Draft Stormwater Impact Algorithm

Updated – 9/19/2012

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Impact Algorithm

- Assigns impact “points” to each entity for each variable value calculated.
- Variables
  - Population Density
  - Impervious Surface (%)
  - Average Slope
  - Distance from Rio Grande (Removed)
  - Pollution Intensity (To Be Added)
- Total points from the four variables are multiplied by the percent of watershed coverage to calculate a total impact score.

Variable Justification

- Population Density
  - As population density increases an area is more urbanized. Urban runoff has been documented to have a higher concentration of pollutants than undeveloped lands. Can be considered a surrogate for bacteria loads. (Likely tied with impervious surface)
- Impervious Surface (%)
  - As the percent of impervious surfaces increase the amount of runoff increases and its pollutant load. Literature values for when waterbodies show impairment are available. Can be considered a surrogate for volume and other pollutants.
- Average Slope
  - As slope increases the potential for soil eroding increases as well as less water being allowed to infiltrate. Can be considered a surrogate for volume and sediment load. (Soil type plays a large role in sediment load, consider adding / more sophisticated analysis (MUSLE equation?))
- Distance from Rio Grande
  - As distance from the Rio Grande increases the more chance water has to infiltrate and for the environment to naturally filter out contaminants. The farther away the less impact an area may have. Based on literature review and discussion in Stakeholder group this variable usefulness has been questioned.
- Pollution Intensity
  - Based on literature review and Stakeholder group discussion this variable will be explored. Will be calculated from modeling.

Challenge

- Cost – Sharing: Total pollutant loading of a jurisdiction
- BMP Implementation: Target highest pollutant loading first to get best bang for buck.

- Example:
  - Large area like County will likely contribute more pollutants total than a small area like EXPO.
  - Watershed priority would be the EXPO.

Purpose

- To facilitate cost sharing
- Example:

Permittee 1, 2, and 3 are planning on working together on a public outreach campaign. Their scores are 255, 80, and 10. The total estimated cost of the campaign is $10,000. The permittees can get a sense of how much they should kick in by adding up the total scores (345) and then calculating what percent of the whole they are.

P 1 is 74% of the whole, so they would kick in around $7400.

P 2 (24%) so about $2300.

P 3 (3%) so about $300.

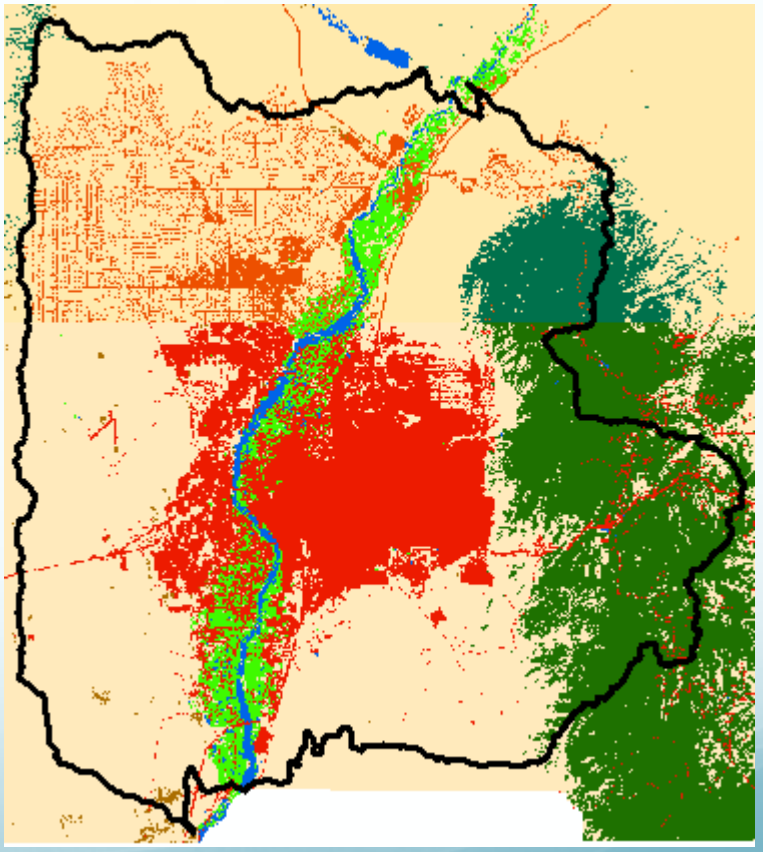
Modeling - Runoff

- Curve Number Method
  - Precipitation
  - Land use
  - Hydrologic soil group data
  - Elevation
- Hec-GeoHMS tool in ArcGIS to facilitate Curve Number Calculation

