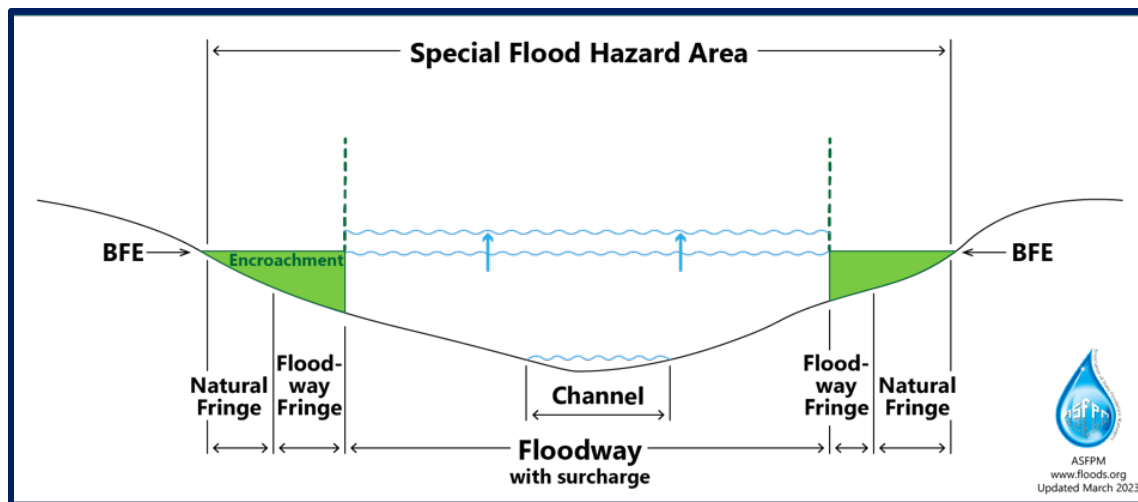


AN INTRODUCTION TO FLOODWAY SURCHARGE

An Outreach Packet



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An Introduction to Floodway Surcharge

Floodways are a tool that may be provided to communities by FEMA to assist in the community's floodplain management. This packet is intended to provide information to communities so that they can make an informed decision regarding a floodway surcharge standard that meets their community's acceptable level of risk and possibly improve the resiliency of their community. Materials enclosed in this packet include:

- [A short summary sheet](#) that clearly defines a floodway, floodway surcharge, and the impacts of floodway surcharge. This resource is intended to be made available to communities at the Discovery Meeting when a mapping project is introduced to the community, and as a common educational resource.
- [A graphical representation of how floodway surcharge is developed](#) that can be used in PowerPoints slides; note that clicking this link (https://no.floods.org/FW_Surcharge_Graphic) will download a PowerPoint whose slides you can copy/paste into presentations.
- A set of best practices presenting higher standards options currently utilized by other communities:
 - [Charlotte/Mecklenburg, NC](#)
 - [San Marcos, TX](#)
 - [King County, WA](#)
- Two letters that the community can sign and provide to the FEMA regional director on official community letterhead:
 - [Letter acknowledging the risks associated with the minimum federal standard](#) (one-foot surcharge floodway) and opting for using the minimum federal or state standard, and
 - [Letter requesting the use of a higher standard surcharge](#).

The information provided herein is intended to improve community understanding of the possible impacts of floodway surcharge.

Acknowledgements

The creation of this document was supported by funding from the Risk Management Directorate (RMD), Federal Emergency Management Agency (FEMA). We extend our genuine thanks to the following individuals who shared their time through interviews, emails, and phone calls for the preparation of this document:

- Tim Trautman, P.E., CFM, Program Manager, Engineering & Mitigation Program, Charlotte-Mecklenburg Storm Water Services, Charlotte, NC;
- Richard Reynosa, PE, CFM Assistant Director of Engineering Capital Improvements/Engineering, City of San Marcos, TX;
- Dave Carlton P.E., CFM, dkcarlton & associates, PLLC, Seattle, WA; and
- Staff from all ten FEMA regions.

