



# COMMUNITY ENGAGEMENT FOR FLOOD MITIGATION

## **Ellicott City, MD** **Case Study**

March 2020

**ResilientAmerica** Program  
*The National Academies of Sciences, Engineering, and Medicine*

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# Flood Mitigation in the Southeastern United States: Ellicott City

## BRIEF PROJECT DESCRIPTION

The Resilient America Program (RAP) of the National Academies of Sciences, Engineering, and Medicine visited select communities in the southeastern region of United States that recently experienced flood-related disasters to learn about mitigation efforts at the local level. Specifically, this project investigated the range of mitigation actions and investments taking place in communities, the challenges communities face mitigating floods, and what communities need that will enable them to make investments in flood mitigation.

The RAP facilitated discussions (July through September 2019) with diverse stakeholder groups in four communities—Biloxi, MS; Ellicott City, MD; Roanoke and Vinton, VA; and Savannah and Tybee Island, GA—about their flood mitigation efforts, successes, and challenges.

Specific project goals are to better understand:

- the risks and impacts of floods on communities,
- actions communities are taking to mitigate future floods,
- flood mitigation success stories, best practices, and lessons learned in communities,
- challenges communities continue to face related to flood mitigation,
- what communities need in order to enable them to make informed decisions about flood mitigation, and
- how communities are funding their flood mitigation activities.

## PURPOSE OF THE COMMUNITY MEETINGS

The purpose of the community meetings was to convene diverse stakeholders, who serve and/or represent different community sectors in Ellicott City, MD. The below sections reflect a summary of the discussions with various community stakeholders during these meetings.

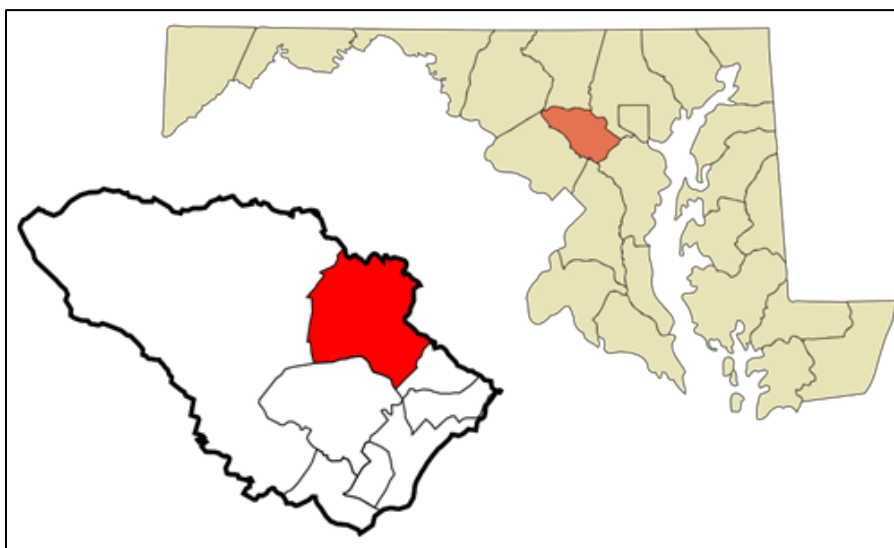
Generally, the stakeholder discussions were guided by the following questions.

- What are the main flood risks/flood hazards in your community?
- How does flooding impact your community?
- What actions has your community already taken to mitigate floods?
- What are your plans for future mitigation actions?
- What are examples of how your community coordinates flood mitigation efforts across the public, private, and/or nonprofit sectors or across jurisdictions?
- How are you/ your community funding your flood mitigation activities?
- What are the main barriers or challenges that impede your ability to take action to mitigate against floods?
- Do you have flood mitigation best practices or lessons learned that you could share with other communities?

## COMMUNITY PROFILE: ELlicOTT CITY, MD

### Background

The settlement of current day Ellicott City began in 1771 when three Quaker brothers from Pennsylvania—Joseph, Andrew and John Ellicott—established a flour mill on the banks of the Patapsco River. The town became one of the largest milling and manufacturing towns on the East Coast.<sup>1</sup> The Patapsco River has been the cause of more than a dozen floods since the town's inception. Today, Ellicott City is an unincorporated community and the county seat of Howard County (see Figure 1). With a population of 65,834 (2010 census), it is the largest unincorporated county seat in the United States.<sup>2</sup> Ellicott City is about 15 miles west of Baltimore and is bordered to the east and north by the Patapsco River, which forms the Baltimore County line.



*Figure 1. Howard County in red on the Maryland state map. Ellicott City within Howard County highlighted in red in the smaller map.<sup>3</sup>*

### Demographics

Data sources consulted for this demographics section are from the U.S. Census Bureau and include the 2010 Census, as well as the 2013 – 2017 American Community Survey (ACS).<sup>4</sup>

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<sup>1</sup> Cram, Joetta, 1990. "Historic Ellicott City: A Walking Tour," Retrieved from, EllicottCity.net, Accessed January 26, 2020, <https://ellicottcity.net/tourism/history/>.

<sup>2</sup> "Ellicott City, Maryland," Wikipedia. 2019, Last modified October 27, 2019, Accessed November 4, 2019 [https://en.wikipedia.org/wiki/Ellicott\\_City,\\_Maryland](https://en.wikipedia.org/wiki/Ellicott_City,_Maryland).

<sup>3</sup> Ibid.

<sup>4</sup> For more information on the methodology of each survey, visit <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>.

## Population

From 2000 to 2017, Ellicott City experienced population growth at a rate of 9.0 percent, which is over two times greater than that of the national average over the same 7-year period.

	Ellicott City	United States
<b>Population</b>		
<i>Census 2010 Total Population, total number*</i>	65,834	308,758,105
<i>2017 Population Estimate, total number**</i>	71,737	321,004,407
<i>Population Percent Change</i>	9.0%	4.0%

\* Source: Demographic Profile 2010

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Age and Sex

	Ellicott City	United States
<b>Population</b>		
<i>2017 Population Estimate, total number**</i>	71,737	321,004,407
<b>Age</b>		
<i>Persons under 5 years, percent**</i>	7.5%	6.1%
<i>Persons under 18 years, percent**</i>	25.3%	22.4%
<i>Persons 65 years and older, percent**</i>	14.9%	16.0%
<b>Sex</b>		
<i>Female persons, percent**</i>	51.6%	50.8%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Race and Hispanic or Latino Origins

Compared to the U.S. population, Ellicott City had fewer residents who identified as *White alone* and more residents who identified as *Asian alone*. In addition, *Hispanics and Latinos* accounted for a lesser proportion of the population compared to the national average.

	Ellicott City	United States
<b>Population</b>		
<i>2017 Population Estimate, total number**</i>	71,737	321,004,407
<b>Race</b>		
<i>White alone, percent**</i>	59.6%	76.5%
<i>Black or African American alone, percent**</i>	8.4%	13.4%
<i>American Indian or Alaskan Native alone, percent**</i>	0.2%	1.3%
<i>Asian alone, percent**</i>	28.1%	5.9%
<i>Native Hawaiian and other Pacific Islander alone, percent**</i>	0.0%	0.2%
<i>Two or more races, percent**</i>	3.1%	2.7%
<b>Hispanic or Latino Origins</b>		
<i>Hispanic or Latino origin (of any race), percent**</i>	3.1%	18.3%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Housing

The median value of owner-occupied housing units in Ellicott City was \$522,700, which is 2.7 times greater than the national average.

	Ellicott City	United States
<b>Population</b>		
<i>2017 Population Estimate, total number**</i>	71,737	321,004,407
<b>Housing</b>		
<b><i>Occupied housing units, total number**</i></b>	25,198	118,825,921
<b><i>Owner-occupied housing units</i></b>		
<i>Total number**</i>	18,895	75,833,135
<i>Percent**</i>	75.0%	63.8%
<i>Median value of owner-occupied housing units**</i>	\$522,700	\$193,500
<i>Selected monthly owner costs as a percentage of household income in the past 12 months**</i>		
<i>Less than 30 percent</i>	77.4%	76.3%
<i>30 percent or more</i>	22.6%	23.7%
<b><i>Renter-occupied housing units</i></b>		
<i>Total number**</i>	6,303	42,992,786
<i>Percent**</i>	25.0%	36.2%
<i>Gross rent as a percentage of household income in the past 12 months**</i>		
<i>Less than 30 percent</i>	52.6%	53.2%
<i>30 percent or more</i>	47.4%	46.8%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Educational Attainment

Compared to the U.S. population, Ellicott City had fewer residents with less than a high school education, high school education or equivalent, and some college or Associate's degree and more residents with a Bachelor's (29.6 percent) or graduate/professional (36.0 percent) degrees.

	Ellicott City	United States
<b>Population</b>		
<i>2017 Population Estimate, total number**</i>	71,737	321,004,407
<b>Educational Attainment</b>		
<i>Population 25 years and older, total number**</i>	48,572	216,271,644
<i>Less than high school graduate, percentage**</i>	3.1%	12.7%
<i>High school graduate or equivalent, percentage**</i>	13.1%	27.3%
<i>Some college or associate's degree, percentage**</i>	17.2%	29.1%
<i>Bachelor's degree, percentage**</i>	29.6%	19.1%
<i>Graduate or professional degree, percentage**</i>	36.0%	11.8%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Employment

About 2 percent of the Ellicott City civilian labor force was unemployed, which is almost half of national unemployment rate.

	Ellicott City	United States
<b>Population</b>		
2017 Population Estimate, total number**	71,737	321,004,407
<b>Employment Status</b>		
Population 16 years and older, total number**	56,068	255,797,692
<b>In civilian labor force</b>		
Total number**	38,046	161,152,546
Percent**	67.9%	63.0%
Employed, percentage**	65.6%	58.9%
Unemployed, percentage**	2.2%	4.1%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Income and Poverty Status

The median household income in Ellicott City is over two times greater than the national average. Only 4.2 percent of residents live below 100 percent of the poverty level, compared to 14.6 percent at the national level.

