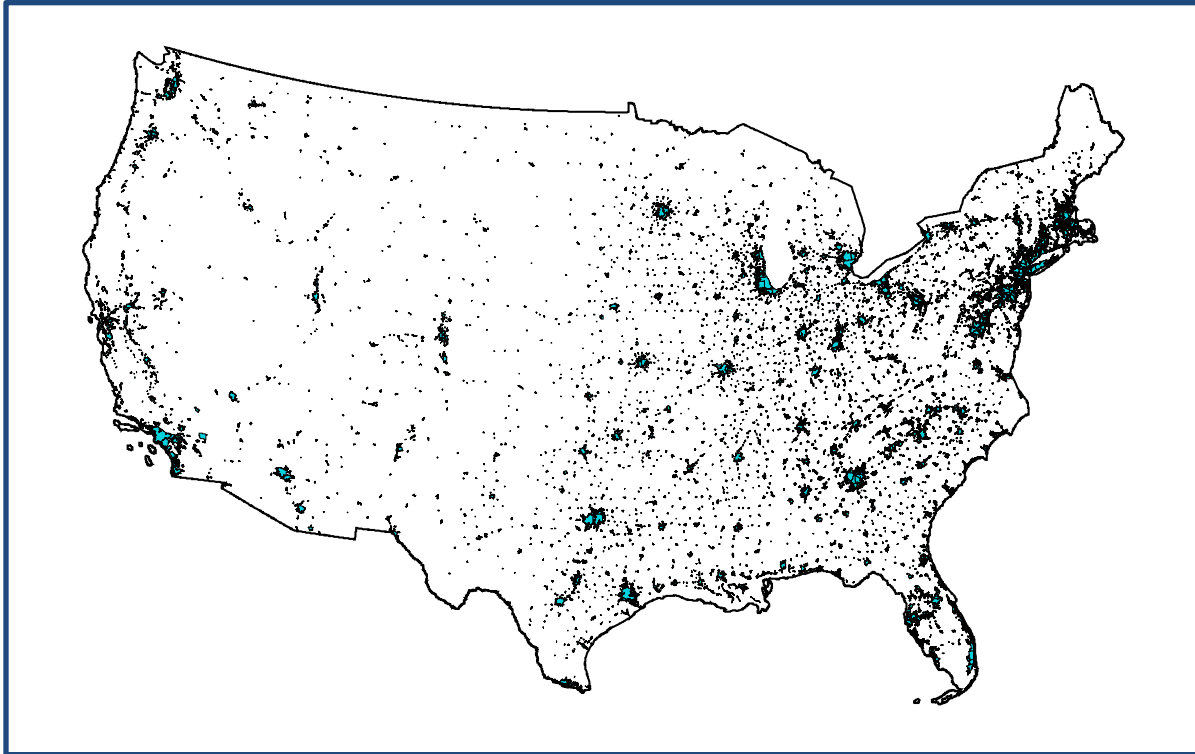


The Use of ESRI Software in the Delineation of Urban Areas for the 2010 Census



For Presentation at the
ESRI International User Conference
July 12th, 2011

Urban Area Definitions

- Represent densely developed territory, encompassing residential, commercial, and other non-residential urban land uses in which social and economic interactions occur.
- Represent the “Urban Footprint”
- Structure has been explicitly defined through measures based primarily on population counts and residential population density
- Criteria have also accounted for non-residential urban land uses that are functionally part of the urban landscape



Urban Area Delineation Software

- ArcGIS 9.x
 - VBA using ArcObjects
- Automated delineation software developed for each major step in the process
 - Initial delineation: pop density
 - Impervious
 - Hops/Jumps
 - Enclaves
- Interactive review and update software developed various review and update stages

