Urban Garden Site Selection Using ArcGIS

Within the Urban Food Desert
of Baltimore City

Agenda

- Urban Gardening / Farming Background
- Initial / Revised Plan
- Shadow Maps Workflow
- Next Steps

Brief History of Urban Gardening

- European system of Allotment Gardens
- Potato Patches (1890 – 1930)
- City Beautiful Movement (1890 – 1910)
- World War I: Liberty Gardens (1917 – 1919)
- Depression Relief Gardens (1930 – 1938)
- World War II: Victory Gardens (1940 – 1945)
- Community Garden Movement (1970 – Present)

http://sidewalksprouts.wordpress.com/history/

Gardening Vs. Farming

- Garden:
  - **Noun** – piece of ground adjoining a house, used for growing flowers, fruit, or vegetables
  - **Verb** – cultivate or work in a garden

- Farm:
  - **Noun** – an area of land and its buildings, used for growing crops and rearing animals
  - **Verb** – make one's living by growing crops or keeping livestock

http://oxforddictionaries.com/definition/english/farm, http://oxforddictionaries.com/definition/english/garden

Urban Agriculture in Baltimore City

- Baltimore City Power in Dirt Program
  - 737 lots adopted, totaling 1.4 million square feet or 31.6 acres
  - 80% of these lots revitalized and maintained
  - 34% of these lots growing food
  - 35% overall reduction in service requests to clean up trash on blocks with adopted lots

- Farm Alliance of Baltimore
  - Non-Profit Organization
  - Coalition of 9 Urban Farms

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Modern Phenomenon: Food Desert

- Department of Planning Definition:
  - An area where:
    - Distance to a supermarket is more than ¼ mile;
    - Median household income is at or below 185% of the Federal Poverty Level;
    - 40% or more of households have no vehicle available;
    - Average HFAI (Healthy Food Availability Index) score for supermarkets, convenience and corner stores is low (as measured using the Nutritional Environment Measurement Survey).

http://sidewalksprouts.wordpress.com/history/

The Initial / Revised Plan

- Initial Plan
  - Within pre-defined Food Desert
  - Shadow analysis of all Vacant Lots
  - Crop Selection
  - Site Optimization

- Revised Plan
  - Within pre-defined Food Desert
  - Shadow analysis of all Vacant Lots at least 1/3 acre and NOT identified as:
    - Brownfields
    - City Parks

Data Selection/Narrowing Focus Area

- 18,042 Vacant Lots
- 105,927 Buildings

- Within Food Desert - 6,972
- 1/3 Acre or Larger – 187
- Brownfields – 4 (183)
- City Parks – 45 (138)