	Ellicott City	United States
<b>Population</b>		
2017 Population Estimate, total number**	71,737	321,004,407
<b>Income</b>		
In the past 12 months		
<b>Households</b>		
Total number**	25,198	118,825,921
With earnings, percentage**	85.2%	77.7%
Mean earnings, dollars**	\$147,952	\$83,186
<b>Median household income, dollars**</b>	\$124,059	\$57,652
<b>Poverty</b>		
<b>Poverty status in the past 12 months</b>		
Population for whom poverty status was determined, total number**	71,269	313,048,563
Below 100 percent of the poverty level, percent**	4.2%	14.6%

\*\*Source: 2013 – 2017 American Community Survey 5-Year Estimates

## Geography

Ellicott City is located in the Tiber Branch Watershed. The watershed is a 3.7 square mile (2,368 acre) area in eastern Howard County that contains three major tributaries: the Hudson, Tiber, and New Cut Branches, which combine to flow through Historic Ellicott City and into the Patapsco River at the bottom of deep valleys where the historic district is located (see Figure 2). Portions of these streams are channeled through rock-lined ditches and concrete culverts under

Main Street. The valley and large water confluence can cause the natural watershed to turn into a river itself and cause catastrophic flooding. A mix of bedrock foundations underlie the watershed and a thin layer of soil sits atop this bedrock, about 8% of which is hydric soil (permanently or seasonally saturated). The eastern edge of the watershed is on the fall line between the Piedmont and the Coastal Plain, making the topographic relief in the Tiber Branch watershed among the most extreme in the county, with slopes greater than 25% grade.<sup>5</sup>

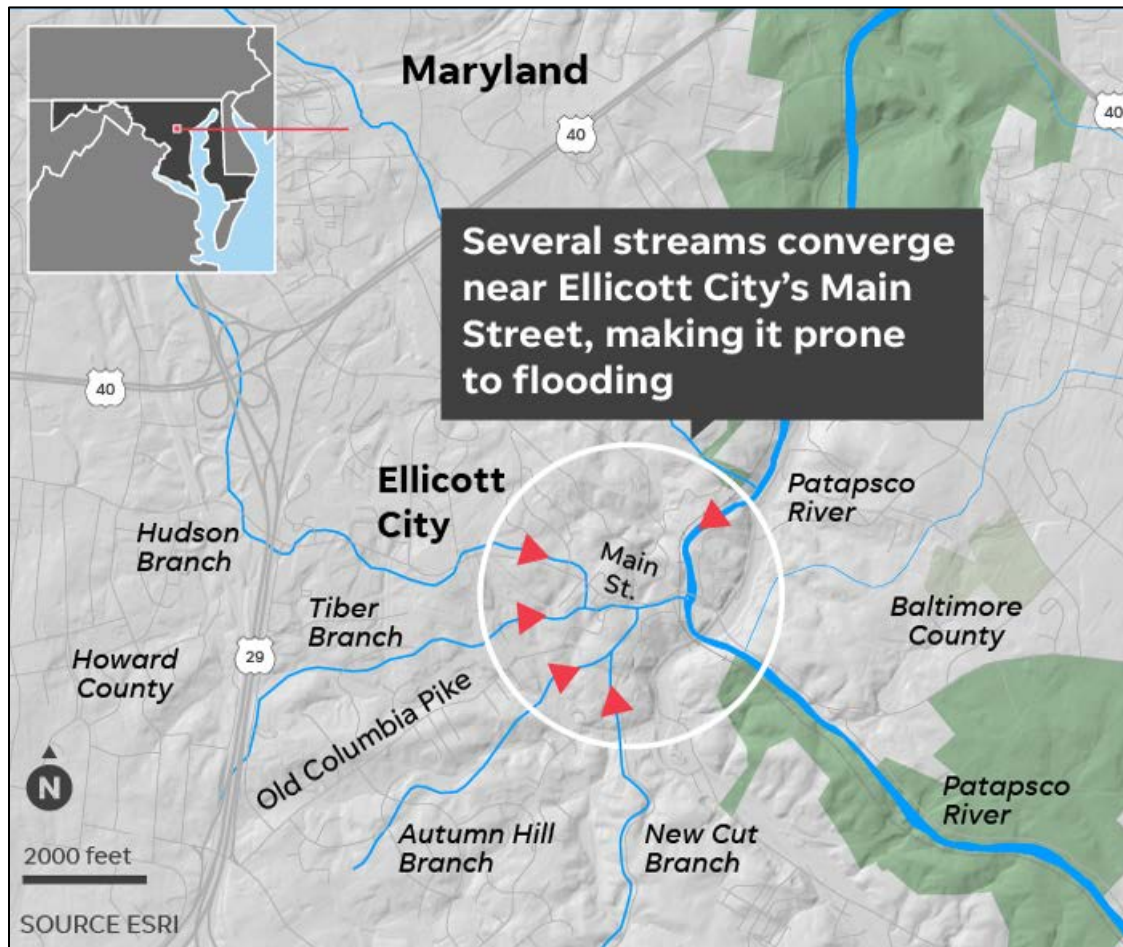


Figure 2. Map showing the tributaries to the larger Patapsco River and the flood-prone area of Main Street in Historic Ellicott City.<sup>6</sup>

Historic Ellicott City is a small area that contains numerous historical buildings and structures that date back to the 18<sup>th</sup> century. Located along Main Street, this historic area is the part of

<sup>5</sup> Howard County, *Tiber Branch Watershed Stormwater Retrofit Study*, Howard County Department of Public Works, Bureau of Environmental Services, Stormwater Management Division, 2019, Accessed January 27, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=SeKdpy3CWGk%3d&portalid=0&timestamp=1561669976225>.

<sup>6</sup> Map Source: Vetra-Carvalho, S. 2019. "Ellicott City Security Cameras Could Offer Useful and Real Time Flood Information." University of Reading. Accessed January 28, 2020, <https://research.reading.ac.uk/dare/2019/06/09/security-cameras-of-ellicott-city-could-offer-useful-and-real-time-flood-information/>.



city that is most prone to flooding because it lies at the bottom of a series of steep slopes in the valley of the Patapsco River (see Figure 3). Main Street runs one mile from the bottom of the historic district at Patapsco River and rises to a height of 140 feet as it follows the narrow valley formed by the Tiber River. Older buildings on the north side of Main Street are built against a steep granite hillside; some of these buildings have incorporated the bedrock into their foundations and back walls. A few buildings at the bottom of Main Street straddle the stream.<sup>7</sup>



*Figure 3. Topographic map of Ellicott City. The historic center (in yellow), with its concentration of buildings in the valley of the Patapsco River, is surrounded by steep slopes. (Map source: Google maps.)*

## Flood History

Ellicott City has experienced 18 major floods since 1789.<sup>8</sup> Riverine flooding in Ellicott City is called “bottom-up” flooding because the source of the floodwaters comes from the Patapsco River at the bottom of the Tiber Branch watershed in Historic Ellicott City. The worst recorded flood occurred in 1868, when the Patapsco River rose 21.5 feet and killed 43 people. The second worst flood occurred in 1972, when heavy rains from Hurricane Agnes caused the Patapsco River to rise 14.5 feet. The 1972 flood claimed the lives of seven people, caused the evacuation of 900 Howard County residents, left 700 residents temporarily homeless, and damaged almost 200 homes and dozens of businesses. After the 1972 flood, the city implemented mitigation measures to protect the city, including a flood warning system,

<sup>7</sup> Kidd, D. 2020. “A River Runs through It,” *Governing: The Future of States and Localities*, January 24, 2020, Accessed January 28, 2020, [https://www.governing.com/community/A-River-Runs-Through-It.html?utm\\_term=A%20River%20Runs%20Through%20It&utm\\_campaign=A%20River%20Runs%20Through%20It&utm\\_content=email&utm\\_source=Act-On+Software&utm\\_medium=email](https://www.governing.com/community/A-River-Runs-Through-It.html?utm_term=A%20River%20Runs%20Through%20It&utm_campaign=A%20River%20Runs%20Through%20It&utm_content=email&utm_source=Act-On+Software&utm_medium=email).

<sup>8</sup> Poon, L. 2019. “In a Town Shaped by Water, the River is Winning,” *City Lab*, Accessed January 28, 2020, <https://www.citylab.com/environment/2019/05/ellicott-city-flood-control-historic-downtown-memorial-day/589054/>.

prohibiting construction in flood-prone areas, and providing funding to businesses to move utilities off the ground.

In 2011, heavy rain from Tropical Storm Lee caused Historic Ellicott City's drains and channels to buckle and resulted in a flash flood that inundated streets, homes, and businesses.<sup>9</sup> Recently, two 1-in-1000 year floods occurred in 2016 and 2018. These floods were "top-down" floods because intense rain events brought water from the top of the watershed down through Main Street where it converged with a flooded Patapsco River, causing Main Street itself to become a river. On July 30, 2016, six inches of rain fell within 90 minutes and claimed two lives, causing \$22 million in damages and \$42 million in lost economic activity over the following months.<sup>10</sup> On May 27, 2018, heavy rains brought more than 10 feet of rapidly moving water down Main Street in Historic Ellicott City claiming one life and sweeping away several roads and cars (see Figure 4).<sup>11</sup> A large portion of southbound Route 29 (located west of Historic Ellicott City) flooded several feet, and heavy rains and rapidly rising water washed away portions of several roads. Most of the repairs from the 2016 floods were destroyed.



Figure 4. Cars being swept away<sup>12</sup> and street damage on Main Street in Historic Ellicott City<sup>13</sup> from the 2016 floods.

In May 2019, Howard County selected a five-year flood mitigation plan for Ellicott City that will cost \$113 million to \$140 million. The multi-phase flood mitigation strategy is part of the larger *Ellicott City Safe & Sound Plan: Option 3G.7.0* master plan and includes demolishing four

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<sup>9</sup> "Historic Context of the Ellicott City Flood," Preservation Maryland, August 4, 2016, Accessed January 17, 2020, <https://www.preservationmaryland.org/historic-context-ellicott-city-flood/>.

<sup>10</sup> "Video and photos: Horrific flooding in 'ruined' Ellicott City, Md," *The Washington Post*, July 31, 2016, Accessed January 17, 2020, <https://www.washingtonpost.com/news/capital-weather-gang/wp/2016/07/31/video-and-photo-horrific-flooding-in-ruined-ellicott-city-md/>.

<sup>11</sup> "May 27, 2018 Flooding – Ellicott City & Catonsville, MD," National Oceanic and Atmospheric Administration, National Weather Service, Accessed January 17, 2020, <https://www.weather.gov/lwx/EllicottCityFlood2018>

<sup>12</sup> "Dramatic video shows major flooding in Ellicott City, Maryland," *CBS News* online, May 27, 2018, Accessed January 28, 2020, <https://www.cbsnews.com/news/ellicott-city-maryland-flooding-today-2018-05-27-live-updates/>.

<sup>13</sup> Patch News Website, "Maryland Governor Declares Howard County in State of Emergency." Available at: <https://patch.com/maryland/ellicottcity/water-rescues-occurring-drivers-advised-stay-inside-hoco-fire-rescue> (accessed January 20, 2020).

buildings in Historic Ellicott City, constructing an underground tunnel to carry floodwater, and water retention and conveyance projects.<sup>14</sup>

## MITIGATION ACTIVITIES AND RESOURCES

This section contains a sample of mitigation activities and resources that the RAP learned about during its community meetings; it is not intended to be a comprehensive list of all available resources.

### *Mitigation and Preparedness*

#### *Flood Mitigation Guide: Maryland's Historic Buildings (2018)*<sup>15</sup>

This guide sets out a framework through which local preservation planners and advocates can better understand floodplain management and engage in local and state emergency management processes.

#### *Ellicott City: Soak It Up Campaign, Tiber Hudson Watershed Boundary (2018)*<sup>16</sup>

A website about Howard EcoWorks' community engagement campaign, which "encourages individual action for stormwater reduction on private property in the Tiber-Hudson watershed."

#### *Community Resilience Planning Guide for Buildings and Infrastructure Systems: Observations on Initial Implementations (2018)*<sup>17</sup>

This report provides an overview of the National Institute of Standards and Technology's (NIST) Community Resilience Planning Guide for Buildings and Infrastructure Systems and describes a six-step process for resilience planning that can be standalone or incorporated into existing community plans.

#### *Top 10 Resilient Design Resources – from the American Institute of Architecture in Baltimore*<sup>18</sup>

Resilient Design resource list, including FEMA design guides and Building Science publications, case studies and lessons learned from past disasters in different cities and contexts, and action lists and criteria checklists to check and verify a building's design standards, and the U.S. Climate Resilience toolkit.

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<sup>14</sup> "Ellicott City Safe and Sound," Howard County, MD, 2019, Accessed November 4, 2019, <https://www.ecsafeandsound.org/>.

<sup>15</sup> Maryland Historical Trust, *Flood Mitigation Guide: Maryland's Historic Buildings*, 2018, Accessed January 28, 2020, [https://mht.maryland.gov/documents/PDF/plan/floodpaper/2018-06-30\\_MD%20Flood%20Mitigation%20Guide.pdf](https://mht.maryland.gov/documents/PDF/plan/floodpaper/2018-06-30_MD%20Flood%20Mitigation%20Guide.pdf).

