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Assignment #2: Flooding in Collin County

I. Description of the Hazard

a. Type

The hazard I have chosen for this risk assessment is flooding. The National Flood Insurance Program (NFIP) defines flooding as follows:

> *A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from:*
> *--Overflow of inland or tidal waters; or*
> *--Unusual and rapid accumulation or runoff of surface waters from any source; or*
> *--Mudflow*

In Collin County severe flooding most often occurs from runoff after storms. This is called "urban flooding." According to the National Oceanic and Atmospheric Administration (NOAA)

> *Urbanization increases runoff by 2 to 6 times over what would occur in natural terrain. Flood waters can fill streets, freeway underpasses, and parking lots and can sweep away cars.*

The website for the city of McKinney, located in northern Collin County, talks more about why and when flooding occurs:

> *Flash flooding occurs during heavy rain events and happens very quickly. It ends quickly as well. Flooding occurs as the result of a more prolonged rain event or lake / creek overflow. It's more gradual, more predictable and lasts longer. Dam / levee failure may result in flash flooding and flooding.*

b. Location

In Collin County the areas most in danger of flooding are low-lying areas adjacent to creeks and creek beds. Erosion in some of these creek beds has caused them to have narrow beds with steep walls, which can contain flood waters until they reach up to twenty feet above the normal water level. Once waters have reached this height, they flood low bridges and water crossings. When they rise higher, they flood the relatively flat areas near the creek beds. This can be seen in Figures 1 & 2, where the creeks and Lake Lavon are shown in blue and the boundaries of the flood areas are shown in pink. Lake Lavon is not a significant flood risk because it is a man-made lake with managed water levels.

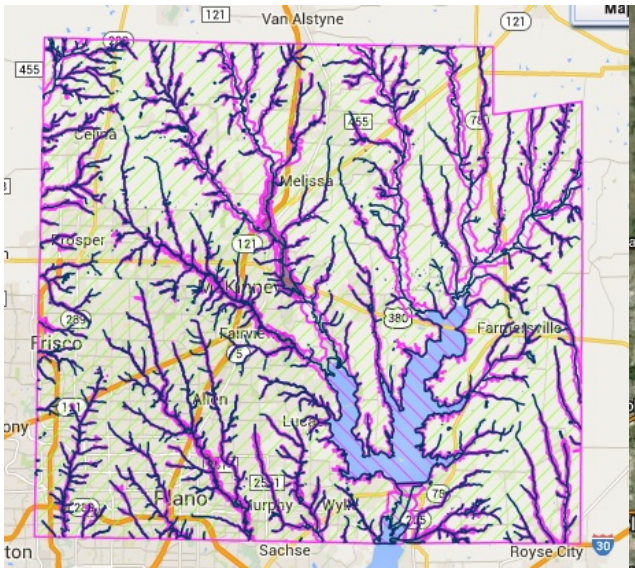

Figure 1.

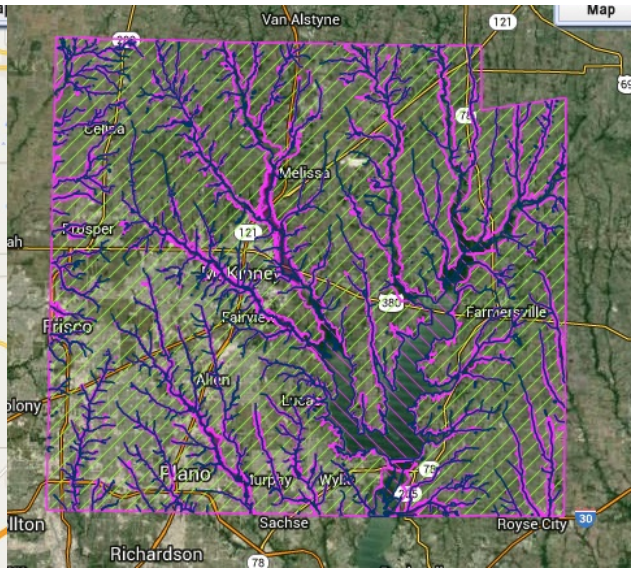

Figure 2.

An example of flooding in low areas is found in Bob Woodruff Park in Plano. In Figure 3, creeks and the man-made pond are blue, flood-prone areas are in pink, and the red star indicates Dooley Elementary. The large pink area next to Dooley has a low elevation, with several fields that are lower than the pond but do not naturally drain well. After each flooding event in this area these fields remain flooded for days, increasing the risk of more severe flooding if another rain event occurs. Dooley Elementary flooded repeatedly in the late 1990's and early 2000's, and was subsequently renovated and expanded with retaining walls and higher foundations.