Land Use

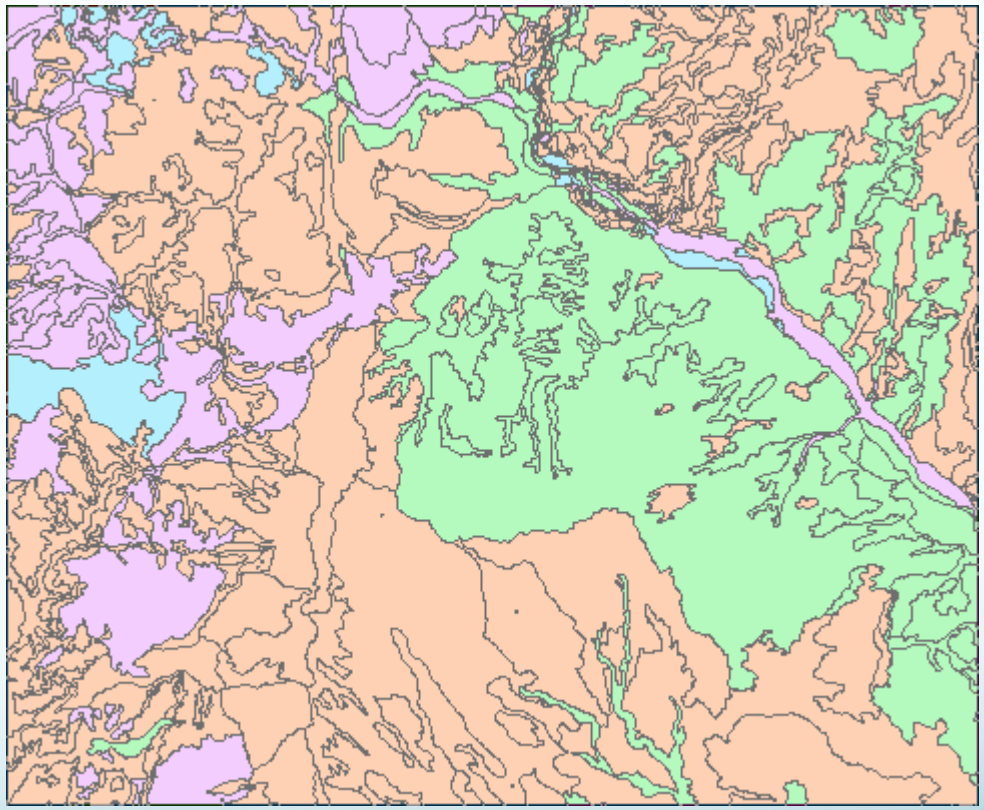
- Reclassified National Land Cover Data Set
  - Blue – Water
  - Red – Residental
  - Dark Green – Forest
  - Light Green – Agriculture
  - Light Tan – Scrub
  - Brown – Barren

*Not sufficient
(need to break out urban)