FLOODWAY SURCHARGE

The **Natural Floodway** (Figure 1) is the portion of the floodplain with moving water. Backwater areas without moving water are the **natural fringe**. It is assumed that if the natural fringe is filled, there is no increase in flood elevations because there is no blockage of moving water. This, however, ignores the impact of the loss of flood storage.

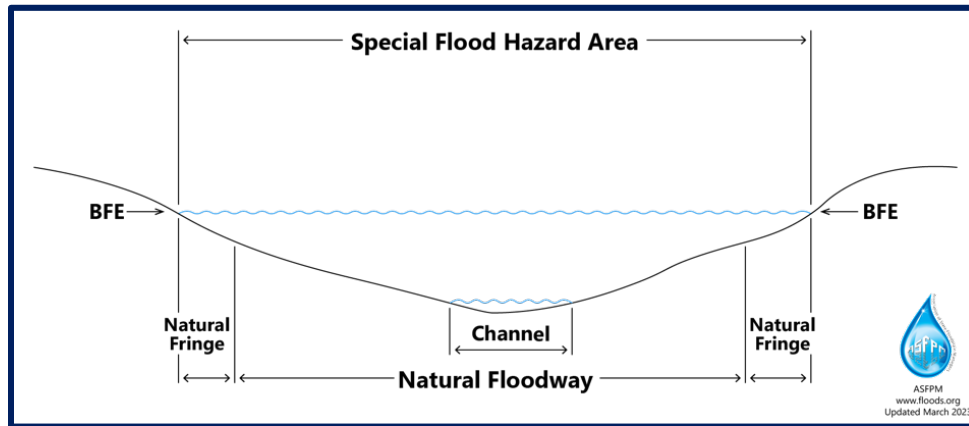


Figure 1. The natural floodway and natural fringe.

A **Regulatory Floodway** is the **channel** of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height in the **Special Flood Hazard Area (SFHA)** (Figure 2). This designated height is limited by 44 CFR 60.3 to one foot or less. Communities must regulate development in these floodways to ensure that there are no increases in flood elevations.

Per Section 2.4 of FEMA's November 2021 Guidance for Flood Risk Analysis and Mapping: Floodway Analysis and Mapping, the "primary benefit to designating a floodway and regulating development within that floodway is to preserve a portion of the floodplain to convey flood waters from upstream or downstream. Without these requirements, development over time would encroach into the floodway and obstruct the flow of floodwaters thus increasing upstream flood elevations."

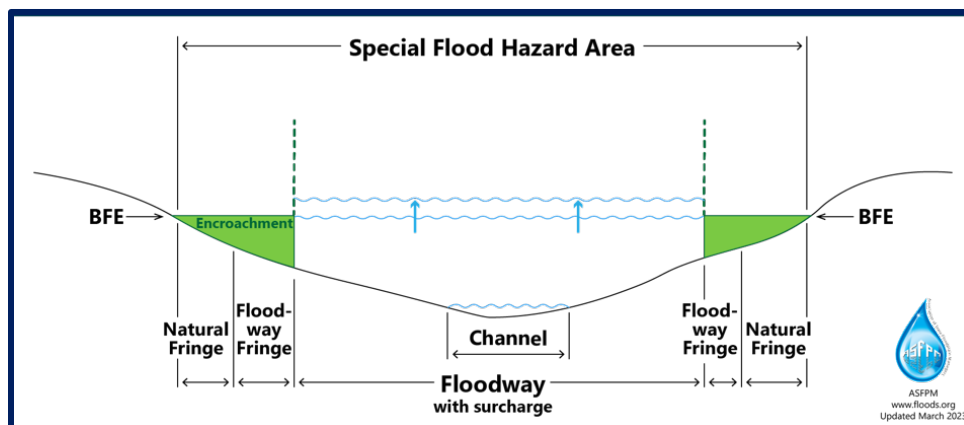


Figure 2. The floodway with surcharge showing a 1-foot rise due to encroachments.

