Identifying the Areas along Johnson Creek that are Most Vulnerable to Flooding

GIS II Winter 2011

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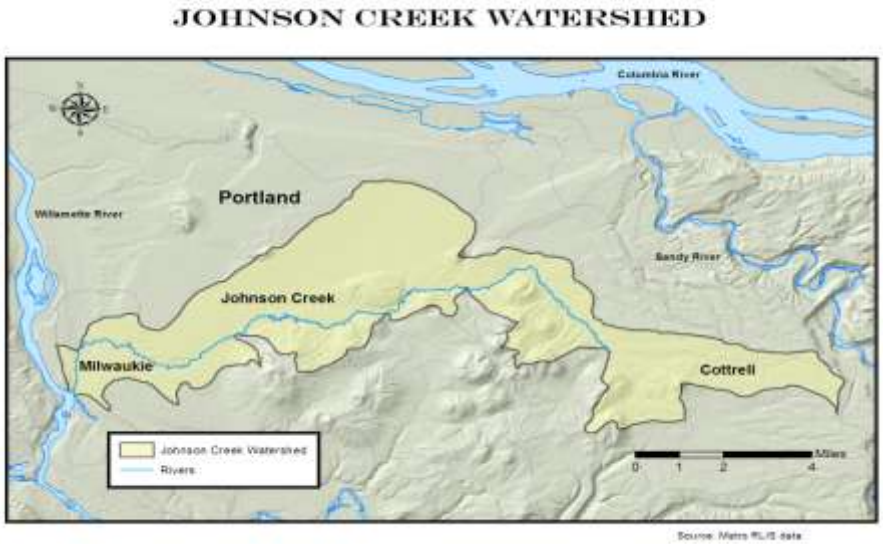
Study Area



Why study flooding along Johnson Creek?

Nearly 175,000 people live in the 54 square mile watershed

Works Progress Administration (WPA) Years

Johnson Creek - 1933

Johnson Creek - 1934

Source: Dean Marriott, City of Portland

The efforts of the WPA in the 1930s only further disconnected Johnson Creek from its floodplain.

This can be evidenced by the fact that Johnson Creek has flooded 40 times in the last 61 years (including this year).

Johnson Creek - 1964

Source: Dean Marriott, City of Portland

Study Variables

Constraint: Must be within the floodplain (Boolean Criteria)

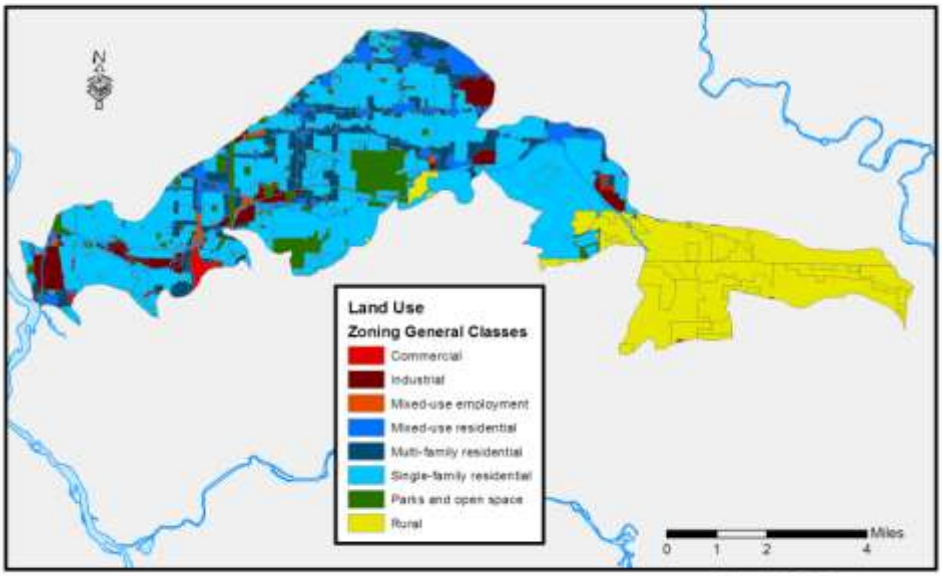
Factors:

- Slope
- Land Use
- Soil Types
- Vegetation Cover

Flooding from Johnson Creek near LKQ at 6241 SE 111th Ave

Source: Dean Marriott, City of Portland

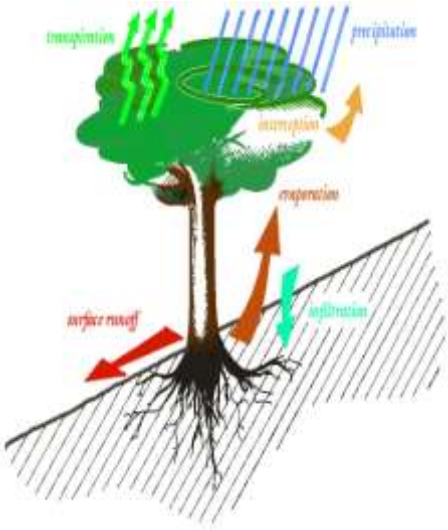
Zones within Johnson Creek Watershed



Source: Metro RLIS data

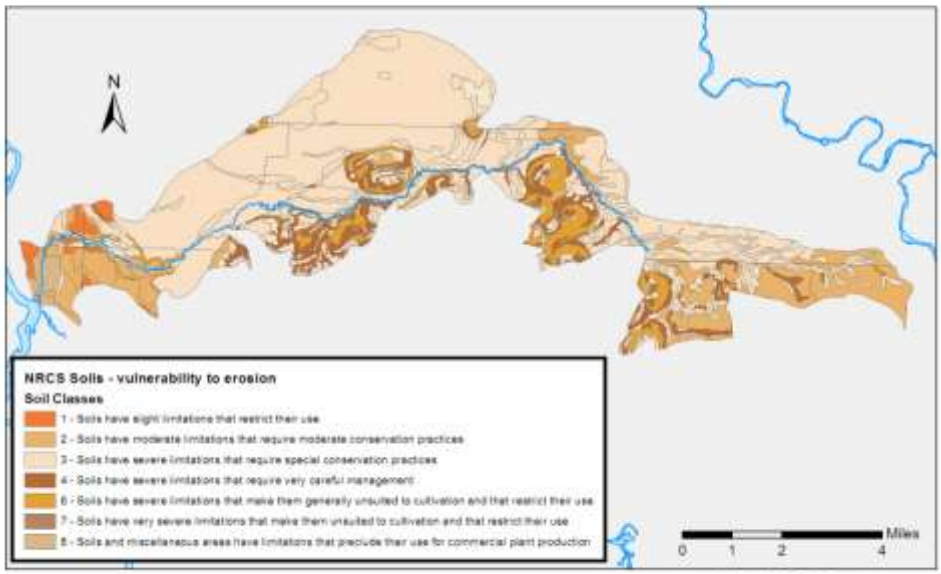
Infiltration

The soil texture and structure, vegetation types and cover, water content of the soil, soil temperature, and rainfall intensity all play a role in controlling infiltration rate and capacity.



