

Mitigation Matters: Policy Solutions to Reduce Local Flood Risk

This brief is one of 13 that examine state and local policies that have resulted in actions to mitigate flooding.



A father and daughter kayak down Magnolia Avenue in Norfolk, Virginia, in 2009 after a severe nor'easter. The city has revamped its zoning regulations to encourage investment in areas less prone to flooding.

Norfolk's Revised Zoning Ordinance Aims to Improve Flood Resilience

Changes include new building standards to help protect Virginia city's residents

Overview

Lying between the Elizabeth River and Chesapeake Bay, Norfolk, Virginia, boasts over 200 miles of shoreline.¹ The long stretch of inlets and beaches lures seasonal visitors, and the deep water offshore provided one of several rationales to build the country's biggest naval base there.

But in the past 50 years, changing precipitation patterns, sea level rise, and land subsidence have led to recurrent flooding.² In 2013, officials decided that Norfolk's zoning ordinance did not support the city's goals and needed to be overhauled to mitigate flooding and promote safer development. The revised ordinance, approved in January 2018, includes new zoning requirements to encourage investment in less risky areas.³

Plans point to flooding challenges

Proximity to the shore benefits Norfolk's economy⁴ and has given residents an attractive quality of life, while also providing a home to Naval Station Norfolk, which employs more than 100,000 active duty personnel and civilians.⁵ But persistent flooding in recent years has damaged homes, businesses, and infrastructure, and posed a threat to military assets.⁶

The risk is exacerbated by a growing population and aging infrastructure.⁷ The sea level has risen over a foot here in the last 80 years,⁸ with the settling or sinking of ground accounting for half of the change.⁹ By 2050, it is expected to be 1.6 feet above 1992 levels.¹⁰

In 2013, the General Assembly asked the Virginia Institute of Marine Science, a research and education center connected to the College of William & Mary, to assess how the state could combat recurrent coastal flooding. The institute predicted in its report¹¹ that it would probably take the state at least two decades to mount an effective response to flooding from rising sea levels but that it could take measures immediately to begin mitigating it.

The measures outlined in the report helped Norfolk include flood mitigation strategies in two successive city plans: The first, *plaNorfolk2030*,¹² guided short-term development; the second, *Norfolk Vision 2100*,¹³ considered a longer time horizon. Both strategies informed Norfolk's decision to rewrite its zoning ordinance.

Ordinance rewrite for cost-effective mitigation

Although still growing, Norfolk is almost fully developed, with only 3.1 percent of land vacant.¹⁴ Balancing the tension between flood risk and being almost at capacity, *plaNorfolk2030* was designed to guide the city's economic and physical development.¹⁵ The plan called for a comprehensive zoning ordinance update to mitigate flooding and sea level rise.¹⁶ Beginning in 2014, the ordinance overhaul involved significant public input and numerous drafts.

As noted by Wetlands Watch, a nonprofit dedicated to protecting the natural environment, "zoning areas are not static, but comprehensive zoning rewrites are rare."¹⁷ The city's undertaking was no small feat, but officials pursued the retooling as a cost-effective way to reduce vulnerability.

In January 2018, officials adopted a zoning ordinance to direct new and more intense development to higher ground.¹⁸ The ordinance, which went into effect that March, largely applies to recent development projects,¹⁹ which account for many of the city's structures that have been subject to flooding problems. It includes a scoring system for approving projects and a series of new resilience overlays.

Resilience quotient

Under the terms of the ordinance, each new development and redevelopment project (both residential and nonresidential) must achieve a minimum threshold of points that are awarded based on whether the project meets standards to boost its resilience against flooding and other threats. Developers are encouraged to meet three standards set for flood risk reduction, stormwater management, and energy resilience.²⁰ The threshold, called a resilience quotient, varies by the type of development and ensures that developers think holistically about site design.

If developers do not plan to meet the three resilience standards, they must go through a more complex site review, in which they must demonstrate that their plans meet a range of additional goals, including conserving water resources, protecting water quality, supporting multimodal transportation and mobility (especially walking and biking), and providing mixed-income residential or mixed-use developments.

Zoning overlays

A zoning overlay district is a geographic area with requirements that go beyond the base zone standards that apply to every property in the city.²¹ A key part of the ordinance update was new overlays, which have their own standards that can add, remove, or modify those of the base zoning district. The overlays relate to flood risk priorities that were outlined in Vision 2100.

