

Exploring the Core Components of Floodplain Management

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Flooding is the costliest type of natural disaster in the United States, but it may also be one of the most commonly misunderstood areas of disaster planning. The circumstances and situations that give rise to a flood can vary greatly, even within a specific place or region. For example, along the Gulf Coast, many communities are susceptible to coastal flooding from storm surge, which is brought about by hurricanes. Riverine flooding is also a major concern due to the region's large river systems and high annual rainfall. Flooding may also be attributable to the failure of manmade systems, such as dams, levees, or city drainage systems. Lack of proper maintenance within a city's stormwater system can result in significant flooding if blockages occur in a drainpipe or spillway, thereby causing water to back up and overflow. Naturally this makes flood mitigation a considerable undertaking for any local government and difficult to plan for in a timely and predictable manner. However, with the aid of innovative mapping and federal guidance programs such as the Federal Emergency Management Agency (FEMA) Community Rating System, communities can begin to tackle flooding hazards in a systematic and proactive way.

The Value of Mapping

In order to get a better sense of the risks associated with flooding, it is first imperative to review the ways in which flood risk is evaluated. For local communities, flood risk is most commonly evaluated through comprehensive mapping of the floodplain. A floodplain may be broadly defined as an area that provides temporary storage space for floodwaters and sediment produced by a watershed.¹ While the vast majority of floodplains typically occur around water channels such as rivers and streams, the size of a floodplain can vary greatly from region to region. For example, within the Northern Gulf of Mexico, there are many oxbow lakes and swamps, which can occur well beyond the main water channel and can significantly expand the scale of the floodplain in question.

Given the variability of the floodplain, most local floodplain managers opt to delineate flood risk using one of two different measurements: the 100-year floodplain, or

the 500-year floodplain. In the 1960s, when the National Flood Insurance Program (NFIP) was established, the United States government used the one percent annual exceedance probability (AEP) as the major regulatory measure for the program.² Because the one percent AEP has an average recurrence interval of 100 years, local policymakers generally use the term 100-year flood. However, as flood damages continue to mount across the country, many communities are now organizing their planning endeavors around the 500-year flood instead. The 500-year flood corresponds to a flood event that has a 1 in 500 chance of occurring within a given year. It should be noted that these terms refer to the probability of a flood event occurring, but a probability is not always an accurate predictor of future events, and it is not uncommon for major flood events to be clustered together.

These two categories are the primary risk factors depicted on Flood Insurance Rate Maps, otherwise known as FIRMs.³ Many of the FIRMs used by local municipalities are incredibly detailed and provide a wealth of information on the general risk profile within a given floodplain. As good as FIRMs are, they aren't without their flaws, and one significant drawback to the maps is that a FIRM is merely a snapshot in time and is not a good predictor for future conditions. To get a sense of future conditions, one needs to go beyond the base requirements of the NFIP to develop local models that can evolve and change with enough frequency to capture the ways in which a floodplain can change over time.

One example of a region which recalibrated its floodplain mapping approach is the City of Charlotte, North Carolina. In response to a series of devastating storms which struck the region in the mid-1990s, local government officials in conjunction with Mecklenburg County instituted a comprehensive mapping initiative to get a better grasp on the potential scope and scale of future flood events. Charlotte and Mecklenburg County adopted a floodplain management guidance document that was premised on assuming ultimate build-out land use conditions for floodplain mapping.⁴ When final build-out conditions are built into a model,

the floodplain takes on new boundaries to account for space taken up by buildings. For the Charlotte-Mecklenburg County area, the average base flood elevations based on an ultimate build-out scenario were 4.3 feet higher than the 1975 maps. These conditions were the basis of a series of updated maps for Charlotte and the greater Mecklenburg County area. The fully digitized maps were first completed in 2003, and they continue to be updated by the local engineering firms that first designed them.⁵

The Value of Maintenance

While mapping may be a complicated undertaking for some small towns and governments when addressing flood management, regular maintenance of stormwater infrastructure is not. Even though many communities have laws and ordinances in place requiring detention ponds and other stormwater management measures in major new developments, it is not always a guarantee that those structures will be maintained adequately. One simple tool communities can employ to encourage stormwater maintenance is to have developers sign a maintenance agreement as part of the permitting process. In the City of Kings Mountain, North Carolina, city staff created a simple four-page form to ensure that local developers complied with basic maintenance measures on their stormwater infrastructure.⁶

Maintenance agreements are not the only tools available to aid and assist communities with their stormwater infrastructure. In fact, a number of sound procedures may be found within FEMA's Community Rating System program (CRS). The CRS was introduced into the NFIP in 1990⁷ as an incentives program for communities to earn a premium discount on flood insurance that can be passed on to its citizens. The discounts are achieved by engaging in flood mitigation activities that go beyond the base requirements prescribed by the NFIP.

One process communities can engage in under the CRS program is known as Activity 540, which covers drainage system maintenance activities. This activity prescribes basic measures related to drainage systems to help reduce flooding impacts. Such measures include: annually inspecting the city drainage system; maintaining a comprehensive inventory of the entire system; and maintaining basic information such as ownership, location, and whether the infrastructure item in question is subject to the city maintenance program.⁸

Another Activity 540 task involves ongoing maintenance for natural water features like creeks or streams. Cities should ensure that water flow is not obstructed. In certain situations, cities may have statutory authority to order private entities to clear creek debris if the creek is visually prominent and can easily be inspected annually from an off-site location such as a bridge. It is also advisable for local governments to look into establishing maintenance easements with private entities to conduct regular inspection and maintenance of a creek on private property.