For watercourses where FEMA has provided **Base Flood Elevations (BFEs)**, but no floodway has been designated, the community must either review floodplain development on a case-by-case basis to ensure that increases in water surface elevations do not occur, or map and adopt a floodway as part of its official FEMA map. With a FEMA mapped floodway, communities are not required to analyze the impacts of development in the floodway fringe unless a community's ordinance has standards that give additional guidance requiring it to do so. Therefore, development in the community can proceed with minimal staff time needed for review and oversight regarding the encroachment's impacts on flooding. (The **floodway fringe** is the portion of the floodplain outside of the floodway that usually contains slow-moving water.)

What is floodway surcharge?

The **floodway surcharge** is the amount of increased flooding deemed acceptable by a community to enable development in the outer portions of flood-prone areas of the community. For a floodway with a surcharge, the natural floodway is pinched in until the surcharge amount is reached. This creates a narrower floodway and wider fringe. When an engineering model is constructed, the floodway calculation inserts imaginary frictionless walls in the model, establishing the floodway boundary limits when the flood height reaches the surcharge limit, as seen in Figure 3. In reality, there is nothing to keep the surcharge in the floodway and, unless all the fill in the floodway fringe is filled to the BFE+1foot, depths will exceed the BFE and extend beyond the limits of the defined SFHA, imposing increased flood risk to existing development and new development built to the BFE.

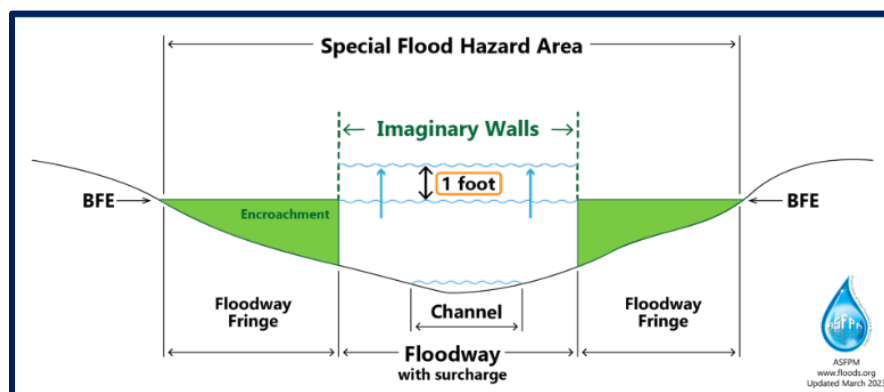


Figure 3. Depiction of how imaginary frictionless walls “contain” the surcharge in models.

The floodway surcharge concept recognizes that there will be some impact from encroachments, but limits the impact to an amount deemed insignificant (without increasing the water surface elevation of that flood more than one foot at any point). [The ASFPM paper titled “Floodway Encroachment Standard: Minimizing Cumulative Adverse Impact”](http://www.floods.org/floodway2013) ([no.floods.org/floodway2013](http://www.floods.org/floodway2013)) documented that a one-foot surcharge creates a floodway fringe that is, on average, half of the width of the floodplain. Lesser surcharges create narrower floodway fringes, which reduces the size of the area where development can occur without an impact analysis.

How far beyond the SFHA the surcharge will go in a community depends on the terrain. In a hilly area, the surcharge may not extend as far as it would in flatter portions of the country. A number of states felt that the one foot surcharge would extend farther than would be acceptable. Eight states have adopted more stringent standards by legally enforceable statutes or regulations.

They are:

- Wisconsin - 0.01 foot
- Illinois - 0.1 foot
- Indiana - 0.1 foot
- Michigan - 0.1 foot
- New Jersey - 0.2 foot
- Colorado - 0.5 foot
- Minnesota - 0.5 foot
- Montana - 0.5 foot

Four of these eight states have established thresholds intended to represent a “measurable amount,” which at the time these regulations were adopted was 0.1 feet, while the remaining four are compromise positions between 0.1 foot and FEMA minimum standard of one foot. Several communities have adopted higher floodway standards that are consistent with the state standards shown above.

