27. The interface includes a scale of 1:30,760 and coordinates 417,386.12E 4,891,416.61N m. Below the map is a table titled 'Near_Table_pro' with the following data:

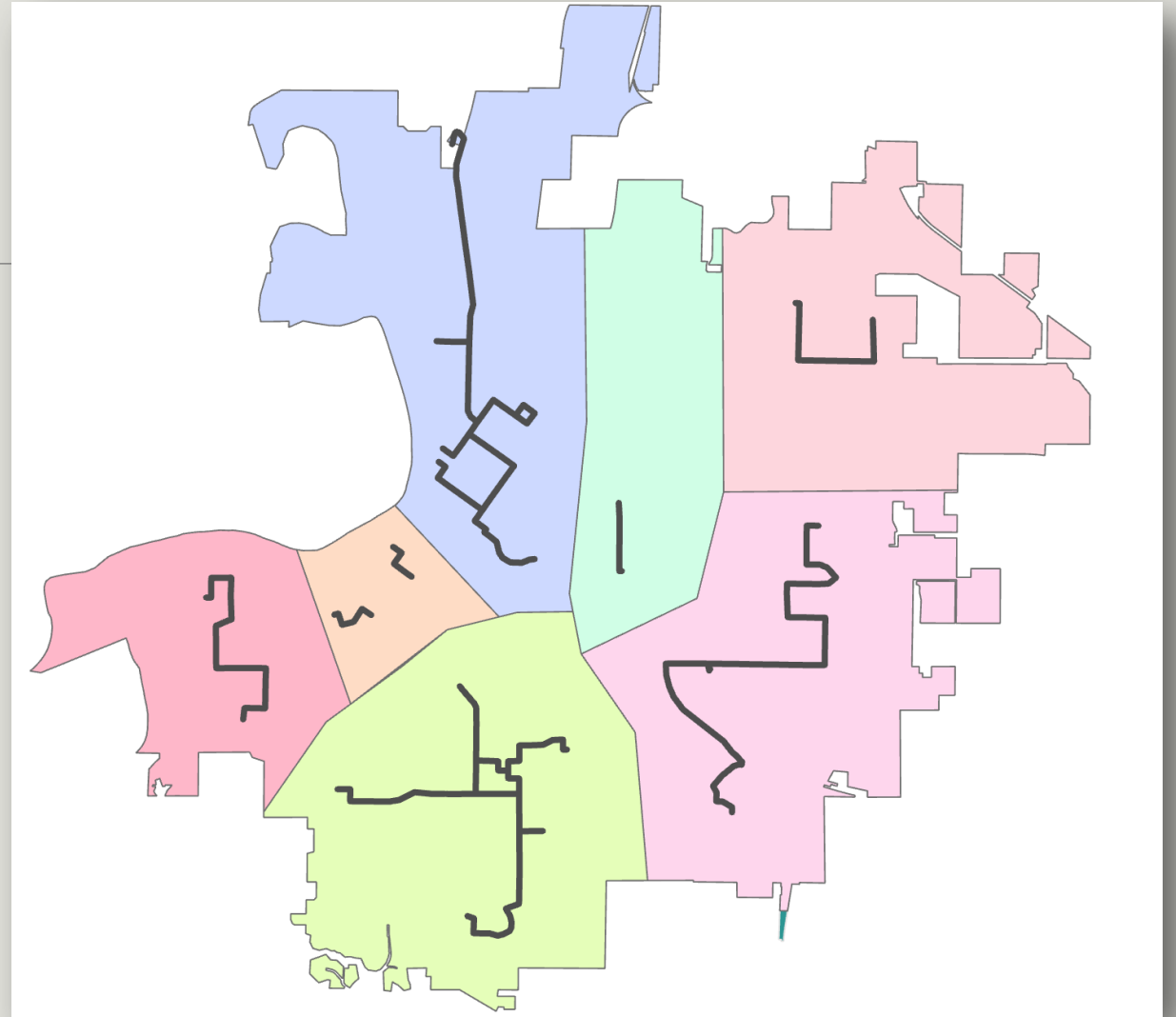
OBJECTID	IN_FID	NEAR_FID	NEAR_DIST
1	1	27	696.068026
2	2	5	510.597617
3	3	17	1109.16522
4	4	9	721.353898
5	5	2	510.597617
6	6	11	297.909261
7	7	19	653.140418
8	8	17	575.298276
9	9	4	721.353898

At the bottom of the interface, it indicates '0 of 28 selected'.

