Prince George's County & City of Laurel

HAZARD MITIGATION PLAN 2023

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Contents

Abbreviations

BRIC	Building Resilient Infrastructure and Communities
CDBG	Community Development Block Grant
COMAR	Code of Maryland Regulations
CRS	Community Rating System
EF	Enhanced Fujita
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GIS	Geographic Information System
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HU	Housing Units
IA	Individual Assistance
IH	FEMA Individuals and Households Program
Hazus-MH	Hazus Multi-hazard
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
PA	Public Assistance
RCP	Representative Concentration Pathway
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental Criteria
SVI	Social Vulnerability Index
SWM	Stormwater Management

Executive Summary

A. Introduction

The Prince George's County and City of Laurel 2023 Hazard Mitigation Plan (HMP) is an update to the 2017 plan. Since the last version, the HMP has progressed to more thoroughly address the evolving risks posed by natural hazards. The purpose of the HMP is to prevent future loss and damage by assessing Prince George's County and the City of Laurel communities' vulnerabilities to natural hazards and preparing a long-term strategy that considers climate change to adequately address those hazards. The direct outcome of this plan will be the implementation of mitigation projects in the communities that need them most.

For more information on the HMP's purpose and planning context, refer to **Chapter 1**.

B. Planning Process

The hazard mitigation planning process is collaborative—involving active participation from County and City officials, community residents, community stakeholders, state officials, and hazard mitigation experts. It involves the following five main steps:

1. Organize the planning process and resources,
2. Assess risks and vulnerabilities from natural hazards,
3. Assess community capabilities to implement hazard mitigation actions,
4. Develop a mitigation strategy, and
5. Adopt and implement the plan.

Prince George's County and the City of Laurel convened a joint Mitigation Advisory Committee to lead HMP development. The Committee formally met four times during the planning process and worked closely with Dewberry Engineers, Inc. to develop the 2023 HMP. The Mitigation Advisory Committee carried out the above steps from September 2022 through March 2023.

Public participation was sought throughout the process, including during the following engagement and input opportunities:

- **Virtual community hazard problem area mapping** (residents placed 'pins' on a map to identify locations of hazard problem areas with descriptions of the issues they've noticed);
- **Virtual public hazard mitigation survey**, which allowed residents to share their opinion of the hazards with the biggest impacts on the County and how they'd like to see the County and City address them;
- **Public meeting** to see an overview of the hazard risk assessment (step 2, above) results and provide feedback on the HMP's revised goal and what mitigation projects we should implement to address the risks and vulnerabilities;
- **Public draft HMP review survey** that gave the public a chance to review the updated draft HMP and provide feedback through a virtual survey;

- **Public meeting** to see an overview of the updated draft HMP and provide feedback; and
- **HMP adoption hearings** where the public could provide comments during the adoption processes for the County and City.

B.1. Planning Committee Membership

The Mitigation Advisory Committee participated in the planning process (outlined in **Chapter 2**) through attendance at a series of meetings, review of materials, comments on draft documents, consideration of hazards and existing programs and policies, and identification of actions that will further reduce the impacts of hazards in Prince George's County and the City of Laurel.

The following agencies are designated members of the Mitigation Advisory Committee:

- Department of Environment (Dawn Hawkins-Nixon, Kelly Flint, Lilantha Tennekoon, Patrick Callahan, Jeffrey DeHan, Sudanshu Mishra, Joanna Smith)
- Office of Homeland Security (Ronald Gill, Meloyde Batten-Mickens, Joey Henderson, Ehsan Bahador, James Carter and Alexandra Harris)
- Police (Major Anthony Cline
- Fire/Emergency Medical Services (Chief James McClellend)
- Public Works and Transportation (Erv Beckert and Mary Sherrill)
- Information Technology (Miles Roesner)
- Family Services (Cathy Stasny)
- Department of Permitting, Inspection, and Enforcement (Rey De Guzman, Behdad Kashanian)
- Department of Parks and Recreation (Wanda Ramos, Andree Checkley, Katina Shoulars)

The following were notified when the planning process was initiated and were asked to review and comment on the HMP before it was finalized:

- The 25 incorporated municipalities located in Prince George's County that do not have separate land use authority and the City of Bowie, which retains some land use authority.
- Interested parties on Planning Board's public notification list of e-mails that is maintained by Maryland-National Capital Park and Planning Commission (civic associations, neighborhood associations, etc.)
- Dam Owners
- Utility companies (e.g., PEPCO, Baltimore Gas & Electric, WSSC Water)
- Adjacent counties (Montgomery, Howard, Charles, Calvert, Anne Arundel)
- Red Cross National Capital & Greater Chesapeake Region
- University of Maryland
- Maryland Department of Emergency Management
- Maryland Department of the Environment
- Natural Resources Conservation Service, Prince George's District Conservationist

For more information on the hazard mitigation planning process, refer to **Chapter 2**.

C. Community Profile

Prince George's County and the City of Laurel are part of the greater Washington-Baltimore metropolitan area (**Figure 1**). The County is bounded on the west by the District of Columbia and Fairfax County, Virginia. To the north are Montgomery and Howard Counties; on the east are Anne Arundel and Calvert Counties, and Charles County is to the south. The City is located midway between Baltimore and Washington, DC.

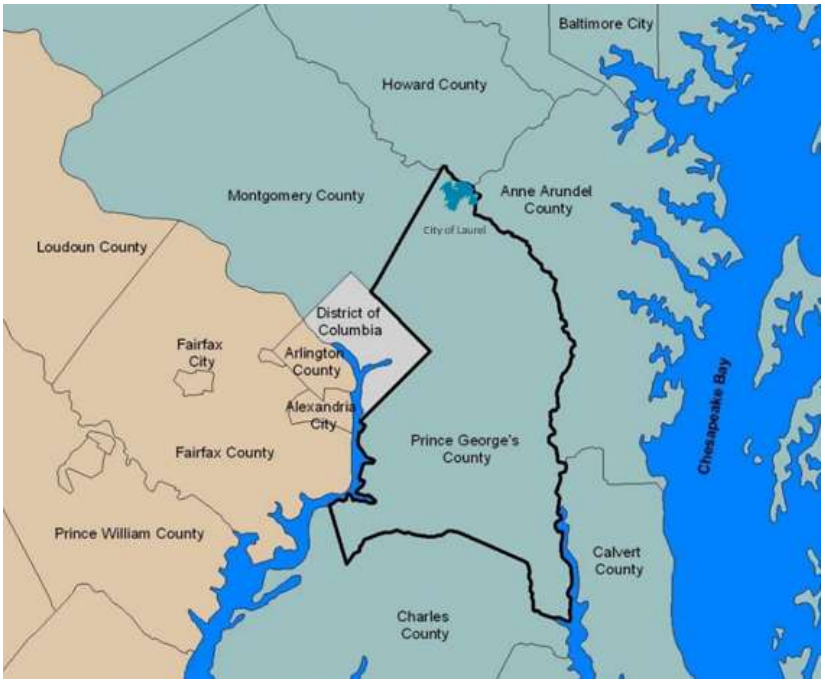


Figure 1: Vicinity map of the County within the Washington-Baltimore area

Although there are 27 separate incorporated municipalities within the boundaries of Prince George's County, only the Cities of Laurel and Bowie retain some degree of land use authority. Only the City of Laurel is recognized separately by FEMA and administers its own floodplain management ordinance, thus the City of Laurel participation has been incorporated into the plan as a separate entity in the planning process with specific community profile information detailed in **Chapter 3**.

For the purposes of planning, Prince George's County is divided into its 37 planning areas which were used during the 2017 plan update planning process.) These planning areas are geographically defined by natural or manmade boundaries and represent the smallest geographical area for which a master plan is prepared. Per the Mitigation Advisory Committee, the 2023 HMP was organized where appropriate into areas consistent with the nine County Council Districts and the City of Laurel as shown in **Figure 2**.

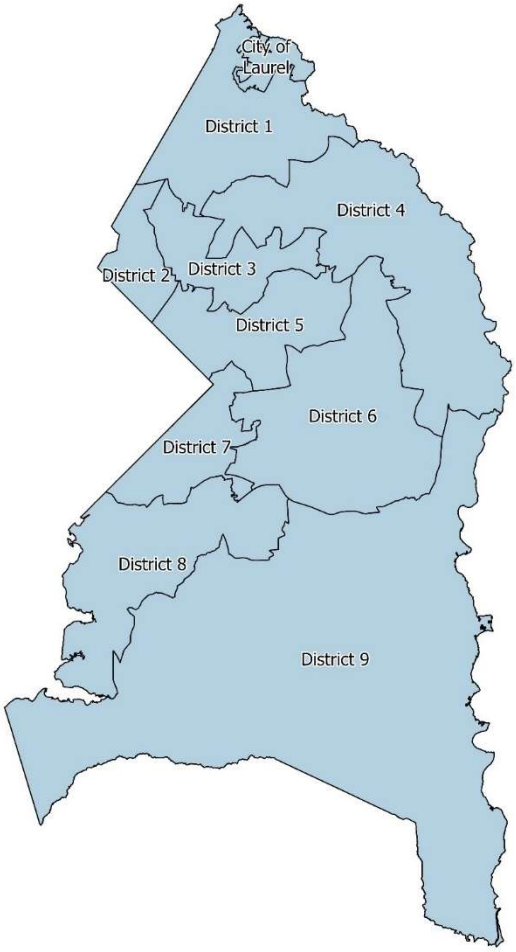


Figure 2: Prince George's County Council District Map

Prince George's County and the City of Laurel has many valued community assets, including housing, transportation networks, utility infrastructure, higher education institutions, natural resources, its economy, and its people. Of these assets, critical facilities, people, and future development are especially prominent throughout the HMP. Critical facilities and people are integral to allowing essential government and business operations to continue during and after a disaster. Considering future development within the County when addressing natural hazards is helpful in planning for a resilient future. The 2023 HMP update uses social vulnerability as a new lens to paint a more complete picture of the community and its assets.

For more information on Prince George's County and the City of Laurel, refer to **Chapter 3**.