SFHAs in states with higher standards have wider floodways. The FEMA one-foot rise floodway is the minimum standard and can be exceeded by states or communities with stronger standards, i.e., lower surcharge thresholds. Section 60.1(d) of the National Flood Insurance Program (NFIP) regulations states that any “regulations adopted by a state or a community which are more restrictive... are encouraged and shall take precedence” (over national minimum standards). For these states and communities, FEMA computes the extent of the regulatory floodways using the higher standards. The current floodway guidance document¹ highlights the implications of a one-foot surcharge:

“NFIP regulations allow up to a one-foot rise in flood stage when designating the floodway... If development occurs outside of the floodway in the floodway fringe and there is an increase in flood stage, there will be an increase in potential flood damages to adjoining and upstream property. In densely populated areas with existing development, even the allowable one-foot increase in depth of flooding could significantly add to flood damages to upstream property. Damages can also occur during the base flood to new buildings in the floodway fringe that are elevated or floodproofed to the [BFE]. Additional areas may be flooded that are not shown on the FIRM as floodplain and not subject to the community’s floodplain management ordinance. In these situations, the community may wish to adopt a more restrictive floodway (surcharge less than one foot) to prevent this increase in damages.”

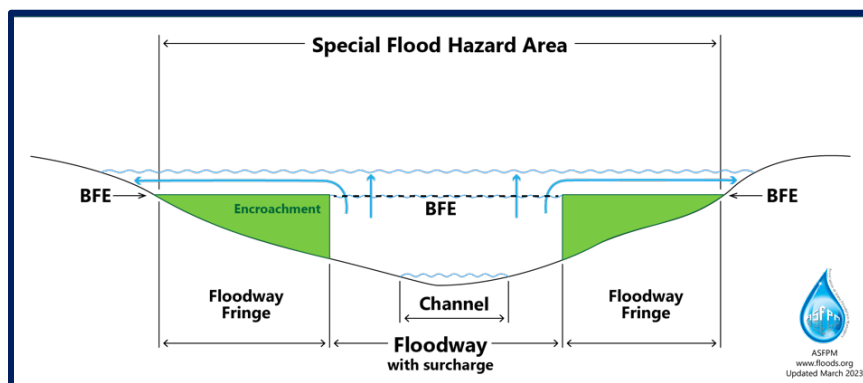


Figure 4. Depiction of how an encroached floodway can cause floodwaters to rise by more than one foot, the FEMA minimum standard for surcharge.

¹ Guidance for Flood Risk Analysis and Mapping, Floodway Analysis and Mapping. FEMA. Guidance Document 79. November 2021, page 9.

CHARLOTTE-MECKLENBURG, NORTH CAROLINA: CONSIDERING FUTURE CONDITIONS

Challenge

Charlotte-Mecklenburg Storm Water Services is a joint municipal/county stormwater utility that includes the City of Charlotte, the surrounding towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville, and Mecklenburg County.

When Charlotte-Mecklenburg observed that encroachments into the floodplain were having a greater impact than desirable, the community looked to reduce its flood risk and improve its open space by pushing development further away from watercourses in the community.

Before taking any action, Charlotte-Mecklenburg conducted two pilot hydrologic and hydraulic studies¹ to evaluate the benefits of a floodplain that anticipates future conditions and includes a lower surcharge floodway. The studies showed the projected impacts of human activities on potential future flooding and indicated that by continuing to use existing conditions (FEMA minimum standard) as the basis for determining runoff, resulting flood heights and BFEs would be under-predicted by an average of approximately 2.2 feet. The studies also indicated that allowing fill material in the floodway fringe area up to the FEMA floodway line (FEMA minimum standard) could actually increase flood surcharge depths in the area by as much as 2.3 feet rather than FEMA's standard maximum of one foot.

Solution

To develop its new higher standards, Charlotte-Mecklenburg engaged in a structured stakeholder engagement process to garner consensus and help avoid opposition to any proposed higher standards. Stakeholders who participated in the process included developers, homebuilders, realtors, and environmentalists. The group was provided with the results of the aforementioned pilot projects and, over a six-month period, worked through an iterative process to evaluate options to limit the impacts of encroachments into Charlotte-Mecklenburg's flood hazard areas.