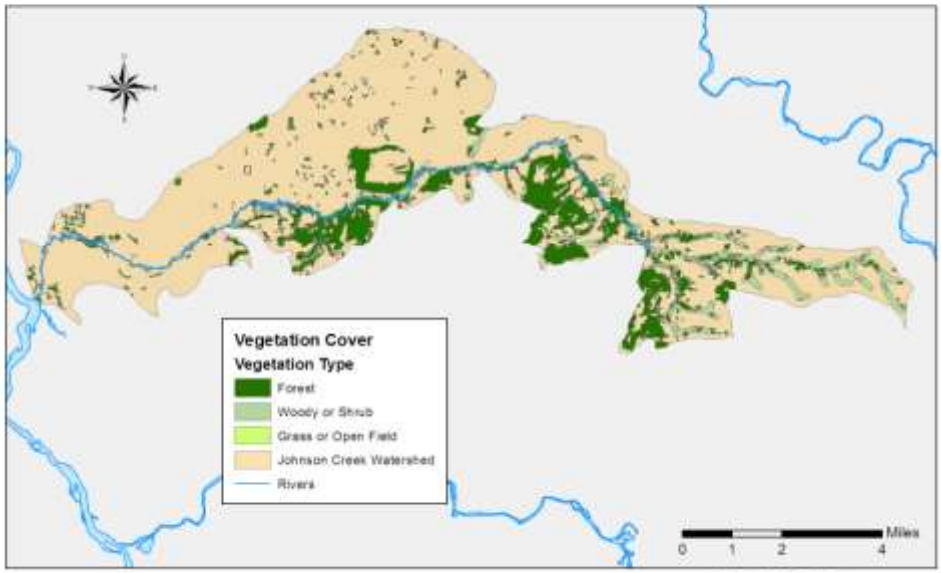
Source: http://www.geflohen.co.cc

Johnson Creek NRCS Soil Classes



Source: Metro RLIS data

Johnson Creek Vegetation Cover



Source: Metro RLIS data

Analytic Hierarchy Process (AHP)

We used pairwise comparison to determine the weight of our variables.

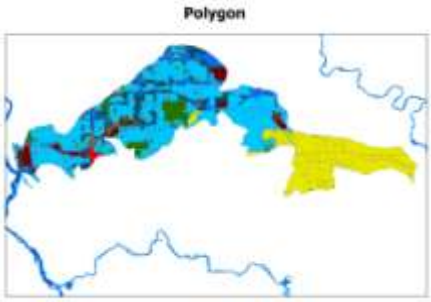
	A	B	C	D
A	1	3	5	5
B	1/3	1	3	3
C	1/5	1/3	1	1
D	1/5	1/3	1	1

A = Slope
B = Land Use
C = Soil Type
D = Vegetation Cover

Preference Index Assigned
1 – Equally important
3 – Moderately more important
5 – Strongly more important
7 – Very strongly more important
9 – Overwhelmingly more important

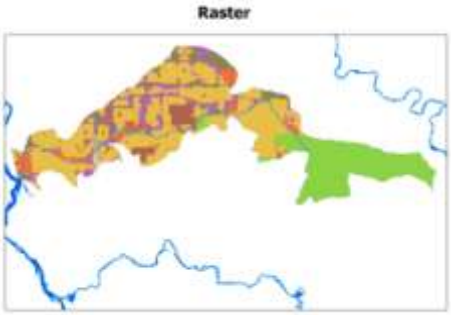
Criterion	Geometric Mean	Weight
A	$(1*3*5*5)^{1/4}$ = 2.94283	0.557864
B	$(1/3*1*3*3)^{1/4}$ =1.31607	0.249484
C	$(1/5*1/3*1*1)^{1/4}$ = 0.508133	0.096326
D	$(1/5*1/3*1*1)^{1/4}$ = 0.508133	0.096326
Sum	5.27517	1