D. Risk Assessment

The hazard identification and risk assessment consists of three parts:

6. Identify which hazards could affect Prince George's County and the City of Laurel,
7. Profile hazard events and determine what areas and community assets are the most vulnerable to damage from these hazards, and

8. Estimate losses and prioritize the potential risks to the community.

The hazards are given priority levels as a part of the hazard profiling process. They are determined based on Mitigation Advisory Committee input, as well as the five criteria to assign a quantitative ranking. Each criterion identifies and categorizes the comparative probability and potential vulnerability for the identified hazards. The framing criteria/questions are:

1. **Occurrence Probability**: Has the hazard occurred in the area before, and if so, how often based on the historical record? Weighting factor: 0.15
2. **Impact**: What are the potential damages and community function disruptions when the hazard occurs? Weighting factor: 0.35
3. **Geographic Extent**: What percentage of the community is impacted by the hazard? Weighting factor: 0.20
4. **Warning Time**: How much time is the community given to prepare for an event? Weighting factor: 0.10
5. **Community Concern**: How much concern does the public have for each of the hazards? Weighting factor: 0.20

This methodology ranks the hazards comparatively for the County based on risk. However, it does not mean that low-scoring hazard will not occur or will not have an impact on the area. It provides an overview of which hazards may pose the greatest risk to Prince George's County and the City of Laurel.

D.1. Hazard Risk Assessment

Each hazard from the 2017 plan was re-evaluated for the 2023 update. The 2023 HMP assigned hazard risk index values based on the five criteria listed above and categorized the hazards into High, Moderate, and Low rankings based on final index scores. Ultimately, the hazards listed in **Table 1** were identified as relevant to Prince George's County, incorporated into the risk assessment, and prioritized. Riverine flood, severe storm (flood-related), severe storm (wind-related), and high wind were the highest-ranked hazards in the County.

For more results from the hazard risk assessment, refer to **Chapter 4**.

Table 1. 2023 Hazard Risk Index Score Results & Overall Ranking

Hazard	Occurrence Probability	Impact	Geographic Extent	Warning Time	Community Concern	Hazard Risk Index Score & Overall Rank	State Ranking (5 = highest)	FEMA Ranking (5 = highest)
Riverine Flood	Highly Likely	Critical	Moderate	Limited	High	**3.25 (High)**	5	2
Severe Storm (Flood-Related)	Highly Likely	Critical	Moderate	Limited	High	**3.25 (High)**	5	N/A
Severe Storm (Wind-Related)	Highly Likely	Limited	Large	Limited	High	**3.1 (High)**	5	3
High Winds	Likely	Limited	Large	Limited	High	**2.95 (High)**	5	3
Tornado	Likely	Critical	Minor	No Notice	Moderate	**2.9 (Moderate)**	5	4
Extreme Heat	Highly Likely	Limited	Large	Extended	Moderate	**2.8 (Moderate)**	4	4
Winter Storm	Highly Likely	Minor	Large	Limited	Moderate	**2.55 (Moderate)**	5	4
Hurricane/ Tropical Storm	Somewhat Likely	Limited	Large	Limited	Low	**2.4 (Moderate)**	4	2
Dam and Levee Failure	Unlikely	Limited	Negligible	No Notice	Low	**1.85 (Moderate)**	4	N/A
Earthquake	Likely	Minor	Minor	No Notice	Negligible	**1.8 (Moderate)**	N/A	2
Extreme Cold	Somewhat Likely	Minor	Large	Extended	Negligible	**1.75 (Moderate)**	4	3
Sinkhole	Highly Likely	Minor	Negligible	Minimal	Negligible	**1.65 (Low)**	2	N/A
Wildfire	Highly Likely	Minor	Negligible	Limited	Negligible	**1.55 (Low)**	4	1
Landslide	Somewhat Likely	Minor	Negligible	No Notice	Negligible	**1.45 (Low)**	2	2
Drought	Somewhat Likely	Minor	Minor	Extended	Negligible	**1.35 (Low)**	4	2
Coastal Flood	Unlikely	Minor	Minor	Limited	Negligible	**1.3 (Low)**	5	2

E. Capability Assessment

Prince George's County and the City of Laurel have a number of resources accessible for implementing hazard mitigation initiatives. These resources include both private and public assets at the local, state, and federal levels. The capability assessment evaluates the current capacity of the communities of Prince George's County and the City of Laurel to mitigate the adverse effects of the natural hazards identified in the hazard identification and risk assessment. By providing a summary of each jurisdiction's existing capabilities, the capability assessment serves as the foundation for designing an effective hazard mitigation strategy. Overall, the County proves to be capable of adequately carrying out mitigation and adaptation projects, but the City of Laurel may need support from the County to accomplish the same.

For more information on the hazard mitigation capabilities of the County and City, refer to **Chapter 5**.

F. Mitigation Strategy

The Mitigation Advisory Committee used the results of the hazard identification and risk assessment and the capability assessment to develop goals and objectives for the County and City of Laurel. The committee members revised and streamlined the goals from the 2017 plan update into the following four **goals**:

Increase public education and awareness of natural hazard risks to people and private property, and promote current and new opportunities to participate in mitigation planning.

Prevent future climate-related damages and losses to communities, critical facilities, and natural resources through ordinances, policies, and plans aligned with regional and state resilience and equity goals.

Implement structural projects that mitigate the risks of natural hazards to people, infrastructure, and environmental assets while equitably distributing project benefits.

Integrate hazard mitigation into regular staff training and responsibilities to improve capabilities and ensure climate adaptation is adequately considered and addressed in county/city actions.

Each mitigation action for the County and City were developed based on past damages, existing risk and vulnerabilities, community input, and current capabilities. The STAPLEE criteria methodology was used to capture these values consistently. It allows for the Mitigation Advisory Committee to take social, technical, administrative, political, legal, economic, and environmental considerations into account when reviewing potential actions for inclusion in the mitigation strategy.

Table 2 and **Table 3** in the following sections outline the mitigations actions for Prince George's County and the City of Laurel, respectively.

For more information on the mitigation strategy, refer to **Chapter 6**.

F.1. Prince George's County Mitigation Actions

Some of the County's actions have been integrated and adapted from other County plans. They are signified by the color of the "Action Number" column accordingly:

- Plan 2035 Prince George's Elements integrated policies are shown in **orange**.
- Climate Action Plan Priority Recommendations are shown in **green**.

Table 2. Prince George's County 2023-2028 Mitigation Actions

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Prevention							
PG-1	Partner with federal agencies, the state, and Non-governmental Organizations to utilize available technical assistance to translate identified risks into mitigation projects, especially for benefit cost analyses for the County and municipalities.	X			X	Office of Homeland Security	Ongoing	Medium
PG-2	Using the best available data, check the locations of HazMat sites, National Pollutant Discharge Elimination System sites, and other land uses; if found to be in flood hazard areas, communicate with the owner/handler of hazardous materials and known pollutants regarding risk and appropriate response and protection measures.			X	X	Department of Environment	Short-term	Medium
PG-3	Integrate mitigation plan requirements and actions into other appropriate planning mechanisms, such as comprehensive plans and capital improvement plans.				X	Maryland-National Capital Park and Planning Commission	Ongoing	High
PG-4	Collect flood depth information to support a grant to provide elevation certificates in areas newly included in the Special Flood Hazard Area or to those experiencing				X	Office of Homeland Security	Funding contingent	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	flooding issues to support Letter of Map Amendments (LOMA) or NFIP premium reductions.							
PG-5	Expand codes and standards enforcement, such as for existing land use regulations and policies.		X		X	Department of Permitting, Inspections and Enforcement	Ongoing	Medium
PG-6	Prohibit all waivers to allow development in floodplains.				X	Department of Permitting, Inspections and Enforcement	Ongoing	High
PG-7	Revise Prince George's County Code of Ordinances to incorporate and require climate-resilient design, nature-based infrastructure, and climate-resilient practices. Adopt and enforce policies to require green infrastructure practices for new and existing properties, especially native plantings, rain gardens, green corridors, runoff retention, and other nature-based ways to reduce and naturally filter runoff on private and public properties.	X			X	Maryland-National Capital Park and Planning Commission, Planning Department	Short-term	High
PG-8	Office of the County Executive must introduce and support a County Council resolution requiring the County to integrate extreme weather and energy-efficiency criteria into building codes.				X	Department of Permitting, Inspections, and Enforcement	Short-term	High
PG-9	Require County Stormwater Management (SWM) Standards to Incorporate Projected Climate Change Impacts by using approved downscaled and up-to-date climate impact information to reevaluate peak rainfall estimates and future design storm profiles. Evaluate SWM standards using this criterion at least every three (3) years. Require all upgrades of County storm drain systems and Capital Improvement Project roadway, bridge, culvert and	X			X	Department of Public Works and Transportation, Stormwater Management Division	Long-term	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	stormwater management repair or renovation projects to meet these updated climate-resilient design criteria.							
PG-10	Avoid Future Development in Flood Inundation Areas Below Existing High-hazard Potential Dams. Require that plan sets for subdivision proposals and permit applications to show the danger reach and inundation area and prohibit new construction in these areas.				X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	High
PG-11	Conduct Countywide Thermal Mapping of Tree Canopy Cover with Shade Study, and Aerial Utility Mapping exercises. Then conduct a neighborhood-level Heat Vulnerability Assessment. Address the identified gaps in the tree canopy through appropriate heat mitigation actions and projects.				X	Department of the Environment	Short-term	High
PG-12	Conduct a study on the feasibility of using climate-smart building materials in mitigation projects and normal County/City construction projects to mitigate impacts from extreme temperatures and rainfall. Examples include those listed on the Maryland Department of the Environment's "Alternative/Innovative Technology List of Approved Practices." Once complete, develop a process that promotes the use of these materials wherever feasible.				X	Department of the Environment	Long-term	Medium
PG-13	Adopt the most recent published edition of the I-Codes (e.g., International Building Code, International Residential Code).				X	Department of Permitting, Inspections and Enforcement	Short-term	High
	Property Protection							