At the conclusion of the process, the stakeholder group recommended that, instead of using the federal 1-foot surcharge minimum standard, Charlotte-Mecklenburg should adopt and map a:

- FEMA regulatory floodway using a 0.5-foot surcharge, and a
- Community encroachment area (a.k.a. "community floodway") using a 0.1-foot surcharge.

The FEMA Floodway is an area of the floodplain that must be kept clear of any obstruction (fill dirt, buildings, etc.) as to not impede water flow. Development in this area is highly restricted, and usually requires a detailed engineering analysis (and FEMA approval) prior to beginning. The location and width of the FEMA floodway area is established by engineering models that determine the area needed to convey the FEMA Base Flood Discharge without increasing the water surface elevation by more than 0.5 feet.

² Mecklenburg County North Carolina. "Consideration of Unsteady and Steady State Modeling Approaches to Produce Floodplain Insurance Rate Maps." January 2008.

Similar to a FEMA floodway but wider, a community encroachment area is an area of the floodplain that must be kept clear of any obstruction (fill dirt, buildings, etc.) as to not impede water flow. Development in this area is highly restricted and usually requires a detailed engineering analysis (and local approval) prior to beginning. The location and width of the community encroachment area is established by engineering models that determine the area needed to convey the FEMA Base Flood Discharge without increasing the water surface elevation by more than 0.1 feet.

Charlotte-Mecklenburg's more conservative community encroachment area is an average of 45% wider than the FEMA minimum.

One of the reasons that Charlotte-Mecklenburg opted to establish a community encroachment area was to give the community more flexibility with proposed encroachments than if the FEMA floodway would have been based upon a 0.1-foot surcharge. An example of a situation where flexibility may be needed would be when an existing structure is compliant with FEMA regulations but not with the community's higher standards. For cases like this, the community developed an exemption process that allows an existing structure to undergo substantial improvements under certain conditions. Full redevelopment must comply with the community's higher standards.

Outcome

- The community encroachment area increases the area in which an analysis of any impacts of proposed encroachments into the floodplain is required.
- The community has specific requirements that involve iterative modeling for encroachments into the floodway. The requirements are intended to account for loss of storage in addition to loss of conveyance in either of the mapped floodways.
- If a project will be removing storage, any analysis of the impact to flood elevations must remove storage in the hydrology.
- If a levee is proposed, it has to be assumed that there is also a levee on the other side of the stream.
- Using a surcharge amount of 0.1 increases the area where an analysis of impacts is required

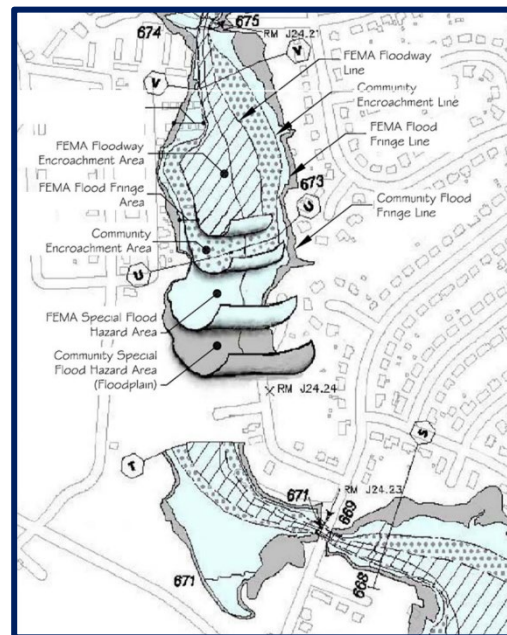


Figure 5. The two floodplains and two floodways that are part of Charlotte-Mecklenburg's FIRMs. Source: Charlotte-Mecklenburg Stormwater Services.

Benefits

- Requiring an analysis of impacts in the community encroachment area in addition to the FEMA floodway helps ensure that existing development will not be adversely impacted (less than 0.1-foot increase) by floodplain fill.
- New buildings are constructed 2.0 feet above the future floodplain Base Flood Elevation, reducing their flood risk.