While ongoing maintenance of city drainage and sewer systems is not enough by itself to protect a community from flood concerns, it does provide simple benchmarks that communities can implement. A community's drainage infrastructure cannot be expected to work at its full design capacity if careful steps are not taken to remove debris and provide regular maintenance. Having maintenance agreements in place with permit applicants is a plus, and if communities are looking for additional guidance on this issue, the Community Rating System is a great resource that covers additional initiatives communities can undertake to keep their drainage infrastructure in good working order.

Using Zoning to Preserve Floodplain Functions

It should be noted though that not every aspect of flood prevention is neatly within the jurisdiction of a community floodplain manager. Zoning, for example, is a powerful tool when it comes to protecting and conserving the floodplain; this is where the knowledge of a community's land use planner becomes paramount. The primary way in which zoning serves as a regulatory tool for floodplain management is by capping the amount of development that can be conducted within the floodplain. Capping or inhibiting the amount of development inside a floodplain is one of the chief tasks a planner carries out with regards to flood mitigation.

One example of zoning being employed in this manner is in the City of Biloxi, Mississippi, where city staff implemented an agricultural restricted zoning category with a minimum lot area per dwelling unit of 217,800 square feet.⁹ An agricultural restricted zoning category is the least dense residential zoning category, with agricultural district as the second least dense residential zoning category. An agricultural district's minimum lot area per dwelling unit is significantly smaller at 43,560 square feet. Biloxi implemented agricultural

restricted zoning in parcels that were within floodways or contained a significant amount of wetlands. This minimum lot area represents a major deterrent to new high density development that will have more impervious surfaces impacting waterflow. By restricting density within the floodplain, local governments can ensure that the development impacts on the floodplain are kept to a minimum.

Restricting density is not the only choice for planners to avoid negative impacts on floodplains. Another technique commonly applied by planning officials is to develop a flood overlay zone. An overlay zone is an easy way of imposing additional regulatory requirements on top of existing zoning categories.¹⁰ Since many communities have grown adjacent to large harbors and waterways, it is quite common for a wide variety of land uses to exist in or around a floodplain, which is why a single zoning category may not always work best.

One example of a flood overlay zone is Lancaster County, Virginia's waterfront residential overlay. The county is part of the Chesapeake Bay watershed. The waterfront residential overlay district applies to all parcels of land recorded on or after May 11, 1988, that are residential in nature and located within 800 feet of tidal waters and wetlands.¹¹ Many of the regulatory goals and intentions expressed by the agricultural restricted zone are shared by Lancaster County's overlay zone. For example, it restricts the minimum lot size: the minimum lot size is 87,120 square feet, or two acres. Also, only one main building and an accessory structure may be erected on any lot. In addition, there is a 100-foot setback from tidal wetlands and a 50-foot setback from the edge of nontidal, isolated wetlands.

Property setbacks, such as the ones referenced above, are another good technique for further circumscribing the development footprint within a flood sensitive area. Setbacks, lot sizes, and restrictions on the number of allowable structures are all good examples of the wide variety of floodplain management issues that can be addressed through the zoning code. Because zoning is responsible for setting the regulatory envelope in which development can be pursued, it is no surprise that any sound flood mitigation strategy will have to consider the role zoning can play in curbing development within the floodplain.

Conclusion

Flooding is a major concern for many communities, and it is unlikely that this will change in the foreseeable future.

However that does not mean that cities are deprived of any agency in addressing the problem. Through comprehensive mapping and basic maintenance of existing stormwater infrastructure, communities can make great strides towards addressing flooding concerns. A local floodplain manager can pursue many of these mapping and maintenance activities, but a sound flood mitigation plan will invariably require a multi-disciplinary approach. For example, planners play a role in flood mitigation by crafting zoning categories and building envelopes, which keep development inside the floodplain to a minimum. Also, as the example from Charlotte demonstrates, cooperation between different sectors of government, such as city and county, can help when it comes to building a more complete picture of flood risk. Neighborhood associations and local citizens can also play a role by establishing maintenance easements with local authorities, allowing access to government staff in order to clear clean creeks and streams of debris. In short, a robust floodplain management program must employ a wide array of tactics and strategies that can evolve and adapt almost as rapidly as floodplains do. 🐼

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Endnotes

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3. Floodsmart, *All About Flood Maps*.
4. LSU Coastal Sustainability Studio, Louisiana Resiliency Assistance Program, *Mecklenburg County, NC* (2018).
5. Madeline Bodin, *Flood Warning: Better Subdivision Design for Drier, Safer Communities*, Planning Magazine (Feb. 2017).
6. City of Kings Mountain Stormwater Dept., *Dry Detention Basin Operation and Maintenance Agreement*.
7. Eugene Frimpong, *Community Level Flood Mitigation Effects on Household-Level Insurance and Damage Claims*, 2016.
8. CRS Resources, *CRS Credit for Drainage System Maintenance* (Aug. 2017).
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10. Wetlands Watch, *Resilient Zoning*.
11. Lancaster County, Virginia, Land Development Code County of Lancaster, *Article 18. - Waterfront Residential Overlay, All Districts, W-1* (Oct. 10, 2017).