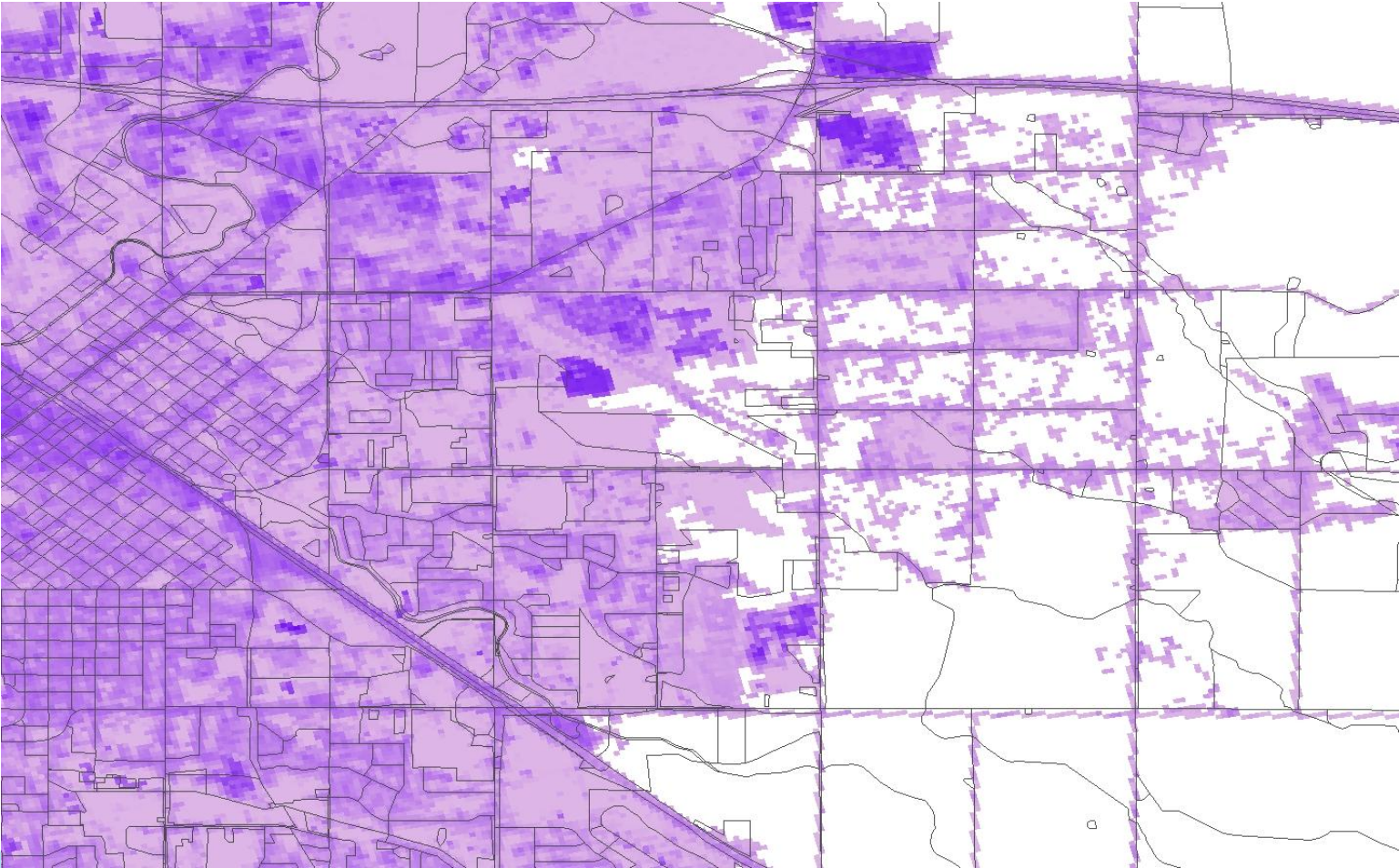
Identification of Impervious Qualifying Blocks

- Allows for inclusion of urban land uses in areas of low population density (commercial and industrial)
- Source: Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) 2006 impervious 30 meter raster dataset
- Use ArcGIS Spatial Analyst

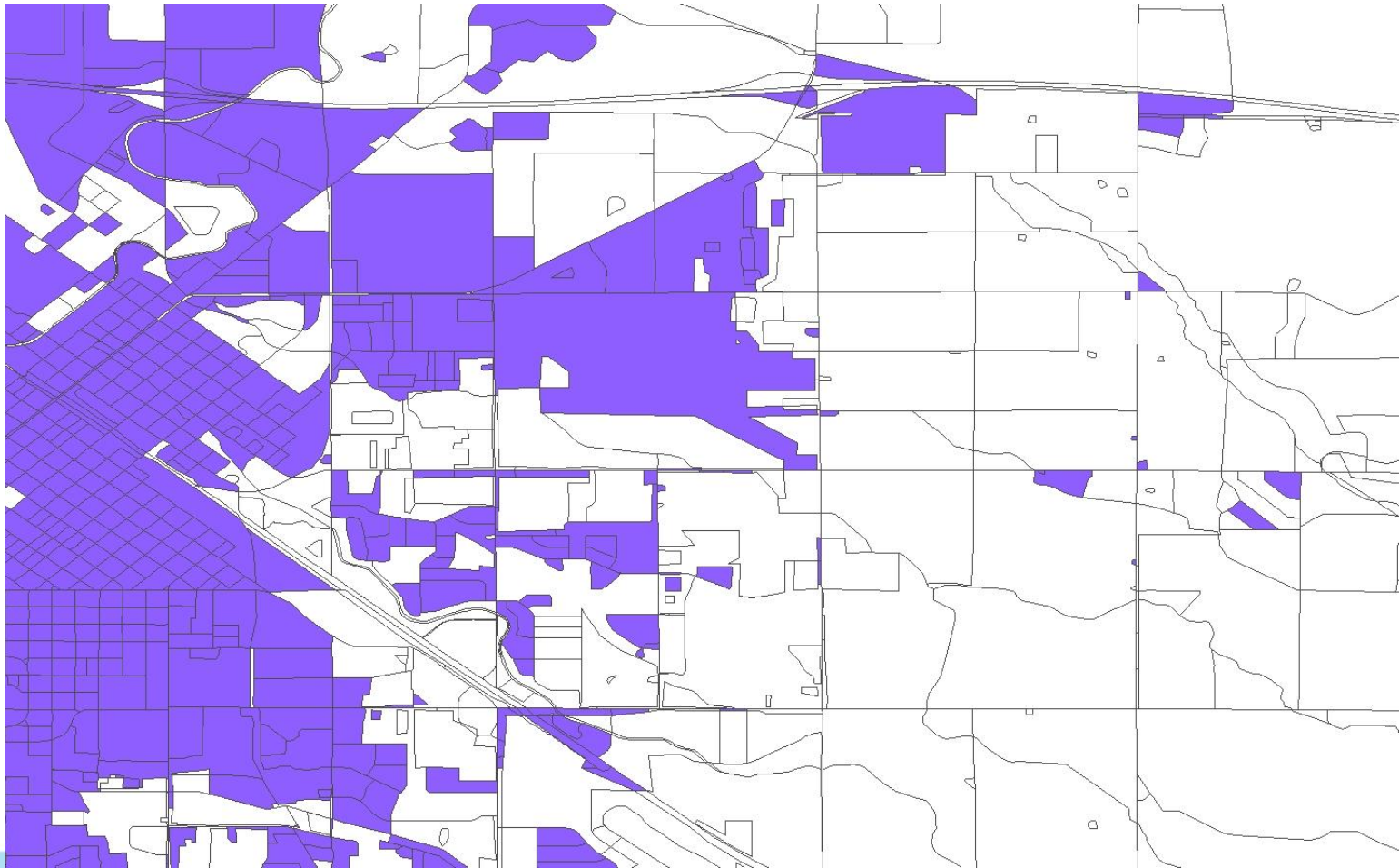
Identification of Impervious Qualifying Blocks