Coastal resilience overlay

The minimum point requirement for the coastal resilience overlay's (CRO's) resilience quotient is higher than in other parts of the city.²² Properties in the flood plain—which overlaps with the CRO—are required to be elevated at least three feet. Basements are prohibited, and electrical system components must be raised a foot above the finished floor.²³ Landscaping must consist exclusively of salt-tolerant and native species,²⁴ requirements for open spaces must be maintained, and limits are set on paved parking spaces that cannot absorb rainwater.²⁵

Norfolk also requires all new construction in the 500-year flood plain (an area with a 0.2 percent annual chance of flooding) to be elevated three feet above the ground or 1.5 feet above the 500-year flood elevation, whichever is higher. When the CRO overlaps with the 500-year flood plain, the rules for that flood plain apply.²⁶

Figure 1

Norfolk Requires Homes Outside the Flood Plain to Be Elevated

Residences built in the flood plain must be raised 3 feet, compared with 16 inches elsewhere in the city



* The structure must be raised this amount from the highest point of the natural ground next to it, also known as the highest adjacent grade.

Note: For developers building outside the flood plain, meeting the resilience quotient standard is one of two methods to comply with Norfolk's zoning ordinances. Where the elevation standards of zoning overlays conflict, the higher requirement applies.

Source: City of Norfolk, Virginia, "Building a Better Norfolk: A Zoning Ordinance for the 21st Century," accessed June 13, 2019, <https://www.norfolkva.gov/norfolkzoningordinance>

© 2019 The Pew Charitable Trusts

Upland resilience overlay

The upland resilience overlay (URO) encourages development in higher areas, with the goal of transforming them into “walkable, bikeable, transit-rich neighborhoods.”²⁷ Property owners in the URO can forgo some resilience requirements in these areas, which have less flood risk²⁸—if they agree to relinquish development rights in areas vulnerable to flooding in the coastal resilience overlay. These properties in the CRO are then put into conservation easements restricting the property’s use to open space, conservation, or reducing the maximum density, with rights conferred to the city to make improvements for water retention or flood protection.²⁹

Elevation requirements outside the CRO

The zoning ordinance contains varying elevation requirements throughout Norfolk for areas not covered by the CRO. The baseline resilience quotient standards for residential development (barring a few exclusions, such as historical properties) in these areas require that homes must be elevated at least 16 inches above the ground. All nonresidential development must be raised 8 inches.

Concerns about growth and future flooding

During the public comment phase and after the ordinance was passed, builders argued that the zoning requirements were being implemented too abruptly and would stifle economic growth.³⁰ Ordinance opponents also pointed to uncertainties in predicting exact levels of sea level rise, but city officials responded that they were confident that the ordinance addresses the appropriate level of risk.³¹ Much of the broader community supported the ordinance changes.³² Perhaps explaining this support, 63 percent of respondents in a community survey in 2018 said they thought flooding had increased in the last 30 years, and more than 70 percent said they were very or somewhat concerned about it.³³

Officials are collaborating with Wetlands Watch to evaluate the URO, assess its effectiveness, and advise on how to market and administer it. Officials are also looking to expand the CRO to other high-risk areas identified in Vision 2100.³⁴

Because the ordinance changes took effect in 2018, it’s too soon to gauge the results. But the measures are likely to be cost-effective; compared with other types of flood-mitigation programs, such as grants, fewer city expenditures are required. And by requiring more resilient construction and encouraging development on higher ground, Norfolk is better positioned to protect its residents and the naval base from the impacts of stronger storms and sea level rise. Officials say it can serve as a model for other coastal cities.

“Mitigation Matters: Policy Solutions to Reduce Local Flood Risk” examines policies in 13 locations: Arkansas; Brevard, North Carolina; Fort Collins, Colorado; Indiana; Iowa; Maryland; Milwaukee; Minnesota; Norfolk, Virginia; South Holland, Illinois; Vermont; Washington state; and Wisconsin.

To prepare the briefs, The Pew Charitable Trusts contracted with the consulting engineering firm Dewberry, which identified a range of state and local policies across the U.S. that are helping to reduce flood risk. Local officials and disaster resilience experts provided input during the research process. Two external reviewers—Nate Woiwode, project manager of The Nature Conservancy’s North American Risk Reduction and Resilience team, and Elizabeth Albright, assistant professor of the practice of environmental science and policy methods at Duke University’s Nicholas School of the Environment—provided expert insight. Neither they nor their organizations necessarily endorse the conclusions.