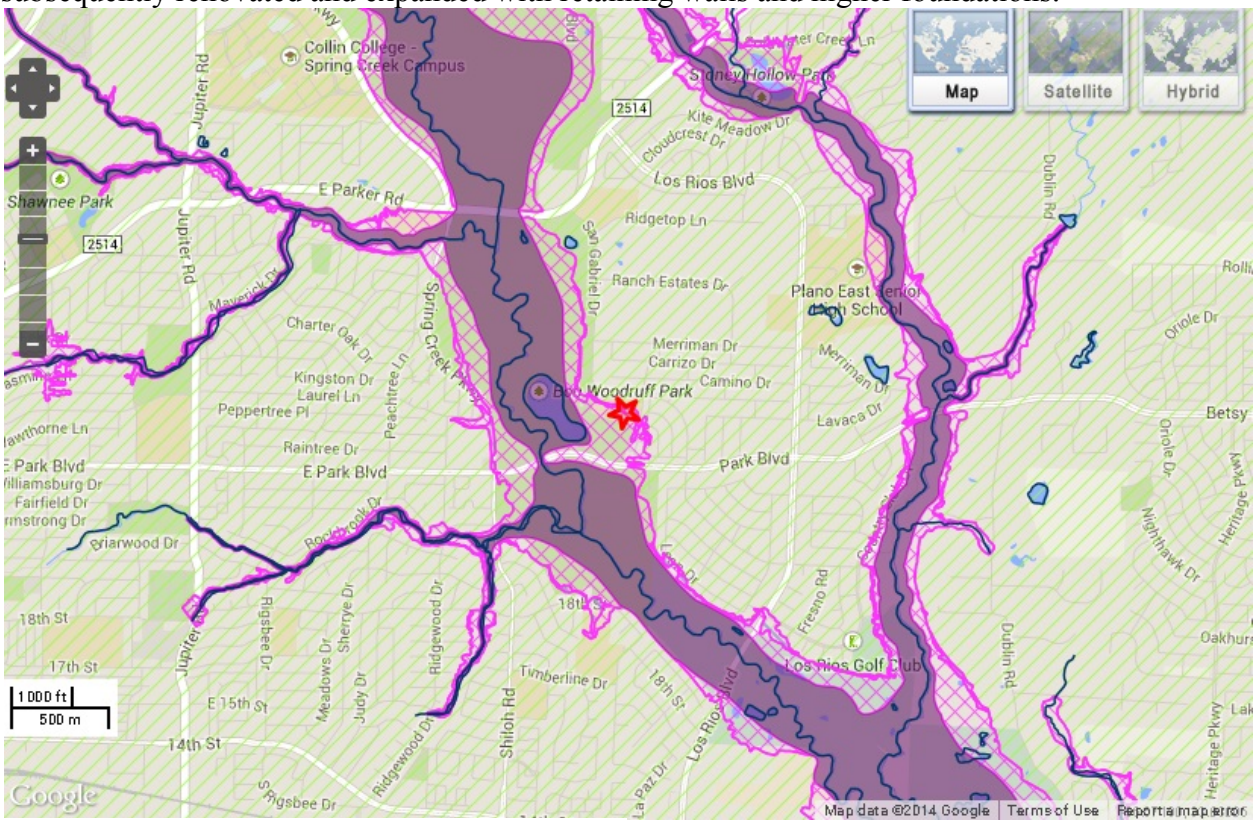

Figure 3.

c. Extent

Flooding is measured by flood gauges, which record the depth of the water at various points along the watercourse. Floods are recorded as compared to the "normal" non-flood depth of the water in these places. Reservoirs such as Lake Lavon, the flood-control lake and reservoir in Collin County, have their depth described as the height of the water level above sea level. Man-made reservoirs are maintained by the Army Corps of Engineers, and kept at pre-determined levels so that they can absorb flood waters without requiring major water releases or allowing flooding of areas upstream.

Flooding in the area is dependent on severe weather events and local precipitation rates, as those are the only local sources of excess water (there are no local ice deposits such as glaciers, and the county is not near the coast). This makes flooding in the areas somewhat predictable. After the onset of rainfall in the watershed flash floods can occur within hours, depending on precipitation rates and the moisture content of the soil. Due to excellent local floodwater management minor flooding rarely lasts more than a few days.