- Overlay blocks on impervious raster and calculate percentage of impervious area
 - If 33.3% or greater, flag block
- Calculate shape index
 - $I = 4\pi A / P^2$ where I is the shape index, A is the area of the block, and P is the perimeter
- Blocks that are at least one-third impervious and are compact ($I \geq 0.185$) are eligible to be added to urban cores
- Non compact blocks with at least one-third impervious are eligible for inclusion if 40% of the perimeter of the block shares a boundary with a previously qualifying block

NLCD Impervious



Impervious Qualifying Blocks



Initial Delineation

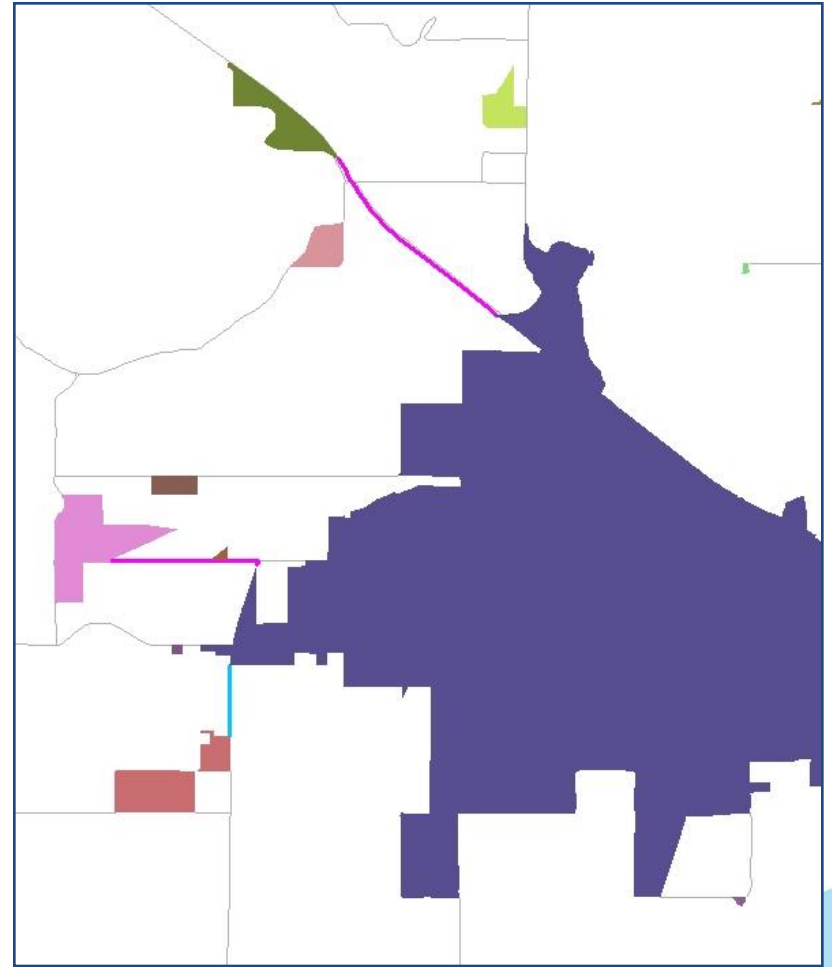
- Tract core development
 - start with tracts with population density of 1000 people per square mile (ppsm)
 - Add adjacent tracts with population density of 500 ppsm
 - Iteratively add blocks of 500 ppsm
- Block core development
 - Start with blocks with population density of 1000 ppsm
 - Iteratively add adjacent blocks with population density of 500 ppsm
- Iteratively add impervious blocks
- Fill in holes (enclaves) less than 5 square miles that are completely surrounded by qualifying land

Initial Delineation Demo

[Click Here for Demo](#)