<sup>16</sup> "Ellicott City – Soak It Up," Howard EcoWorks, Howard County, MD, Accessed January 28, 2020, <http://www.howardecoworks.org/home/learn/ellicott-city---soak-it-up>.

<sup>17</sup> Stephen A. Cauffman. 2018. "Community Resilience Planning Guide for Buildings and Infrastructure Systems: Observations on Initial Implementations," The National Institute of Standards and Technology, U.S. Department of Commerce, Accessed January 27, 2020, <https://nvlpubs.nist.gov/nistpubs/ir/2018/NIST.IR.8229.pdf>.

<sup>18</sup> "Top 10 Resilient Design Resources," The American Institute of Architecture in Baltimore, Accessed January 28, 2020, <http://www.aiabaltimore.org/top-10-resilient-design-resources/>.

### [Guidelines on Flood Adaptation for Rehabilitating Historic Buildings \(2019\)](#)<sup>19</sup>

This report provides technical guidelines on how to apply flood mitigation adaptations to historic buildings that will preserve their historic character and make them more resilient to the impacts of floods, while also meeting the national standards of “The Secretary of the Interior’s Standards for Rehabilitation.”

### [Comprehensive Flood Grant Press Release \(2019\)](#)<sup>20</sup>

The press release announces the passing of a Comprehensive Flood Management Grant Program for Flood Damage and Mandatory Funding from the Maryland House of Delegates.

### [Ellicott City Historic District Design Guidelines \(1998\)](#)<sup>21</sup>

This document describes the architectural and landscape elements that reflect Ellicott City's history and suggests guidelines for rehabilitation and new construction to best preserve the town's historic character. The guidelines provide a framework for the Historic District Commission's review of applications and help property owners plan their projects and prepare applications for the Commission.

## [Reports and Studies](#)

### [Tiber-Hudson Branch: Stream Corridor Assessment \(2016\)](#)<sup>22</sup>

This assessment evaluates the Tiber-Hudson Branch stream corridor in Historic Ellicott City and the Hudson Branch contributing corridor to the west along Frederick Road, assessing potential conditions that could exacerbate flooding and/or result in potential threats to property and infrastructure; such as road crossings, erosion sites, debris blockages, and channelization.

### [Nonstructural Flood Proofing Study for Ellicott City \(2018\)](#)<sup>23</sup>

A report that assesses the potential for nonstructural flood risk management (FRM) measures for structures located in and near the floodplain.

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<sup>19</sup> Jenifer Eggleston, Jennifer Parker, and Jennifer Wellock. 2019. “Guidelines on Flood Adaptation for Rehabilitating Historic Buildings,” U.S. Department of the Interior’s National Park Service, Cultural Resources, Partnerships & Science. Washington, D.C., Accessed January 28, 2020, <https://www.nps.gov/tps/standards/rehabilitation/flood-adaptation-guidelines.pdf>.

<sup>20</sup> Maryland General Assembly, *Comprehensive Flood Management Grant Program*, Annapolis, Maryland, U.S., April 2019, Accessed January 28, 2020, [https://docs.wixstatic.com/ugd/b4c4bd\\_0bfc8bb2a0874055ac6031f4a48030b7.pdf](https://docs.wixstatic.com/ugd/b4c4bd_0bfc8bb2a0874055ac6031f4a48030b7.pdf).

<sup>21</sup> Howard County Historic District Commission, *Ellicott City Historic District Design Guidelines*, Howard County, MD, 1998, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=OPNgiauENPk%3d&portalid=0>.

<sup>22</sup> Smith Planning and Design, LLC., *Tiber-Hudson Branch: Stream Corridor Assessment*, [prepared for: Howard County Office of Emergency Management], 2016, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=SqypBxxK56A%3d&portalid=0>.

<sup>23</sup> USACE, *Nonstructural Flood Proofing Study for Ellicott City*, Baltimore Maryland, 2018 [prepared for: Howard County Government, Stormwater Management Division, Bureau of Environmental Services] Howard County, MD, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=dHPynIDuG5I%3d&portalid=0>.



[After Action Report: Ellicott City, Maryland Flood of 2016](#)<sup>24</sup>

This report documents the involvement of Preservation Maryland in the 2016 flood recovery efforts and encourages organizations in Maryland and elsewhere to learn from their experience and become involved in the work of disaster response and recovery.

[Ellicott City Watershed Master Plan: Public Meeting Presentation \(2019\)](#)<sup>25</sup>

Presentation slides from the Ellicott City Watershed Master Plan public meeting; an accompaniment to the Watershed Master Plan summary report (below).

[Ellicott City Watershed Master Plan - Summary Report \(2019\)](#)<sup>26</sup>

This report includes the results from an online input option following the October 15, 2019 Ellicott City Watershed Master Plan public workshop. Through the online input option participants weighed in on guidelines for various topics and geographic areas. In total, the county received 226 responses.

[Tiber Branch Watershed: Stormwater Retrofit Study \(2019\)](#)<sup>27</sup>

This study evaluates the existing hydrology within the Tiber Branch watershed. Among others, activities for the study included: assessing existing storm drain infrastructure, investigating citizen drainage complaints, and identifying opportunities to address localized flooding and storm drain improvements within the watershed.

[Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis \(2017\)](#)<sup>28</sup>

This study is an expansion of the original 2014 Ellicott City Flood Study and Concept Mitigation Report. It supersedes the original report by providing a detailed hydraulic model of the flood flows encountered along Frederick Road/Main Street in Ellicott City.

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<sup>24</sup> Preservation Maryland, *After Action Report: Ellicott City, Maryland Flood of 2016*, Baltimore, Maryland, 2017, Accessed January 28, 2020, <http://www.preservationmaryland.org/wp-content/uploads/2017/07/preservation-maryland-ellcott-city-flood-after-action-report-2017-web.pdf>.

<sup>25</sup> "Ellicott City Watershed Master Plan: Public Meeting Presentation," The Howard County Department of Planning & Zoning with Mahan Rykiel Associates, Arnett Muldrow & Associates, RK&K, Land Studies, South Coast Consulting, and Preservation Consulting, Ellicott City, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=fq5I8URjyUg%3d&portalid=0>.

<sup>26</sup> "Ellicott City Watershed Master Plan - Summary Report," The Howard County Department of Planning & Zoning with Mahan Rykiel Associates, Arnett Muldrow & Associates, RK&K, Land Studies, South Coast Consulting, and Preservation Consulting, Howard County, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=NVSGTm6RmyM%3d&portalid=0&timestamp=1574087142899>.

<sup>27</sup> Biohabitats, Inc. in conjunction with McCormick Taylor, *Tiber Branch Watershed: Stormwater Retrofit Study*, [prepared for: Howard County Department of Public Works, Bureau of Environmental Services, Stormwater Management Division], Baltimore, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=SeKdpy3CWGk%3d&portalid=0&timestamp=1561669976225>.

<sup>28</sup> McCormick Taylor, *Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis*, Baltimore Maryland, 2016, [prepared for: Howard County Government Storm Water Management Division, Bureau of Environmental Services], Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=t3mtiyi2qIlg%3D&portalid=0>.

### [Case Study: Ellicott City Flood Event of 2016](#)<sup>29</sup>

This case study collects and documents information about properties that were impacted by the flood waters along the Tiber-Hudson Branch in historic downtown Ellicott City during the 2016 flood. It also provides a descriptive narrative of the flood based on first-hand witness accounts.

### [The Economic Impact of the 2016 Ellicott City Flood](#)<sup>30</sup>

This study calculates the economic contribution to the Howard County economy of downtown Ellicott City, specifically the Main Street Corridor businesses. It also estimates the displaced business and economic activity incurred by Howard County as a result of the 2016 flood.

### [Plans and Strategies](#)

#### [2015-2020 Emergency Management Strategic Plan](#)<sup>31</sup>

This plan provides a programmatic and strategic direction to effectively allocate resources toward Howard County's emergency management program.

#### [Ellicott City Community Development Corporation Exploration Committee \(2019\)](#)<sup>32</sup>

A recommendation from a committee of community representatives, business leaders, and residents to County Executive Calvin Ball to create a community development organization for Ellicott City that fosters sustainability, vibrancy, and diversity.

#### [Countywide \(Howard County\) Implementation Strategy: TMDL and Impervious Surface Restoration Plan \(2017 Update\)](#)<sup>33</sup>

This plan discusses how to meet the Total Maximum Daily Load (TMDL) of stormwater waste loads and establishes a framework for annual reporting under the County's MS4 permit, among other objectives.

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<sup>29</sup> Smith Planning and Design, LLC. *Case Study: Ellicott City Flood Event of 2016*, [prepared for: Howard County Office of Emergency Management], 2017, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=jsvBPIHL1F8%3d&portalid=0>.

<sup>30</sup> The Jacob France Institute, *The Economic Impact of the 2016 Ellicott City Flood*, Baltimore, MD, 2016, Accessed January 28, 2020, <http://www.jacob-france-institute.org/wp-content/uploads/Economic-Impact-Ellicott-City-Flood-2016.pdf>.

<sup>31</sup> Howard County Office of Emergency Management, *Howard County 2015-2020 Emergency Management Strategic Plan*, Howard County, MD, 2014, Accessed January 28, 2020, [https://www.howardcountymd.gov/LinkClick.aspx?fileticket=hFtl8lId\\_Qc%3d&portalid=0](https://www.howardcountymd.gov/LinkClick.aspx?fileticket=hFtl8lId_Qc%3d&portalid=0).

<sup>32</sup> "Ellicott City Community Development Corporation Exploration Committee," [prepared for: County Executive Calvin Ball III], Ellicott City, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=F2cZ4Tl0CoE%3d&portalid=0>.

<sup>33</sup> KCI Technologies, Inc. 2017. *Countywide Implementation Strategy*, [prepared for: Howard County Department of Public Works, Stormwater Management Division], Columbia, MD, Accessed January 28, 2020, [https://www.cleanwaterhoward.com/sites/default/files/howard\\_county\\_cis\\_2017\\_12\\_18.pdf](https://www.cleanwaterhoward.com/sites/default/files/howard_county_cis_2017_12_18.pdf).

*"A Place for the Past: Preserving Ellicott City's Heritage and Securing its Future" - A Report about Historical Preservation Alternatives to Demolitions (2018)*<sup>34</sup>

This report lists several different preservation alternatives to demolition for buildings in Historic Ellicott City.

## OUTCOMES OF THE DISCUSSIONS

### Stakeholder Discussions

#### *Discussion with Infrastructure, Engineering, and Public Works Stakeholders*

##### **Stakeholders**

- Howard County
  - Executive Office
  - Department of Planning and Zoning
  - Department of Public Works
  - Stormwater Management Division
- U.S. Army Corps of Engineers
- U.S. Geological Survey

##### **Mitigation Activities**

Ellicott City Safe and Sound Plan: In 2019, Howard County's new administration rolled out the Ellicott City Safe and Sound Plan 3G.7.0, which includes a multi-phase flood mitigation program (see Figure 5).<sup>35</sup> Some of the mitigation projects noted in the plan include enhanced stream and river cleaning, high-ground access points in Historic Ellicott City for flood evacuation, and several large-scale infrastructure projects. The cost of the entire plan is estimated at about \$140 million over 5 years. Currently, the city has secured about a third of this money. [More details about the Ellicott City Safe and Sound Plan can be found in the [one-on-one meeting with Howard County Executive Calvin Ball](#), below.]

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<sup>34</sup> Preservation Maryland, "A Place for the Past: Preserving Ellicott City's Heritage and Securing its Future," Baltimore, MD, 2019, Accessed January 28, 2020, <http://www.preservationmaryland.org/wp-content/uploads/2018/08/preservation-maryland-ellicott-city-special-report-august-2018.pdf>.