SAN MARCOS, TX: ENTIRE SFHA DESIGNATED AS FLOODWAY

Challenge

San Marcos is a city in central Texas of more than 50,000 people, located approximately fifty miles from San Antonio and thirty miles from Austin. Its population is growing substantially due to Texas State University's student enrollment expansion and its proximity to the growing San Antonio and Austin metro areas.

San Marcos experiences flooding on a consistent basis because the San Marcos River, the Blanco River, and Purgatory Creek run through the middle of the city. Due to this confluence and the fact that many of the streams in the community split in a number of locations, it is difficult to develop a floodway with a surcharge. When streams split, it can be challenging to determine what percentage of floodwaters will flow into which splits. In addition, when pinching in the natural floodway to attain the desired amount of surcharge, one stream might be blocked from development while another is open for development on the bed of a stream branch, which could lead to development in an area at risk of high-velocity floodwaters.



Figure 6. USGS Map of the San Marcos River. Source: <https://edits.nationalmap.gov/apps/gaz-domestic/public/summary/1375972>.

Solution

In 2015, following major flood events on Memorial Day weekend and in October, San Marcos decided to adopt higher floodplain standards to reduce flood risks in the community. The city's process for adopting higher standards was to amend the city code of ordinances. Amending the city code was a six-month process that included two readings of the standards proposed for adoption and a public hearing for citizen input. During this review process, the citizens of San Marcos did not raise any objections to the proposed higher standards which would restrict any development that may increase flood risks.

The adopted higher standards included:

- Freeboard,
- Compensatory storage requirements,
- Building setbacks,
- Requirements for dryland access,
- Requirements of a no-rise analysis for any stream that does not have a mapped floodway, and
- Restrictions related to increases in velocity; the city ordinance states that the "mean velocity of stream flow at the site after fill shall be no greater than the mean velocity of the stream flow under existing conditions."

The city also removed any reference to floodway surcharge from its city ordinance. As mentioned above related to the no-rise requirement, the ordinance states that for any streams without a regulatory floodway, “no new construction, substantial improvements, or other development (including fill) shall be permitted within zones A 1 - 30 and AE on the FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood at any point within the community.”

While the city was updating its ordinance, FEMA was in the process of providing updated SFHA maps for the community. The engineering firm conducting the study to develop the flood engineering models for the new maps was finding it difficult to develop the floodway with a one-foot surcharge due to the aforementioned challenge with the community’s multiple rivers and creeks. The engineer asked the community if they would be willing to adopt a floodway that encompassed the entire FEMA Special Flood Hazard Area. Given their recent floods and ongoing discussions around higher standards, the city agreed. As a result, FEMA developed FIRMs wherein the full extent of the AE zones in the SFHA was mapped as floodway, meaning that there is no floodway fringe.

Outcome

With no floodway fringe, an engineering analysis of the impacts of proposed development is required in all areas of the Special Flood Hazard Area. In terms of administration, while the city requires a no-rise analysis for any construction in the floodplain, due to modeling challenges, they accept a rise of less than 0.1 ft with review by the City as long as it is shown this rise will not damage any structures. An additional minor rise (up to six inches) is allowed if it only impacts the property owner, and not any downstream or upstream properties.

There is an abrupt change in the floodway width at the county boundary as the floodways in the county are mapped with a surcharge of one foot. Therefore, these floodways are much narrower. Fortunately, the city has Extraterritorial Jurisdiction (ETJ)³, which gives the city the legal authority to require an analysis of impacts three miles beyond the city boundary. This helps ensure that new development near but outside of the city limits does not cause increased flooding for existing development in the city.

Benefits

The residents of San Marcos have a higher level of awareness of flood risk. People recognize that the floodway has a high level of risk and is an area in which development should be avoided. While development is not prohibited, no development can occur unless it can be demonstrated via an engineering analysis that the development will not cause any increase in flood elevations. This helps ensure that existing development will not be adversely impacted by increased flooding caused by new development.

³ The Extra-Territorial Jurisdiction (ETJ) is a designated buffer area located just outside of the city limits. Each municipality is afforded an ETJ by the Texas Local Government Code as a method of defining potential growth and future service boundaries.