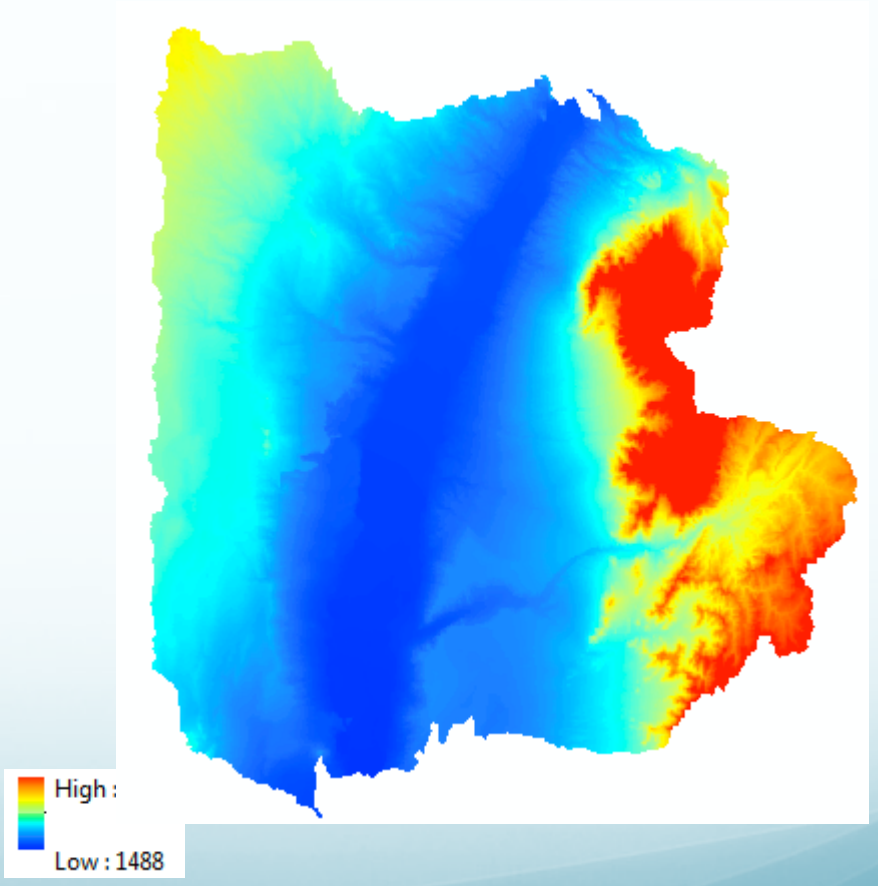
Soils

- Soil Groups



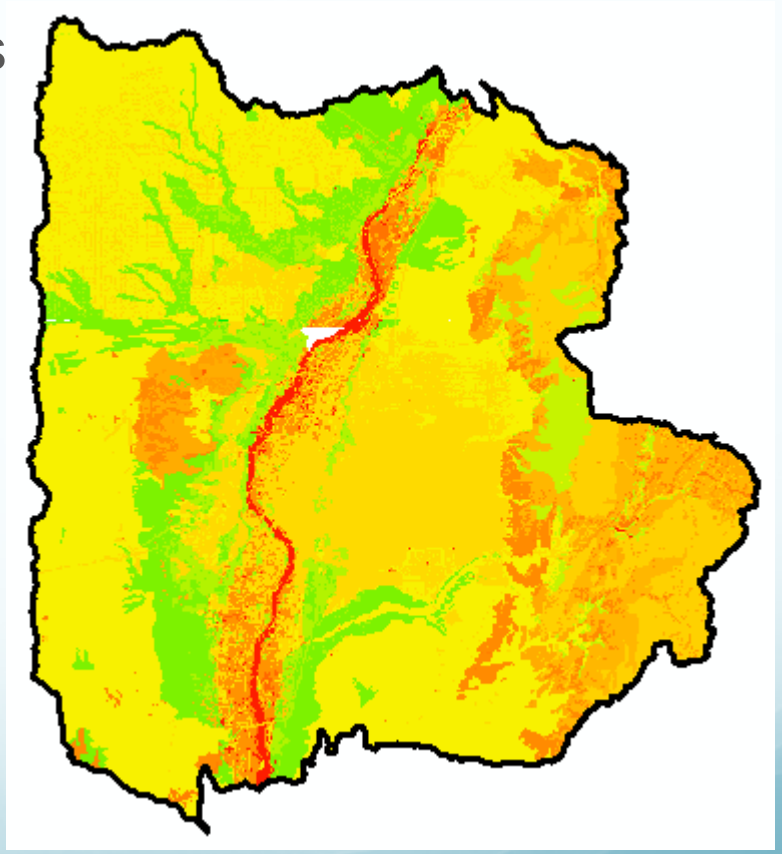
Elevation Data

- National Elevation Dataset



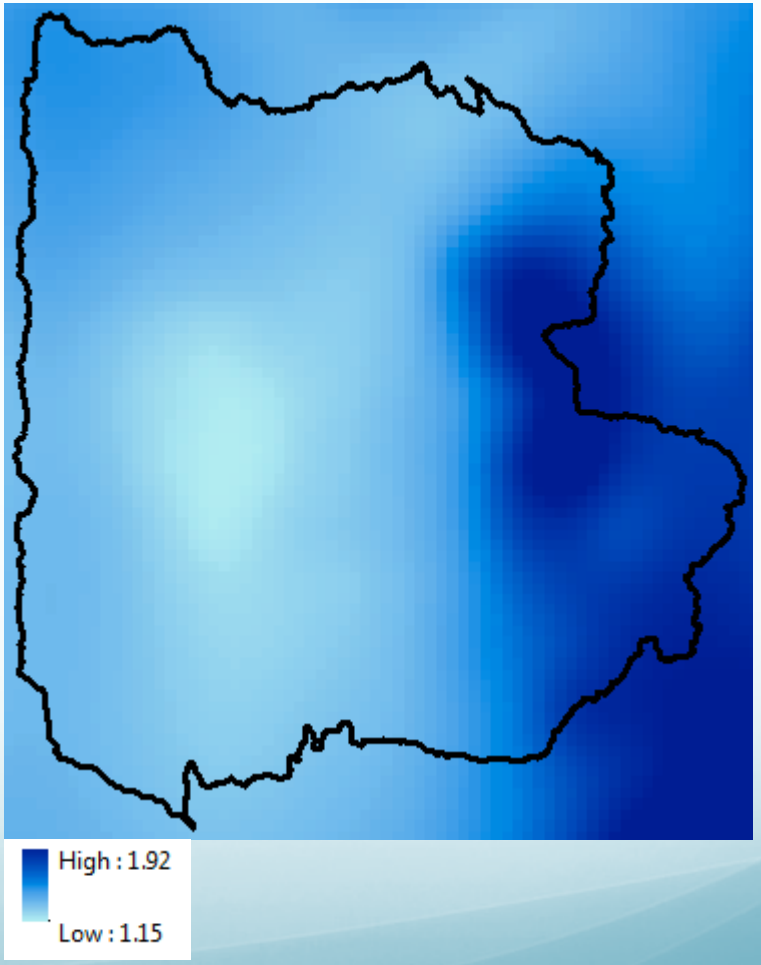
Curve Number

- Tool output
  - Raster dataset of curve numbers



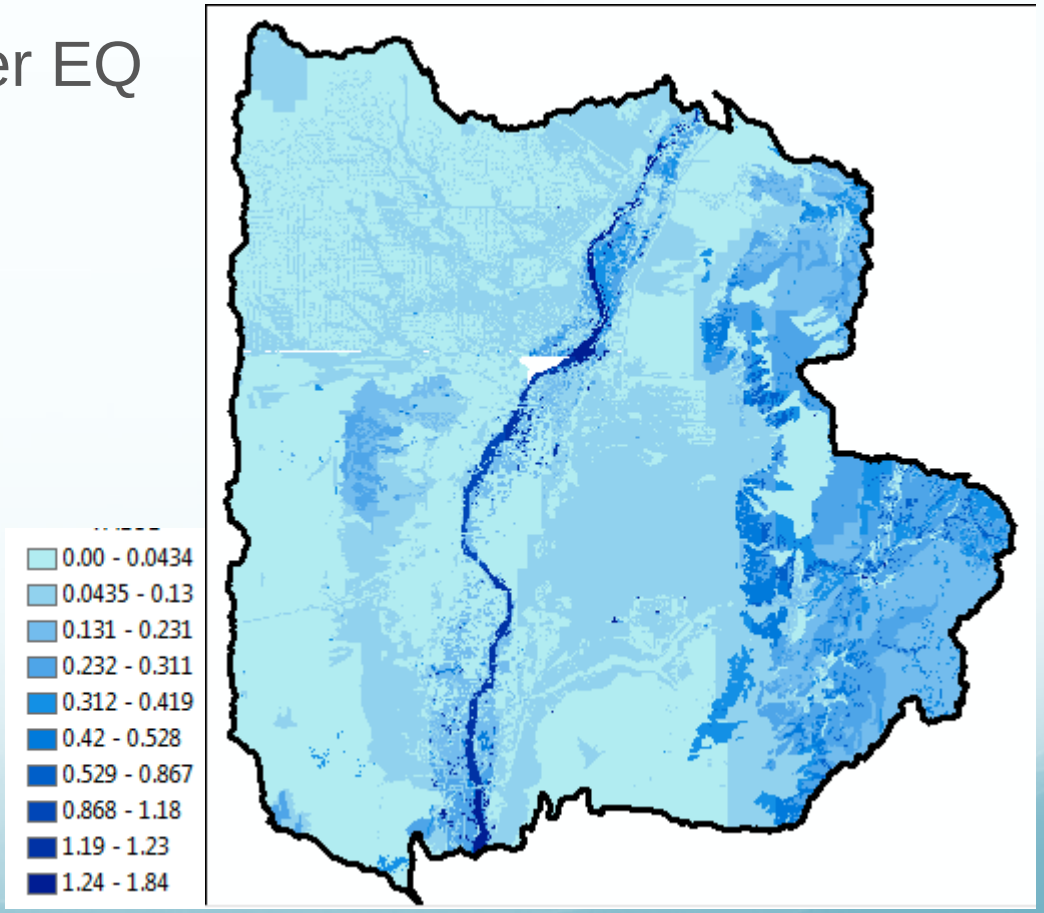
Precipitation

- 2 Year – 24 Hour
- High – 1.92 inches
- Low – 1.15 inches
- Large cell size



Runoff

- Runoff calculation in inches
- Using curve number EQ



Method

- Allows runoff off to be calculated by raster cell
- Statistics can be calculated for our “arbitrary” boundaries – i.e. political boundaries
- Calculating Q Peak or by watershed would require us to find a way to assign it back to political boundaries
- Drawback – The land use data available is very limited and leads to over simplifying the situation. This is not as critical as it is for the pollution loading.

Modeling – Pollution Loading

- Event Mean Concentration – National Dataset
- Assigned to Land Use

Putting the two together

- Raster of volumes
- Raster of event mean concentration
- Multiplied together gives mass of pollutant per grid cell
- Divide that by area of political boundary to calculate pollutant loading (mass/area).

Results – 1 st Run