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-14	Support mitigation projects that will result in the protection of public or private property from natural hazards. Eligible projects include but are not limited to: 1. acquisition of hazard-prone property or structures 2. Elevation of flood-prone structures 3. Minor structural flood control projects 4. Relocation of structures from hazard-prone areas 5. Retrofitting of existing buildings, facilities, and infrastructure 6. Retrofitting of existing buildings and facilities for shelters 7. Critical infrastructure protection measures 8. Stormwater management improvements 9. Advanced warning systems and hazard gauging systems (weather radios, reverse-911, stream gauges, I-flows) 10. Targeted hazard education 11. wastewater and water supply system hardening and mitigation	X		X	X	Office of Homeland Security	Ongoing	Medium
PG-15	Implement appropriate mitigation measures for hazard-vulnerable priority critical facilities	X			X	Department of Public Works and Transportation	Long-term	High
	Natural Resource Protection							
PG-16	Use the Watershed Implementation Plan to prioritize stabilization projects, especially if funding from outside resources is available for the mitigation of environmental impacts.	X			X	Department of the Environment	Ongoing	Medium
PG-17	Coordinate with Pepco, Baltimore Gas and Electric, and any other utility companies (as appropriate) to schedule and perform regular tree trimming to mitigate the risk of power outages during windstorms. Maintenance should be conducted to retain a healthy tree canopy, ensure trees' longevity, and decrease the risk of power outages. Prioritize socially vulnerable neighborhoods/ populations first and maintain old-growth trees with large canopies to encourage tree retention for extreme heat mitigation.	X			X	Department of Public Works and Transportation	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Develop mutual aid with the City of Laurel to provide limited resources and personnel to assist in trimming ang tree control as needed.							
PG-18	Implement proposed flood mitigation projects from the upcoming watershed study for the Collington Branch Stream. Develop a Memorandum of Agreement with the City of Laurel to inspect and clean the portion of the stream that runs through their jurisdiction.				X	Department of the Environment	Long-term	High
PG-19	Conduct a study to determine the feasibility of creating a stormwater park/greenway (or another watershed- or landscape-scale flood risk reduction project) that will improve natural floodplain functions in areas of high risk.				X	Maryland-National Capital Park and Planning Commission	Short-term	Medium
PG- 20	Develop a program to utilize vacant land (both publicly and privately owned) for stormwater management. Acquire land to serve the dual purpose of green infrastructure/ stormwater infiltration and recreational/open space.				X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	Medium
PG-21	Use conservation subdivisions (or other site planning and landscape conservation tools) when developing in Established Communities near Rural and Agricultural Areas to cluster development, transition density, and encourage the preservation of green infrastructure corridors, as defined by the County's Green Infrastructure Plan.	X			X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	Medium
PG-22	To preserve environmentally sensitive land and to encourage development in the Regional Transit Districts, evaluate a transfer of development rights program, density exchanges, or purchase of development rights program for the Rural and Agricultural Areas. Explore opportunities to transfer development rights within areas and to coordinate with the Watershed Implementation Plan and Maryland Accounting for Growth Policy				X	Department of the Environment	Ongoing	Low

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-23	Align Economic Development Plans with the Climate Action Plan, preserving existing agricultural land and natural areas and promoting development in already-developed areas near high-capacity transit. Perform an economic development and climate adaptation analysis of existing agricultural land and natural areas that are crucial to climate resilience on a subwatershed basis. Identify areas of open space for preservation and optimum use for climate resilience.				X	Department of the Environment	Short-term	High
	Structural Projects							
PG-24	Create metrics to track routine stormwater maintenance and monitor how the work is increasing capacity and where additional capacity may be needed through retrofits.				X	Department of Public Works and Transportation	Ongoing	Medium
PG-25	Conduct a Countywide Flood Assessment (including pluvial mapping) to understand the impact of updated rainfall intensity estimates per the latest version of NOAA Atlas 14, recent elevation data, and stormwater controls. Identify priority areas for mitigation projects and update the stormwater ordinance as needed.				X	Department of the Environment	Ongoing	High
PG-26	Develop structural and action plans with inundation mapping for all High Hazard Potential Dams with poor conditions and no Emergency Action Plans. Develop structural and action plans for high-risk pump stations, levees, and other flood control infrastructure. Ensure a process for supporting affected "downflow" communities that a dam failure hazard would inundate.			X	X	Department of Public Works and Transportation	Long-term	High
PG-27	Implement stormwater management projects, such as drainage retrofits, to address pluvial/stormwater flooding in community-identified areas. Prioritize restoration projects from the Watershed Implementation Plan (WIP) that will	X			X	Department of Public Works and Transportation	Ongoing	High

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	support the Plan 2035 future land use pattern. Downtowns should be given priority for stormwater retrofits, especially environmental site design practices. Land acquisition or ecological restoration activities should be targeted to stronghold watersheds.							
PG-28	To reduce system outages from natural hazards, perform energy grid modernization in socially vulnerable areas by adding a solar microgrid. Prioritize areas that are known to suffer multiple outages during the year.	X			X	Department of Public Works and Transportation	Ongoing	Low
PG-29	Evaluate new and existing government buildings, critical facilities, and infrastructure for solar energy generation potential and install solar panels and batteries if feasible.				X	Department of Public Works and Transportation	Ongoing	Low
	Emergency Services							
PG-30	Update Upper Marlboro Emergency Response Plan to address flooding, including evacuation, emergency response, mitigation, etc.			X	X	Office of Homeland Security	Short-term	Medium
PG-31	Update the County's disaster recovery plan to include a post-disaster strategic rebuilding decision framework that comprehensively integrates equity.				X	Office of Homeland Security	Short-term	Medium
PG-32	The Department of Family Services Agency on Aging will continue its outreach to seniors and other vulnerable populations about health and safety during periods of extreme heat and extreme cold. Information will be added to the Family Service's web page and frozen meal distribution with supplement provision of hot meals during severe weather periods from January through March.			X	X	Department of Family Services	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-33	Develop a plan with the Department of Social Services, Department of Health, and Office of Sustainability to create Resilience Hubs in vulnerable communities to increases community capacity to prepare for, withstand, and respond to natural hazard impacts and emergency situations. These should also function as heating/cooling centers.	X			X	Department of Social Services; Department of Health; Office of Sustainability	Long-term	Low
PG-34	Assess Climate Projections and Consequences of Dam and Levee Failure. Analyze baseline conditions against local/regional climate projections to highlight future vulnerabilities and risk. Model hydrological loads to the consequences of failure under present and future conditions and jointly evaluate dams, levees, and interdependent components. Incorporate Findings in Emergency Action Plans.				X	Office of Homeland Security	Ongoing	High
	Educations & Awareness							
PG-35	Continue annual flood risk awareness and mitigation mailing to all owners of high-risk properties in the Special Flood Hazard Area, including Repetitive Loss/Severe Repetitive Loss structures. Provide additional outreach in response to new/upcoming grant opportunities and funding.			X	X	Office of Homeland Security	Ongoing	High
PG-36	Work with County municipalities and/or develop public-private partnerships to provide hazard awareness messaging and information on hazard preparedness and mitigation in secondary languages for promotion using local newspapers, municipal websites, social media, etc.		X	X	X	Department of Community Relations	Ongoing	High
PG-37	Integrate hazard mitigation considerations in future updates of the Citizens' Preparedness Guide and Business Preparedness Guide, including mitigation projects they can implement and how they can get their project included in an upcoming grant application.			X	X	Office of Homeland Security	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-38	Conduct outreach to homeowners located on Founders Terrace (and other high-priority streets/neighborhoods) on opportunities to get funding for potential flood mitigation projects for the streams that run behind their homes.			X	X	Department of Community Relations	Short-term	Medium
PG-39	Develop a County Hazard Mitigation Hub website similar to the public outreach website for Vision Zero. This should be combined with the future Climate Resilience Website as described in Plan 2035 if possible. Coordinate with various county agencies, such as the Department of Environment (DoE), Office of Homeland Security, and Office of Information Technology (OIT).			X	X	Office of Homeland Security	Short-term	Medium
PG-40	Demonstrate County commitment to climate action through publicly transparent tracking, monitoring, evaluation, and reporting. Require the Maryland-National Capital Park and Planning Commission to create and establish a public Smart Growth Dashboard that tracks approved preliminary plans of subdivisions, approved site plans and development proposals. Integrate this into the hazard mitigation/climate action hub website (refer to Action PG-41).			X	X	Maryland-National Capital Park and Planning Commission	Ongoing	Medium
PG-41	Develop an action guide for socially vulnerable communities that provides step-by-step guidance on how they can get their home considered for inclusion in a mitigation project/grant application.			X	X	Office of Homeland Security	Short-term	Medium
PG-42	Send a digital copy of the 2023 HMP to all County and City staff, as well as all homeowner associations within the planning area.		X	X	X	Office of Homeland Security	Short-term	High
PG-43	Integrate conducting an annual/semi-annual comprehensive grant availability search and information dissemination into a County staff member's job description. This staff member should coordinate an annual workshop		X			Office of Homeland Security	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	with the County and its municipalities to discuss county-wide priorities and projects that should be submitted in grant applications.							

F.2. City of Laurel Mitigation Actions

Table 3. City of Laurel 2023-2028 Mitigation Actions

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Prevention							
L-1	Partner with federal agencies, the state, and non-governmental organizations to utilize available technical assistance to translate identified risks into mitigation projects, especially for benefit-cost analyses.		X		X	Office of Emergency Management	Ongoing	Medium
L-2	Integrate mitigation plan requirements and actions into other appropriate planning mechanisms, such as comprehensive plans and capital improvement plans.				X	Office of Emergency Management	Ongoing	High
L-3	Adopt the most recent published edition of the I-Codes (e.g., International Building Code, International Residential Code).				X	Department of the Fire Marshal and Permit Services	Short-term	High
	Property Protection							

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
L-4	Support mitigation projects that will result in the protection of public or private property from natural hazards. Eligible projects include but are not limited to: 1. acquisition of hazard-prone property or structures 2. Elevation of flood-prone structures 3. Minor structural flood control projects 4. Relocation of structures from hazard-prone areas 5. Retrofitting of existing buildings, facilities, and infrastructure 6. Retrofitting of existing buildings and facilities for shelters 7. Critical infrastructure protection measures 8. Stormwater management improvements 9. Advanced warning systems and hazard gauging systems (weather radios, reverse-911, stream gauges, I-flows) 10. Targeted hazard education 11. wastewater and water supply system hardening and mitigation	X			X	Department of Economic & Community Development	Ongoing	Medium
L-5	Promote the use of climate-smart building materials in mitigation projects and normal City construction projects to mitigate impacts from extreme temperatures and rainfall, such as those listed on the Maryland Department of the Environment's "Alternative/Innovative Technology List of Approved Practices."	X			X	Department of Economic & Community Development	Ongoing	Medium
	Structural Projects							
L-6	After flood events, the City will evaluate whether to pursue funding to implement flood mitigation projects.	X			X	Office of Emergency Management	Ongoing	High
L-7	Assess Climate Projections and Consequences of Dam and Levee Failure. Analyze baseline conditions against local/regional climate projections to highlight future vulnerabilities and risk. Model hydrological loads to the consequences of failure under present and future conditions and jointly evaluate dams, levees, and		X		X	Department of Public Works; Department of the Environment	Short-term	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	interdependent components. Incorporate Findings in Emergency Action Plans.							
L-8	To reduce system outages from natural hazards, perform energy grid modernization in socially vulnerable areas by adding a solar microgrid. Prioritize areas that are known to suffer multiple outages during the year.	X			X	Department of Public Works	Funding contingent	Medium
L-9	Evaluate new and existing government buildings, critical facilities, and infrastructure for solar energy generation potential and install solar panels and batteries if feasible.	X			X	Department of Public Works	Short-term	Low
L-10	Implement stormwater management projects, such as drainage retrofits, to address pluvial/stormwater flooding in community-identified areas.	X			X	Department of Public Works	Ongoing	High
	Emergency Services							
L-11	At the intersection of Van Dusen Road and Contee Road (Anderson's Corner), add a comprehensive recreational building, comprised of indoor recreational space, gymnasium(s), and meeting rooms. Unlike a typical community center, the City envisions more of a steel building structure with a hybrid use between drop-in programs for local residents and a larger multiuse footprint to host a wider range of recreational sports and activities. The City will conduct a feasibility study that includes considering stormwater runoff effects and the potential to use the facility as a hazard shelter and/or extreme temperature refuge.	X		X	X	Department of Economic & Community Development	Long-term	Medium
	Educations & Awareness							