Polygon to Raster

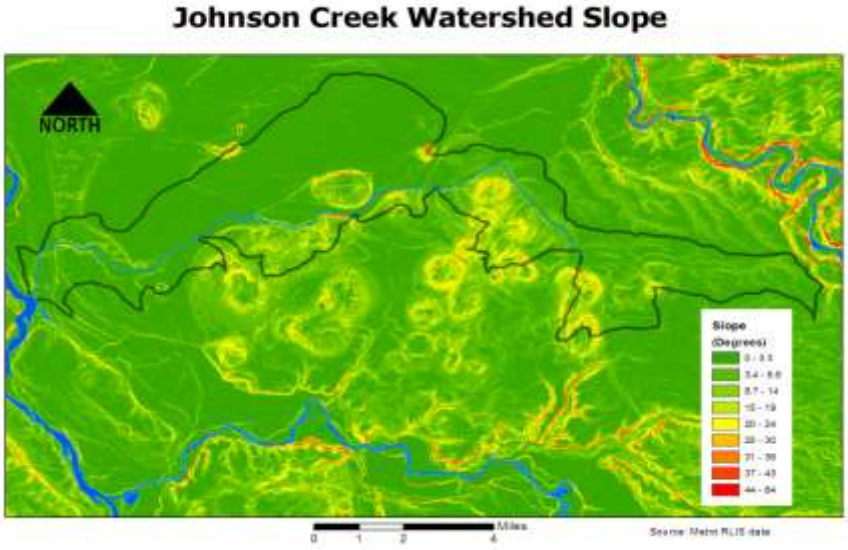


Land Use

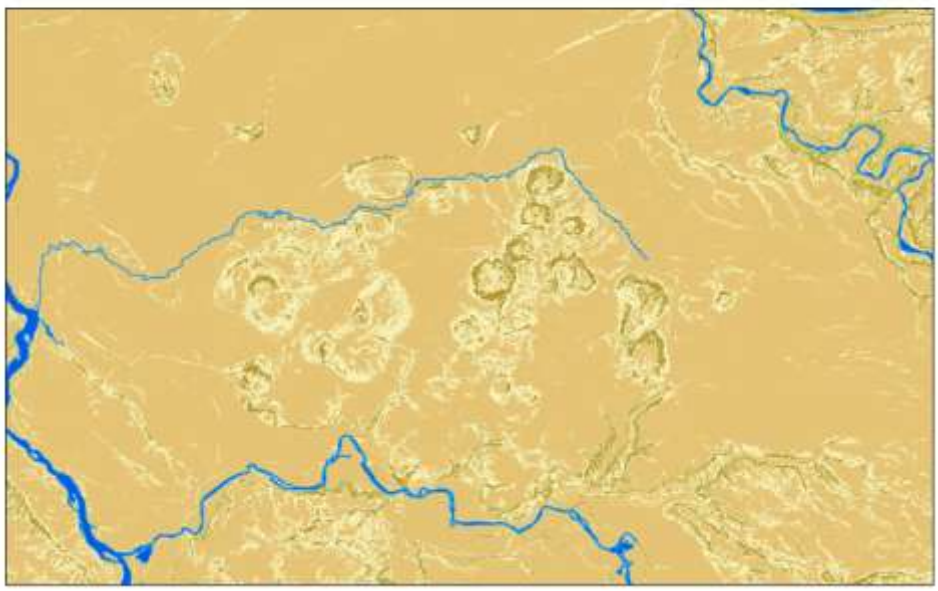
We converted all of our polygons to rasters for each of the variables we wanted to include in our final flood-risk map.