- Poppleton Neighborhood – 10 Vacant Lots
- Buildings within 60 Feet - 49

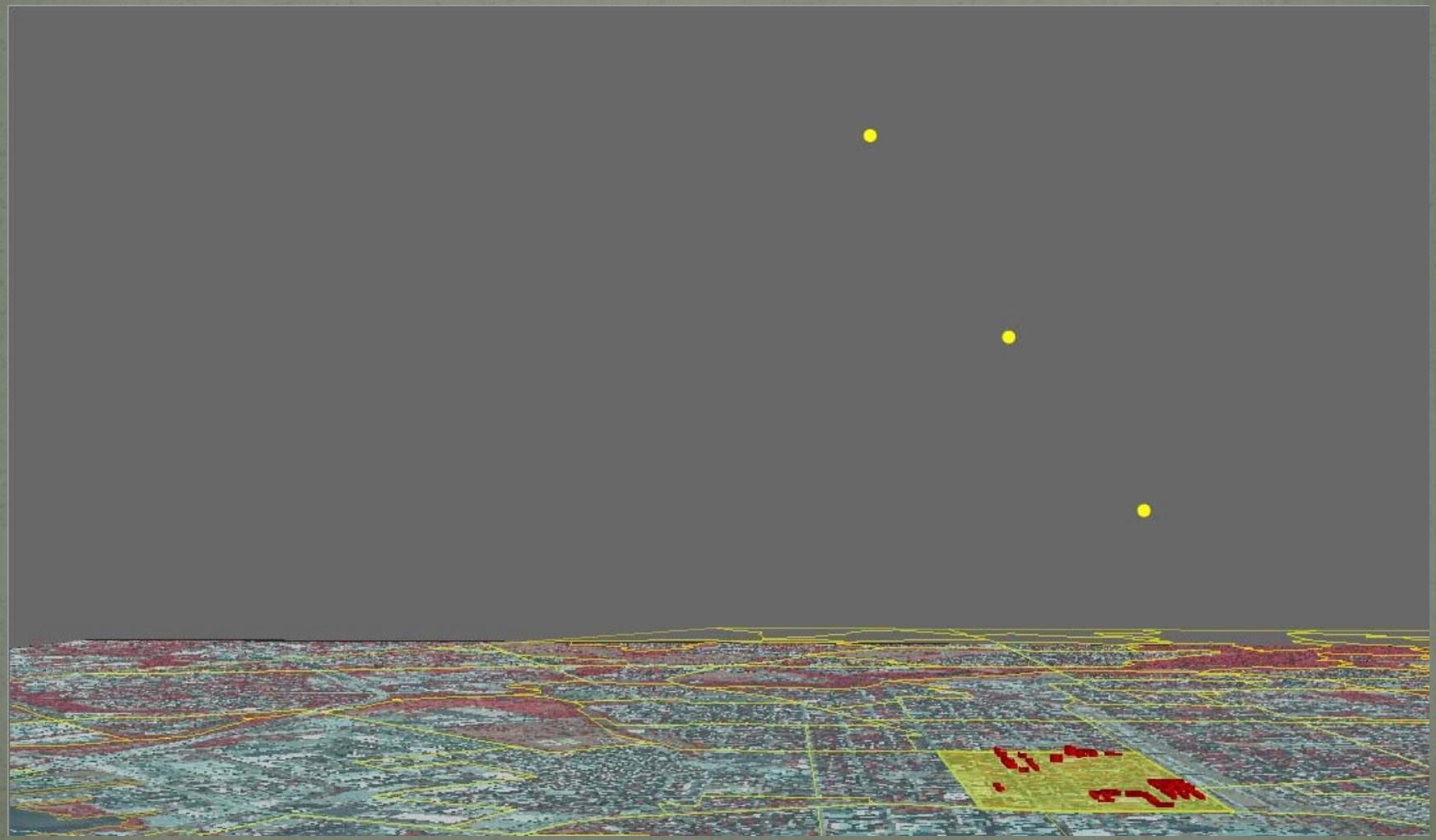
Extensions/Tools Used

- Spatial Analyst
- 3D Analyst
- Model Builder
- Python (ArcDesktop environment + IDLE)

ShadowMap Process Workflow

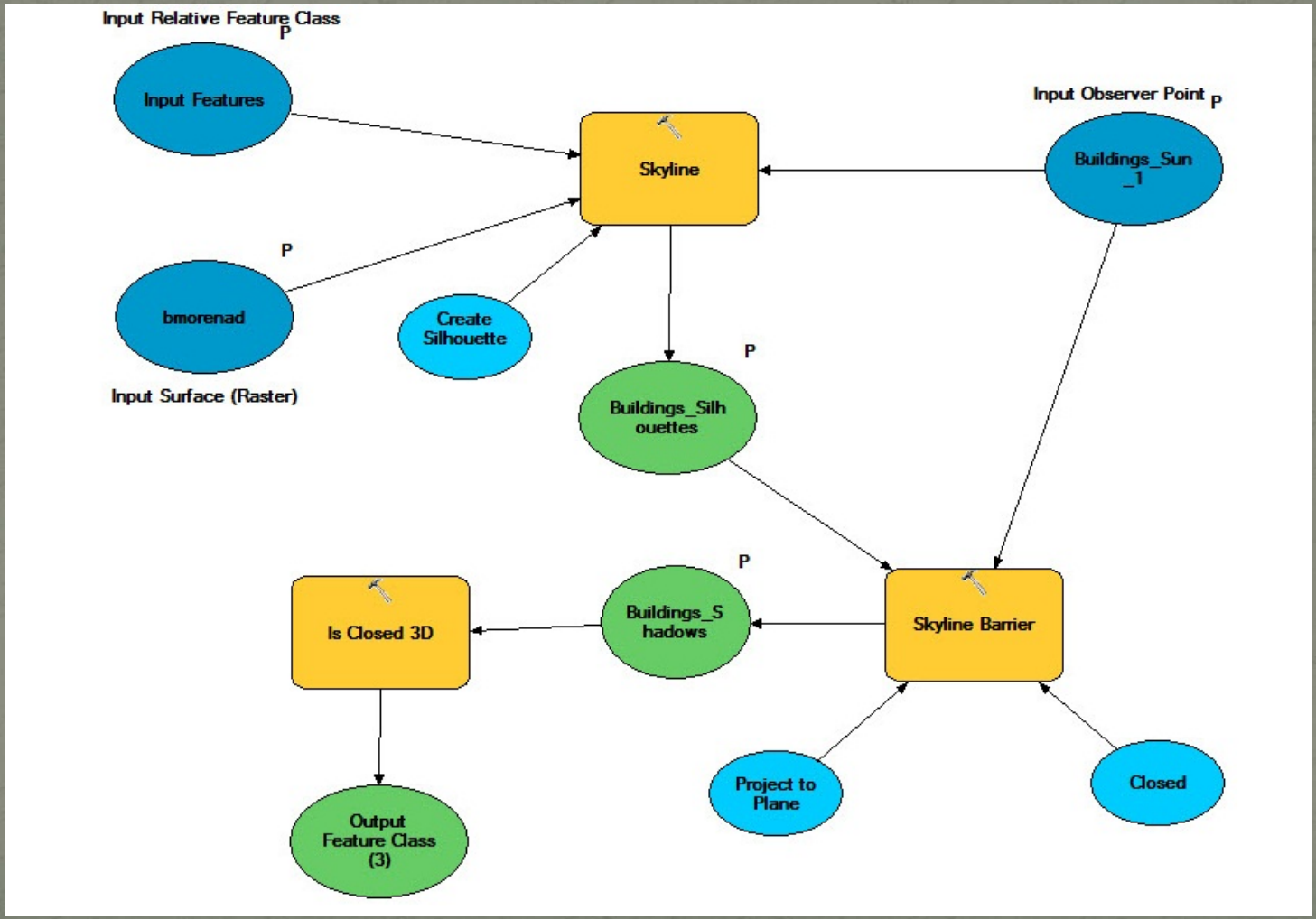
- Create 3D Multipatches of Features (buildings)
- Create a Sun SkyMap
- Generate shadows
- Create base raster layers
- Intersect shadows with vacant lots
- Create shadow footprint rasters of intersected areas
- Summarize shadow footprint rasters into a composite raster