<sup>35</sup> The flood mitigation program is one component of the Ellicott City Safe and Sound Plan. The plan as a whole is "...a multi-phase plan built around the need for public safety, supporting business and property owners, preparing the county for a changing climate, and creating a more inclusive, community driven process for decisions regarding Ellicott City's future." This information was obtained from the Ellicott City Safe and Sound website, "What is EC Safe and Sound?" Accessed November 4, 2019, <https://www.ecsafeandsound.org/ec-safe-and-sound-phases-1-2>.

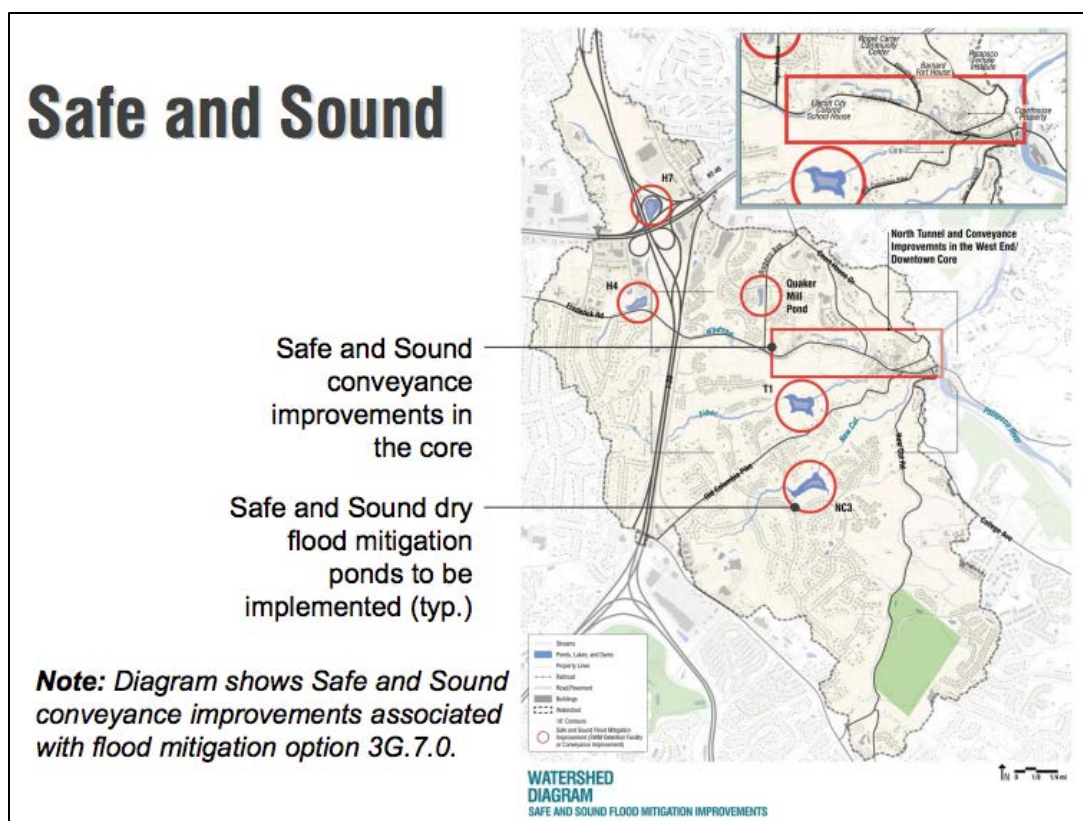


Figure 5. The Ellicott City Safe and Sound 3G.7.0 flood mitigation plans, including water conveyance improvements and retention ponds.<sup>36</sup>

**Flood Warning System:** Howard County partnered with the National Weather Service and the Department of Homeland Security Science and Technology Directorate on a project to install 48 rain and stream gauges at 16 sites throughout the watershed. This network of gauges acts as a flood warning system and is monitored during storms. The public has access to the most important gauges through a portal on the county's website.<sup>37</sup>

As part of the Ellicott City Safe and Sound Plan, flood sirens were installed in Historic Ellicott City to warn pedestrians of a potential flash flood. The alert system will be triggered by National Weather Service flood warnings and can also be set off manually by local public safety officials. Recently, the National Weather Service designated Historic Ellicott City as a separate geographic place to use for flood alerts, rather than alerting the entire city.<sup>38</sup>

<sup>36</sup> "Ellicott City Watershed Master Plan: Public Meeting Presentation," The Howard County Department of Planning & Zoning with Mahan Rykiel Associates, Arnett Muldrow & Associates, RK&K, Land Studies, South Coast Consulting, and Preservation Consulting, Ellicott City, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=fq518URjyUg%3d&portalid=0>.

<sup>37</sup> "Flood Protection: Local Flood Warning System, Real Time Gauges, and NOAA Radios," Howard County, MD, Accessed January 28, 2020. <https://www.howardcountymd.gov/Departments/Public-Works/Bureau-Of-Environmental-Services/Stormwater-Management/Flood-Protection>.

<sup>38</sup> Erin B. Logan. "National Weather Service to specify warning designation for historic Ellicott City," The Baltimore Sun, July 30, 2019. Accessed January 28, 2020, <https://www.baltimoresun.com/maryland/howard/cng-ho-weather-ellcott-city-0731-20190730-refcasbhdhbwzgz725mwfbn67ri-story.html>.



## Challenges Discussed

Unpredictability of Flash Flooding: Of the 44 counties covered by the Baltimore/Washington National Weather Service station, Howard County is the most difficult to warn about flooding ahead of time because of the speed at which storms develop and flooding occurs. Stream gauges do not help much with flash flood prediction.

Economic Constraints of Small Businesses: Local businesses in Historic Ellicott City are reliant on a consistent stream of traffic to maintain their livelihoods. Having to remain closed through the recovery period of the 2016 flood came at a heavy economic cost for some small businesses because they could not afford to remain closed for long periods of time. Following the 2016 floods, many small businesses did not have the time or financial resources to adequately flood proof or take action to mitigate future floods. As a result, some of these small businesses experienced similar, or worse, impacts during the 2018 flood; some businesses shut down permanently.

Resiliency is not Built into Federal Policies: Recent flash flooding in Ellicott City, coupled with the city's longer history of flood events, has damaged drainage and transportation infrastructure, such as roads and culverts. The county would like to rebuild or replace damaged infrastructure that would be more resilient to the impacts of future flooding. However, some FEMA (and U.S. Army Corps of Engineers) funding only allows for infrastructure to be built back to its pre-flood state.

When to Warn the Public about a Flash Flood: There were over a dozen flash flood warnings in Howard County in 2018. Communicating flash flood warnings to the public is challenging because flash floods are difficult to predict, the warning can be in effect for a lengthy period of time, and it can cause stress and anxiety for some community members.

## Lesson Learned

Flood Documentation and Recordkeeping: Individuals, business owners, and local government are required to submit specific information, data, and records in order to access grants and funds post-disaster. After the 2011 and 2016 floods, community members learned that keeping accurate documentation and recordkeeping were critical. These practices (the methods used and the actual records) should be institutionalized in case of staff turnovers.

## Discussion with Development Stakeholders

Stakeholders:

- Howard County Economic Development Authority
- Law Offices of Talkin and Oh

## Mitigation Activities

Flood Relief Grant Program: After the 2018 floods, the local nonprofit, Ellicott City Partnership, partnered with the Howard County Community Foundation to raise \$800,000 in flood relief funds. They established a flood relief grant program for flood-affected nonprofits, businesses, commercial and residential property owners, individuals and households, and employees of impacted businesses. Grants of \$10,000 were available to those businesses that would reopen in Ellicott City and grants of \$5,000 were available to individuals who would reopen elsewhere or were unsure of their future.<sup>39</sup>

## Challenges Discussed

Negative Impacts of Upstream Development: Upstream development has the potential to exacerbate downstream flooding. Developers and property owners upstream may not understand how their activities could contribute to flooding downstream.

Flood Proofing Historical Buildings: When rebuilding and restoring damaged infrastructure, owners of historical buildings are often required to use materials that adhere to the special requirements for maintaining and rebuilding historic buildings according to federal guidelines and codes designated by the Howard County Historic Preservation Commission. In some cases, flood-proofing activities may compromise the historic integrity of a building (see Box 1).

### Box 1 Flood Mitigation and Historic Preservation

Downtown Ellicott City is listed on the National Register of Historic Places<sup>40</sup> and is also a designated historic district by the Howard County Historic Preservation Commission.<sup>41</sup> It is located in a flood-prone area since it straddles the Patapsco River valley and is surrounded by steep slopes that channel rain water directly into it.

Several historical buildings in Historic Ellicott City were damaged in the recent flood events. When rebuilding and restoring flood damaged infrastructure, building owners are often required to use materials that meet the requirements for maintaining and rebuilding historic buildings, but some flood-proofing activities may compromise the historical integrity of a building. In order to effectively flood proof their buildings, property owners need updated guidance and historic building regulations need to be more flexible. In the fall of 2017, the Historic Preservation Commission and the Howard County Department of Planning and Zoning launched a project to update the *Ellicott City Historic*

<sup>39</sup> More information about the Flood Relief Program is available at the Howard County Community Foundation website, “FAQs” Flood Relief Grants,” Accessed January 28, 2020, <https://cfhoco.org/faqs-flood-relief-grants/>.

<sup>40</sup> “Ellicott City Historic District,” Wikipedia 2019, Last Modified September 19, 2019, Accessed November 8, 2019, Available at: [https://en.wikipedia.org/wiki/Ellicott\\_City\\_Historic\\_District](https://en.wikipedia.org/wiki/Ellicott_City_Historic_District).

<sup>41</sup> The federal guidelines for historic preservation are called “The Secretary of the Interior’s Standards,” which for the basis for the Ellicott City Design Guidelines. The Ellicott City guidelines are much more detailed and specific than the federal guidelines, see: “Ellicott City Historic District Design Guidelines (1998), by the Howard County Historic District Commission, Accessed December 18, 2019, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=0PNgiuENPk%3d&portalid=0>.

*District Design Guidelines* to incorporate current preservation standards and address issues such as sustainability, the use of compatible substitute materials, and flood mitigation.<sup>42</sup>

Preservation Maryland supports the historic preservation of Historic Ellicott City through a project called *Save Historic Ellicott City*.<sup>43</sup> Since the 2016 flood, Preservation Maryland has been an active partner in the flood response and recovery efforts in Historic Ellicott City. Their work includes public and private partnerships, a grant program, and technical assistance to property owners. After the 2018 flood, Preservation Maryland released a report that provides several preservation alternatives to building demolition and explores specific case studies in the region where flood-prone historic buildings have been adaptively reused.<sup>44</sup>

The Maryland Historical Trust produced *Flood Mitigation Guide: Maryland's Historical Buildings*.<sup>45</sup> This document provides a framework through which local preservation planners and advocates can better understand floodplain management and engage in local and state emergency management processes.

**Few Businesses Have Flood Insurance:** Less than 25 percent of businesses in Historic Ellicott City have some type of flood insurance. Many small businesses cannot afford it and others are unaware of their insurance options. Many businesses in Historic Ellicott City are specialty stores that carry niche items such as art and antique objects, which the NFIP and most private flood insurance policies do not cover.

**Balancing Flood Risk Communication with Fear:** Flash flood signage has been installed along Main Street in Historic Ellicott City. Some of these communication tools may be scaled back over time because there is concern they may make the area seem more dangerous than it actually is.