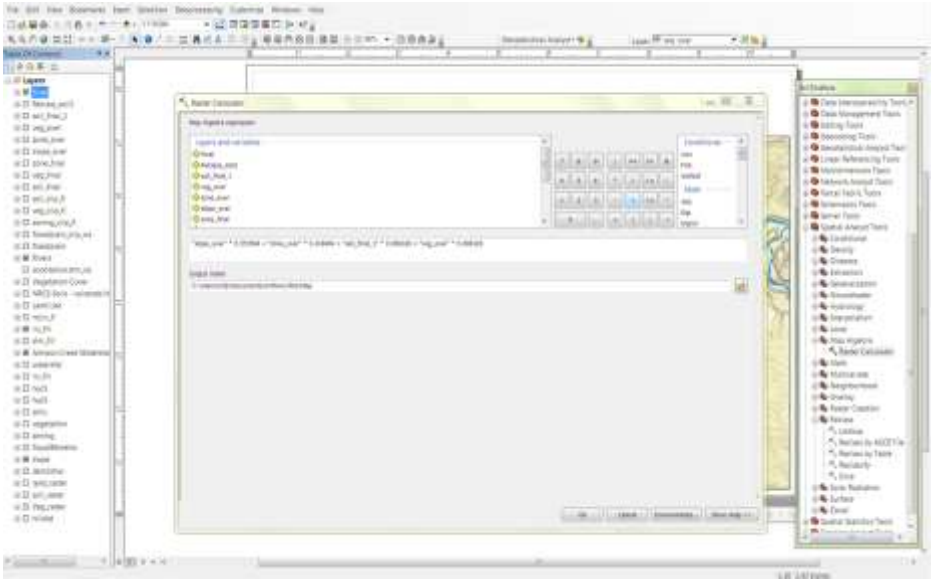
Derive Slope from Elevation



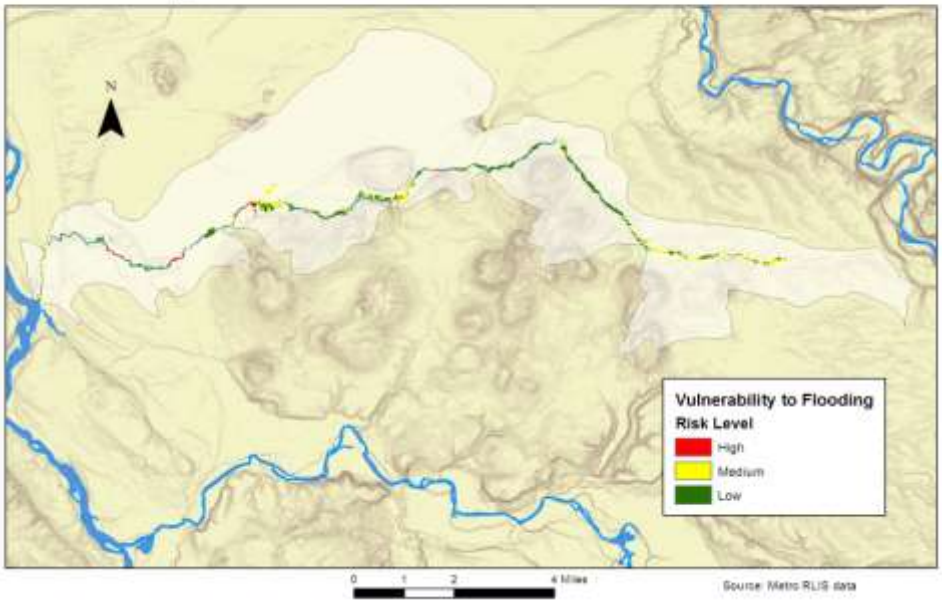
Slope Reclassified



Raster Calculator



Johnson Creek Flood Risk



A Closer Look …

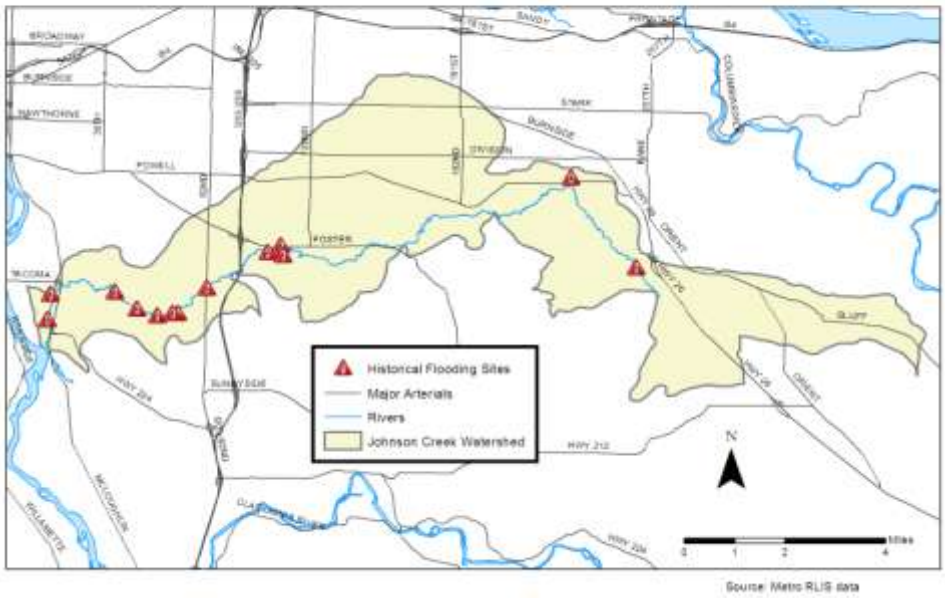
Model Validation

In order to do a quick validation of our model, we utilized a 2003 Action Plan from the Johnson Creek Watershed Council and news articles from The Oregonian that listed detailed addresses of where flooding had occurred along Johnson Creek.

These addresses should mostly fall within the areas which were predicted to be most vulnerable to flooding. The addresses were gathered randomly with no attention to their physical locations prior to geocoding them.