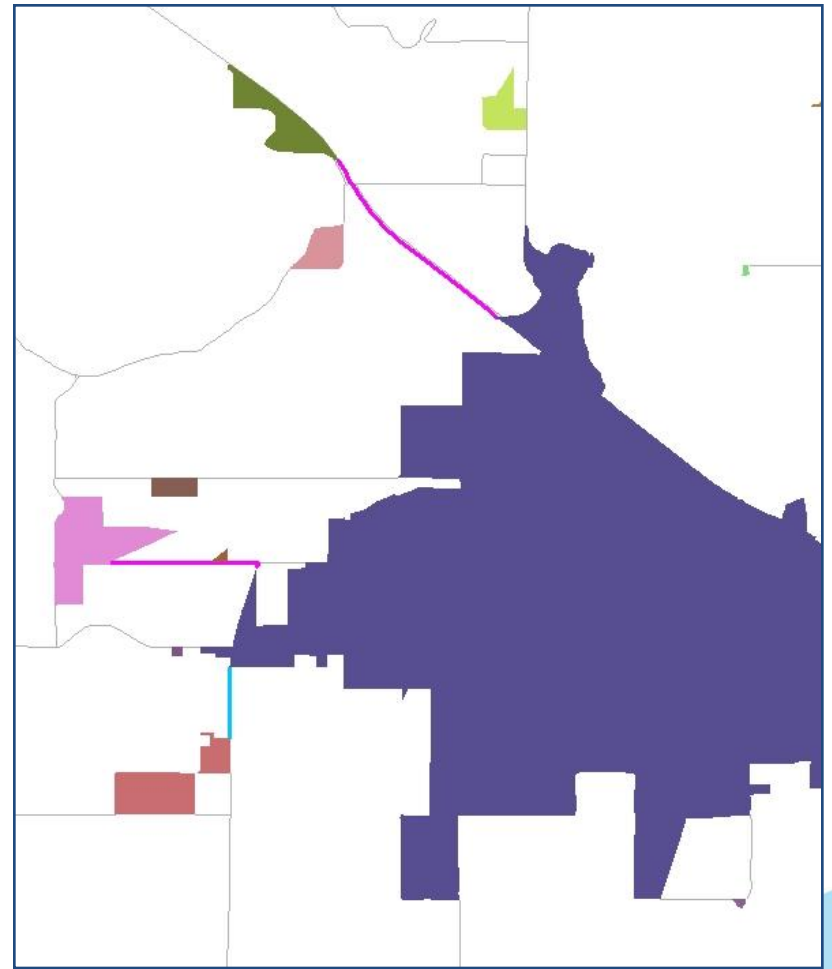
Hops and Jumps

- Use ArcGIS Network Analyst
- Connect urban territory through road connections of less than 0.5 miles for hops and 2.5 miles for jumps
- Evaluate blocks on each side of connection to form highest density corridor

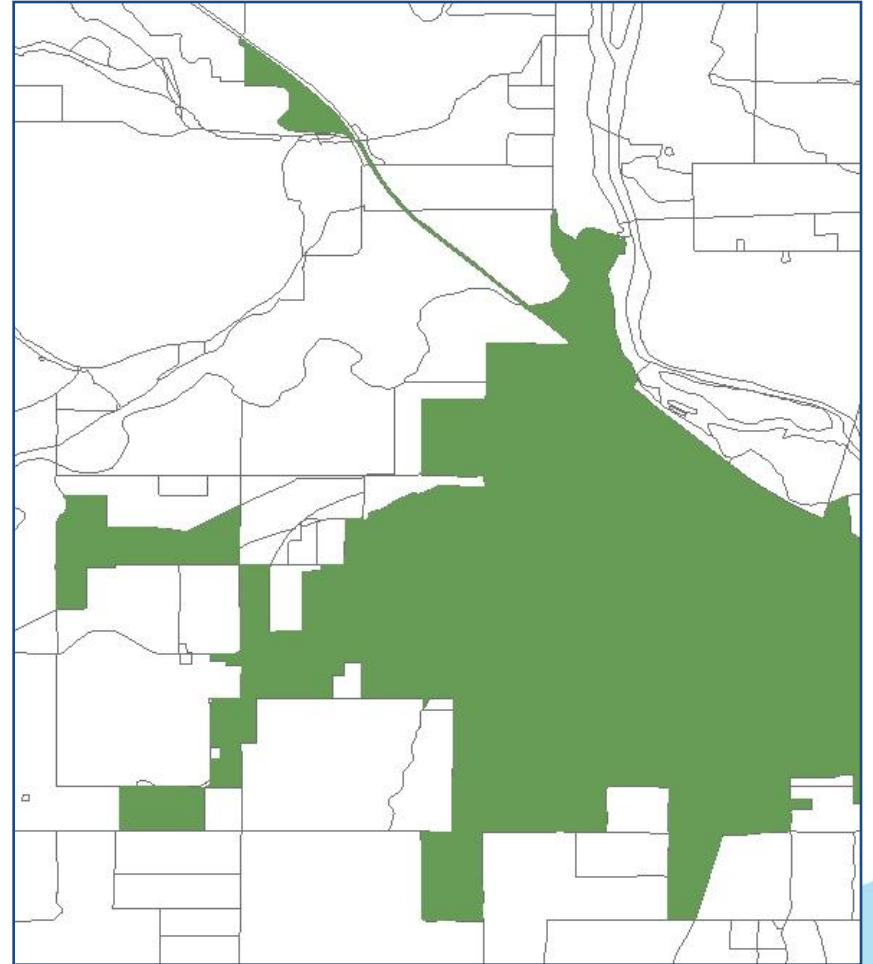
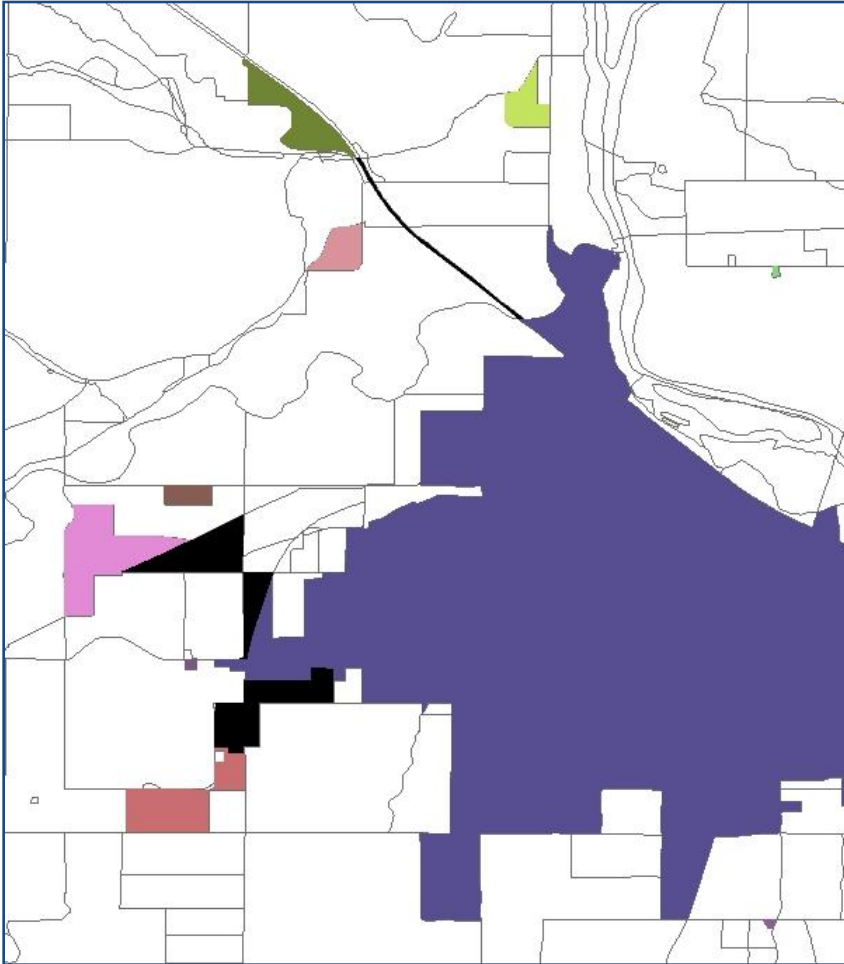