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
L-12	Work with City closed circuit television network to produce seasonal hazard awareness and topical mitigation programming.		X	X		Office of Emergency Management	Short-term	Low
L-13	Develop an action guide for socially vulnerable communities that provides step-by-step guidance on how to get their home considered for inclusion in a mitigation project/grant application.		X	X	X	Office of Emergency Management	Short-term	Medium
L-14	Send a digital copy of the 2023 HMP to all County and City staff.		X	X		Office of Emergency Management	Short-term	Medium

G. Plan Implementation

The HMP identifies procedures for implementing and maintaining the HMP as a living document that continuously guides actions within Prince George's County and the City of Laurel. The County and City will submit a 5-year written update to the State and FEMA Region III, unless a disaster or other circumstances lead to a different time frame. In the interim, the HMP will be integrated into county plans, municipal plans, and other documents as applicable and the Committee will hold an annual meeting to evaluate and monitor progress.

Since feedback from residents, businesses, and other stakeholders is a critical part of hazard mitigation planning, public notice of the annual review will be given, and public participation will be actively invited. The County will post a link to the HMP on the Prince George's County Department of the Environment's website, the Office of Homeland Security's website, and the City of Laurel's website.

For more information on how the HMP will be implemented, refer to **Chapter 7**.

Chapter 1. Introduction

This chapter provides the purpose for the HMP's development and provides federal, state, and local context for the County and City's hazard mitigation planning process.

A. Purpose

The 2023 Prince George's County and City of Laurel Hazard Mitigation Plan (HMP) is an actionable, FEMA-approved plan. The purpose of the HMP is to identify natural hazard risk within the planning area, understand what matters most to residents, and develop a long-term strategy for protecting communities. The overall goal of mitigation planning is to break out of the cycle of sustaining disaster damage and rebuilding, only for the process to start again.

Hazard Mitigation

The effort to reduce or eliminate risk to people, property, and the environment by lessening the impact of hazards.

The HMP represents the County and City's commitment to reducing risks from natural hazards. Local officials can refer to the plan in their day-to-day activities when making decisions regarding regulations, ordinances, permits, outreach, and funding for capital improvements and other community initiatives. Additionally, the HMP may help the State of Maryland prioritize future grant funding as it becomes available.

The Prince George's County and City of Laurel HMP will continue to be a useful tool for all community stakeholders by increasing public awareness about local hazard risks and providing information about options and resources available to reduce those risks. Educating the public about potential hazards will help the jurisdiction protect itself against the effects of future hazards and will enable informed decision-making regarding where to live, purchase property, or locate business.

B. Planning Context

B.1. Authority and Scope

On October 30, 2000, President Clinton signed into law the Disaster Mitigation Act of 2000 (DMA2K), which required state and local mitigation plans that would help to reduce loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters.

The new law amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act and added a new section to the law, Section 322, Mitigation Planning. Section 322 requires local governments to prepare and adopt jurisdiction-wide hazard mitigation plans for disasters declared after November 1, 2004, as a condition of receiving Hazard Mitigation Grant Program (HMGP) project grants and other non-disaster related mitigation grant assistance programs.

Local governments must review and, if necessary, update their mitigation plans every five years from the original date of the plans to continue Hazard Mitigation Assistance program eligibility. The requirements

for local mitigation plans are found in Section 44 Code of Federal Regulations Part 201.6. FEMA's "Local Mitigation Planning Policy Guide" issued on April 19, 2022 provides updated FEMA interpretation and explanation of local plan mitigation regulations and FEMA's expectations for mitigation plan updates.[1] In addition, FEMA uses the Local Mitigation Plan Review Tool (updated in 2022) to ensure that a plan meets FEMA's regulatory requirements.

B.2. State-Level Hazard Mitigation and Climate Planning

The State of Maryland is working to both mitigate its carbon emissions and adapt to the effects of climate change that are already present or all but guaranteed in the future. On the mitigation front, the Maryland Department of the Environment's Climate Change Program oversees the 2030 Greenhouse Gas Emissions Reduction Act Plan and its related greenhouse gas emissions inventory. The Plan, recognizing the 2020 achievement of a 20% reduction in statewide greenhouse gas emissions, will be updated in 2023 to establish a new 60% reduction goal by 2031 and net-zero emissions by 2045.[2] This represents one of, if not the most, ambitious climate change law adopted by any U.S. state.

Among other efforts, the Climate Change Program also supports the Maryland Commission on Climate Change. The Commission was established in 2015 and tasked with advising the government "on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change."[3] The Adaptation and Response (Resilience) working group – one of 8 Commission working groups – focuses on dealing with the impacts of climate change, and it has developed a framework for guiding and prioritizing resilience actions over the next ten years. The Maryland Adaptation and Resilience Framework Recommendations has three focus area and goals, with one of them being "Local Government Action and State Service Delivery."

> **Focus Area #2: Local Government Action & State Service Delivery**
>
> Goal: Build local government capacity to adapt to climate change; Collaborate between state and local governments to understand climate impacts and implement adaptation solutions; Co-create local adaptation solutions through supporting and engaging in regional partnerships; Conduct public educational outreach; Provide sufficient funding, tied to adaptation goals, to support local governments.

Under the local government action focus area, there are five service delivery goals, and each one has activities for the state and local governments. **Table 4** outlines the goals and associated local activities. The County and City, in addition to their locally-designed actions in **Chapter 6**, aim to carry out the Framework's activities whenever feasible.

Table 4. Maryland Adaptation and Resilience Framework Recommendations service delivery goals and local government activities

Activity	Details
Goal 1: Capacity Building	

[1] The Local Mitigation Planning and Policy Guide is effective on April 19, 2023, for all FEMA plan approvals.
[2] Maryland Department of the Environment. The 2030 Greenhouse Gas Emissions Reduction Act Plan. https://mde.maryland.gov/programs/air/ClimateChange/Pages/Greenhouse-Gas-Emissions-Reduction-Act-%28GGRA%29-Plan.aspx
[3] Maryland Commission on Climate Change. https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/index.aspx

Activity	Details
1.2.1	Participate in the small group discussions introduced in Activity 1.1.4[4] to provide feedback and help improve the toolkit (the Adaptation and Response Working Group will provide a web-based toolkit of capacity-building tools, resources, grant opportunities, training, etc. to assist local partners).
1.2.2	Apply the toolkit resources to local projects.
1.2.3	Provide feedback on lessons learned during Activity 1.2.2 to share success stories, identify gaps, explain suggested improvements, etc.
Goal 2: Collaborative Assessment, Planning and Action	
2.2.1	Voluntarily expand use of existing tools and criteria (ex. Watershed Resources Registry, MD EJScreen, CS- Climate Ready Action Boundary, and Coast Smart criteria) when implementing all siting and design projects.
2.2.2	Voluntarily adopt higher regulatory standards to go beyond minimum NFIP requirements to ensure protection against worsening flooding forecasted due to climate change and that reflect the state of climate science. This applies to jurisdictions in both tidal and non-tidal areas.
2.2.3	Assign oversight of climate adaptation plan and strategy alignment and implementation as a permanent responsibility to a high-level managerial staff position. Where possible, establish a Sustainability Manager or Chief Resilience Officer position to carry out this work.
Goal 3: Co-Creating Local Adaptation Solutions	
There is not a local strategy for this goal.	
Goal 4: Educational Outreach	
4.2.1	Engage communities through listening sessions to learn about local climate impacts and resilience needs. This will help to honor community voices and experience and provide direction for the development of the outreach approach.
4.2.2	Maximize opportunities for parallel and complementary education efforts among regional groups, local governments, Non-governmental Organizations and state agencies (e.g., Maryland Flood Awareness Month).
4.2.3	Integrate public outreach campaigns with existing public engagement processes developed by local jurisdictions for climate change adaptation.
Goal 5: Funding	
5.2.1	Evaluate existing sources of funding that can support adaptation activities, including state and federal grant programs.
5.2.2	Identify projects that satisfy multiple programs' needs and leverage funds across those programs to implement them.
5.2.3	Consider pursuing innovative financing approaches, such as green banks, public-private partnerships, and resilience authorities, to support adaptation action.

[4] State agencies and environmental or land trust Non-governmental Organizations coordinate to convene small group discussions among and within local governments, including elected officials and staff, to assist in the use of the toolkit and identify improvements . Provide opportunities for local governments to network with experts for peer-learning among local governments both within and outside of Maryland.

B.3. County-Level Hazard Mitigation and Climate Planning

Prince George's County has been taking action to respond to and reduce its contributions to climate change for over a decade. In 2008, the County Council established emissions reduction targets to reduce County emissions to 80% below 2008 levels by 2050. Since then, the County has implemented a number of initiatives to provide reliable and environmentally sound energy solutions to maximize energy savings.[5]

In 2020, the County Council unanimously passed a Council Resolution (CR-007-2020) mandating a Climate Action Commission to develop a Climate Action Plan for Prince George's County to prepare for and build resilience to regional climate change impacts, and to set and achieve climate stabilization goals.[6] The Climate Action Commission consists of sixteen commissioners representing public, private, and government interests. The overarching goal of the Commission is to provide actionable County strategies to both mitigate climate change through reduced greenhouse gas emissions and help protect the County's communities from the increasing likelihood of significant climate change impacts.

In January 2022, a draft Climate Action Plan was completed and presented to the public. The Plan aims to help the County reach its carbon emissions goal of a 50% reduction by 2030 (compared with 2005 levels). This goal aligns with the State of Maryland's projection for 50% emission reduction by 2030 through the implementation of the Maryland 2030 Greenhouse Gas Reduction Plan and the Metropolitan Washington Council of Government's goals for the region.