List of Johnson Creek's Historical Flooding Sites		
Address	**City**	**Zip**
7001 SE Johnson Creek Blvd	Portland	97206
6241 SE 111th Ave	Portland	97266
9300 SE Bell Ave	Portland	97222
9204 SE 55th Ave	Portland	97206
1902 SE Milport Rd	Portland	97222
2098 SE Clatsop St	Portland	97202
4500 SE Johnson Creek Blvd	Portland	97222
9386 SE Linwood Ave	Portland	97222
8352 SE 82nd Ave	Portland	97266
6510 SE 106th Ave	Portland	97266
6678 SE 110th Dr	Portland	97266
219 S Main Ave	Gresham	97080
6918 SE 252nd Ave	Gresham	97080

Johnson Creek's Historical Flooding Sites



Validation?

Not Completely

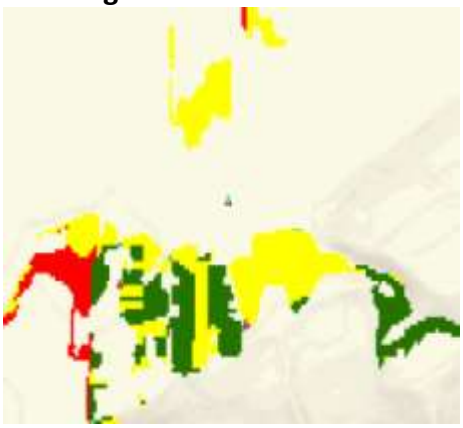
What about this location?

LKQ Auto Parts
6241 SE 111th Ave
Portland, OR 97266

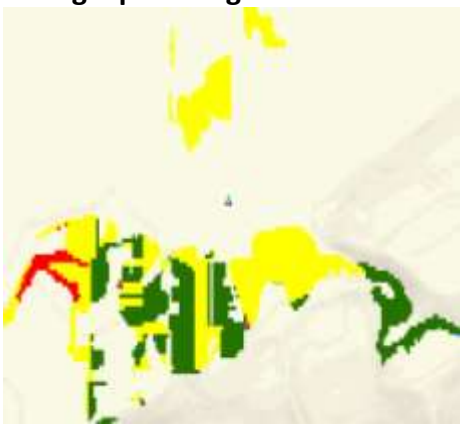
Source: Dean Marriott, City of Portland

Better than Equal Weights

Using our AHP



Using Equal Weights



Potential Future Analysis

- Include population density
- Also possibly include precipitation?
- Other missing variables …
- Some different datasets (soil type – sandy loam versus clay)
- More time
- Attempt to remove some of the subjectivity involved, especially in reclassification
- Weighting criteria differently
- More geocoded sites to test the model against
- Human error

References

National Resources Conservation. 2009. NSSH Part 662. Available from: <http://soils.usda.gov/technical/handbook/content s/part622.html#00> Accessed 2011 Feb 28

Portland Bureau of Environmental Services. 2009. About the Watershed. Available from: <http://www.portlandonline.com/bes/index.cfm?c=33211> Accessed 2011 Feb 28

Johnson Creek Watershed Council. 2003. Action Plan: Chapter 2.7, Flow and Hydrology. Available from: <http://www.jcwc.org/actionPlan/ch2c.htm#2.7.0.0> Accessed 2011 Feb 28

Johnson Creek Watershed Council. 2006. Johnson Creek Watershed: A Decade of Change. Available from: <http://www.jcwc.org/pdf/JCWC_AnnualReport2006.pdf> Accessed 2011 Feb 28

The Oregonian. 2007. UPDATE: Johnson Creek floods, closing nearby roads. Available from: <http://blog.oregonlive.com/breakingnews/2007/12/johnson_creek_reaches_flood_st.html> Accessed 2011 Feb 28

Yalcin, Y., Akyurek, Z. 2002. Analyzing Flood Vulnerable Areas With Multicriteria Evaluation. Available from: <http://www.isprs.org/proceedings/XXXV/congress/comm2/papers/154.pdf> Accessed 2011 Feb 28