Sun Skymap



Creating Shadows

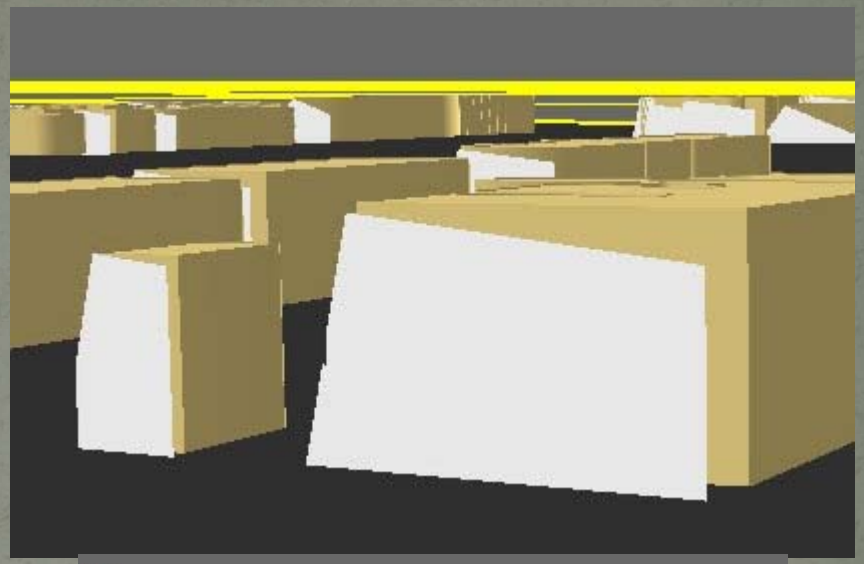
3D Analyst



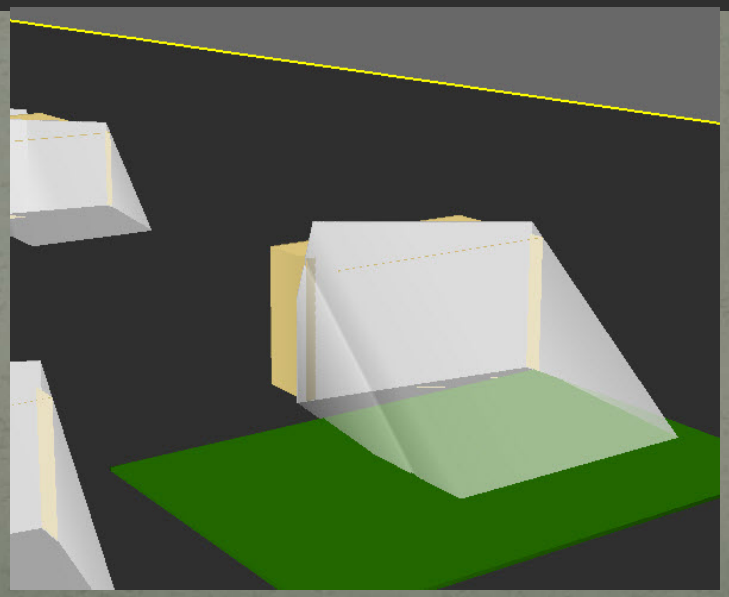
Creating Shadows

3D Analyst

- Skyline Tool
  - Observer Points
  - Input Features