## **Lessons Learned**

**Local Government Should Cultivate Relationships with Nonprofits:** The nonprofit community is a huge asset during disasters and post-disaster recovery. Local governments should build and cultivate relationships with nonprofits to better harness the power of the nonprofits in their communities.

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<sup>42</sup> For more information, see: The Howard County website, "Ellicott City Historic District Design Guidelines Update," Howard County, MD, Accessed January 28, 2020, <https://www.howardcountymd.gov/ECdesignguidelines>.

<sup>43</sup> For more information, see the Preservation Maryland website, "Save Historic Ellicott City," Accessed January 28, 2020, <https://www.preservationmaryland.org/programs/six-to-fix/projects/current-projects/ellicott-city-flood-recovery/>.

<sup>44</sup> "A Place for the Past: Preserving Ellicott City's Heritage and Securing its Future" Preservation Maryland, Baltimore, MD, 2019, Accessed January 28, 2020, <http://www.preservationmaryland.org/wp-content/uploads/2018/08/preservation-maryland-ellicott-city-special-report-august-2018.pdf>.

<sup>45</sup> Maryland Historical Trust, *Flood Mitigation Guide: Maryland's Historical Buildings*, 2018, Accessed January 28, 2020, [https://mht.maryland.gov/documents/PDF/plan/floodpaper/2018-06-30\\_MD%20Flood%20Mitigation%20Guide.pdf](https://mht.maryland.gov/documents/PDF/plan/floodpaper/2018-06-30_MD%20Flood%20Mitigation%20Guide.pdf).

## Discussion with Community Organization Stakeholders

### Stakeholders

- Howard County Department of Community Resources and Services
- Howard County Council Member and Council Aide
- Howard County, NAACP
- Neighborhood Associations
- Saint Peter's Church

### Mitigation Activities

Relationship-building and Risk Communication with Vulnerable Populations: The Howard County Department of Community Resources and Services takes an active role in assisting at-risk community members (e.g., low-income families, non-native English speakers, the elderly) to prepare for floods. They partner with trusted community leaders to facilitate the distribution of risk communication materials, including materials in different languages. Their work also includes long-term relationship building, for example, by attending community events.

Community-Developed Flood Surveillance System: After the 2016 floods, a local resident of Ellicott City designed, financed, and installed a network of video cameras to provide a much-needed flood surveillance and warning system (see Figure 6 and Box 2).



Figure 6. Flood surveillance cameras monitoring the Tiber and New Cut Branches in Historic Ellicott City (left)<sup>46</sup> and a screenshot from YouTube showing shows images during the 2018 flood (right).<sup>47</sup>

<sup>46</sup> Photo source: Resilient America staff, May 9, 2019, Ellicott City, MD.

<sup>47</sup> You Tube. 2019. "Ellicott City 2018 Flood Multicam REVISED." Uploaded on January 15, 2019, Accessed January 28, 2020, [https://www.youtube.com/watch?time\\_continue=3&v=CgVRnrk4Rv8](https://www.youtube.com/watch?time_continue=3&v=CgVRnrk4Rv8).

**Box 2**  
**Community-Developed Flood Surveillance and Warning System**

After the 2016 floods, a local Ellicott City resident designed, financed, and installed a network of video cameras to provide a much-needed flood surveillance and warning system.<sup>48</sup>

The system currently has 17 surveillance cameras located at different points along the tributaries that flow into Historic Ellicott City. The cameras track the rise of flood waters upstream to downstream and transmit video in real-time so people can monitor the river levels. Each camera is labeled and time stamped. This camera network captured all four hours of the 2018 floods, and the value of the footage far exceeds any data that was captured by other technologies used.

Howard County Office of Emergency Management, the National Weather Service, and community residents have access to the camera network. Howard County used the camera network during the 2018 flood for rescue operations in Historic Ellicott City and continues using it to monitor potential floods, for general security, and to monitor traffic.

In 2019, the camera network was upgraded by adding a water level sensor that sends a video and text notification to the network developer when the water level in streams or rivers reach a predetermined height. The system upgrade was very cost-effective: the sump pump switch was \$28, other materials were about \$50, and the HD camera was \$300. Two more flood alert switches will be installed at other locations and the community will be given the option to join the network and receive the alerts so they can make informed decisions.

**Household Flood Proofing Measures:** Ellicott City residents have taken a variety of actions to flood proof their homes and businesses in Historic Ellicott City. Some of these measures include flood proofed doors and windows, sump pumps, concrete walls behind front porches to keep out water without changing the historic look of older buildings; waterproof flooring (e.g., polished concrete) on the first floor of buildings; moving valuable assets to the second or third floor of buildings; and filling basements with concrete.

### **Challenges Discussed**

**Lack of Preparedness for Floods:** In general, many community members do not understand their flood risk and are not prepared for future floods. People who do not live or work in Historic Ellicott City may not have experienced the recent flash floods and may not be aware of the increasing risk of flash flooding. People who have experienced the floods may not have the resources to address or mitigate their risk to future events. There is also a need for resources to help people learn how to prepare for and mitigate floods. Additionally, the majority of businesses in Historic Ellicott City do not have flood insurance nor do they have business continuity plans in place should a flood occur.

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<sup>48</sup> Neugent, K. January, 31, 2019. "Ellicott City's Hometown Hero: A Story of Resilience in the Wake of Extreme Flash Flooding," Weather Blog, Accessed January 26, 2020, <https://www.shadetreemeteorology.com/blog/flooding/ellicott-citys-hometown-hero-a-story-of-resilience-in-the-wake-of-extreme-flash-flooding/>.

**Mental Health Issues:** It is challenging for people to build resilience and become better prepared for flooding events when they have not yet processed the trauma of previous floods. Some residents and business owners in Historic Ellicott City experienced post-disaster anxiety and post-traumatic stress disorder from the 2016 floods, conditions that resurfaced with the 2018 flood. Experiencing two floods of this magnitude has caused a sense of helplessness among some people that has led to inaction and/or a denial that such a flood could happen again. Some business owners are concerned that continuing to remind the public about the recent floods—for example, by installing public warning signs and holding public discussions about flood risks—will dissuade their customers from returning to the downtown area. Other people felt a sense of guilt for not being impacted by the floods. For example, some people felt guilty if their house was on a higher level in Historic Ellicott City, if they lived in a portion of the city that did not flood, or for not being available for the response and recovery phases.

**Flood Warning System:** After the 2016 floods, flood sirens were installed in Historic Ellicott City. The sirens are intended to warn people that a flood is imminent. However, the sirens cannot be heard from inside many of the buildings. In addition, many people do not understand that the sirens signal a 2-minute warning, what they are supposed to do when the sirens go off, or what triggers the sirens to go off. During the 2018 flood, Main Street was already flooded by the time the sirens sounded.

**Low Uptake of Flood Insurance:** Many residents and business owners in Historic Ellicott City do not have flood insurance because it is costly. One property owner noted that flood insurance would cost \$5000 per year with a \$10,000 deductible. Additionally, people are confused as to the differences between private insurance and the NFIP, what the NFIP does and does not cover, and how to apply for the NFIP.

## **Best Practices and Lessons Learned**

**Relationship Building:** It is important to build and cultivate relationships across stakeholder groups. After the 2016 and 2018 floods, county government officials, including elected officials, were on the street every day talking to people and holding meetings that focused on how to help the community recover and take steps to move forward. Relationships that developed after the 2016 floods helped to speed the response and recovery of the 2018 floods.

## ***Discussion with Environment, Sustainability and Preservation Stakeholders***

### **Stakeholders:**

- Howard County, Department of Parks and Recreation
- Howard County, Department of Planning and Zoning
- Howard County, EcoWorks
- Local Environmental Advocate
- Patapsco Heritage Greenway
- Preservation Maryland

## Mitigation Activities

Recreation & Parks Response and Recovery Assistance: The Howard County Department of Recreation & Parks assisted with emergency support functions (e.g., transportation, mass care and sheltering, damage assessment, technology and communication) during and after the 2018 floods.<sup>49</sup> Department staff from various divisions helped to operate the flood recovery centers at St. Peter’s Episcopal Church and the George Howard Building. Full-time and contingent staff members created photo ID badges for residents and business owners, helped organize volunteers (1,564 in total), and provided information and material resources to those impacted by the flood.

Ellicott City Preservation Resource Center: After the devastating 2016 floods, the nonprofit historic preservation organization, Preservation Maryland, opened a Preservation Resource Center. The center is staffed with preservation professionals able to help property owners navigate the complexities of rehabilitating historic structures and understand how to utilize existing financial incentives to preserve each building’s historic character.<sup>50</sup>

Stream Watch Program: The Patapsco Heritage Greenway recruits volunteers for the Stream Watch Program for the Patapsco River Valley—a citizen-based environmental monitoring program (see Figure 7). Adult volunteers and/or families are trained to monitor a short stretch of the streams that flow into the Patapsco River and collect specific information on damage, pollution, debris pile-up, and/or potential restoration opportunities observed within the stream or stream bank. Volunteers also report back on the general health of the stream and stream bank (e.g., visible wildlife, erosion, trash, or other environmental concerns) that can impede stream flow and increase the likelihood of flooding during rain events.<sup>51</sup>

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<sup>49</sup> “Recreation and Parks Annual Report, Fiscal Year 2018,” Howard County, MD, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=IxSMkp98Y7I%3d&tabid=1542&portalid=0>.

<sup>50</sup> For more information about the Ellicott City Preservation Resource Center, visit: “Ellicott City Preservation Resource Center,” Preservation Maryland, Accessed January 28, 2020, <https://www.preservationmaryland.org/ellicott-city-preservation-resource-center/>.

<sup>51</sup> “Stream Watch,” Patapsco Heritage Greenway, Accessed January 28, 2020, <https://patapsco.org/environment/stream-watch/>.





Figure 7. The Patapsco Heritage Greenway Stream Watch program.<sup>52</sup>

## Challenges Discussed

Prioritizing Recovery Activities: People came together after the 2016 floods, and there was an overall atmosphere of support and encouragement. After the 2018 floods, differences arose (e.g., among residents, historic preservationists, business owners) in terms of what recovery activities should be prioritized and how recovery money should be spent.

Mental Health Issues: For a number of people who experienced the 2016 and 2018 floods, whenever it rains they experience anxiety. Others experience survivor's guilt because they were not in town when one of the floods occurred or their businesses or residences are located higher up the hill on Main Street so they did not experience flood impacts. Some people feel anxious when they visit Historic Ellicott City and do not want to work in that part of the city because they fear another flood occurring there.

Balancing Historic Preservation with Flood Proofing: When it comes to making decisions about rebuilding in Historic Ellicott City after the floods, some people favor preserving the historic integrity of the buildings while others emphasize the importance of flood proofing. Historic Ellicott City attracts a lot of tourism because of its historic value. There is concern that some

<sup>52</sup> Ibid.



types of flood proofing of buildings may destroy the historic value of the downtown which may impact tourism.

Data to Inform Decision Making: States and counties may not take into account return on investment (ROI) when making flood mitigation investment decisions, often because government funding is conducted on a year-to-year basis. Data are needed to assess ROI over the long-term when making mitigation investment decisions.