KING COUNTY, WASHINGTON

Challenge

In the 1980s, King County, WA was concerned about loss of flood storage due to development in the floodway fringe. The county conducted a flood study⁴ using engineering modeling to determine the impact of fill on floodplain storage in two watersheds. The study found that the impact of fill in the floodway fringe was up to three feet, rather than FEMA's standard maximum of one foot. It also demonstrated that the velocity of floodwaters would increase substantially. The increases averaged five percent for one watershed and 15 percent for the other, with a maximum of 70 percent in one location. The county was concerned that these increases could result in channel instability, increased erosion, and more flood damage in the area.

Solution

In response, the King County floodplain management regulations for riverine flooding were amended to address several flood zones: the zero-rise floodway fringe (includes major backwater AE Zones, AO Zones, and AH Zones), zero-rise floodway (entire Zone AE), and FEMA floodway (as shown on FIRMs).

Zero-rise floodway fringe. To limit the potential impacts of fill documented in the aforementioned study, the county adopted floodplain regulations that require a no-rise analysis in the floodway fringe in addition to the FEMA regulatory floodway.

Zero-rise floodway. While King County's FIRMs show a standard 1-foot surcharge floodway, the county opted to regulate the entire Zone AE as a zero-rise floodway. No effort was made to get FEMA to change the FIRM because Washington state has a prohibition on residential structures in the FEMA Floodway, so that line was still needed. Applicants for any floodplain development must show that their development causes zero rise in the Base Flood Elevation. The ordinance officially states that proposed floodplain development:

- cannot create a measurable increase to the water surface elevations or energy grade line for the 1% annual chance (100-year) flood when compared to the existing conditions or pre-project conditions,
- cannot reduce the effective base flood storage volume of the floodplain and must provide compensatory storage if grading or other floodplain development displaces any effective flood storage volume, and
- is not allowed if the base flood depth exceeds three feet and the base flood velocity exceeds three feet per second.

In addition to these zero-rise floodway requirements, the county enforces a 3-foot freeboard standard and compensatory storage requirements; prohibits buildings where the flood depths exceed three feet and the velocity of flow exceeds three feet per second; and allows no new or substantially improved residential structures in the FEMA floodway.

⁴ Carlton, David E.; Barker, Bruce; Nelson, Ralph and Stypula, Jeanne; Surface Water Management Division, King County, WA; Effect on Floodplain Storage on Flood Peaks.

Zero-Rise Analysis Requirements

According to King County Code 21A.24.240C, a “civil engineer shall prepare a base flood depth and base flood velocity analysis and submit the analysis to the department. The director may waive the requirement for a base flood depth and base flood velocity analysis for agricultural structures that are not used for human habitation. Development proposals and alterations are not allowed if the base flood depth exceeds three feet and the base flood velocity exceeds three feet per second, except that the director may approve development proposals and alterations in areas where the base flood depth exceeds three feet and the base flood velocity exceeds three feet per second for the following projects;

- Agricultural accessory structures;
- Roads and bridges;
- Utilities;
- Surface water flow control or surface water conveyance systems;
- Public park structures; and

Flood hazard mitigation projects, such as, but not limited to construction, repair or replacement of flood protection facilities or for building elevations or relocations.”

Outcome

King County has found that requiring a zero-rise analysis throughout the AE Zone, in combination with other higher standards, can prevent most new development within the SFHA, as long as the requirements are enforced.

Benefits

There has been very little fill in the SFHA in King County over the last 30 years, except for some minor agricultural livestock pads to allow cattle to escape when the river rises. This successful restriction of fill has prevented loss of flood storage and the need for stormwater management capital projects, making existing development more resilient and limiting future flood damage.

Additionally, some restrictions associated with the FEMA mapped floodway have been avoided. A couple examples of avoided restrictions are:

- The State of Washington has regulations that limit residential development in the FEMA Regulatory Floodway. Residential development is not restricted in the King County Zero-Rise Floodway (the floodway fringe of the FEMA special flood hazard area), however, because the county did not include restrictions in their ordinance.
- King County is able to apply for federal Housing and Urban Development (HUD) agency funding despite restrictions on funding projects in the FEMA Regulatory Floodway because it has officially designated the floodway fringe as the King County Zero-Rise Floodway, limiting the impacts of development in the floodway fringe without invoking federal funding restrictions.