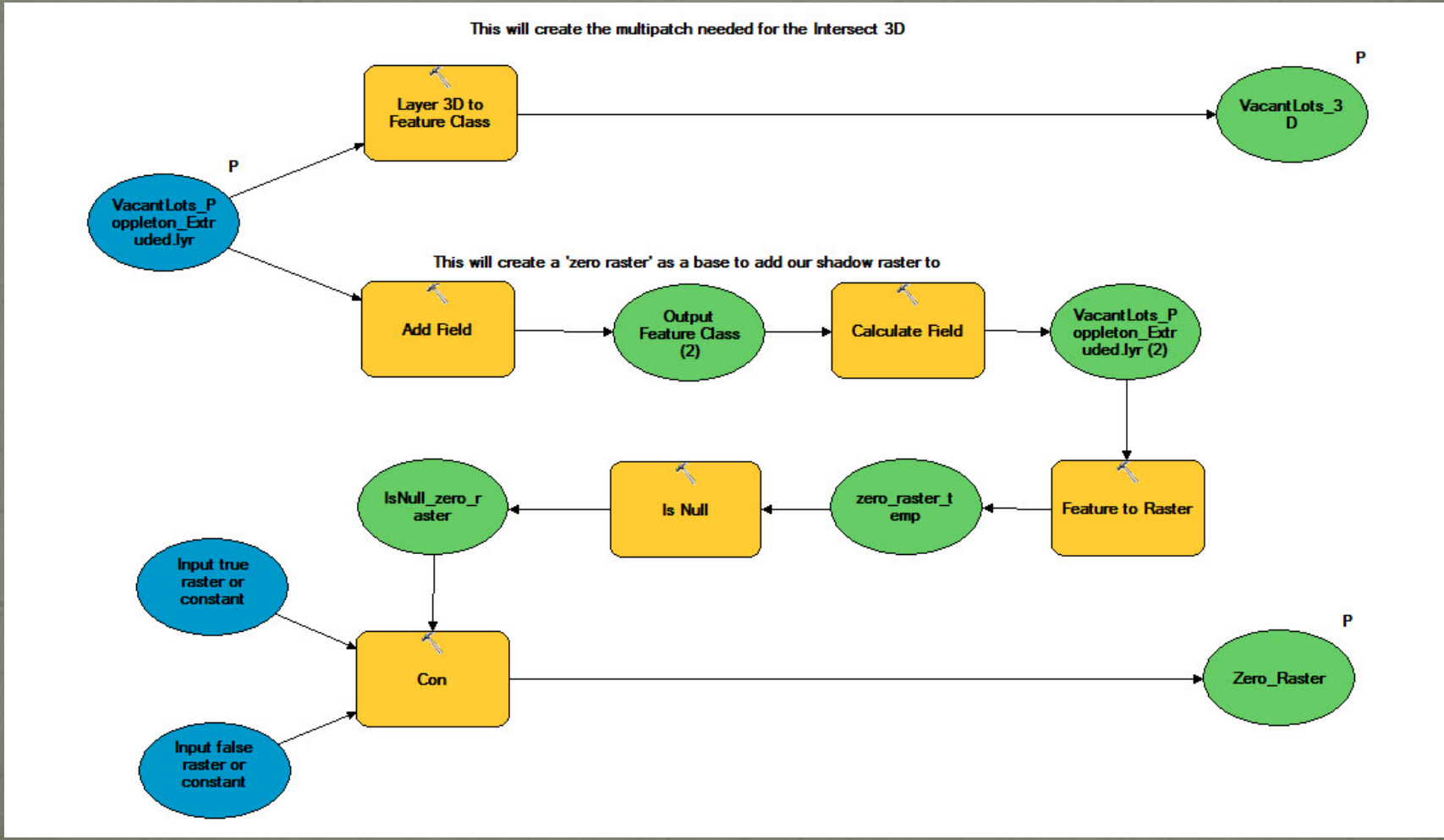


- Skyline Barrier
  - Observer Points
  - Input Features



Creating the Base Layers

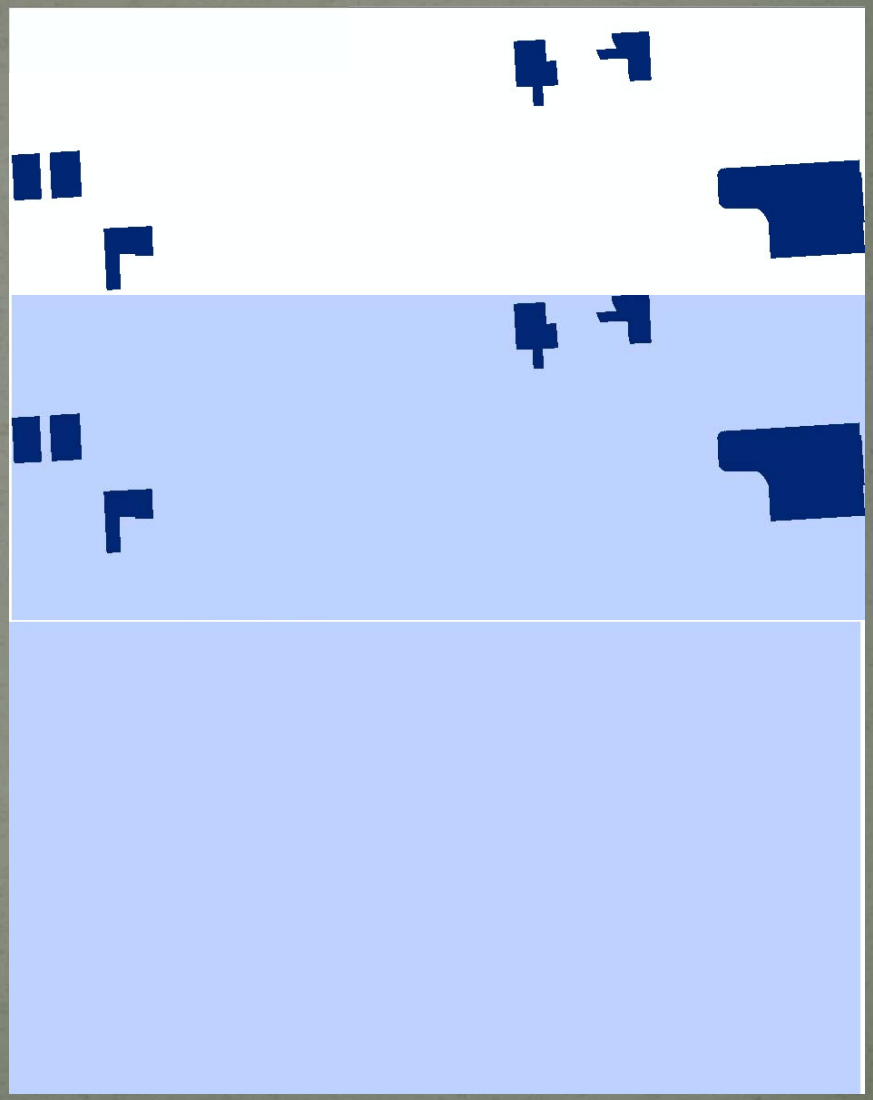
Spatial Analyst



Creating the Base Layers

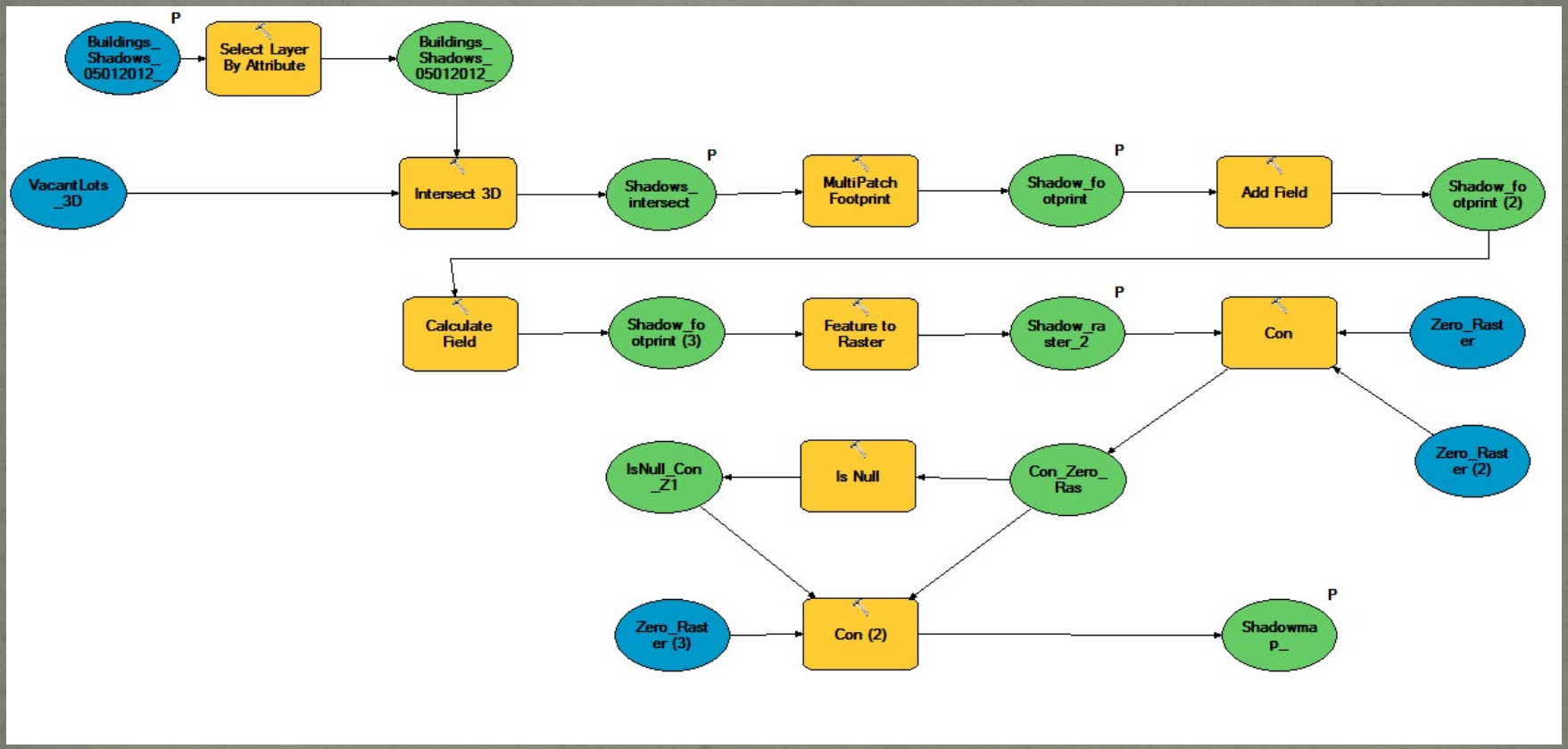
Spatial Analyst

- Temp Zero Raster
  - Vacant lots with added shadow field
  - Feature to raster tool
- IsNull Zero Raster
  - Temp Zero Raster
- Zero Raster
  - Conditional Statement
  - If 'True' = 0
  - If 'False' = 0