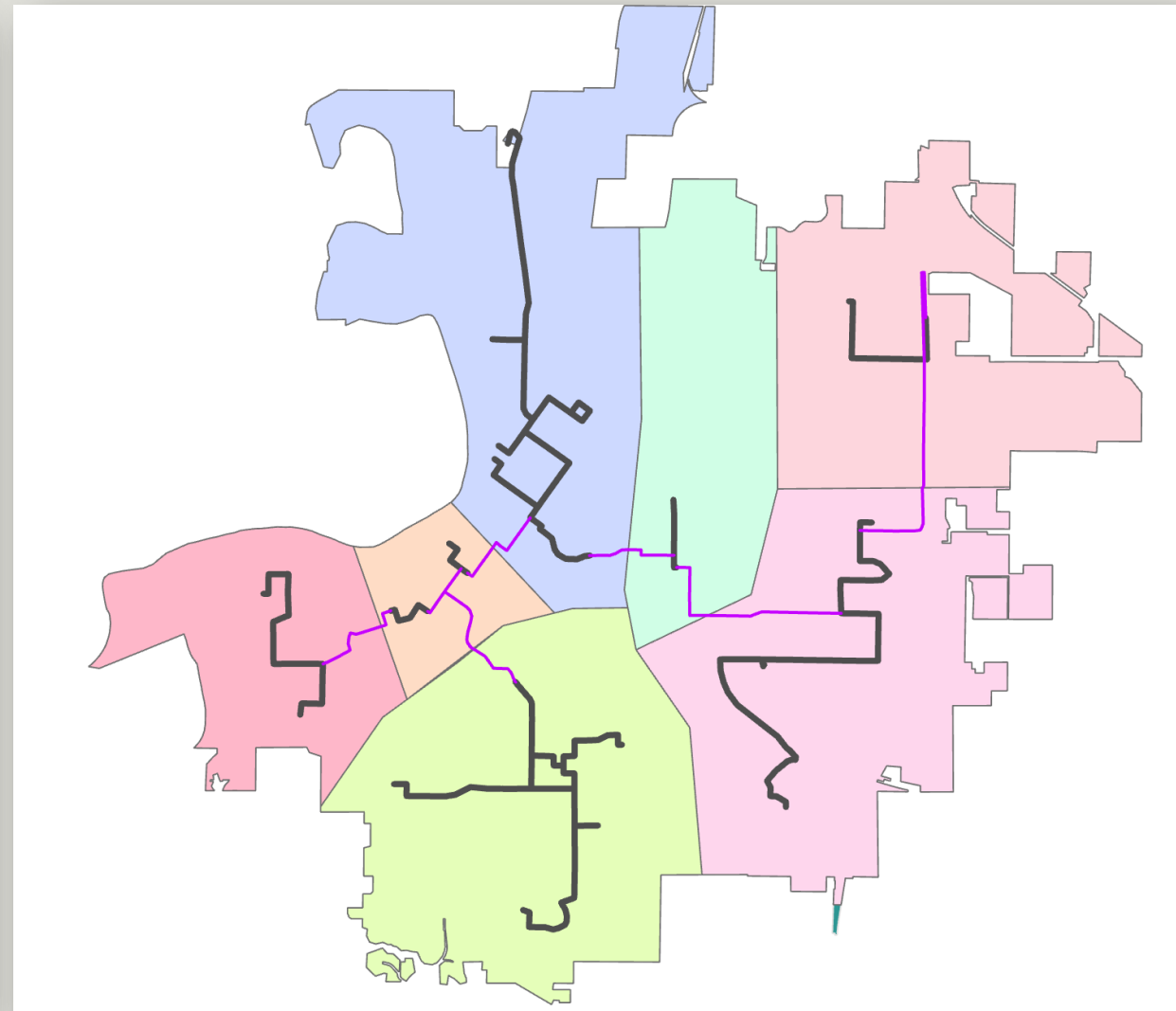
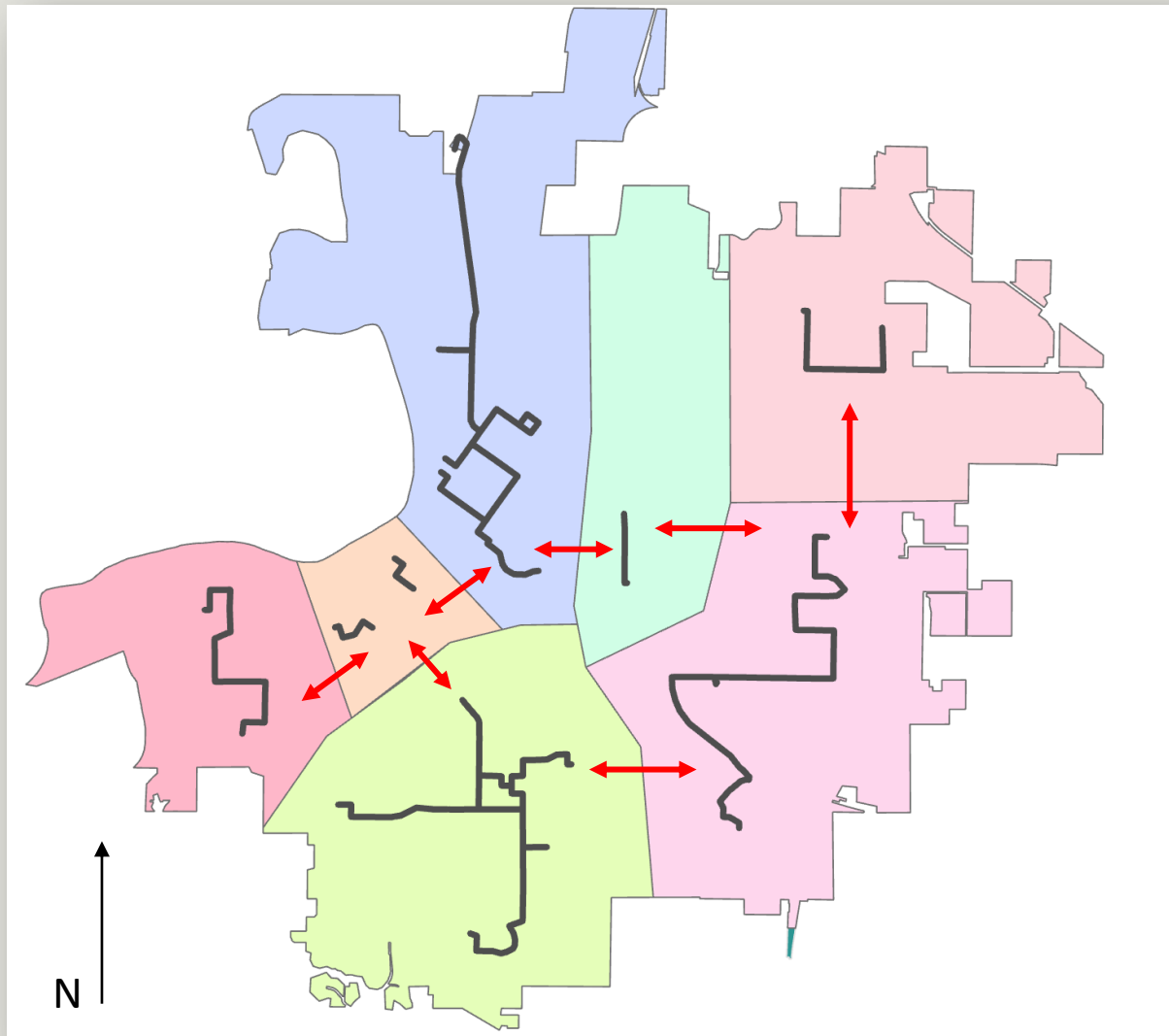
Network Analysis