C. Plan Organization

An executive summary is included in the beginning of the HMP to provide a high-level overview of the findings and chosen actions. The HMP itself contains the following seven chapters that cover the steps of the hazard mitigation planning process used in the plan:

- **Chapter 1. Introduction** provides the purpose for the HMP's development and provides federal, state, and local context for the County and City's hazard mitigation planning process.
- **Chapter 2. Planning Process** defines the processes followed throughout the update of this plan, including public participation and stakeholder engagement.
- **Chapter 3. Community Profile** contextualizes the HMP by providing background on Prince George's County and the City of Laurel.
- **Chapter 4. Risk Assessment** provides an overview of the natural hazards that have been identified as potentially affecting Prince George's County and the City of Laurel and an assessment of their risks to the planning area.
- **Chapter 5. Capability Assessment** evaluates Prince George's County and the City of Laurel's capabilities and resources available to implement the actions in the Mitigation Strategy.
- **Chapter 6. Mitigation Strategy** outlines the methodology of project selection and prioritization and provides an overview of the hazard mitigation goals, actions, and projects selected for the 2023-2028 planning horizon.

[5] DMV Climate Partners. Climate Initiatives: Prince George's County. https://climatepartners.org/initiatives/local/prince-georges-county/
[6] Prince George's County Council. Climate Action Commission. https://pgccouncil.us/810/Climate-Action-Commission

- **Chapter 7. Plan Implementation** describes the implementation plan, identifies available programs and resources to support implementation, and outlines procedures for maintaining the plan as a living document.

The **Appendices** contain supplemental reference materials as well as detailed calculations and methodologies used in the planning process as follows:

- **Appendix A – Mitigation Advisory Committee** includes Committee meeting materials and the Mitigation Strategy Feedback Survey results.
- **Appendix B – Outreach and Engagement** includes public outreach and engagement materials, including public meeting notes and Public Hazard Mitigation Survey results.
- **Appendix C – Hazard History** lists historical hazard events by date for each of the hazards in the Risk Assessment.
- **Appendix D – Critical Facility Hazard Analysis** lists critical facilities that fall into one or more hazard risk areas within the County and City.
- **Appendix E – 2017-2023 Mitigation Actions Status Report** discusses actions from the 2017 HMP Update and their status, including which actions were carried over into the 2023 HMP Update.
- **Appendix F – 2023-2028 Mitigation Action Plans** provides implementation action plans for each high priority mitigation action committed to by Prince George's County and the City of Laurel for the 2023 HMP.
- **Appendix G – Record of Changes** lists changes made to the 2017 HMP during the 2023 HMP update process .
- **Appendix H – Adoption Resolutions** includes sample and final HMP adoption resolutions for Prince George's County and the City of Laurel.
- **Appendix I – FEMA Requirements** includes the FEMA Local Plan Review Tool, FEMA approval letters, and the annual HMP progress report template.
- **Appendix J – Hazus Reports** provides the Hazus reports for riverine flood, coastal flood, hurricane wind, and earthquake used in the risk assessment.

D. Acknowledgements

The 2023 HMP was supported by a Hazard Mitigation Assistance Building Resilient Infrastructure and Communities (BRIC) grant, which is administered by the Maryland Department of Emergency Management with funding from the Federal Emergency Management Agency. The project was facilitated by Dewberry Engineers, Inc.

Chapter 2. Planning Process

This chapter defines the process followed throughout the update of the HMP, including public participation and stakeholder engagement.

A. Planning Process

The Prince George's County Department of the Environment and the Office of Homeland Security in partnership with the City of Laurel's Office of Emergency Services led the development of their first regional hazard mitigation plan for the jurisdictions in 2005.

For the required 2023 update, the County and City continued a joint planning process in 2022, resulting in the 2023 Prince George's County & the City of Laurel HMP being approved by FEMA pending adoption by Prince George's County and the City of Laurel in March 2023. The combined effort leveraged the advantage of shared resources, including technical assistance provided by Dewberry Engineers, Inc. (Dewberry), and built on the success of similar multi-jurisdiction partnering agreements.

The Mitigation Advisory Committee ensured that potential stakeholders participated in the planning process, including reviewing the draft and final versions of the plan. Prince George's County received a Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance grant to support the 2023 plan update.

The 2023 plan update followed the traditional mitigation plan update process initiated with a Mitigation Advisory Committee HMP update kick-off meeting on September 16, 2022. The Hazard Identification Risk Assessment was refreshed using updated data sources during the Fall of 2022, including adding new components (climate projections, social vulnerability, and future development). The hazard identification and risk assessment results were presented to the Mitigation Advisory Committee at a meeting on November 16, 2022, where the plan's 2017 mitigation goal was reviewed and revised into four new goals. The **Community Profile**, **Mitigation Strategy** and **Plan Implementation** chapters were updated during the fall and winter of 2022.

The County leveraged community outreach events during November 2022 and January 2023 to seek input and feedback on the draft risk assessment, stakeholders' perceptions of hazard exposure and mitigation, and feedback on the draft 2023 HMP. Social media, newsletters, and community outreach listservs were used to reach the public. A sampling of outreach materials and messaging may be found in **Appendix B**.

B. The Mitigation Advisory Committee

Prince George's County convened a Mitigation Advisory Committee comprising representatives from departments within Prince George's County and the City of Laurel, community stakeholders, state representatives, and a FEMA Region 3 representative. The Mitigation Advisory Committee worked with the Dewberry team to provide input at each key stage of the planning process, including reviewing the format and content of the previous plan and making decisions on what information to carry forward into the 2023 plan update. Mitigation Advisory Committee members responded to queries detailing plan implementation and mitigation capabilities; updated their 2017 plan actions; participated in Mitigation Advisory Committee meetings; participated in email correspondence, a feedback survey, and a virtual

meeting to create a comprehensive menu of 2023-2028 mitigation actions; reviewed document drafts; and supported outreach efforts.

Appendix G contains the record of changes that documents how each chapter in the 2017 plan was updated in the 2023 plan. Efforts to involve County and City departments and community organizations that might have a role in implementing the mitigation strategy included invitations to attend meetings and serve on the Mitigation Advisory Committee, access to draft updated plan chapters, e-mail updates, mitigation action development discussions, public outreach events and opportunities for input and comment on all draft deliverables. **Table 5** lists contributing Mitigation Advisory Committee members.

Table 5: Mitigation Advisory Committee

Name	Jurisdiction/ Category	Department	Title
Ronald Gill	Prince George's County	Office of Homeland Security	Director, Office of Homeland Security
Meloyde Batten-Mickens	Prince George's County	Office of Homeland Security	Deputy Director
Joey Henderson	Prince George's County	Office of Homeland Security	Manager, Preparedness and Outreach
Alexandra Harris	Prince George's County	Office of Homeland Security	Emergency, Management Specialist
Ehsan Bahador	Prince George's County	Office of Homeland Security	Regional Planner
Dawn Hawkins-Nixon	Prince George's County	Department of the Environment	Associate Director
Lilantha Tennekoon	Prince George's County	Department of the Environment	Engineer, Sustainability Division – Flood Management
Patrick Callahan	Prince George's County	Department of the Environment	GIS Analyst
Jeffrey DeHan	Prince George's County	Department of the Environment	Associate Director, Stormwater Management
Frank L. Galosi	Prince George's County	Department of the Environment	Section Head, Stormwater Management Division
Sudanshu Mishra	Prince George's County	Department of the Environment	Assistant Associate Director, Stormwater Management Division
Joanna Smith	Prince George's County	Department of the Environment	Engineer

Name	Jurisdiction/ Category	Department	Title
Major Anthony Cline	Prince George's County	Police Department	Executive Officer, Bureau of Homeland Security and Intelligence
Chief James McClellend	Prince George's County	Fire/ Emergency Medical Services	Battalion Chef
Erv Beckert	Prince George's County	Department of Public Works and Transportation	Chief, Highway and Bridge Design Division
Mary Sherrill	Prince George's County	Department of Public Works and Transportation	Storm Drain Manager
Sangrea Watkins	Prince George's County	Economic Development Corporation	Special Assistant to President/CEO & Operations Manager
Rey De Guzman	Prince George's County	Department of Permitting, Inspection, and Enforcement	Floodplain Administrator
Behdad Kashanian	Prince George's County	Department of Permitting, Inspection, and Enforcement	Associated Director
Courtney Mariette	Prince George's County	Office of Community Relations	Associate Deputy Director
Mychael Dickerson	Prince George's County	Prince George's County Public Schools	Chief of Staff
Gary Cunningham	Prince George's County	Prince George's County Public Schools	Director of Safety and Security
Wanda Ramos	Prince George's County	Department of Parks and Recreation	Deputy Director, Maryland-National Capital Park and Planning Commission
Andree Checkley	Prince George's County	Department of Parks and Recreation	Planning Director
Katina Shoulars	Prince George's County	Department of Parks and Recreation	Division Chief, Countywide Planning
Cathy Stasny	Prince George's County	Department of Family Services, Area Agency on Aging	
James Carter	Prince George's County	Office of Homeland Security	Critical Infrastructure Protection

Name	Jurisdiction/ Category	Department	Title
Joanne Barr	City of Laurel	Administration	Deputy City Administrator
Robert Love	City of Laurel	Economic and Community Development	Economic and Community Development Director
Christina Cornwell	City of Laurel	Department of Community Resources and Emergency Management	Director/Emergency Manager
Carreen Koubek	City of Laurel	Office of the City Administrator	Special Assistant to the City Administrator
Miles Roesner	City of Laurel	Department of Information Technology	GIS Analyst
Jesse Delph	Maryland	Maryland Department of Emergency Management/ Hazard Mitigation Branch	Senior Hazard Mitigation Specialist
Caitlin Whiteleather	Maryland	Maryland Department of Emergency Management/ Hazard Mitigation Branch	State Hazard Mitigation Officer
Joshua Norris	Federal Emergency Management Agency (FEMA) Region III	Hazard Mitigation Branch	FEMA Region 3 Hazard Mitigation Planner and Reviewer for the State of Maryland
Kelly Flint	State of Maryland	Department of the Environment	Senior Engineer (Dam Safety Representative)
Stephanie Robinson	City of Bowie	Emergency Management	Emergency Management Specialist
Courtney Gosse	Red Cross National Capital & Greater Chesapeake Region	---	Disaster Program Manager
Erin Meyer	University of Maryland	Emergency Management and Business Continuity	Director