Permittee	q (inches)	TSS (g)	TSS/Area (g/m^2)
Rio Rancho	0.040	1044421	5.7E-03
UNM	0.047	14812	7.0E-03
Albuquerque	0.065	3624007	7.8E-03
Sandoval County	0.055	2648406	8.4E-03
EXPO NM	0.056	7537	9.2E-03
SSCAFCA	0.049	3330372	9.6E-03
AMAFCA	0.082	9122441	1.0E-02
Santa Ana	0.104	589572	1.4E-02
Bernalillo	0.108	172868	1.4E-02
Isleta	0.110	1876061	1.5E-02
Bernalillo County	0.125	8747987	1.7E-02
KAFB	0.130	2556228	1.8E-02
Sandia	0.152	2031171	2.0E-02
Sandia/DOE	0.141	1081103	2.0E-02
Corrales	0.174	613817	2.1E-02
Los Ranchos	0.230	332431	3.1E-02
Tijeras	0.277	97419	4.4E-02

- Not quite as expected – Likely from limited Land Use
- Curve number can be improved
- Refine land use classes for pollutant

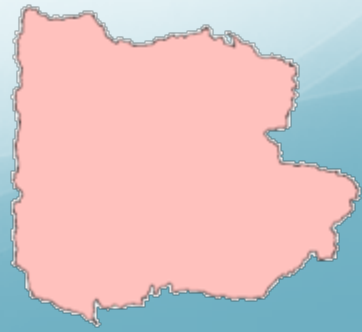
Data Variables

Area

- General rule for how a jurisdiction is clipped
  - If an entity is autonomous and does not need to follow what larger entity does it was clipped out from the larger entity.
- Example: KAFB was removed from the County as it is federal land and autonomous to county laws.
- Example: Conveyors were not removed as they are not truly autonomous.
- The clipped jurisdiction area is calculated in ArcGIS and divided by the total study area (873 sq. miles) to find what percent of total permitted area.