Hops and Jumps

- Connect to the area if
 - Total population of the destination is greater than 1,000 or
 - Population density of the destination and the hop/jump corridor is greater than 500 ppsm



Hops and Jumps



Post Hop/Jump Enclaves

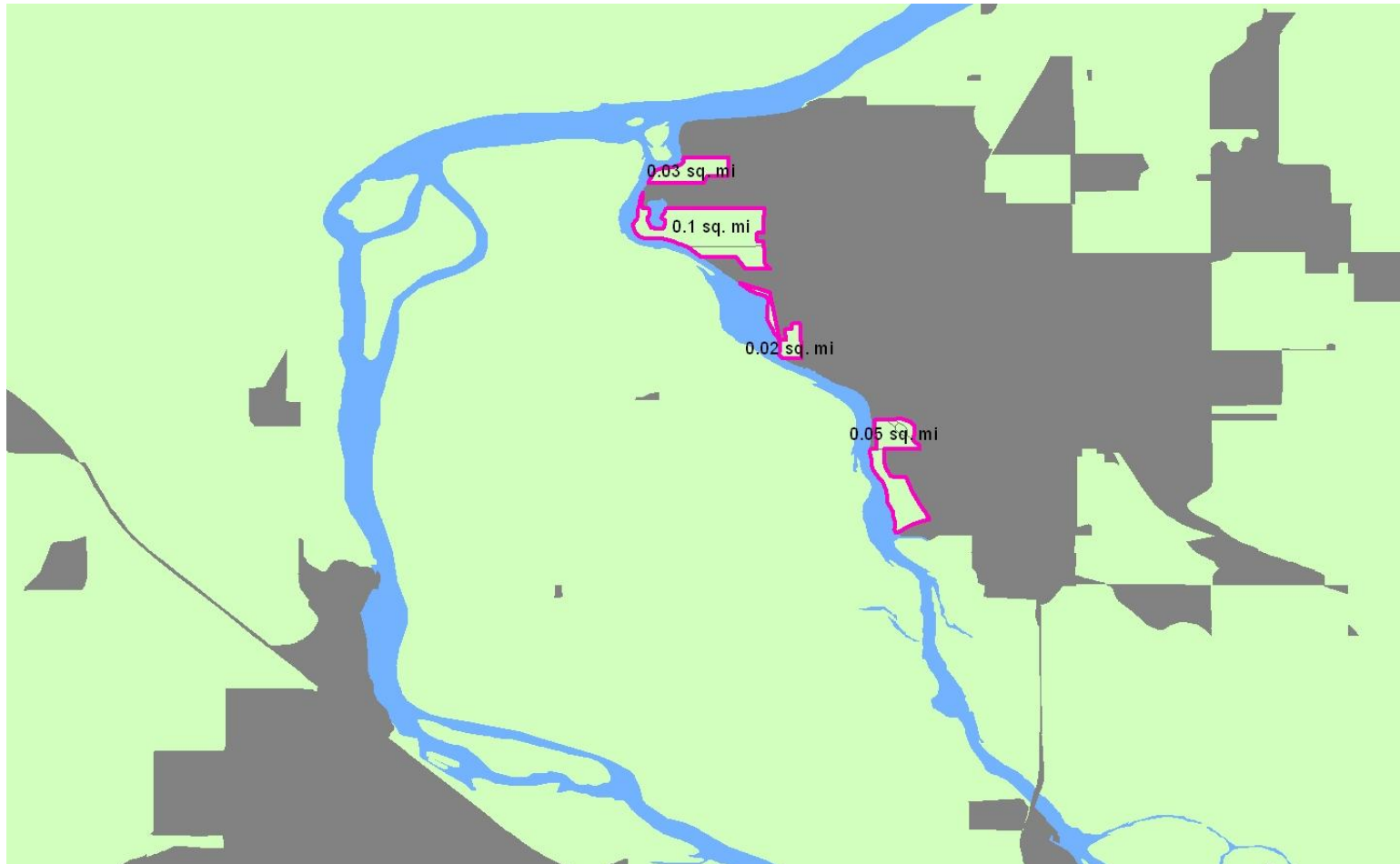
- There are three types of enclaves:
 - Less than or equal to 5 square miles, surrounded by qualifying land only
 - Greater than 5 square miles, greater than 2.5 miles from the edge of the UA
 - Less than or equal to 5 square miles, surrounded by qualifying land and non-qualifying water territory