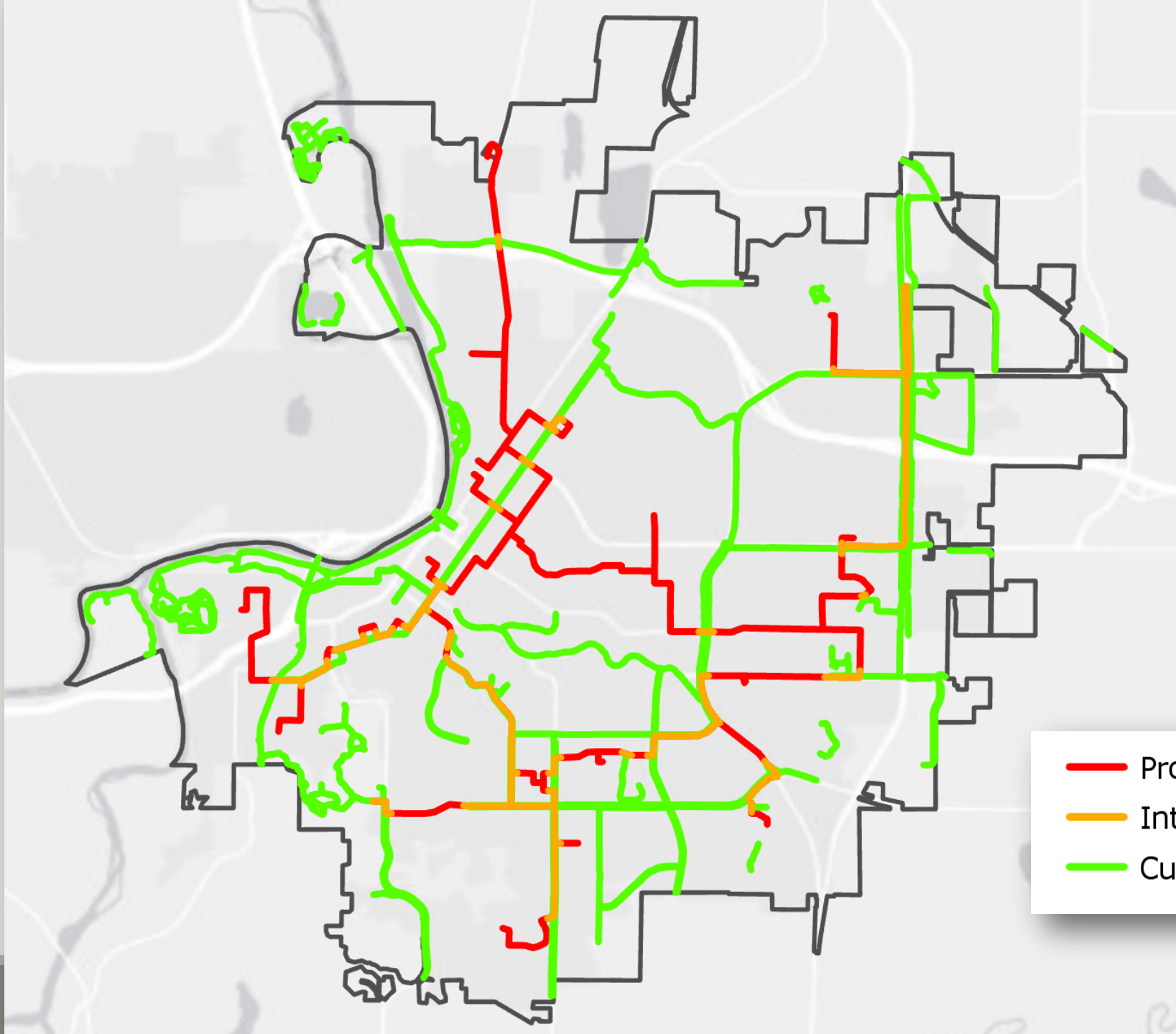
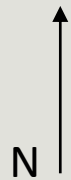
Once the routes were found, they were **divided up into sections**, to be connected to each other.