Area

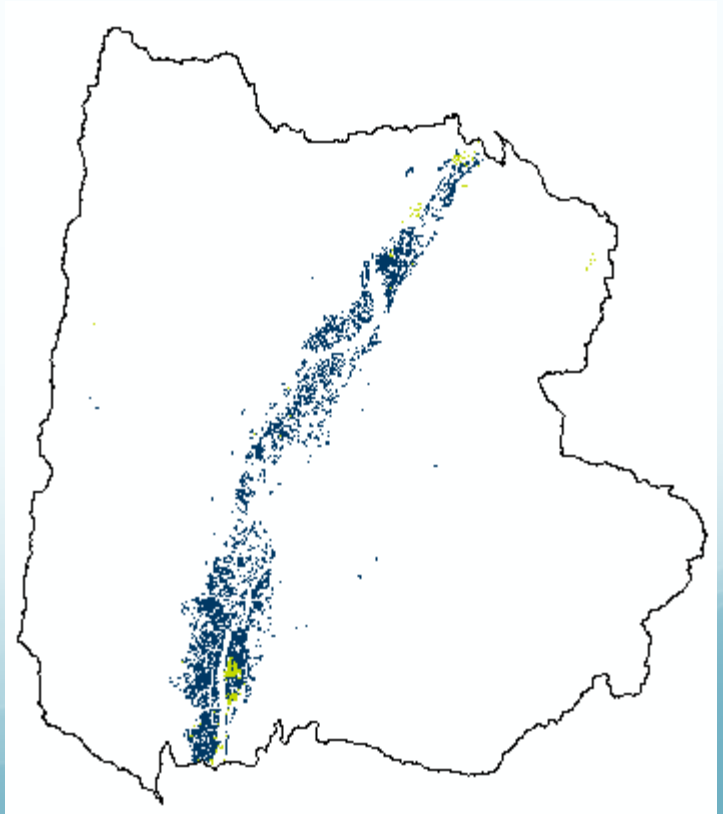
- How was each jurisdiction “clipped”?
  - Rio Rancho – SA
  - Albuquerque – SA, UNM
  - Bernalillo County – SA, Sandia Pueblo, Isleta Pueblo, EXPO NM, Albuquerque, Los Ranchos, Tijeras, KAFB, US Forest Service
  - Sandoval County – SA, Sandia Pueblo, Santa Ana Pueblo, Corrales, Rio Rancho, Bernalillo, US Forest Service
  - Kirtland Airforce Base - SA
  - AMAFCA – Lead Agency or OMAgency
  - NMDOT – “Major Roads”
    - Interstate – 2 lanes * 12 ft/ln + 10ft (outer shoulder) + 4ft (inside shoulder)
    - Highways – 2 lanes * 12ft/ln + 4ft (shoulders)



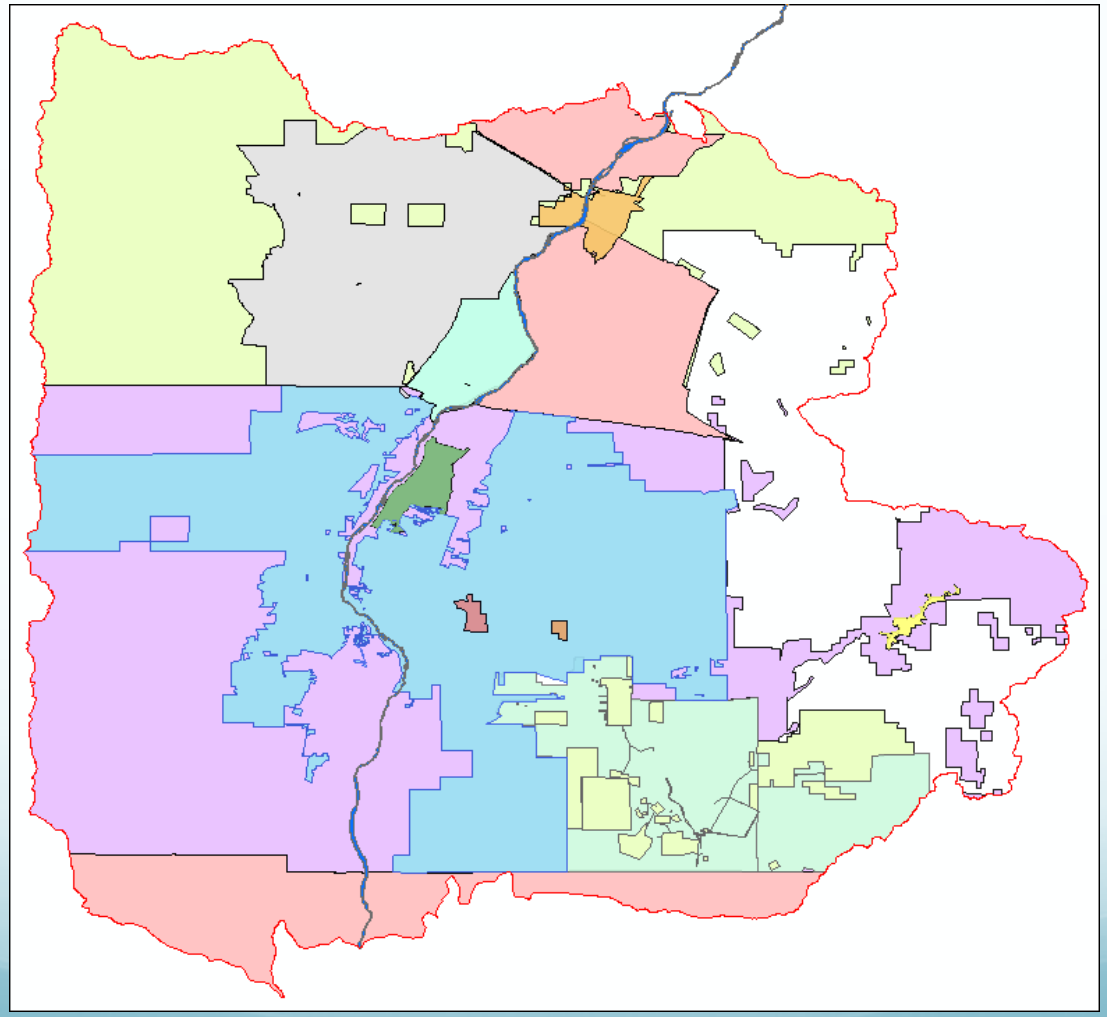
SA – Study Area Boundary
21 HUC Watersheds

Agricultural Exemption

- Calculated area of “Hay / Pasture” and “Cultivated Crops” from NLCD.
- Subtracted from total eligible area before calculated watershed percent.