Endnotes

- 1 Green Infrastructure Center Inc., "A Green Infrastructure Plan for Norfolk: Building Resilient Communities" (2018), <http://www.gicinc.org/PDFs/GreenPlan-CityofNorfolk-FinalReport%202018.pdf>.
- 2 M. Mitchell et al., "Recurrent Flooding Study for Tidewater Virginia" (Virginia Institute of Marine Science, College of William and Mary, 2013), http://ccrm.vims.edu/recurrent_flooding/Recurrent_Flooding_Study_web.pdf.
- 3 Georgetown Climate Center, Adaptation Clearinghouse, "Building a Better Norfolk: A Zoning Ordinance of the 21st Century," last visited October 2019, <https://www.adaptationclearinghouse.org/resources/building-a-better-norfolk-a-zoning-ordinance-of-the-21st-century.html>.
- 4 U.S. Climate Resilience Toolkit, "Norfolk Establishes Strategy for Coastal Resilience," last modified Dec. 11, 2017, <https://toolkit.climate.gov/case-studies/norfolk-establishes-strategy-coastal-resilience>.
- 5 Naval Technology, "Naval Station Norfolk, Virginia," last visited Oct. 8, 2019, <https://www.naval-technology.com/projects/navalstationnorfolk/>.
- 6 N. Kusnetz, "Rising Seas Threaten Norfolk Naval Shipyard, Raising Fears of 'Catastrophic Damage'" NBC News and InsideClimate News, Nov. 19, 2018, <https://www.nbcnews.com/news/us-news/rising-seas-threaten-norfolk-naval-shipyard-raising-fears-catastrophic-damage-n937396>.
- 7 City of Norfolk, Virginia, "Norfolk Vision 2100," <https://www.norfolk.gov/DocumentCenter/View/27768/Vision-2100---FINAL?bidId=>.
- 8 Mitchell et al., "Recurrent Flooding Study for Tidewater Virginia."
- 9 Ibid.
- 10 Virginia Institute of Marine Science, "Norfolk, Virginia: Sea-Level Report Card," accessed June 26, 2019, <https://www.vims.edu/research/products/src/localities/nova/index.php>; Mitchell et al., "Recurrent Flooding Study for Tidewater Virginia."
- 11 Mitchell et al., "Recurrent Flooding Study for Tidewater Virginia."
- 12 City of Norfolk, Virginia, "plaNorfolk2030" (2018), <https://www.norfolk.gov/index.aspx?nid=1376>.
- 13 City of Norfolk, Virginia, "Norfolk Vision 2100."
- 14 City of Norfolk, Virginia, "plaNorfolk2030."
- 15 Ibid.
- 16 City of Norfolk, Virginia, "plaNorfolk2030."
- 17 Wetlands Watch, "Resilient Zoning," <http://wetlandswatch.org/resilient-zoning>.
- 18 City of Norfolk, Virginia, "Building a Better Norfolk: A Zoning Ordinance for the 21st Century," accessed June 13, 2019, <https://www.norfolkva.gov/norfolkzoningordinance>.
- 19 City of Norfolk, Virginia, "Norfolk Zoning Ordinance Rewrite," NorfolkTV, June 7, 2017, <https://www.youtube.com/watch?v=CGkEEdb5PhE>.
- 20 City of Norfolk, Virginia, "Building a Better Norfolk."
- 21 Ibid.
- 22 Ibid.
- 23 Ibid.
- 24 Ibid.
- 25 Ibid.
- 26 J. Sharp (principal planner, city of Norfolk), interview with Jessica Fleck, Dewberry.
- 27 City of Norfolk, Virginia, "plaNorfolk2030."
- 28 Sharp, interview.
- 29 Ibid.
- 30 R. Murphy, "New Rules Aim to Make Norfolk Resilient. But Will They Make It Too Expensive to Build New Homes?" *The Virginian-Pilot*, Jan. 25, 2018, https://pilotonline.com/news/government/local/article_0433ddaf-da39-577b-a547-e9b27d57f77b.html.
- 31 K. Spencer (deputy resilience officer, city of Norfolk), interview with Jessica Fleck, resilience planner, Dewberry, Jan. 29, 2019.
- 32 N. Kusnetz, "Norfolk Wants to Remake Itself as Sea Level Rises, but Who Will Be Left Behind?" InsideClimate News, May 21, 2018, <https://insideclimatenews.org/news/15052018/norfolk-virginia-navy-sea-level-rise-flooding-urban-planning-poverty-coastal-resilience>.
- 33 S. Parker et al., "Life in Hampton Roads Report" (Old Dominion University, 2018), <https://www.odu.edu/content/dam/odu/col-dept/ssrc/docs/lihr-report-2018-final.pdf>.
- 34 Sharp, interview.

For further information, please visit:
pewtrusts.org/mitigationmatters

Contact: Matt Fuchs, officer

Email: mfuchs@pewtrusts.org

Project website: pewtrusts.org/flood-prepared-communities

The Pew Charitable Trusts is driven by the power of knowledge to solve today's most challenging problems. Pew applies a rigorous, analytical approach to improve public policy, inform the public, and invigorate civic life.