Creating the ShadowMaps

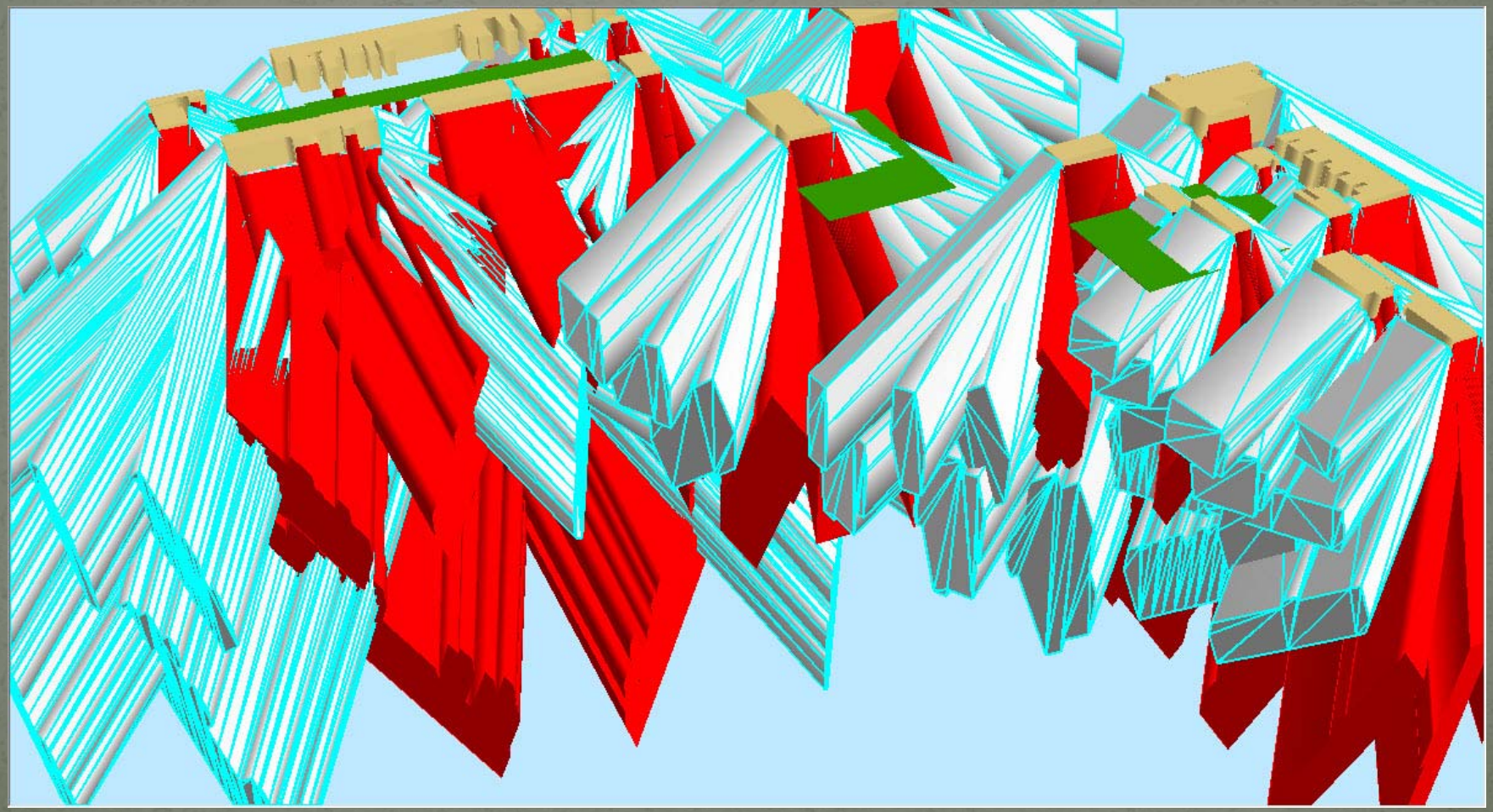
3D Analyst, Spatial Analyst



Creating the ShadowMaps

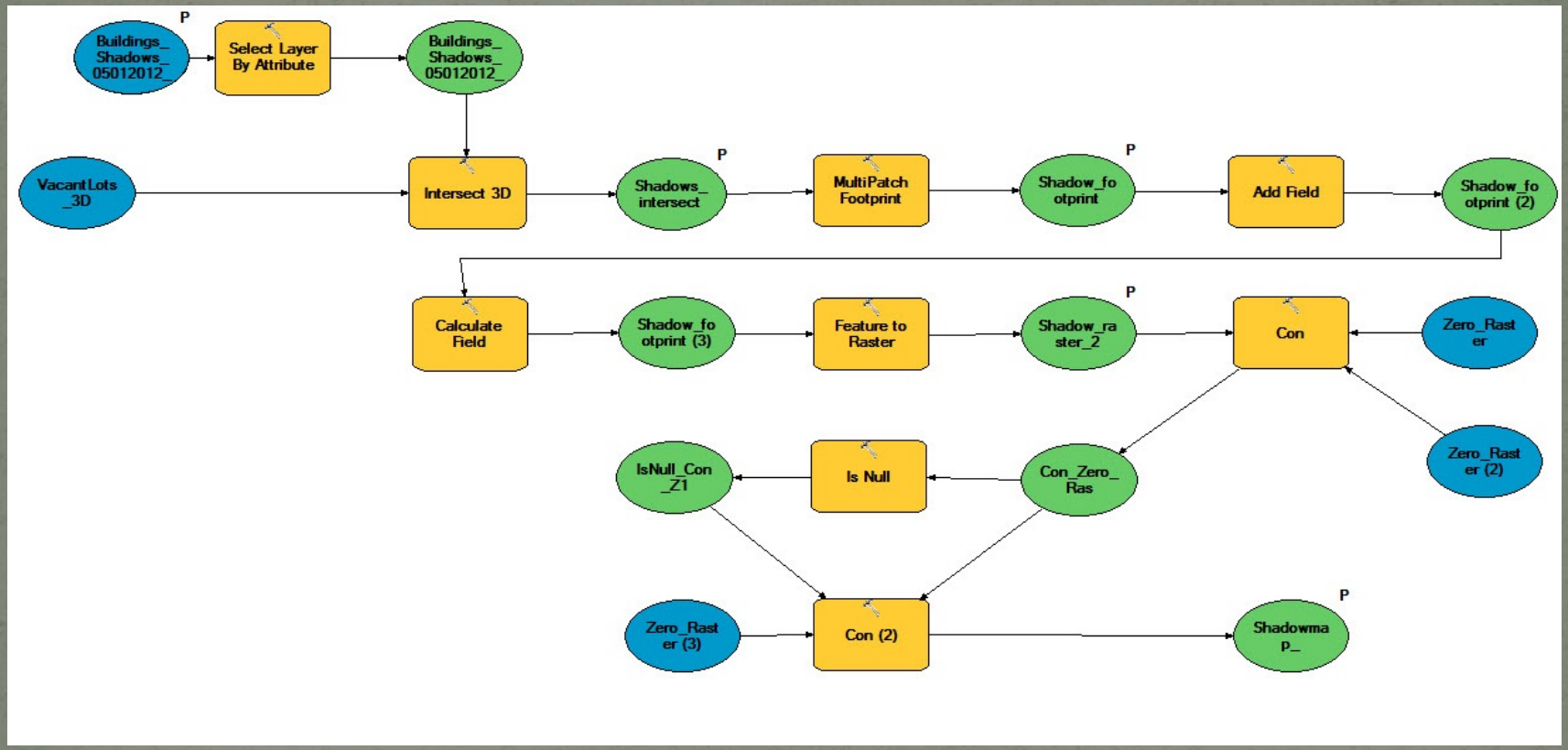
3D Analyst, Spatial Analyst

Intersect 3D – Feature Geometry issues



Creating the ShadowMaps

3D Analyst, Spatial Analyst



Creating the ShadowMaps

3D Analyst, Spatial Analyst

1. Multipatch Footprint

- Select layer by attribute
- Intersect 3D

2. Footprint Shadow Raster

- Add field/calculate field
- Feature to Raster

3. Con Zero Raster

- Input Con: Zero Raster
- Input True: Zero Raster
- Input False: Shadow Raster

4. IsNull Con Zero Raster

- IsNull Tool

5. ShadowMap Raster