Post Hop/Jump Enclaves



Less than or equal to 5 square miles, surrounded by qualifying land only

Post Hop/Jump Enclaves



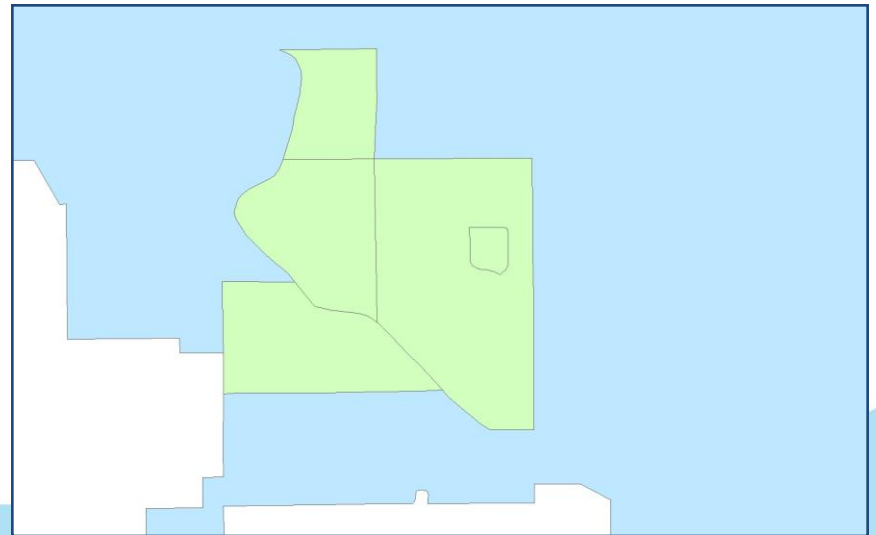
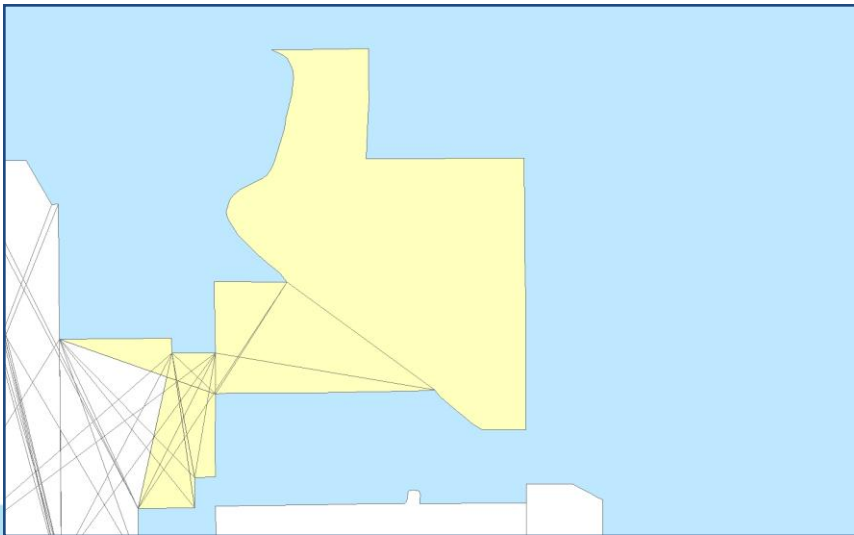
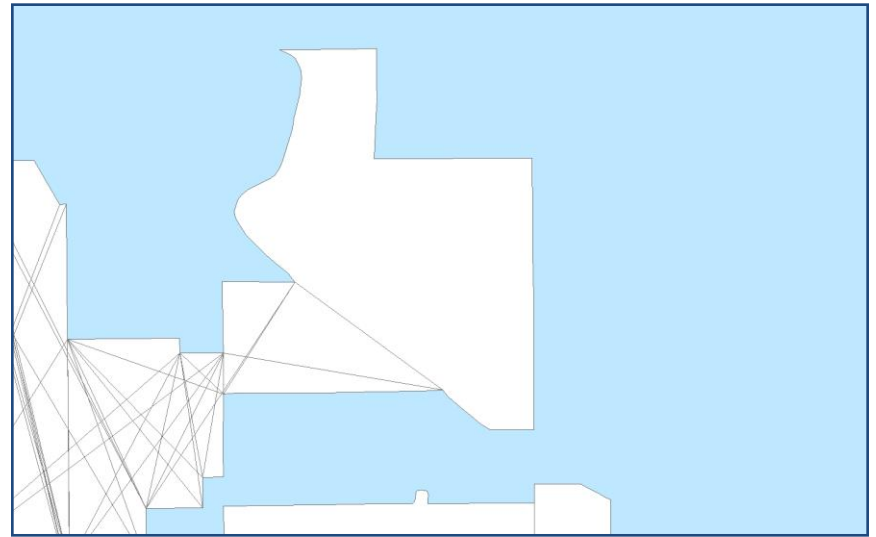
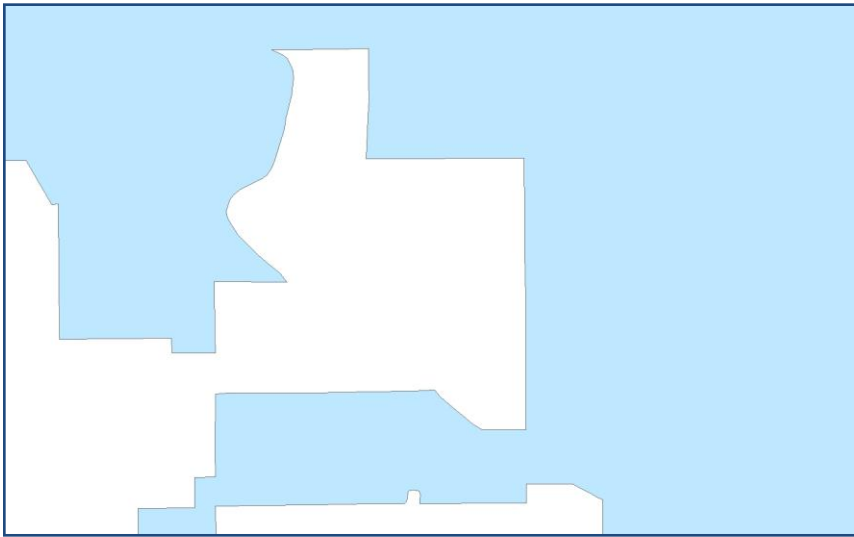
Less than or equal to 5 square miles, surrounded by qualifying land and non-qualifying water territory