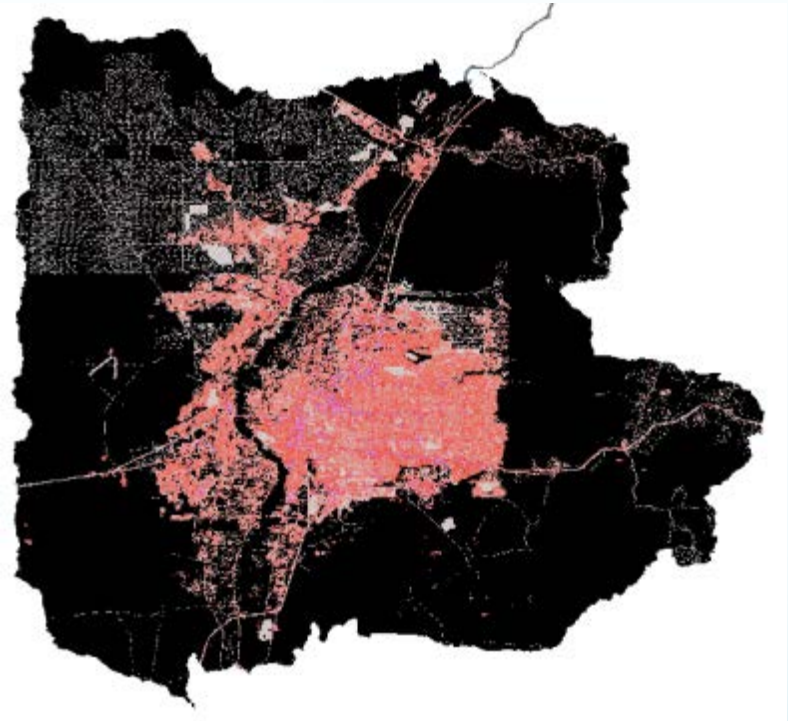


Area



Impervious Area (%)

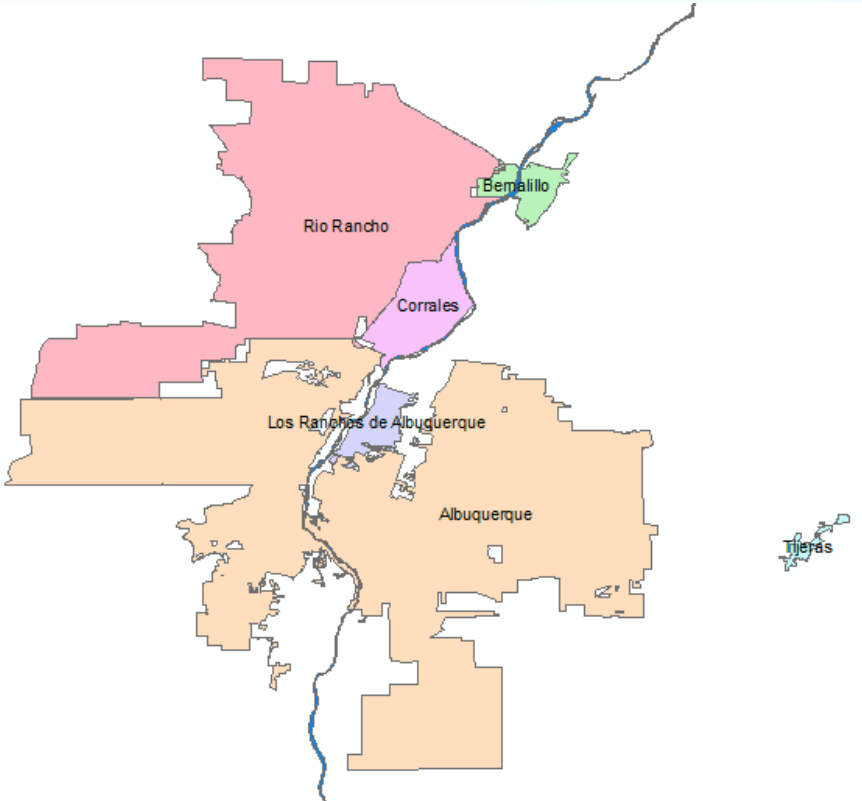
- National Land Cover Database 2006 - Percent Developed Impervious
- Clipped raster to each entity
- Pixel value is percent impervious
- 30 meter pixels
- Sum(Value * PixelArea)=Total Impervious Area
- Bins from literature



Bin	Score
<5%	0
5%-10%	1
10%-15%	2
15%-20%	3
20%-25%	4
25%-30%	5
30%-35%	6
35%-40%	7
40%-45%	8
45%-50%	9
>50	10