Figures 4 & 5 below are an additional reference. Figure 4 is a plain political map, whereas Figure 5 has an overlay of the flood plain as determined by Collin County in light blue and creeks in dark blue.

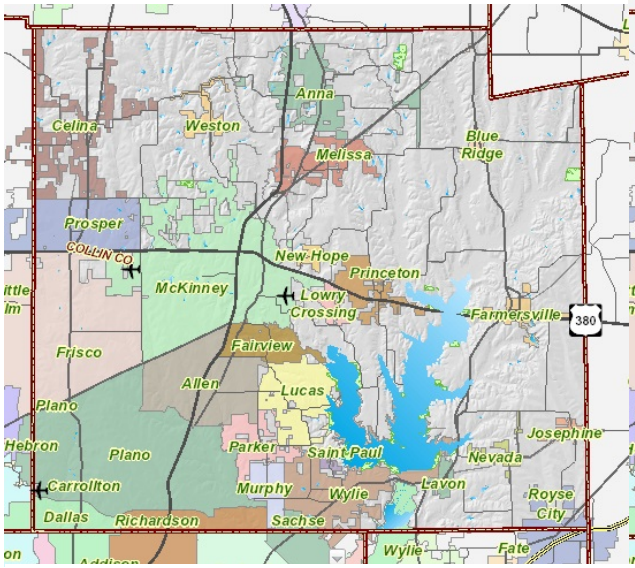

Figure 4.

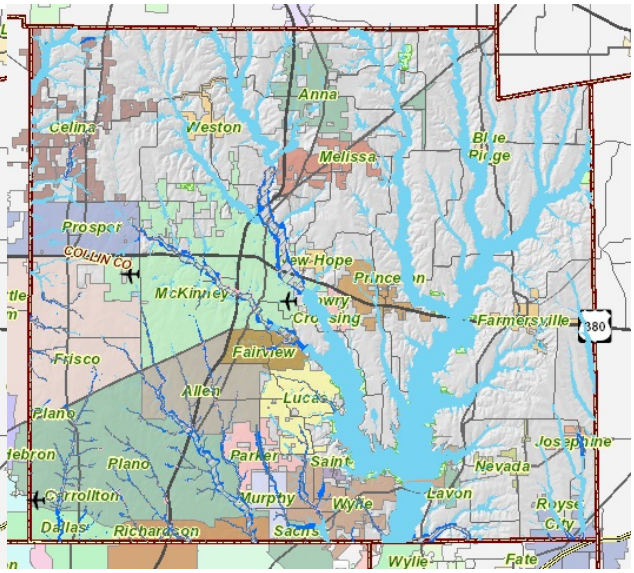

Figure 5.

II. Hazard History and Frequency

a. Hazard History

There was a Major Disaster Declaration recorded by FEMA due to severe storms and flooding that included Collin County on May 12, 1966. This included qualifications for both individual and public assistance. However, details on damage in Collin County could not be found; other references to the flooding in the area on this date only talk about damage in Dallas County. Collin County was far less densely populated in 1966 than it is today, with most of the

population concentrated around the old city centers, which are all safely above the floodplain. Damage due to this flood event is therefore assumed to be minimal in Collin County.

There are no other recorded floods causing significant damage in the county.

b. Disaster Probability

Due to the way flood hazards are calculated, risk maps (see Figures, above) are created with delineations indicating areas that have a 1% annual chance of flooding (the "hundred-year" flood zone) and 0.2% annual chance of flooding (the "500-year" flood zone). Areas that have a higher than 1% annual risk of flooding are not allowed to have buildings built on them in Collin County (see IIIb. Structures at Risk, below).

Within areas at risk for flooding, flooding is most likely to occur during or immediately after severe weather events within the local watershed, which extends north into southern Grayson County. Also relevant is the water level of creeks in neighboring Denton County, as the westernmost portion of Collin County drains westward into Denton County. Flash floods are more likely during drought years, as the water absorbing capacity of the local clay soil is reduced. Regular, non-flash floods are more likely in wet years during the summer, when there can be several days' worth of precipitation and accumulated runoff raising creek levels. They can more rarely occur due to winter storms, but this happens rarely in Texas due to low levels of snow and ice accumulation compared to more northerly latitudes.

III. Hazard Impacts

a. Population Risks

A very small proportion of the houses in Collin County are at direct risk of flooding, due to county regulations about building in the floodplain (see next section).