Indentations

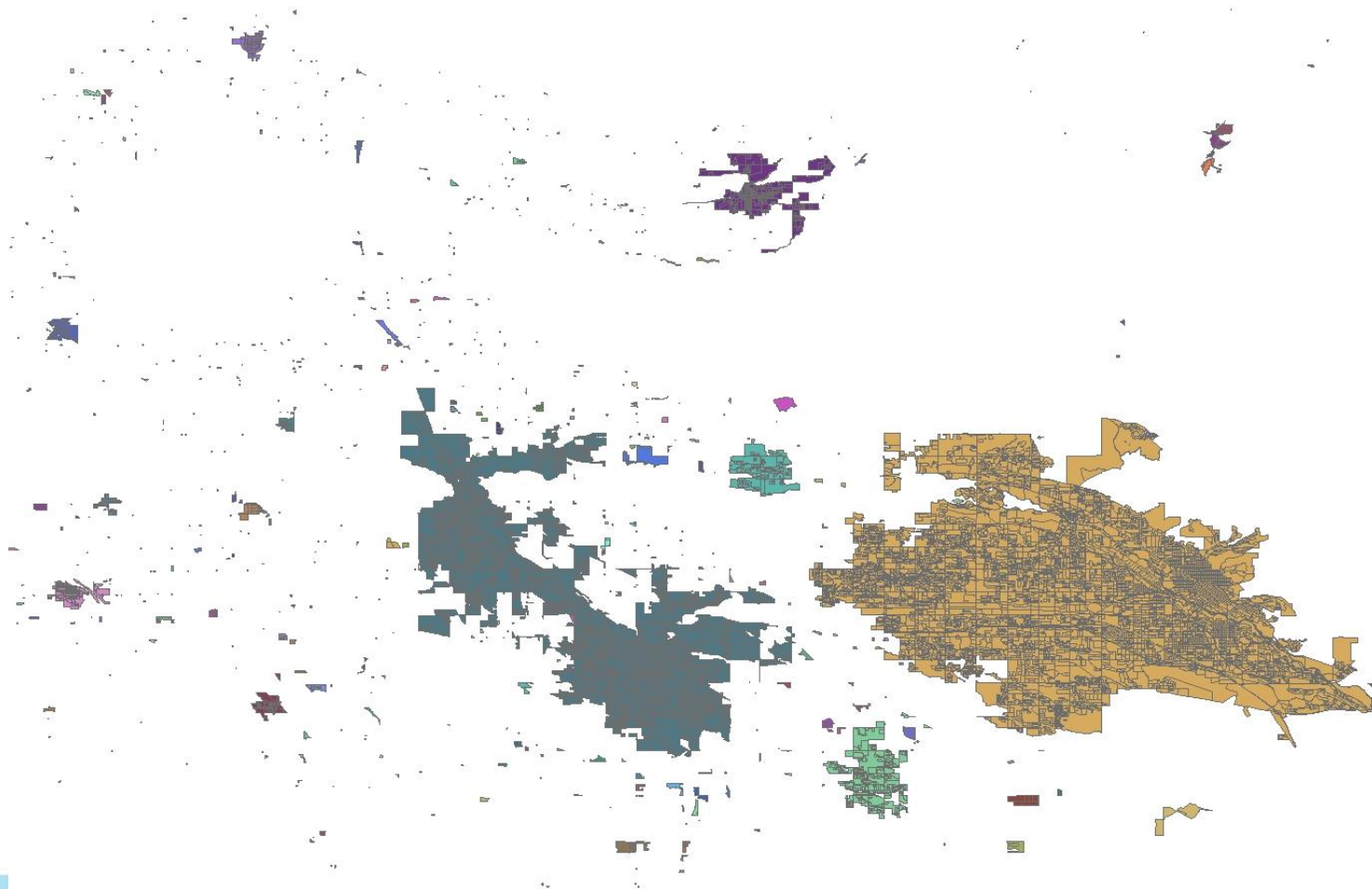
- Use closure lines to close off areas that are indentations in the boundary.
- The length of the closure line serves as the diameter of a circle. If four circles with the diameter fit into the indentation, we add territory to the UA.
- If $A_i \geq 4\pi(\frac{1}{2}L_i)^2$ and $A_i \leq 3.5$ where A_i = area of indentation and L_i = length of indentation closure line, then add the territory.