Name	Jurisdiction/ Category	Department	Title
John Bailey IV	Homeowner and Civic Association	Camps Springs Civic Association	---
Lakia Prue	Homeowner and Civic Association	Binkley Towns Homeowners Association	---
Cary Nelson	Homeowner and Civic Association	Brook Manor Civic Association	---
Dr. Toye Latimore	Homeowner and Civic Association	Founders Woods Homeowners Association	---
Sarah Cavitt	Homeowner and Civic Association	Indian Head Hwy Area Action Council	---
Charles Hawkins	Homeowner and Civic Association	Tantallon North Area Civic Association	---
Earle A. Gumbs	Homeowner and Civic Association	Hillcrest-Marlow Heights Civic Association	---
Regina Jeter	Homeowner and Civic Association	Apple Grove Squires Woods	---
Dennis Serette	Homeowner and Civic Association	Barnaby Manor Civic Association	---
Antewan Brown	Homeowner and Civic Association	Birchwood/Clearview Civic Association	---
Olaf "Pete" Pedersen III	Utilities	PEPCO	Manager of Emergency Preparedness
Ervin McDaniel III	Utilities	Baltimore Gas & Electric Company	External Affairs Manager
Michael Block	Utilities	Washington Suburban Sanitary Commission Water	CHHS Contractor/Consult
Sara Basehart	Community Groups	Independence Now	Executive Director

Name	Jurisdiction/ Category	Department	Title
Kim Finch	Prince George's County	Planning Department Environment Section	Environmental Planner
Stephanie Dalke	University of Maryland	University of Maryland – Environmental Finance Center	Water Resources and Climate Adaption Program Manager
Brandy Espinola	University of Maryland	University of Maryland – Environmental Finance Center	Climate Resilience and Sustainability Program Manager

From September 2022 through January 2023, the Mitigation Advisory Committee held three meetings and supervised work on the 2023 HMP. Extensive coordination through email occurred between Prince George's County Office of Homeland Security and Dewberry consultants. Additionally, coordination was conducted with the City of Laurel Office of Emergency Services staff. The Mitigation Advisory Committee members coordinated and consulted with other entities and stakeholders to identify and delineate natural hazards within the community and to assess the risks and vulnerability of public and private buildings, facilities, utilities, communications, transportation systems, and other vulnerable infrastructure. In addition, the Mitigation Advisory Committee members worked with the County Office of Homeland Security and the Dewberry consultants to review program capabilities, provide 2017 mitigation action status updates, and to update the 2023 mitigation strategy.

During the HMP update, most communication occurred through emails, meetings, and feedback surveys. The Mitigation Advisory Committee and Dewberry consultants mutually chose this strategy rather than in-person meetings to accommodate budgets, schedules, and safety concerns due to the COVID-19 pandemic. **Table 6** documents meeting dates and their purposes. Meeting materials are located in **Appendix A** and **Appendix B**. Participation in plan update activities is summarized in **Table 7**.

Table 6: Mitigation Advisory Committee Meetings

Date	Meeting	Summary
September 16, 2022	HMP Update Project Kick-off Meeting	During the Mitigation Advisory Committee Plan Update Kick-off Meeting, the planning process and schedule was presented. Committee members committed to the project and schedule. The list of hazards and rankings from the 2017 plan update were validated through a prioritization exercise. The previous plan structure and content was discussed; a decision was made to retain structure and general level of content. The update process and role of the Mitigation Advisory Committee members, project schedule, and desired plan outcomes were discussed.
November 16, 2022	Risk Assessment Results and Goals Update Workshop	The hazard identification and risk assessment results were presented with maps and data provided in a power point presentation. The 2017 plan goal was reviewed and revised into four new goals. Public outreach needs were discussed.

Date	Meeting	Summary
December 14, 2022	Mitigation Strategy Development Workshop	Reviewed the project status, mitigation goals, and action prioritization methodology. An Airtable database was used to discuss and make decisions on the actions for the updated Mitigation Strategy. Discussions were held throughout the presentation so Dewberry could gather feedback from the Mitigation Advisory Committee.
February 1, 2023	Plan Draft Review Meeting	An overview of the 2023 Draft Hazard Mitigation Plan was presented to the Committee. There was then a discussion with Committee members to answer questions and gather feedback on the Draft Plan. The meeting closed with a discussion on next steps in the planning process and an open forum for questions or comments from the Committee.

Table 7:Mitigation Advisory Committee Meeting Summary and Attendance

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Ronald Gill	Office of Homeland Security	X		X			
Meloyde Batten-Mickens	Office of Homeland Security			X		X	X
Joey Henderson	Office of Homeland Security	X	X	X		X	X
Alexandra Harris	Office of Homeland Security	X					
Ehsan Bahador	Office of Homeland Security	X	X	X	X	X	X
Dawn Hawkins-Nixon	Dept. of Environment	X	X	X			X
Lilantha Tennekoon	Dept. of Environment	X		X	X		X
Patrick Callahan	Dept. of Environment		X	X	X		X
Jeffrey DeHan	Dept. of Environment		X				X

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Sudanshu Mishra	Dept. of Environment		X	X			X
Frank L. Galosi	Dept. of Environment		X		X		X
Joanna Smith	Dept. of Environment		X	X			
Major Anthony Cline	Police Dept.		X	X	X		
Chief James McClellend	Fire/ Emergency Medical Services		X				
Erv Beckert	Dept. of Public Works and Transportation						
Mary Sherrill	Dept. of Public Works and Transportation		X	X			X
Sangrea Watkins	Economic Development Corporation						
Rey De Guzman	Dept. of Permitting, Inspections, and Enforcement		X	X			
Behdad Kashanian	Dept. of Permitting, Inspections, and Enforcement						

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Courtney Mariette	Office of Community Relations						X
Mychael Dickerson	PG County Public Schools						
Gary Cunningham	PG County Public Schools			X			
Wanda Ramos	Dept. of Parks and Recreation		X				
Andree Checkley	Dept. of Parks and Recreation						
Katina Shoulars	Dept. of Parks and Recreation		X				
Cathy Stasny	Dept. of Family Services, Area Agency on Aging						
Joanne Barr	Administration		X				X
Robert Love	Economic and Community Development		X	X			X
James Carter	Homeland Security Critical Infrastructure		X	X			

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Christina Cornwall	Dept. of Emergency Services	X		X	X	X	X
Miles Roesner	Dept. of Information Technology		X	X			
Jesse Delph	Maryland Department of Emergency Management (MDEM)						
Caitlin Whiteleather	Maryland Department of Emergency Management (MDEM)						
Joshua Norris	Federal Emergency Management Agency (FEMA) Region III						
Kelly Flint	Maryland Department of Environment		X	X			X
Stephanie Robinson	Emergency Management, City of Bowie		X	X	X	X	X
Courtney Gosse	American Red Cross					X	
Erin Meyer	University of Maryland			X			X
John Bailey IV	Camps Springs Civic Association						

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Lakia Prue	Binkley Towns Homeowners Association						
Cary Nelson	Brook Manor Civic Association						
Dr. Toye Latimore	Founders Woods Homeowners Association	X	X		X	X	
Sarah Cavitt	Indian Head Hwy Area Action Council						
Charles Hawkins	Tantallon North Area Civic Association						
Earle A. Gumbs	Hillcrest-Marlow Heights Civic Association						
Regina Jeter	Apple Grove Squires Woods						
Dennis Serette	Barnaby Manor Civic Association						
Antewan Brown	Birchwood/Clearview Civic Association						
Olaf "Pete" Pedersen III	PEPCO		X				

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Ervin McDaniel III	Baltimore Gas & Electric Company						
Michael Block	Washington Suburban Sanitary Commission Water		X				X
Sara Basehart	Independence Now						
Joanne Hall Barr	City of Laurel						X
Carreen Koubek	Office of City Administrator, City of Laurel		X				X
Kim Finch	Prince George's County Planning Department, Environmental Section		X	X			X
Stephanie Dalke	University of Maryland – Environmental Finance Center (EFC)						X
Brandy Espinola	University of Maryland – Environmental Finance Center (EFC)			X	X		
Brian K. Lee*	City of Laurel				X		X
Daniel L. Dornan*	Prince George's County				X		

Member	Department	Kick-Off	Risk Assessment & Goal Workshop	Mitigation Strategy Workshop	Mitigation Action Feedback Survey	Public Meetings	Draft Plan Review Meeting
Bill Bailey*	City of Laurel				X		

* Not in the Mitigation Advisory Committee, but contributed their subject matter expertise to the planning process

C. Public Participation and Stakeholder Engagement

C.1. Public Participation

The public involvement element of the planning process involved a hazard mitigation survey, an online Story Map and community mapping opportunity, a hazard mitigation planning webpage, two virtual public meetings, and a draft review period. Further details on the virtual public meeting are shown in **Table 8**. The hazard mitigation survey was available online to the public from November 1, 2022 – January 3, 2023. The survey was promoted via social media (**Appendix B**) and shared through the following local community channels:

- County Department of the Environment Twitter account
- County Office of Emergency Management Facebook page
- NextDoor
- County Connect Prince George's Facebook page
- County Reddit page

External public participation was initiated in November 2022 by the Prince George's County Office of Homeland Security supplemented by efforts of the Prince George's County Department of the Environment.

Examples of community outreach and engagement include a public meeting held on November 6, 2022, to update the public on the 2023 hazard mitigation update process, share risk assessment results, field questions, and discuss their thoughts and concerns for their community.

Prince George's County citizens were notified of the plan revisions and asked to participate through posts on Facebook, Twitter, Reddit, and on the Emergency Management section of the county website. This method of soliciting public participation in the plan will be utilized during the next 5 years.

Table 8: Public Meetings

Date	Meeting	Summary
November 9, 2022	Public Meeting #1	During the first Public Meeting, an overview of the planning process, current progress, preliminary results from the risk assessment, and discussion of potential planning goals were all presented. The public also had an opportunity to give input and ask questions, and were provided with opportunities for further involvement.
February 2, 2023	Public Meeting #2	During the second Public Meeting, an overview of the 2023 Draft Hazard Mitigation Plan was presented. Additionally, there was a discussion to gather feedback from the public on the Draft Plan. The meeting closed with next steps in the planning process and an opportunity for the public to ask further questions.

C.2. Public Survey Results

The public survey collected a total of 39 responses from Prince George's County residents, business owners, workers, and students, faculty, and staff of colleges and universities in the jurisdiction. The survey was conducted from September to December of 2022 and included several questions on hazard awareness, hazard mitigation techniques, and hazard mitigation preferences. Three quarters of the respondents to the survey were residents of Prince George's County. Aside from residents, other respondent types included people who work in the County or who represent a federal/state/private agency or organization with a vested interest in Prince George's County.