### Discussion with Private Sector Stakeholders

#### **Stakeholders:**

- Ellicott City Partnership
- Fels Lane Neighborhood Association
- Forget Me Not Factory
- Howard County Chamber of Commerce
- Howard County Economic Development Authority
- Maryland Insurance Administration
- Park Ridge Trading Company
- Su Casa Furniture
- Sweet Elizabeth Jane

#### **Mitigation Activities**

Flood Mitigation Assistance Grants: In 2019, Howard County implemented a “Flood Mitigation Assistance Pilot Program” for property and business owners. This matching grant program provides funding for flood mitigation projects on structures located in flood zones A, AE, or Shaded X, which includes the following Ellicott City communities: Valley Mede, Chatham, Dunloggin, Historic Ellicott City, and communities off Frederick Road, Old Columbia Pike, and New Cut Road. The county provided up to \$5,000 per project. Examples of eligible projects could include flood doors, sealant, shields, drainage systems, and relocation of HVAC units.<sup>53</sup>

#### **Challenges Discussed**

Recouping Costs Not Covered By Flood Insurance: Many residents and business owners in Historic Ellicott City incurred expenses from water-damaged structures and assets, including store inventory, household possessions, and cars. Additionally, some small- to medium-sized businesses lost income from tourists and local customers who were unable to access Historic Ellicott City while buildings and infrastructure were being repaired. Loss of revenue cannot be recouped through insurance. One business owner estimated that he lost \$200,000 in revenue after the 2016 floods, but his insurance only paid \$25,000 for flood-related damages.<sup>54</sup>

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<sup>53</sup> “Safe And Sound Website: Flood Mitigation Assistance Pilot Program,” Howard County, MD, Accessed November 7, 2019, <https://www.ecsafeandsound.org/flood-mitigation-assistance>.

<sup>54</sup> After the 2016 floods, the Jacob France Institute conducted a study that assessed the economic contribution of Downtown Ellicott City/Main Street Corridor businesses to the Howard County economy and that also estimated the displaced business and economic activity that occurred in Howard County as a result of the 2016 flood. The

Impact of Development on Flash Flooding: Some Ellicott City stakeholders believe an increase in upstream development and impervious surfaces contributed to, or caused, the 2016 and 2018 flash floods. Other community stakeholders believe there will be economic losses if communities stop developing.

Lack of Understanding of How Flood Insurance Works: Many business and property owners in Ellicott City do not understand how the NFIP works, what it covers, what it does not cover, and what other types of insurance are available that could cover flood damages and losses. After the 2016 flood, some people did not know if FEMA grants were available for commercial properties and some thought flood insurance was not available to them because their property or business was located in a floodplain. Many people who had flood insurance had difficulty navigating the complex system of filing claims.

## **Lessons Learned**

Importance of Relationships: Building and cultivating relationships with other community stakeholders is critical. For examples, community stakeholders came together during the 2016 flood to help each other in the aftermath of the flood. As a result, local business owners established new relationships with each other. These relationships supported the community during the 2018 flood and flood recovery.

## ***Discussion with Emergency Management & First Response Stakeholders***

### **Stakeholders:**

- Howard County Department of Fire and Rescue Services
- Howard County Office of Emergency Management
- Howard County Police Department
- Maryland Department of the Environment
- Maryland Emergency Management Agency (MEMA)

## **Mitigation Activities**

Flood Sensor Pilot Project: The Department of Homeland Security (DHS) Science and Technology (S&T) Directorate's Flood Apex Program is working to improve community resilience to floods. Its flood sensor project involves partnering with five communities around the country to test and evaluate low-cost flood inundation sensors. Ellicott City was selected as a pilot community for this flood sensor project, and is testing 48 flood sensors at 16 sites in the Tiber-Hudson watershed around Ellicott City (see Box 3).

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study estimated that Howard County economic activity could be reduced by \$67.2 million, with a resulting loss of 151 jobs and labor income reductions of \$27.2 million, with County government revenue losses of as much as \$1.3 million. Source: The Jacob France Institute, "The Economic Impact of the 2016 Ellicott City Flood," November 2016, Accessed November 8, 2019, <http://www.jacob-france-institute.org/wp-content/uploads/Economic-Impact-Ellicott-City-Flood-2016.pdf>.

### BOX 3

#### DHS Flood Sensor Pilot Project

The DHS S&T Directorate's Flood Apex Program applies new and emerging technologies to improve community resilience to floods.<sup>55</sup> One Flood Apex project involves partnering with five communities around the country to test and evaluate low-cost flood inundation sensors to develop an effective, low-cost gauge for communities.<sup>56</sup> <sup>57</sup> Ellicott City was selected as a pilot community for the Flood Apex Flood Sensor Project.

DHS S&T partnered with Howard County and the National Weather Service to deploy 16 flood sensor units throughout the Tiber-Hudson watershed. Each unit is composed of one sensor from three different vendors (48 flood sensors total). The purpose is to test the performance of each vendor's sensor at each location. The sensors are also placed at locations where there is a USGS river gauge to compare them to the USGS gauges which provide highly accurate and reliable data. Each vendor sensor is different. For example, they may test soil moisture content, catchment levels, or stream levels. Some sensors have cameras. Normal gauges, such as those used by the USGS, typically cost \$10,000 to \$20,000 each and are difficult to maintain and use. DHS expects the new pilot sensors to cost under \$1,000 each.<sup>58</sup> When the test period is complete, Howard County will be able to keep the sensors.

**Mutual Aid Agreements:** First responders and emergency managers have mutual aid agreements in place with surrounding jurisdictions. If an agreement is not in place, MEMA helps with resource acquisition. During an event, emergency management directors in other counties will often reach out to offer help before Howard County requests assistance.

**Risk Communication:** Howard County is focused on messaging and public alerts and warnings to relay flood risks. County personnel visit Main Street in Historic Ellicott City and hand out preparedness and business continuity information and hold public meetings. They are also distributing NOAA weather radios to the public. The county has about eight different methods to contact people including text alerts and social media.

#### Challenges Discussed

**Accessing FEMA Funding:** Accessing FEMA funding can be difficult, especially in terms of meeting FEMA requirements. For example, FEMA requires benefits-cost analyses (BCA) for mitigation projects. FEMA wants benefits to be standalone and attached to a specific project,

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<sup>55</sup> "Flood Apex Program," Department of Homeland Security S & T, Accessed January 16, 2020, <https://www.dhs.gov/science-and-technology/flood-apex#>.

<sup>56</sup> A 2019 update about the DHS-S&T flood sensor project is available at: "Flood Sensor Fact Sheet," DHS, Accessed January 28, 2020, [https://www.dhs.gov/sites/default/files/publications/floodsensor\\_factsheet.pdf](https://www.dhs.gov/sites/default/files/publications/floodsensor_factsheet.pdf)

<sup>57</sup> For more information about the DHS S&T Flood Sensor Project visit <https://www.dhs.gov/science-and-technology/news/2018/11/06/snapshot-st-nc-partner-test-flood-sensors-build-resilience>.

<sup>58</sup> "Ellicott City Is Hoping DHS' Flood Apex Program Is a Match Made in Heaven," Government Technology Emergency Management website, Accessed January 28, 2020, <https://www.govtech.com/em/preparedness/Ellicott-City-is-Hoping-DHS-Flood-Apex-Program-Is-a-Match-Made-in-Heaven.html>.

but in Ellicott City it is hard to have a single, cost-effective project that will have a significant increase in flood protection. MEMA wanted to look at the combined benefits of three Ellicott City projects, but this did not meet FEMA guidelines for cost effectiveness. BCAs are not beneficial to flash flood scenarios, and the worse the storm is, the harder it is to reach the BCA requirements. BCAs are generally designed for disasters that are more frequent.

Lack of Understanding of Flood Insurance Coverage: After the 2018 flood, there was confusion among business owners and residents about what flood insurance covered (e.g., the building and/or the contents within the building; the basement and/or the first floor). Even though Maryland Insurance Administration provides presentations to businesses about flood insurance and what it covers, many people are not receiving the information.

Lack of an Effective Flash Flood Alert System: Flood warning and response data and technology are either not available or not yet accurate enough to identify if and where a flash flood will occur. Modeling may be able to predict a flash flood but not where exactly it is going to happen. This lack of forewarning about intensity and location impedes effective response.

Low Uptake in Flood Insurance: There are several reasons why people do not buy flood insurance: it is too expensive; their building or home is not located in the mapped flood zone so they do not think they need flood insurance; or they think they can get funds through FEMA's Individual Assistance Program instead.

Interdepartmental Coordination: One major challenge is coordinating across different county departments on flood mitigation-related projects, for example, to develop plans, submit reimbursements related to a flood disaster, or develop and submit grant proposals.

FEMA's benefits cost analysis: The FEMA BCA does not take into account the value of historic or other significant resources, nor does it take into account death or injuries from disasters. Ellicott City is valuable as a historic site, but it is going to cost more than the value of the buildings to address its flood challenges. There are a few ways FEMA can change the BCA requirement. One solution would be to allow for an appeals process for those communities that are unable to reach a 1:1 ratio for a mitigation project. Another solution would be to allow communities to match funds.

## **Best Practices and Lessons Learned**

Building Relationships: Cultivating relationships within and across jurisdictions, and with nonprofits and community members, is crucial for effective planning, response, and recovery. Before the 2016 floods, the Howard County Office of Emergency Management (HoCo OEM) implemented a new emergency operation plan. In the process, the HoCo OEM developed relationships with many other agencies and organizations. These relationships were important during the 2016 and 2018 floods.

FEMA Disaster Assistance Is Not Immediate: FEMA disaster assistance does not flow to communities immediately after a disaster. Applications to FEMA are not due until 12 months

after an incident. Thus, communities need a financial plan that addresses immediate and mid-term needs.

Understanding the Capabilities of Emergency Operations Centers: For effective emergency response planning, communities need to understand the capabilities of their emergency operations centers, what resources these centers have (e.g., inventory, human resources), and at what level and for how long they can operate within the context of a disaster.

### *Meeting with a Business and Property Owner*

This meeting was with a longtime resident of Howard County who runs a business in a historic building on Main Street in Historic Ellicott City.

### **Mitigation Activities**

The owner purchased a large 4-story historic building in 2008 and spent two years renovating it. All renovations were compliant with historical preservation codes. The building was outfitted with numerous flood mitigation measures. The first floor was redesigned with a polished concrete floor, raised electric panels, and foam on the interior of the walls that could be dried out. The first floor can withstand internal flooding of up to eight feet, which is about two feet above the Hurricane Agnes waterline for that building. In the 2011 flood, the building incurred no damage. In the 2016 flood, all the windows and the door withheld but the door frame shattered. The 2018 flood broke a window and the first floor was flooded with 7.5 feet of water. To ensure business continuity in the event of a disaster, the owner set up a backup server in a remote location.

### **Challenges Discussed**

Need for Advanced Warning to Secure Property: During previous flood events (e.g., Hurricane Agnes in 1972, Hurricane Eloise in 1975, and Tropical Storm Juan in 2011), there was adequate time for people to secure their assets and property and evacuate. However, with the 2016 and 2018 floods, there was only enough time to do a few last-minute preparations before having to retreat to the upper levels of buildings for safety.

Identifying Common, Community-wide, Priority Flood Mitigation Solutions to Implement: The 2016 flood united different sectors of the community during recovery and clean-up. However, after the 2018 floods, there were numerous ideas about what should be done to mitigate future floods in Historic Ellicott City. Community stakeholders want flood mitigation measures to be implemented, but have not come to an agreement on what types of mitigation actions should be prioritized and implemented. Several community stakeholders suggested that a neutral convening body bring together community stakeholders, provide information exchange about flood mitigation options, and facilitate productive community-wide discussions to reach collective decisions.

Historical Preservation Regulations: Historic building renovations must comply with preservation guidelines. But local and federal regulations guiding preservation are sometimes at odds with each other and can be confusing.

## **Lessons Learned**

Business Continuity Plan: Many businesses are not prepared for disasters. Small business owners should create a business continuity plan to ensure they can maintain operations during a disaster and through recovery.