Special populations especially threatened by this hazard include the homeless and people who spend time in low-lying parkland, such as people participating in athletic activities (walking, running, cycling, horseback riding, disc golf, etc.) and children playing.

The homeless population is at higher risk because they may be sleeping in parks and under bridges during the warmer months, and could easily be trapped by rising waters or swept away during a flash flood. They may also be sleeping in cars parked in unsafe locations.

b. Structures at Risk

Although there were 340 properties newly included in the flood plain when the maps were updated in 2012, there are relatively few buildings at risk in Collin County because "[d]eveloping in the floodplain is restricted in Collin County." (Chambers, Allen American) In the same article, "Higher Ground," it is revealed that flood damage to structures is not a serious issue in unincorporated areas of the county. Quoted by the article is Jason Lane, Assistant

Emergency Management Coordinator for the Collin County Department of Homeland Security in 2012.

> *"When someone wants to build something and it butts up on a floodplain, you have to show how that structure is not going to disrupt the floodplain," Lane said. "This is the right, [and] as a result of that they don't have big flooding issues in McKinney, even when we have a lot of rain." […] Although the county does not calculate impact in the "out" plains like McKinney does due to expense, Lane said a hazard mitigation study for its unincorporated areas from 2009 revealed only one residence which suffered serious loss from flooding. While those are pretty good odds, Lane encouraged vigilance in knowing one's location as it relates to flood risk.*

In Plano, Texas there is a facility called the Holifield Science Learning Center (also locally known as the Outdoor Learning Center) which is owned by Plano ISD and located in the floodplain in Bob Woodruff Park. It consists of several buildings, including the Jim Dunlap Living Materials Center, which houses wild and domesticated animals used in teaching PISD students. Students from schools across the district go on field trips to the Holifield Center.

In addition, adjacent to the same park is Dooley Elementary, which was built on the edge of the flood plain. As stated previously it has flooded in years past.

c. Critical Facilities

There seem to be no critical facilities at risk of flooding. Collin County does not have any power plants, and all water and wastewater treatment plants are at elevations above the floodplain.

IV. Annotated Bibliography

The National Flood Insurance Program | FEMA.gov. (n.d.). Retrieved October 29, 2014, from https://www.fema.gov/national-flood-insurance-program

- Definition of flooding

NOAA. (n.d.). Floods/Flash Floods. Retrieved October 29, 2014, from http://www.srh.noaa.gov/hgx/?n=severe_weather_awareness_flashflood

- Definition of urban flooding

Flooding. (n.d.). Retrieved November 2, 2014, from https://www.mckinneytexas.org/index.aspx?NID=815

- How and why floods occur

Alexandria Bradley, author, primary source.

- Discusses knowledge of topic gained by growing up in Collin County and playing in parks and creek beds as a child.
- Discusses knowledge of topic gained by previous informal conversation with her father, Bill Bradley, who has extensively traveled the publically-owned land and creek beds in Collin County during the course of serving community service.

Flood Information Portal for Collin County, TX. (n.d.). Retrieved October 29, 2014, from http://maps.riskmap6.com/TX/Collin/

- Source for Figures 1, 2, 3

WFAA: "Citizens angry Corps of Engineers releasing Lake Lavon water" (2012, March 24). Retrieved November 2, 2014.

- Description of extent of possible flooding in Collin County

Collin County Interactive Maps. (n.d.). Retrieved October 30, 2014, from http://gismaps.collincountytx.gov/

- Source for Figures 4 & 5

Disaster 218 Designated Areas: Texas SEVERE STORMS, FLOODING. (1966, May 12). Retrieved November 2, 2014, from https://www.fema.gov/ar/disaster/218/designated-areas

- Major Declared Disasters in Collin County

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Stiffman, E. (2014, January 31). The Dallas Morning News: "Survey reveals growing homeless issue in Collin County." Retrieved November 2, 2014.

- Information on homelessness in Collin County

Watkins, M. (2012, November 27). The Dallas Morning News: "340 Plano properties may be added to the new FEMA floodplain" Retrieved November 2, 2014.
Chambers, K. (2012, October 3). Allen American: "Higher ground: FEMA asks Collin County residents for feedback on flood maps" Retrieved November 2, 2014.

- Information about new flood plain maps released in 2012, including quotes from Jason Lane, Assistant Emergency Management Coordinator with the Collin County Department of Homeland Security.

Holifield Science Learning Center. (n.d.). Retrieved November 2, 2014, from http://k12.pisd.edu/holifield-science-learning-center

- Information Holifield Science Learning Center