

# IF A RAINDROP FALLS IN THE FOREST...

## EXPLORING RUNOFF IN ONSLOW COUNTY, NC

### INTRODUCTION

Located on the southeastern coast of North Carolina, Onslow County consists of seven major townships and the city of Jacksonville. Partially due to the presence of Marine Corps Base Camp Lejeune, Onslow County has seen steady growth in the past two decades. The rapid land development associated with such growth has led to the conversion of many previously forested, undeveloped areas into residential and commercial buildings, as well as additional roadways.

Previous spatial studies have investigated the effect of land development on runoff in the context of cities and towns, including importance of infiltration (Paule-Mercado, Khan). Water that does not infiltrate becomes runoff and can overwhelm existing infrastructure and cause flooding. The goal of this project is to identify areas in Onslow County where there is a lack of infiltration so that further investigation may be conducted in the future to determine if measures to increase infiltration are necessary.

### METHODOLOGY

In order to evaluate runoff across Onslow County, aspects of the natural and built environments needed to be known. For the built environment, impervious area and land development needed to be found, while soil infiltration and precipitation were required for the natural environment.

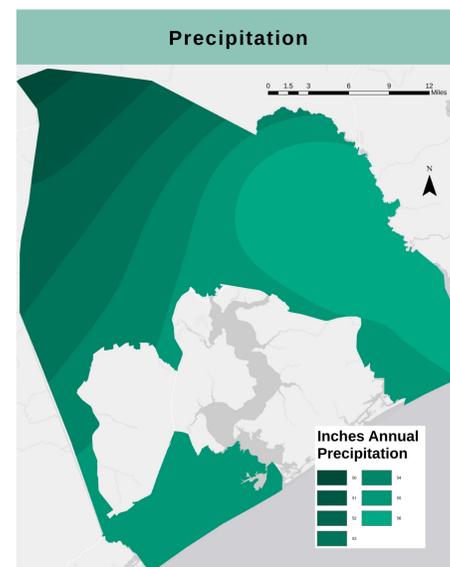
Impervious surface area was determined by combining the building and road footprints for Onslow County. Road footprints were estimated through standard lane widths and the number of lanes for each roadway. Land development was determined by reclassifying land use data. Soil infiltration and precipitation were already available as a field from their respective data files.

Each factor of the analysis was converted to raster and reclassified according to the effect on runoff, allowing late usage of the raster calculator. It was decided that higher numbers would represent better infiltration. Impervious surfaces were rated 1 or 0, with 0 corresponding to impervious. Soil infiltration and precipitation were rated from 1 to 7, with 7 representing extremely rapid infiltration or low precipitation. Land use was rated from 20 to 100 in increments of 20. The rating system for land use was different so that the undeveloped land areas would correspond to 1 for pervious surfaces.

$$\text{Infiltration} = \left( \text{Impervious Areas} * \frac{\text{Land Development}}{100} * \text{Soil Condition} \right) + \text{Precipitation}$$

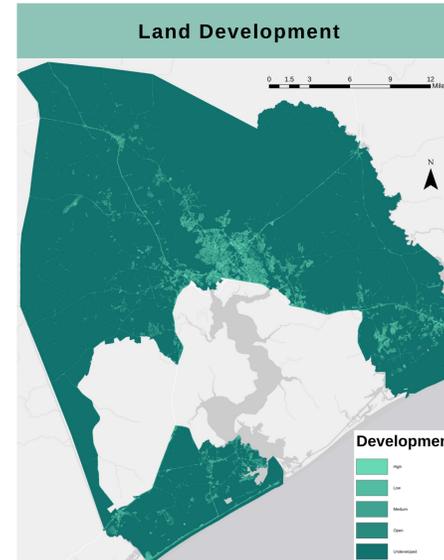
The above equation represents the raster calculation conducted to determine the final raster. Impervious areas, land development, and soil condition were grouped together because they directly impacted infiltration. Precipitation was added so that the amount of rainfall an area experiences would be considered, but not considered as if infiltration and precipitation were directly related.

The results of the raster analysis demonstrate that the areas of most concern are in the eastern portion of the county (Swansboro area). While the Swansboro area does not have development to the scale of the inland areas of Onslow County (Jacksonville area), the precipitation that Swansboro receives is greater than in other areas, therefore the final ratings for the area were overall poor or very poor. Results would likely be different if precipitation had been excluded.

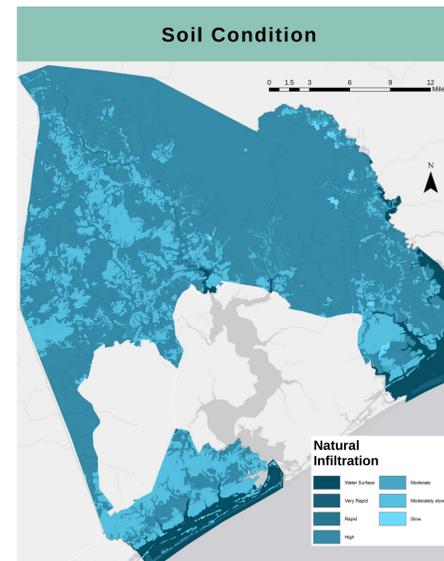


Accuracy of this analysis may be limited by a couple of factors. Precipitation data is often interpolated, leading to some uncertainty. Land use ratings were based on the assumption that all undeveloped lands' original soil had not been altered or removed.