### *Meeting with County Executive Calvin Ball*

Mr. Calvin Ball III was elected as the County Executive of Howard County in November 2018. In May 2019, his administration rolled out the Ellicott City Safe and Sound plan, a “multi-phase plan built around the need for public safety, supporting business and property owners, preparing the county for a changing climate, and creating a more inclusive, community driven process for decisions regarding Ellicott City’s future.”<sup>59</sup> This plan includes new flood mitigation initiatives.

## **Mitigation Activities**

Enhanced Stream and River Cleaning: Until County Executive Ball took office, streams and rivers were cleared of debris on a quarterly basis. A new “Clearing the Waterways” clean-up protocol monitors and removes debris from public properties after every weather event. An interactive web-based application shows the progress of the “Clearing the Waterways” program, inspection sites, and sites slated for clearing (see Figure 8).<sup>60</sup> Priority debris for removal includes debris within and immediately upstream of culverts or other areas of constriction, debris that has the potential to mobilize during an event and create a blockage downstream, and debris that otherwise poses or may pose a risk to adjacent infrastructure.<sup>61</sup> Ten tons of debris had been removed from waterways by November 2019.<sup>62</sup>

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<sup>59</sup> “Safe and Sound: Phases one and Two,” Ellicott City Safe & Sound, Accessed November 18, 2019, <https://www.ecsafeandsound.org/ec-safe-and-sound-phases-1-2>.

<sup>60</sup> The Clearing the Waterways tool is available at: “Safe & Sound Stream Debris Removal,” Howard County, MD, Accessed January 16, 2020, <https://data.howardcountymd.gov/SafeandSoundStreamDebrisRemoval/Web.aspx>

<sup>61</sup> “Clearing the Waterways,” Ellicott City Safe & Sound, Accessed January 28, 2020, <https://www.ecsafeandsound.org/clearing-the-waterways>.

<sup>62</sup> Kristin Danley-Greiner, “Residents Updated On Safe And Sound Plan In Ellicott City,” Patch News, November 22, 2019, Accessed January 28, 2020, <https://patch.com/maryland/ellicottcity/residents-updated-safe-sound-plan-ellicott-city>.

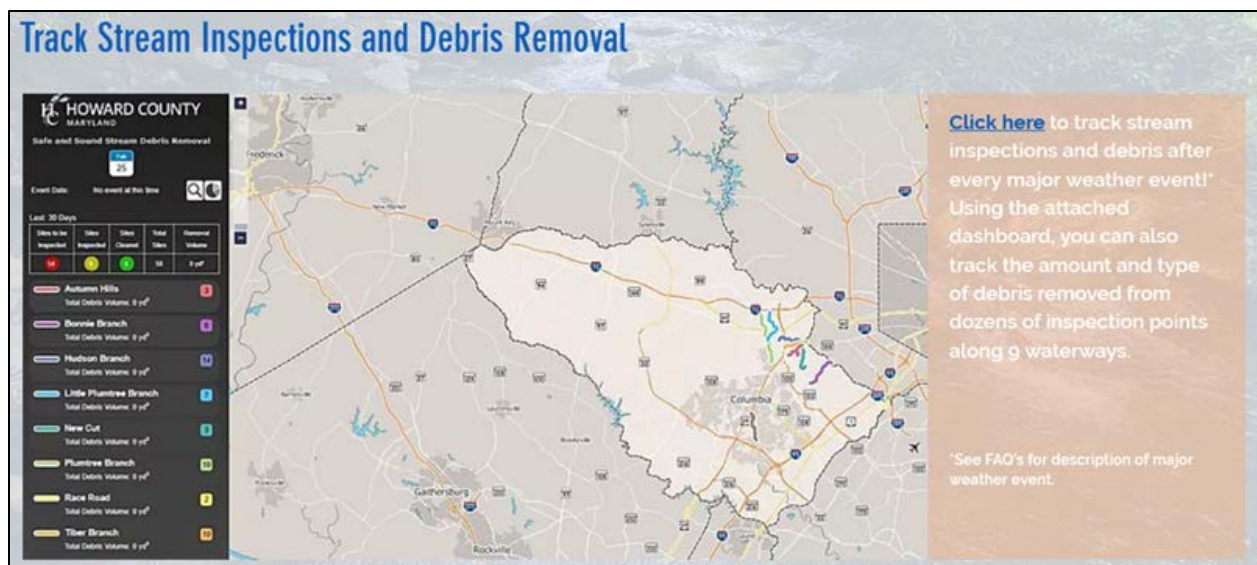


Figure 8. Interactive stream tracking and debris removal application.<sup>63</sup>

**Watershed Protection Fee:** The Howard County Watershed Protection Fee (a.k.a., stormwater utility fund) funds projects that treat stormwater runoff, improve the stormwater infrastructure, and improve the water quality in the rivers and streams around Howard County. The fee is included on annual property tax bills and amounts to \$15 for owners of townhouses and condominiums, \$45 for owners of homes on lots of one-quarter acre or less, and \$90 for homes on lots larger than one-quarter acre. Funds may also be used to support educational stormwater programs that engage community members and enlist their support in identifying problems and working on solutions to improve water quality. The county offers reimbursement for on-site stormwater management practices of 50 percent of the cost of whichever practice is implemented, up to a maximum of \$1,200. Stormwater management practices can include rain barrels, rain gardens, removal of impervious covers, or conservation landscapes.<sup>64</sup>

**Public and Private High-Ground Access Points:** As part of the Ellicott City Safe and Sound plan, public access, high ground evacuation areas have been designated and marked by signage along different points on Main Street in Historic Ellicott City (see Figure 9). The signage directs pedestrians toward higher ground (see Figure 10). Howard County is also working on agreements with business and property owners on the lower end of Main Street in Historic Ellicott City to allow the public to access high ground that is located on private property during a flood or potential flood. Gates to private high ground areas will be designed as fail-proof during floods, and first responders and emergency managers would have access and control of them during flood events.

<sup>63</sup> Image source: "Clearing the Waterways," Ellicott City Safe & Sound, Howard County, MD, Accessed January 28, 2020, <https://www.ecsafeandsound.org/clearing-the-waterways>.

<sup>64</sup> "Watershed Protection Fee: FAQs," Howard County Stormwater Solutions, Howard County, MD, Accessed November 18, 2019, <https://www.cleanwaterhoward.com/watershed-protection-fee/faqs>.



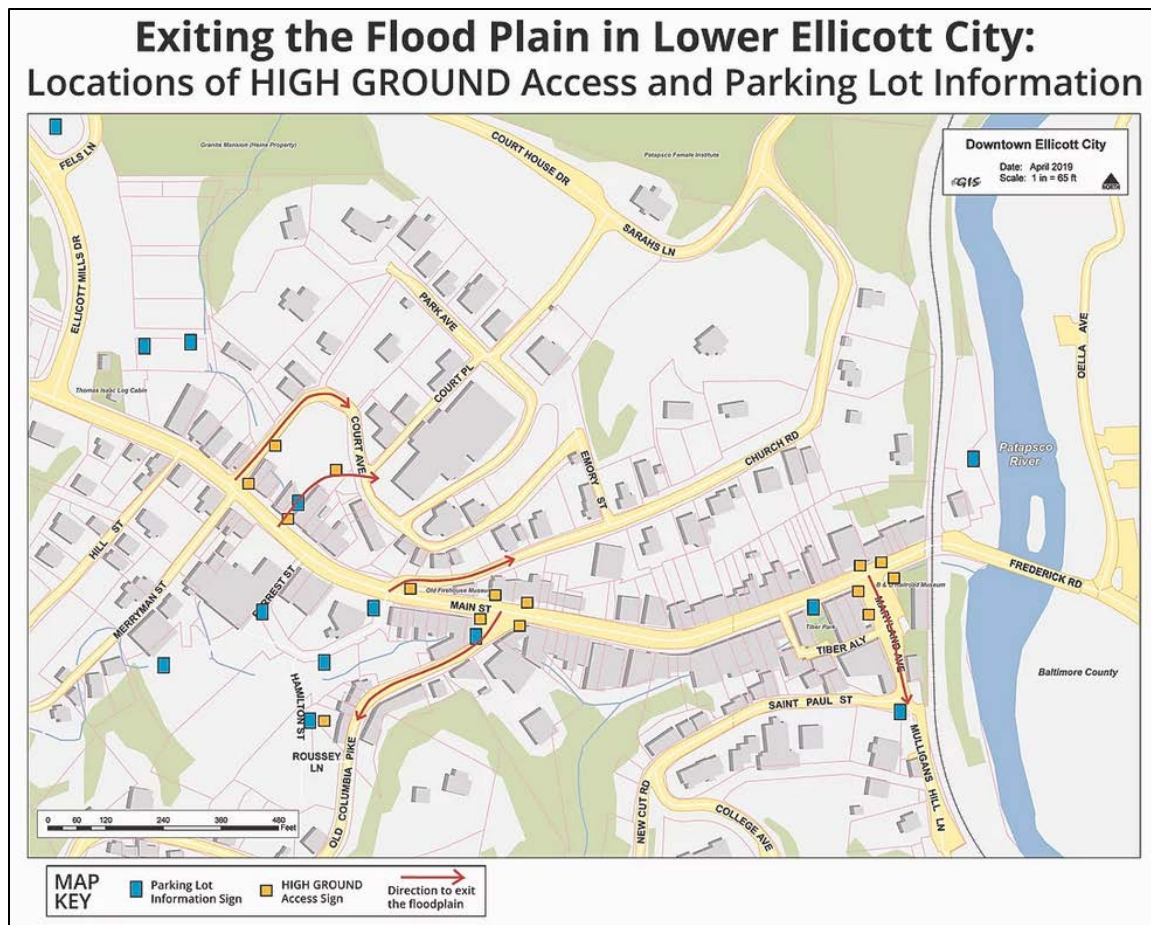


Figure 9. Location of high ground access point signs and the evacuation routes to higher ground areas.<sup>65</sup>

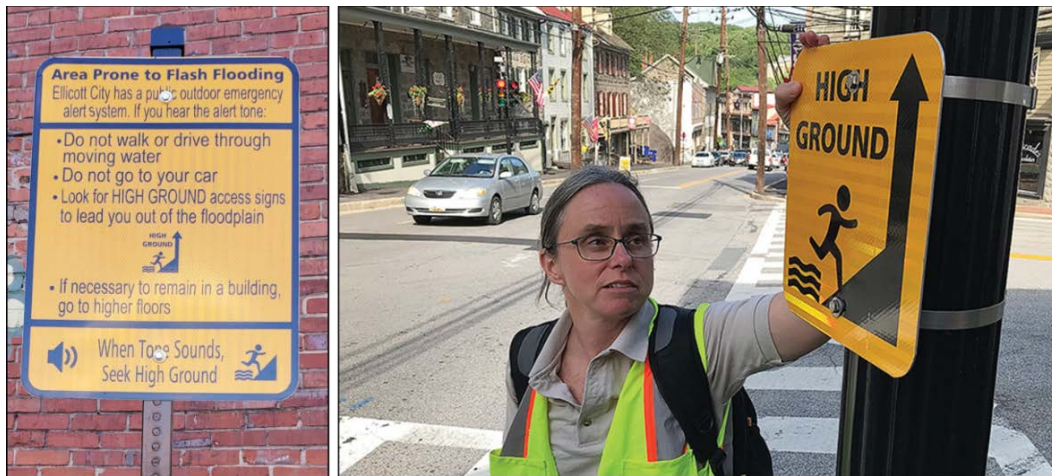


Figure 10. Flash flood warnings signs on Main Street Ellicott City.<sup>66</sup>

<sup>65</sup> Image source: "High Ground Access Points," Ellicott City Safe & Sound, Howard County, MD, Accessed January 16, 2020, <https://www.ecsafeandsound.org/high-ground-access-points>.