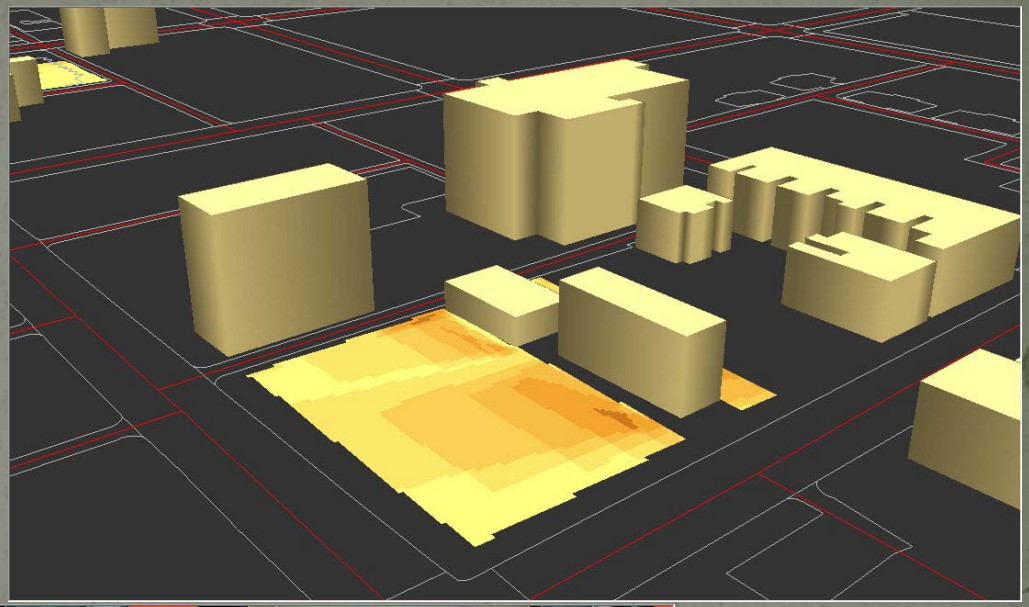
- Input Con: IsNull Con Zero Raster
- Input True: Zero Raster
- Input False: Con Zero Raster

Creating the ShadowMaps

3D Analyst, Spatial Analyst

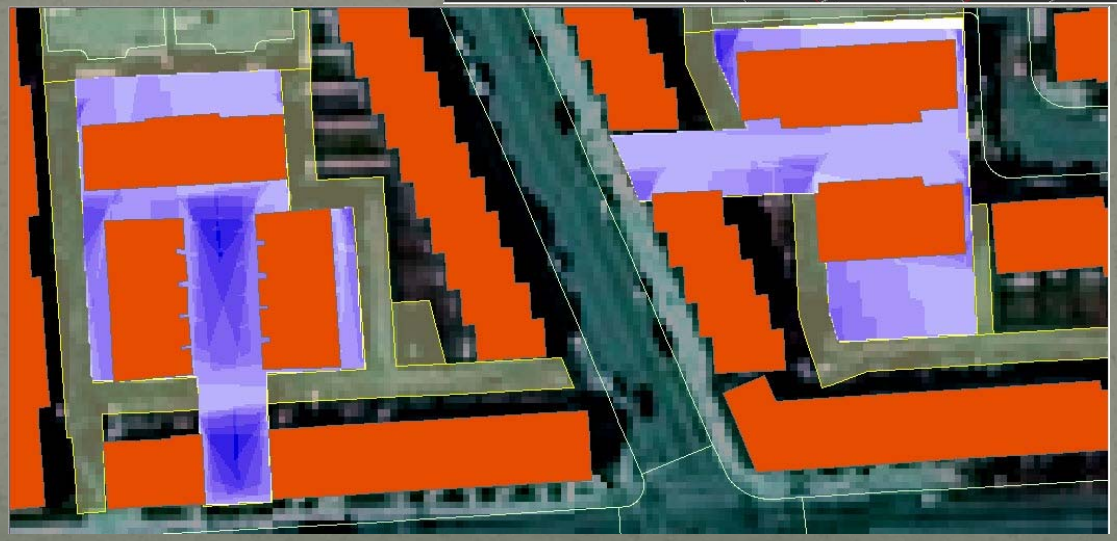
Summarize ShadowMaps

Spatial Analyst



Summary ShadowMap

- Map Algebra
- Conditional Statement



Next Steps

- "Ground Truthing"
  - Visit selected sites
  - Survey alternative sites
  - GPS data collection
- Scientific Approach
  - Soil/Water Analysis
  - Crop Identification
  - Site Optimization
  - Project Potential Output
- Business / Legal Analysis
  - Zoning / Legal Requirements
  - Identify / Engage Stakeholders

Questions

Urban Agriculture Resources

- Urban Farming Charity – www.urbanfarming.org
- Baltimore City Urban Agriculture - http://baltimoreurbanag.org/
- Baltimore City Food Policy Initiative - http://www.baltimorecity.gov/Government/AgenciesDepartments/Planning/BaltimoreFoodPolicyInitiative/UrbanAgriculture.aspx

ArcGIS Resources

- 3D Virtual City: Shadows over time
- Shadow Analysis: Shadow Maps

Data Sources

- Imagery – 2007 NAIP

  Courtesy USDA Natural Resources Conservation Service
- Baltimore City Data – Open Baltimore

  https://data.baltimorecity.gov/
- Maryland Food System – Food Desert

  http://mdfoodsystemmap.org/
- US EPA Brownfields

  http://www.epa.gov/enviro/geo_data.html