Over half of the survey respondents reported that they live in the Berwyn Heights community of the County. The community with the second highest number of respondents was Greenbelt. No respondents reported they live in the City of Laurel. The "Other" responses included two respondents from Fort Washington and one from Chapel Oaks. Survey respondents' reported communities are shown in **Figure 3.**

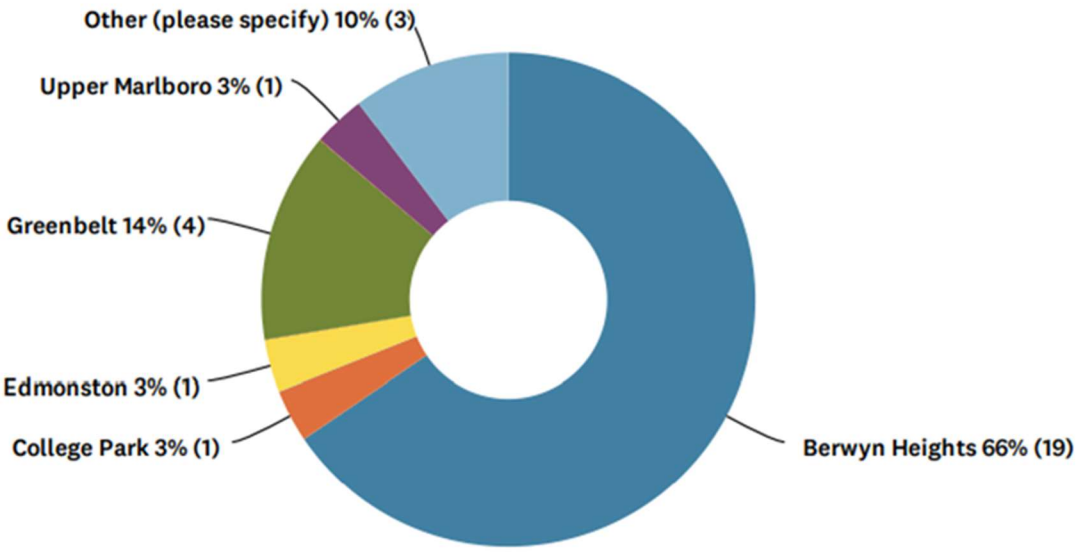


Figure 3: Public Survey Respondent's Communities

Prince George's County residents are concerned about flooding and flood-related and wind-related severe storms. In line with these concerns, more than half of respondents reported that their home, business, community, college or university, or organization had been previously affected by either a flood, high winds, or wind-related or flood-related severe storm. Additionally, more than half of respondents reported winter storm/blizzard ranked as a hazard that has had the biggest impact on the County, ranking high among the most impactful hazards. All responses to the hazard that has had the biggest impact on the County are shown in **Figure 4.**

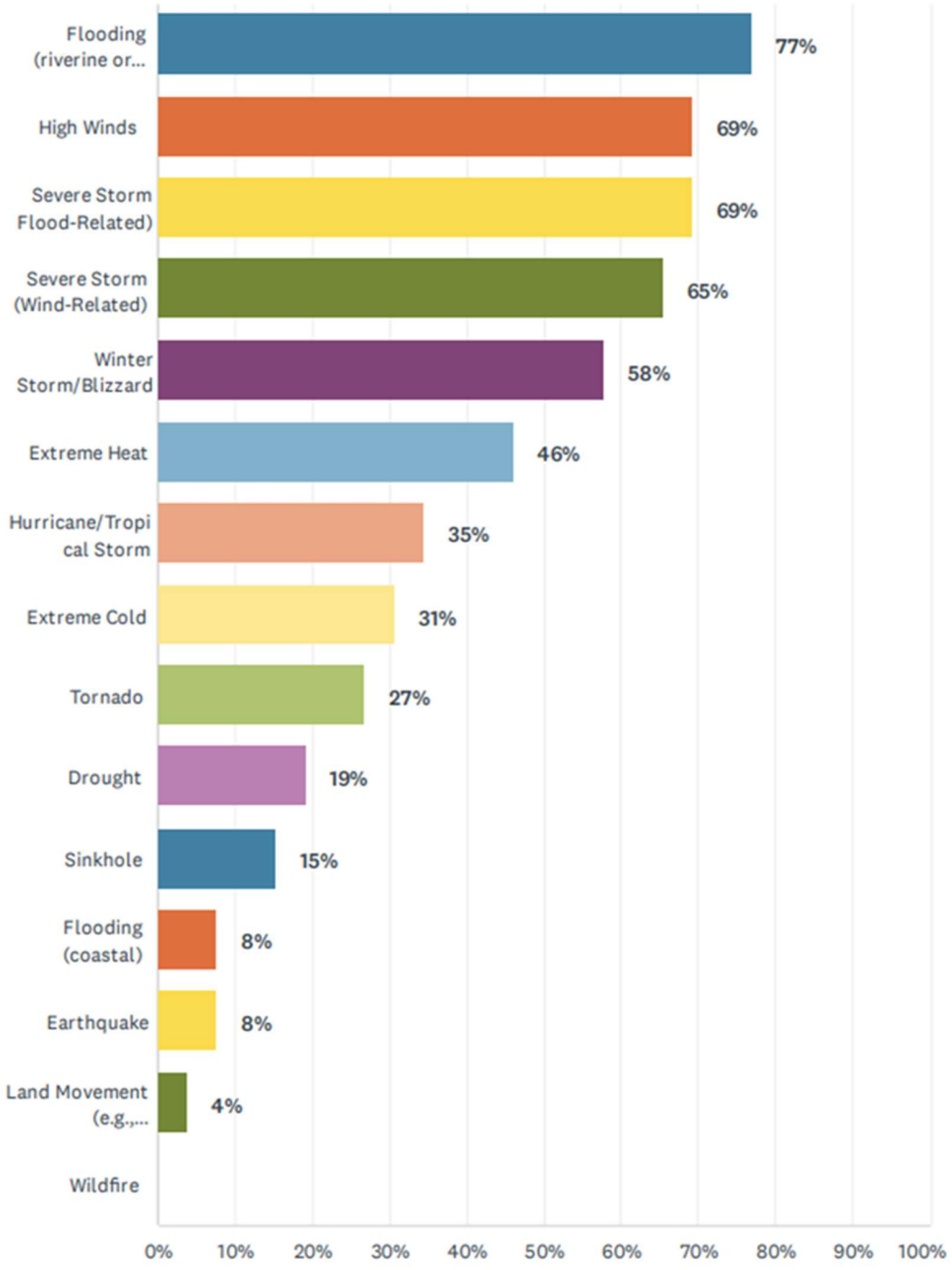


Figure 4: Hazards with the Largest Impact on the County

Although flooding is a top concern for County residents, 68% do not have flood insurance. Respondents reported multiple reasons for not having flood insurance, with the most common reasoning being that they are not required to, or they do not think they need it. Residents who cited "other" reasons reported that insurance does not offer flood insurance for their home. Survey respondents reported many occurrences of past home flood damage, with the majority of responses relating to flooding in the basement of residents' homes. Additionally, respondents reported inadequate storm drainage worsening property damage due to flash flooding. However, perceptions of hazards do not appear to affect residents' decisions to live in the area: more than half (64%) of respondents said they would repair or rebuild their property in the same location if a disaster substantially damaged their home.

Prior to taking the survey, only 33% of respondents knew that Prince George's County maintains a hazard mitigation plan. Similarly, only 44% of respondents are signed up for the Alert Prince George's emergency notification system, and 30% of respondents had never heard of Alert Prince George's before. Therefore, there is limited knowledge among the public of the County's hazard mitigation efforts.

Survey participants were asked what they believed the most important actions that Prince George's County could take to mitigate hazards and become more resilient over time. Residents could select multiple important actions. More than two-thirds of respondents cited localized flood-risk reduction projects, the most of any action. Other commonly cited actions included providing technical assistance to residents, businesses, jurisdictions, and organizations to help with hazard mitigation (63%), outreach and education to residents to help with hazard mitigation (59%), enact and enforce regulations, codes and ordinances, such as zoning regulations and building codes (56%), and implement a warning system to alert the public of impending hazards (56%). When asked to identify one mitigation action the County could take, many respondents provided open-ended answers related to flood and stormwater mitigation projects, public education and outreach to vulnerable populations about hazards, and taking action to reduce power outages due to tree damage.

Overall, the hazard mitigation survey illustrated Prince George's County residents' high concern for flooding, severe storms, and high winds. Only one third of survey respondents knew that the County maintains a hazard mitigation plan. This highlights the need for a strong hazard mitigation effort in Prince George's County that is responsive to the risks and vulnerabilities outlined later in this plan, as well as the concerns of residents, especially flood-risk reduction projects.

C.3. Stakeholder Engagement

Internal stakeholder engagement began in September 2022 when the members of the 2017 Prince George's County and City of Laurel Mitigation Advisory Committee were notified that the plan would be updated, and the committee would be revitalized to reconvene at a project kick-off meeting on September 16, 2022. Additional invitations to serve on the Mitigation Advisory Committee were sent out to a wider group of people that included significantly more stakeholders from within the County and City, throughout the communities, and at the state/regional levels. The stakeholder groups invited to participate through either the Mitigation Advisory Committee or draft plan review opportunities include the following:

- The 25 incorporated municipalities located in Prince George's County that do not have separate land use authority and the City of Bowie, which retains some land use authority.
- Interested parties on Planning Board's public notification list of e-mails that is maintained by Maryland-National Capital Park and Planning Commission (civic associations, neighborhood associations, etc.)
- Dam Owners
- Utility companies (e.g., PEPCO, Baltimore Gas & Electric, WSSC Water)
- Emergency managers of adjacent counties (Montgomery, Howard, Charles, Calvert, Anne Arundel)
- Red Cross National Capital & Greater Chesapeake Region
- University of Maryland
- Maryland Department of Emergency Management
- Maryland Department of the Environment
- Natural Resources Conservation Service, Prince George's District Conservationist

Engagement of community stakeholders in the review of the 2023 HMP has been an ongoing effort. In addition to posting a digital version of the HMP on the Prince George's County website, stakeholders were encouraged to provide input through the community hazard mapping activity in the 2023 HMP virtual Story Map, Hazard Mitigation Survey, and Draft HMP Review Survey. Prince George's County Office of Homeland Security staff continue to use

an open floor (or unarranged times) during meetings and trainings to solicit feedback and discuss the 2023 HMP with community stakeholders.