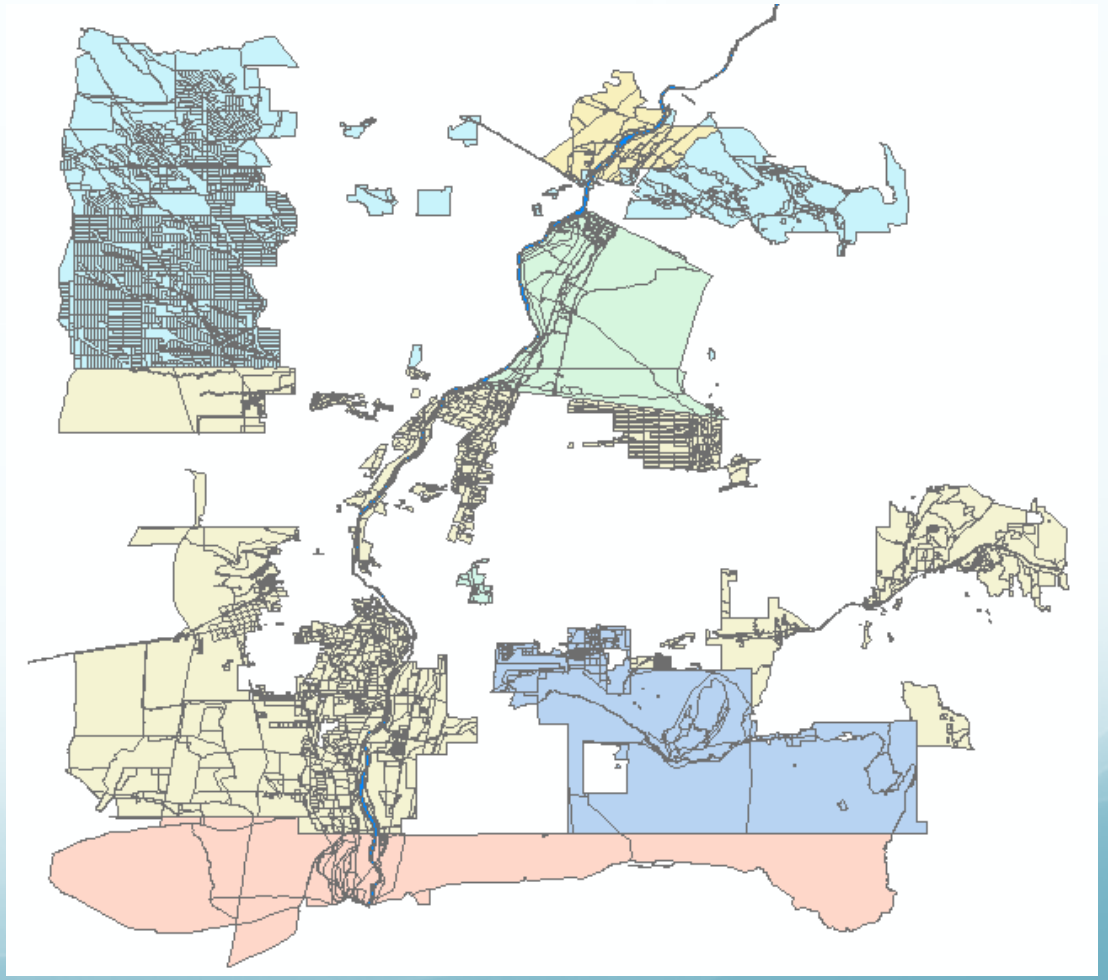
Population Density

- 2010 US Census
- “Places”
  - Took land area and population directly from census and calculated density



Population Density

- Census Blocks for the rest
- Total population divided by total land area from the tracts



Population Density

- UNM
  - Took rounded average of the Full Time Equivalent (FTE) for Fall, Spring, and Summer semesters (2011-2012)
  - Dorms hold about 3000 students
  - Assumed 40% of time spent on campus for those who don’t live there
- EXPO NM
  - Assumed equal to Albuquerque

Bin	Score
<100	0
100-250	1
250-500	2
500-750	3
750-1000	4
1000-1250	5
1250-1500	6
1500-1750	7
1750-2000	8
2000-2500	9
>2,500	10

Distance

- Calculated centroid of each polygon
- Calculated shortest distance to Rio Grande