<sup>66</sup> Photo on the left taken by Resilient America staff. Source of photo on the right: The Bay Journal website, "Ellicott City unveils flood plan to weather increasingly severe storms." (Photo by Jeremy Cox), Accessed January 28, 2020, <https://www.bayjournal.com/article/ellicott-city-unveils-flood-plan-to-weather-increasingly-severe-storms>.



Flood Mitigation Assistance Grants: As part of Phase One of the Ellicott City Safe and Sound plan, Howard County offers flood mitigation assistance grants in the Plum Tree, Little Plum Tree, Tiber-Hudson, and New Cut watersheds to assist in offsetting the costs of flood mitigation improvements. The county will match up to \$5,000 for these improvements. Examples of eligible projects include flood doors, sealant, relocation of HVAC units to the roof or to higher ground, and improved drainage systems on properties.

Acquisition of Flood-prone Buildings: By November 2019, Howard County had acquired nine of ten flood-prone buildings on and near Main Street in Historic Ellicott City as part of the county's plan to reduce risk from future flooding. Before Ball took office, the county planned to raze ten historic buildings that were damaged in the 2016 and 2018 floods. Under Ball's plan, only four of the buildings will be demolished.<sup>67</sup>

## **Challenges Discussed**

Post-disaster Trauma: A number of residents in Ellicott City who were impacted by previous floods experience fear, anxiety, guilt, or anger when there are heavy rains or potential flooding. These ongoing mental health issues can make recovery and flood awareness campaigns challenging because flood information can trigger anxiety.

Loss of Tax Revenue When Implementing Infrastructure Projects for Flood Mitigation: Ellicott City is the cultural and commercial hub of Howard County and its second largest source of tax revenue. The majority of this tax base is in Historic Ellicott City.<sup>68</sup> Implementing large-scale flood mitigation infrastructure projects in Historic Ellicott City can disrupt this revenue and also decrease the income of local small businesses.

Balancing Mitigation Funding across Unincorporated Communities: Howard County is the responsible governing and administrative body of the county's unincorporated communities, including Ellicott City (the largest unincorporated community in the United States). Historic Ellicott City is a small part of Ellicott City (see Figure 11) though it provides significant tax revenue to the county. Historic Ellicott City is 325 acres in size, compared to 19,200 acres for all of Ellicott City and 161,920 acres for Howard County. Because it has experienced some of the most devastating floods, the county is investing a significant amount of funding into flood mitigation efforts in Historic Ellicott City. It can be challenging trying to balance mitigation funding across numerous unincorporated communities when one of those communities has experienced a disproportionate amount of damages from disasters.

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<sup>67</sup> Neal Augenstein, "Most buildings bought in Ellicott City flood mitigation plan," WTOP News, November 18, 2019, Accessed January 28, 2020, <https://wtop.com/howard-county/2019/11/most-buildings-bought-in-ellicott-city-flood-mitigation-plan/>.

<sup>68</sup> Source: "The Economic Impact of the 2016 Ellicott City Flood," The Jacob France Institute, November 2016, Accessed November 8, 2019 <http://www.jacob-france-institute.org/wp-content/uploads/Economic-Impact-Ellicott-City-Flood-2016.pdf>.



Figure 11. A map of Howard County showing the size of Historic Ellicott City in relation to the rest of Ellicott City and the rest of Howard County.<sup>69</sup>

**Managing Expectations with the Public:** Ellicott City Safe and Sound is a multi-year and multi-phase plan that includes over a dozen flood mitigation projects.<sup>70</sup> One challenge is managing expectations and communicating with the public about project timelines, completion dates, and expected impacts.

## Best Practices

**Transparency and Public Engagement about Flood Mitigation:** Transparency and public engagement are important during all aspects of flood mitigation projects. For example, Howard County uses several social media outlets to announce mitigation and flood awareness news, and the Ellicott City Safe and Sound plan has its own webpages and Facebook page to post news and updates about the plan's progress. Each Ellicott City Safe and Sound project has an extensive FAQ section. The county utilizes text messaging, phone calls, and in-person interactions with residents to explain the plan and relay updates. Although the most damaging floods have occurred in Historic Ellicott City, the county stresses the importance of making every sector of the county feel that they are seen, heard, and valued.

<sup>69</sup> "Neighborhoods / Housing," The Howard County Economic Development Authority, Howard County, MD, Accessed January 28, 2020, <http://www.hceda.org/why-howard-county/living/neighborhoods/>.

<sup>70</sup> These project are available on an interactive web-based map on the Ellicott City Safe and Sound website, "E.C Safe and Sound: Flood Mitigation Projects," Accessed January 28, 2020, <https://www.ecsafeandsound.org/flood-mitigation-projects>.

## COMMON CHALLENGES ACROSS STAKEHOLDER GROUPS

Economic Impacts of Flood Mitigation: In Howard County, some of the most devastating flood-related impacts occurred in Historic Ellicott City. Some businesses on Main Street operate on thin profit margins and cannot afford to remain closed for long periods of time; thus, being able to reopen quickly after a flood is crucial. How quickly a business can open depends on various factors including how long it takes them to get back up and running or how long it takes for roads or other infrastructure to be repaired. Many businesses in Historic Ellicott City experienced economic losses from the 2016 and 2018 floods. Some did not have the time or financial resources to adequately flood proof their buildings or place of business after the floods. Regarding the newly adopted Ellicott City Safe and Sound Plan, one concern is that the implementation of large-scale infrastructure projects to mitigate floods in the historic district may disrupt public/tourist access to the small businesses and landmarks.

Mental Health Issues: Some residents and business owners in Historic Ellicott City who experienced the 2016 and/or 2018 floods have lingering anxiety or other mental health issues (e.g., post-traumatic stress disorder, survivor's guilt) when it rains. Some people feel that there is nothing they can do to prepare themselves for future floods.

Need for an Effective Flood Warning System: Flood sirens were installed in Historic Ellicott City after the 2016 floods. However, it is difficult to hear the sirens from inside buildings, and some people do not understand what to do when the siren goes off or that the sirens signal a 2-minute warning. When the siren went off during the 2018 flood, Main Street was already flooded. In addition, flash flooding is difficult to predict due to the speed at which the Tiber Branch Watershed becomes inundated during heavy rain events and because there is a lack of flood warning and response data and predictive modeling technology.

Low Flood Insurance Uptake: Only a small portion of residents and business owners in Ellicott City have flood insurance. People do not buy flood insurance because it is too expensive, they do not think they need it because they are not located in a mapped flood zone, or they do not think another devastating flood will occur.

Lack of Understanding about How Flood Insurance Works: Across stakeholder groups, many people are not well-informed about the NFIP and what it does and does not cover, other private insurance options, or details such as how the value of flood losses at the time of the claim is based on the Actual Cash Value (depreciated cost), not the replacement cost.

Balancing Historic Preservation with Flood Proofing: The most flood-prone part of Ellicott City is "Historic Ellicott City." It is unclear which flood proof measures comply with both local and federal historical preservation guidelines. It can also be challenging to find replacement parts for flood-damaged buildings.

## CHALLENGES UNIQUE TO ELLICOTT CITY, MARYLAND

Historical Structures: Historic Ellicott City, which has more than 200 18<sup>th</sup> and 19<sup>th</sup> century buildings, is one of Howard County's most visible and recognizable historical landmark communities.<sup>71</sup> These structures are a challenge to flood proof because some mitigation solutions (e.g., elevation) can compromise their historical integrity.

Topography: The Tiber Branch Watershed is a 3.7 square mile (2,368 acre) area located in eastern Howard County and contains three major tributaries, the Hudson, Tiber, and New Cut Branches, which combine to flow under Historic Ellicott City and into the Patapsco River. A mix of bedrock foundations underlie the watershed and a thin layer of soil sits atop this bedrock, about 8% of which is hydric soil. The eastern edge of the watershed is on the fall line between the Piedmont and the Coastal Plain, making the topographic relief in the Tiber Branch watershed among the most extreme in the county, with slopes greater than 25% grade.<sup>72</sup> These steep grades are prevalent in the central-eastern areas and along stream corridors. Stormwater retention in the upland area around Historic Ellicott City is impeded by poor soil, exposed bedrock, and impervious surfaces due to development. Stormwater runs off the steep valley grades, picks up velocity, and channels through Historic Ellicott City and into the Patapsco River. Additionally, the Patapsco River, which collects water from the tributaries of Tiber Branch Watershed, is also prone to flooding. Thus, Ellicott City is prone to both top-down and bottom-up flooding.

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<sup>71</sup> "Ellicott City Historic District," Wikipedia, 2019, Last Modified September 19, 2019, Accessed January 28, 2020, [https://en.wikipedia.org/wiki/Ellicott\\_City\\_Historic\\_District](https://en.wikipedia.org/wiki/Ellicott_City_Historic_District).

<sup>72</sup> Biohabitats, Inc. in conjunction with McCormick Taylor, *Tiber Branch Watershed: Stormwater Retrofit Study*, [prepared for: Howard County Department of Public Works, Bureau of Environmental Services, Stormwater Management Division], Baltimore, MD, 2019, Accessed January 28, 2020, <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=SeKdpy3CWGk%3d&portalid=0&timestamp=1561669976225>.

# FINAL AGENDA FOR ELLICOTT CITY, MARYLAND

The National Academies of Sciences, Engineering, and Medicine  
**Resilient**America Program

## FLOOD MITIGATION STAKEHOLDER MEETINGS

### Agenda

September 24-26, 2019  
Ellicott City, MD

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**Tuesday**  
**September 24, 2019**

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3:00 pm – 4:30 pm      **Discussion with Infrastructure, Engineering, and Public Works Stakeholders**

Representatives

- Howard County Executive Office
- Howard County Department of Planning and Zoning
- Howard County Department of Public Works
- Howard County Storm Water Management Division
- U.S. Army Corps of Engineers
- U.S. Geological Survey

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**Wednesday**  
**September 25, 2019**

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9:00 am – 10:30 am      **Discussion with Real Estate, Insurance, & Development Stakeholders**

Representatives

- Howard County Economic Development Authority
- Law Offices of Talkin and Oh

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11:30 pm – 1:30 pm      **Discussion with Community Organizations**

Representatives

- Howard County Council Member and Council Aide
  - Howard County Department of Community Resources & Services
  - Howard County NAACP
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- Neighborhood Associations
  - Saint Peter's Church
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2:30 pm – 4:00 pm

**Meeting with Emergency Management Stakeholders**

Representatives

- Howard County Department of Fire and Rescue Services
  - Howard County Office of Emergency Management
  - Howard County Police Department
  - Maryland Department of the Environment
  - MEMA
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**Thursday  
September 26, 2019**

10:00 – 11:30 am

**Discussion with Environment, Sustainability and Preservation Stakeholders**

Representatives

- Howard County Department of Parks and Recreation
  - Howard County Department of Planning and Zoning
  - Howard EcoWorks
  - Patapsco Heritage Greenway
  - Preservation Maryland
  - Local Environmental Advocate
- 

1:00 pm – 2:30 pm

**Discussion with Private Sector Stakeholders**

Representatives

- Ellicott City Partnership
  - Fels Lane Neighborhood Association
  - Forget Me Not Factory
  - Howard County Chamber of Commerce
  - Howard County Economic Development Authority
  - Maryland Insurance Administration
  - Park Ridge Trading Company
  - Su Casa Furniture
  - Sweet Elizabeth Jane
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2:00 pm

**Adjourn**

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