The goal of this to great a **seamless connection** of all the major centers of the city by neighborhoods.



USING FIND ROUTE TO CONNECT DIVISIONS





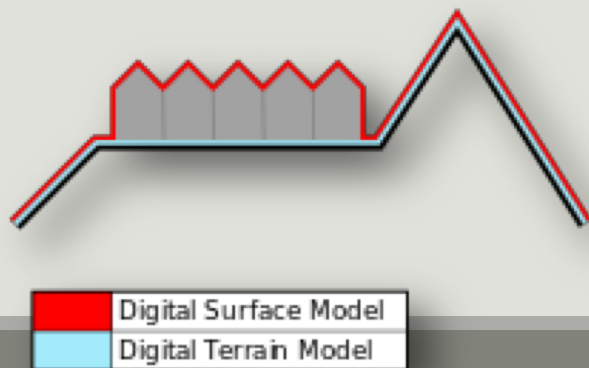
Use of Buffer and Intersect to find commonalities between proposed routes and current routes

- Proposed Routes
- Intersected Proposed/Current
- Current Routes

3D Fly Through

Using either ArcGIS Pro or ArcScene, animations can be made going through proposed bike paths. This gives a sense of reality, elevation and scenery; a glimpse of what the trail might look like.

- DEM for 3D surface
- Random Points, DSM, and calculation of Mean Z value for Building Heights



DSM



DEM



ANY QUESTIONS?