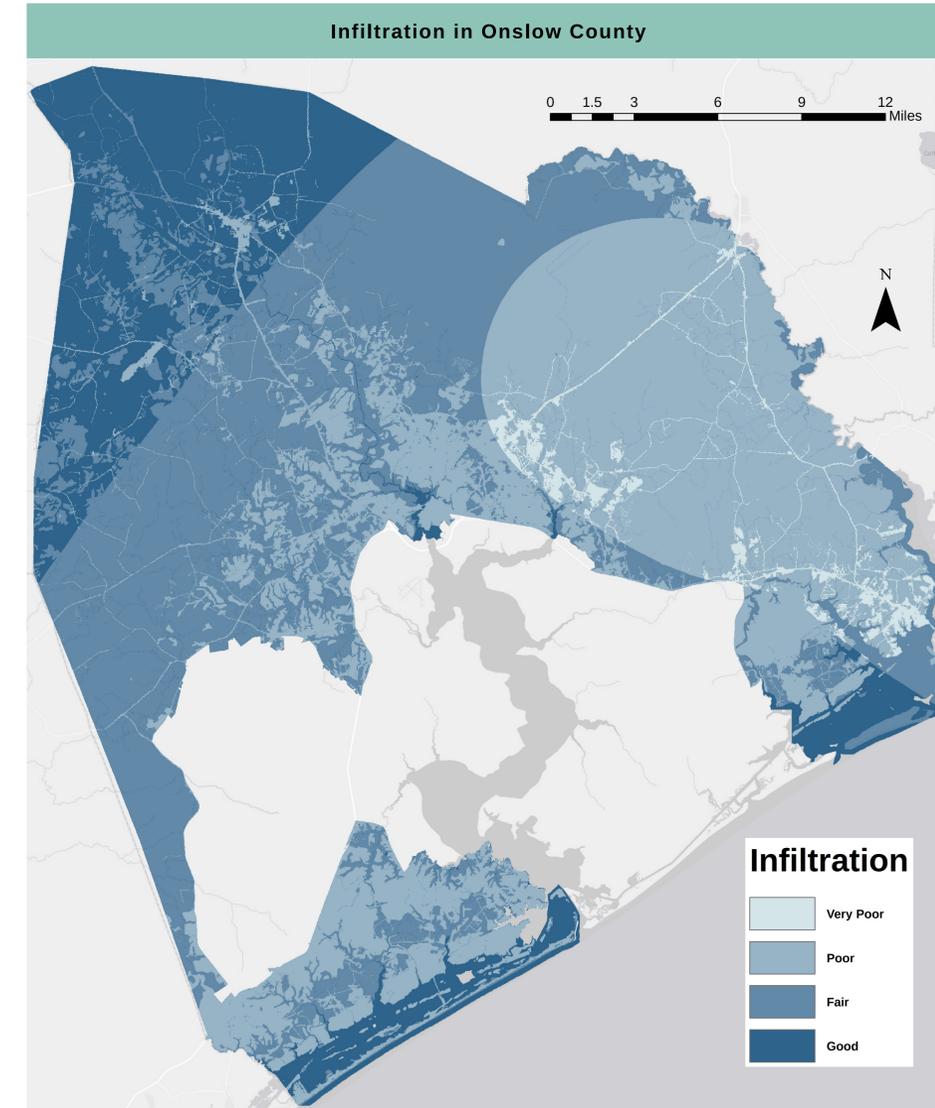
Additionally, the duration and intensity of precipitation events on the infiltration ability of the soil was not considered. In the future, results would benefit from the incorporation of these two factors.



Neither Marine Corps Base Camp Lejeune or Marine Corps Air Station New River were included in this analysis. This was done because Onslow County has no jurisdiction within the bounds of either the military base or the air station and would be unable to make any changes to improve infiltration. Since development will likely continue along established roadways and city centers, the expansion of the poor infiltration areas is very possible.



### RESULTS



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CEE187 Intro to GIS | May 3, 2019

**Data Sources:** Onslow County GIS Office, NC Department of Environmental Quality, USDA Natural Resources Conservation Service, ESRI

**Projection:** NAD 1983 StatePlane North Carolina 3200 Feet

#### References:

Paule-Mercado, M.a., et al. "Influence of Land Development on Stormwater Runoff from a Mixed Land Use and Land Cover Catchment." *Science of The Total Environment*, vol. 599-600, 1 Dec. 2017, pp. 2142-2155., doi:10.1016/j.scitotenv.2017.05.081.

Khan, Nasreen. "Temporal Mapping and Spatial Analysis of Land Transformation Due to Urbanization and Its Impact on Surface Water Systems: A Case from Dhaka Metropolitan Area, Bangladesh." Amsterdam 2000.