SAMPLE LETTER FOR REQUESTING ONE-FOOT SURCHARGE FLOODWAYS

This letter should be put on official community letterhead and sent to the FEMA regional director for the region in which the community sits.

Note: if your community opts for or state requires a floodway surcharge standard that is less than one foot, this letter should be modified to reflect that level.

Sample Letter

Dear FEMA Regional Director [Insert Name],

[Insert community name] is a community that has joined the National Flood Insurance Program. To maintain eligibility in the NFIP, we have adopted and enforce floodplain management regulations based on data (e.g., Flood Insurance Rate Maps) provided by the FEMA administrator.

FEMA is in the process of updating the FIRMs for our community. FEMA's mapping standards allow natural floodways to be encroached to the extent that the FEMA regulatory floodway would result in one foot of increased flooding above existing flood elevations.

§ 60.3 (d) states that communities shall: "Select and adopt a regulatory floodway based on the principle that the area chosen for the regulatory floodway must be designed to carry the waters of the base flood, without increasing the water surface elevation of that flood more than one foot at any point."

We hereby indicate that we "select" a regulatory floodway based on the principle that the area chosen for the regulatory floodway be designed using a surcharge of one foot.

Therefore, we officially request FEMA to map floodways within our community using a surcharge of one foot because:

1. While we recognize that mapping our floodways using one foot of surcharge will increase flooding over time in our community as the floodway fringe is filled, we feel that the amount of increased flooding would not be significant.
2. We want to enable consideration for new development within the FEMA Special Flood Hazard Area in our community.

Respectively submitted,

[insert name and signature of the community's chief executive officer]

cc: FEMA headquarters

SAMPLE LETTER FOR REQUESTING ZERO SURCHARGE FLOODWAYS

This letter should be put on official community letterhead and sent to the FEMA regional director for the region in which the community sits.

Note: if your community opts for a higher floodway surcharge standard, the community should identify the selected surcharge threshold of less than one foot, and the letter should be modified to reflect that level.

Sample Letter

Dear FEMA Regional Director [Insert Name],

[Insert community name] is a community that has joined the National Flood Insurance Program. To maintain eligibility in the NFIP, we have adopted and enforce floodplain management regulations based on data (e.g., Flood Insurance Rate Maps) provided by the FEMA administrator.

FEMA is in the process of updating the FIRMs for our community. FEMA's mapping standards allow natural floodways to be encroached to the extent that the FEMA regulatory floodway would result in one foot of increased flooding above existing flood elevations.

§ 60.3 (d) states that communities shall: "Select and adopt a regulatory floodway based on the principle that the area chosen for the regulatory floodway must be designed to carry the waters of the base flood, without increasing the water surface elevation of that flood more than one foot at any point."

We hereby indicate that we "select" a regulatory floodway based on the principle that the area chosen for the regulatory floodway be designed to carry the waters of the base flood without increasing the water surface elevation of that flood.

Therefore, we officially request FEMA to map [zero or the alternative selected higher standard surcharge threshold of less than one foot] surcharge floodways within our community because:

1. We are required to "review all permit applications to determine whether proposed building sites will be reasonably safe from flooding" (§ 60.3). By definition 1-foot rise floodways could ultimately cause new building sites to be subjected to a foot of flooding and therefore would not be "reasonably safe from flooding." As a result, we feel that we cannot fulfill this requirement with a mapped 1-foot surcharge regulatory floodway.
2. We have a responsibility to owners of existing development in our community to ensure that new development does not cause increased flooding to existing buildings. We cannot fulfill this responsibility unless [zero or the alternative selected higher standard surcharge threshold of less than one foot] surcharge floodways are mapped for our community.

Respectively submitted,

[insert name and signature of the community's chief executive officer]

cc: FEMA headquarters