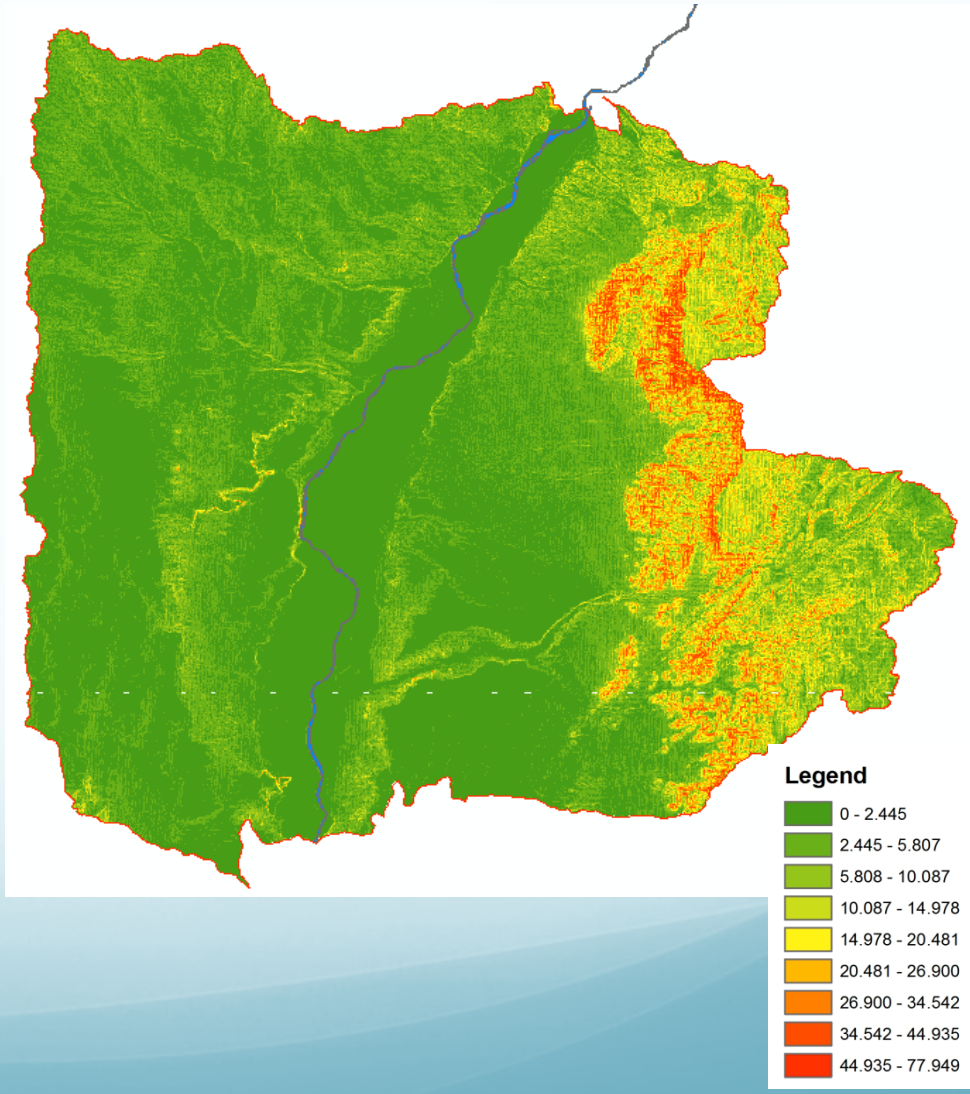
- REPLACED
  - Conveyance
  - (5 points if you are a direct discharger)

Bins	Score
>5	0
3-5	1
2-3	2
1-2	3
0.5-1	4
<0.5	5

Average Slope

- Created a slope layer from the National Elevation Dataset (10m)
- Calculated the average slope for each zone or entity

Bin	Score
<1	0
1-2	1
2-3	2
3-4.5	3
4.5-6	4
>6	5



“Scores”

	Population Density	Slope	Impervious Surface %	Distance	Points	Watershed Percent	Total Score
Albuquerque	10	1	4	0	15	20.23	303
Bernalillo	7	1	3	0	11	0.50	6
Bernalillo County	3	2	0	0	5	20.99	105
Corrales	4	1	0	0	5	1.00	5
Los Ranchos	6	0	2	0	8	0.50	4
Rio Rancho	4	2	1	0	7	8.09	57
Sandoval County	0	3	0	0	3	13.99	42
Tijeras	2	5	1	0	8	0.50	4
AMAFCA	0	1	0	5	6	30.00	180
SSCAFCA	0	2	0	5	7	15.41	108
ESCAFCA	0	1	2	5	8	0.50	4
UNM	10	1	8	0	19	0.50	10
EXPO NM	10	3	8	0	21	0.50	11
Sandia/DOE	0	5	0	0	5	2.33	12
NMDOT	0	3	10	0	13	1.00	13
KAFB	0	5	0	0	5	6.14	31
Isleta	0	2	0	0	2	5.32	11
Santa Ana	0	2	0	0	2	1.71	3
Sandia	1	4	0	0	5	4.07	20

Red Font means estimated data

“Scores” - Ranked

	Population Density	Slope	Impervious Surface %	Conveyor	Points	Watershed Percent	Total Score
Albuquerque	10	1	4	0	15	20.23	303
AMAFCA	0	1	0	5	6	30.00	180
SSCAFCA	0	2	0	5	7	15.41	108
Bernalillo County	3	2	0	0	5	20.99	105
Rio Rancho	4	2	1	0	7	8.09	57
Sandoval County	0	3	0	0	3	13.99	42
KAFB	0	5	0	0	5	6.14	31
Sandia	1	4	0	0	5	4.07	20
NMDOT	0	3	10	0	13	1.00	13
Sandia/DOE	0	5	0	0	5	2.33	12
Isleta	0	2	0	0	2	5.32	11
EXPO NM	10	3	8	0	21	0.50	11
UNM	10	1	8	0	19	0.50	10
Bernalillo	7	1	3	0	11	0.50	6
Corrales	4	1	0	0	5	1.00	5
Los Ranchos	6	0	2	0	8	0.50	4
Tijeras	2	5	1	0	8	0.50	4
ESCAFCA	0	1	2	5	8	0.50	4
Santa Ana	0	2	0	0	2	1.71	3

Next Steps

- Meet with permittees to address specific concerns
- Improve modeling by recalculating curve number

Consensus Based
Is the Goal

INPUT?