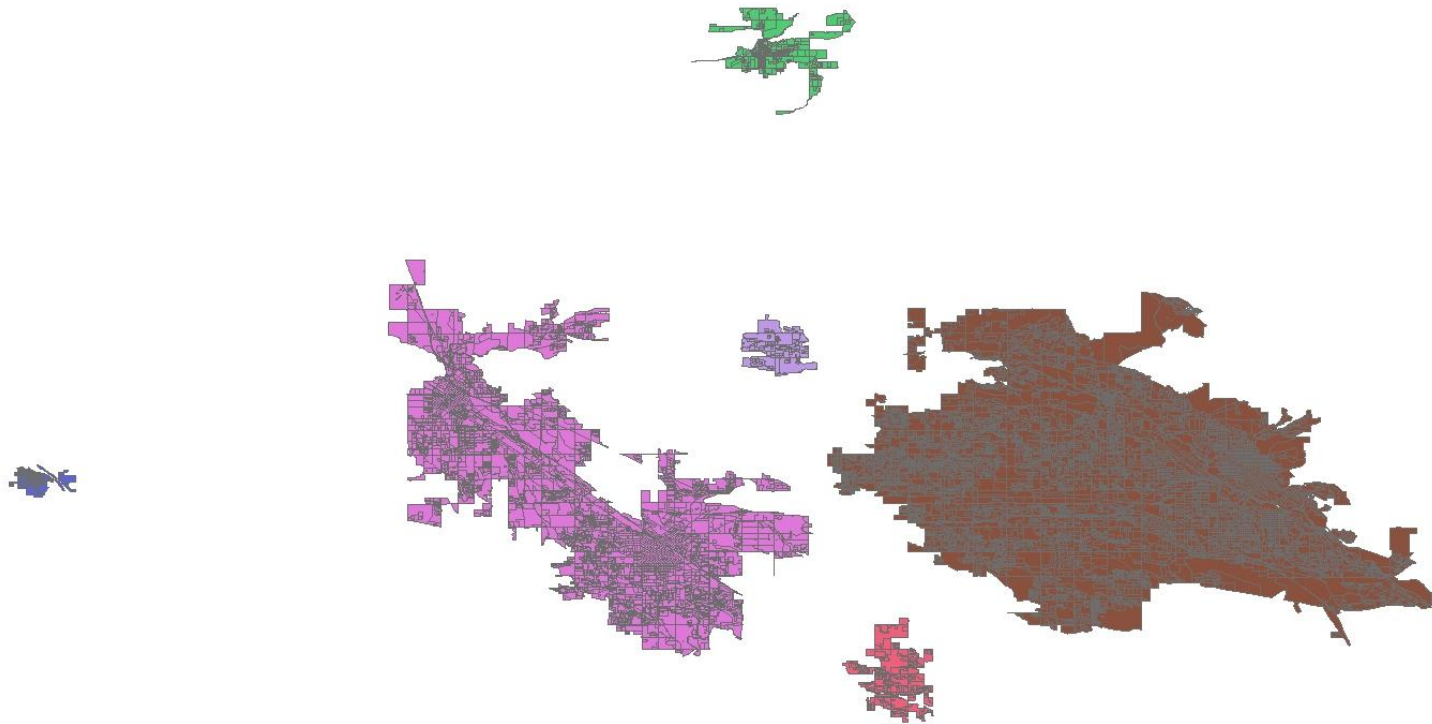
Indentations



Before Removal of Nonqualifying Cores



After Removal of Nonqualifying Cores and Inclusion of Indentations



Questions? Comments?

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