June is Prince George's County Flood Awareness Month which has been used to introduce the public and stakeholders to the Hazard Mitigation Planning process and flood awareness through several intensive activities. Each owner of flood prone property depicted on the County's Flood Insurance Rate Maps as being within the Special Flood Hazard Area is sent a letter encouraging the purchase of flood insurance even if not lender required, mitigation options and sources of more information through the County's web-based Floodplain Lookup Tool and other programs. The City of Laurel Emergency Manager apprised internal City staff of plan update status at weekly department director meetings. City of Laurel homeowner's association have been briefed and linked to the draft plan are on the city's website encouraging citizen comment.

A summary of Prince George's County and City of Laurel outreach efforts, scanned materials, and screen captures of messaging are in **Appendix B**.

C.3.a. Dam Safety Coordination

Dam owners and dam safety experts were both asked to provide input into the HMP as well as provide general feedback. A Dam Safety Representative was consulted from the outset of the planning process and was included on the Mitigation Advisory Committee. Emergency Action Plans, mapped inundation zones, location and size of the population at risk, and potential impacts to structures were all integrated into the plan. The Dam Safety Permits Division of the Stormwater, Dam Safety, and Flood Management Program within the Maryland Department of the Environment reviewed the draft Dam and Levee Failure section in Chapter 4, dam-related mitigation and adaptation actions, and appendices for accuracy and completeness.

While all dam owners were offered opportunities for involvement, four provided feedback on the draft HMP or participated in the Mitigation Advisory Committee. They included:

- Prince George's County Department of the Environment- Stormwater Management
- Prince George's County Department of the Environment- Flood Management
- City of Laurel Department of Emergency Services
- City of Bowie Emergency Management

The dam owners approved of the HMP and had no major concerns or comments; however, they did state interest in being included in any future planning or discussions regarding their affected dams

C.3.b. Virtual Story Map

A virtual Story Map was created in ArcGIS Online and presented to the public to collect community hazard location information. The Story Map contains background information on the HMP update, as well as the purpose of Hazard Mitigation Plans. Additionally, there is a section of the Story Map that lists the identified hazards for Prince George's County and the City of Laurel that are discussed in the **Risk Assessment** chapter of this Plan. The public could identify community problem areas through a survey linked in the Story Map, shown in **Figure 5**.

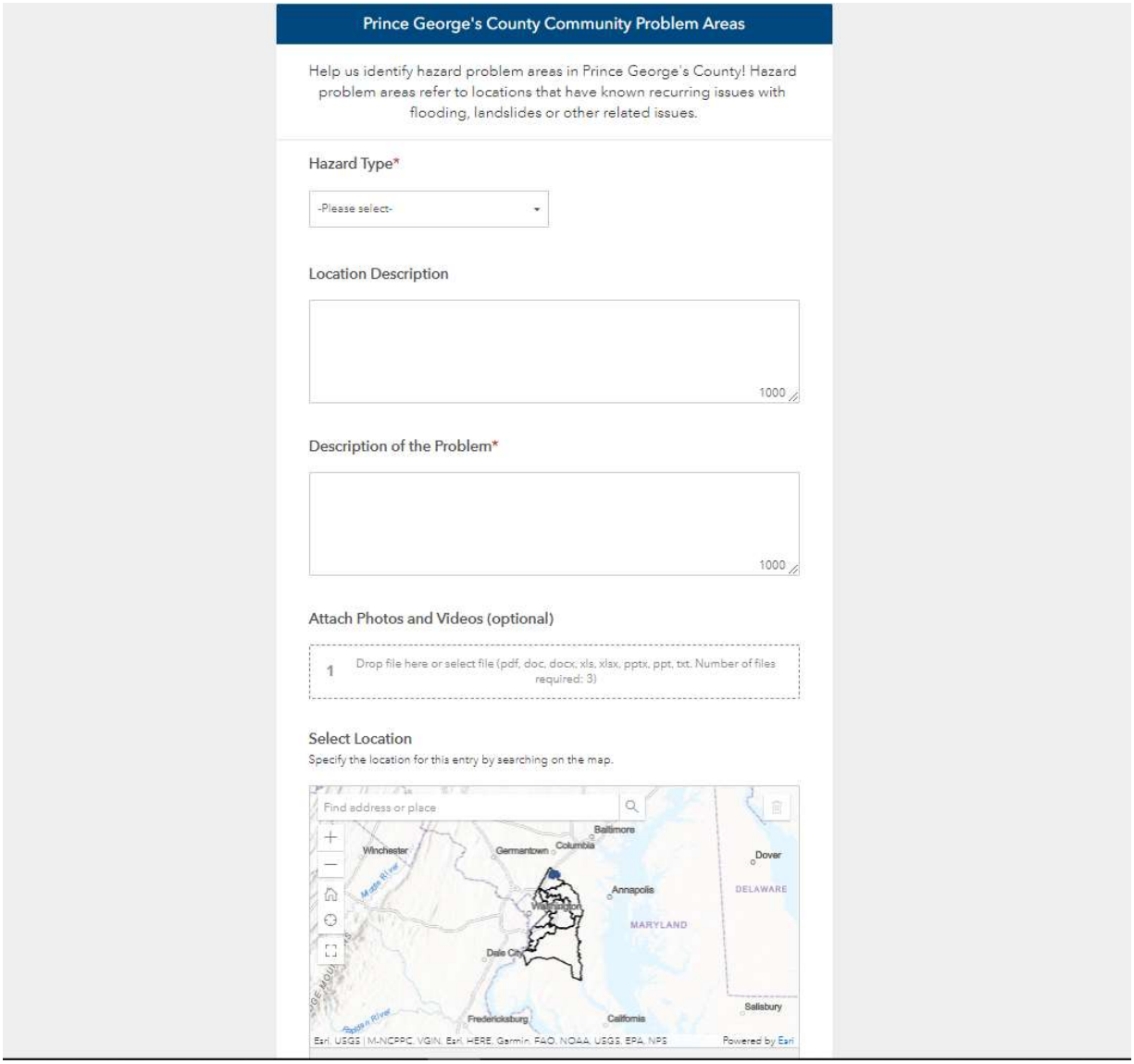


Figure 5: Community Problem Area Survey

Seven community problem areas were identified by members of the public through the survey. The location of the community problem areas identified through the survey are shown in **Figure 6**. A description of each identified problem area is shown in **Table 9**. Six out of the seven responses were for flooding hazards, and one response was a wind-related hazard.

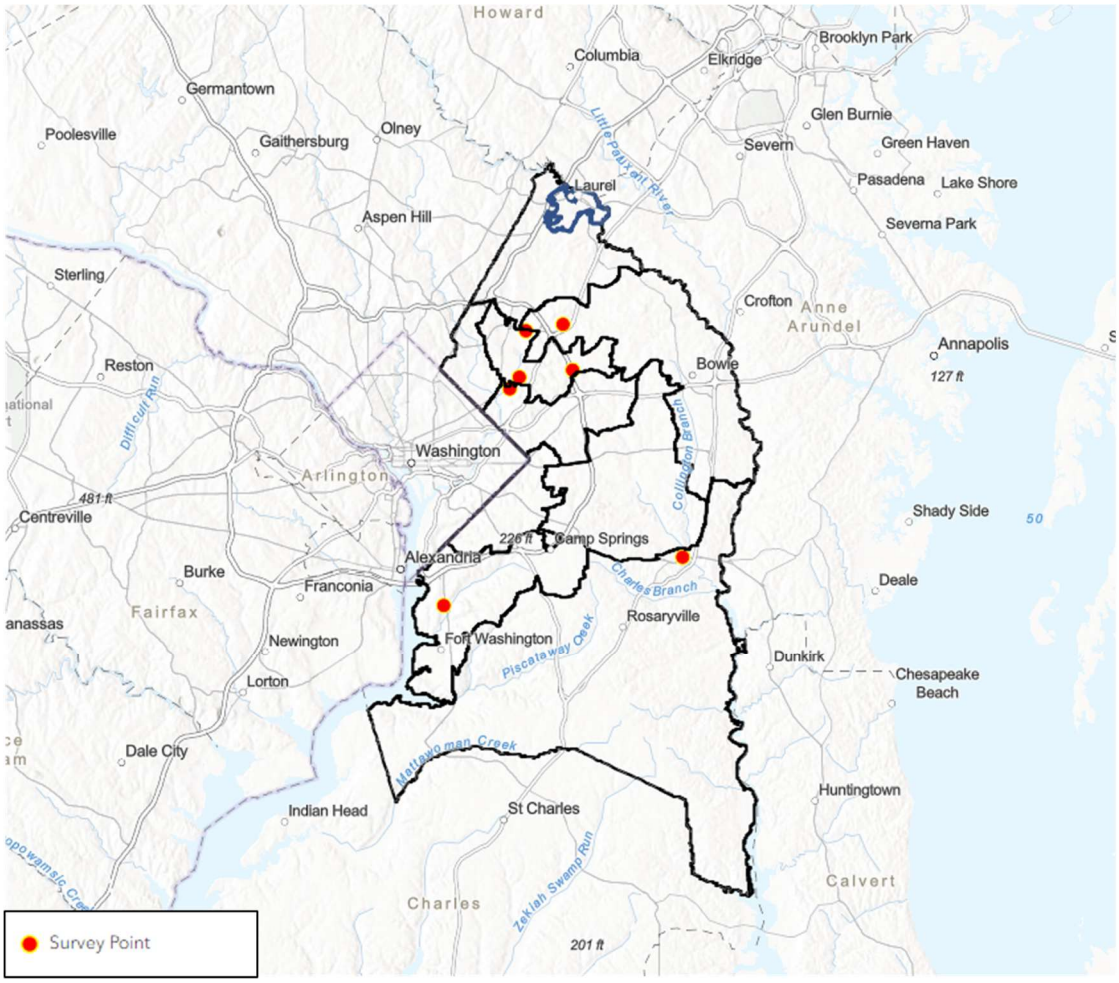


Figure 6: Community Problem Areas Map

Table 9: Identified Community Problem Areas

Hazard Type	Location Description	Description of the Problem
Flooding	n/a	Insufficient stormwater drainage leads to stormwater filling up a below-grade concrete walkway. During the flooding of August 10th, the first floor of an apartment building was flooded here.
Severe Storm (Wind-Related)	Greenbelt Area	Recent windstorms, especially in 2022, caused power outages. Pepco tree trimming a few years ago reduced the problem, but work needs to continue to reduce vulnerability.
Flooding	Fort Washington, MD	Streams in the back of single family homes located on Founders Terrace.

Hazard Type	Location Description	Description of the Problem
Flooding	Parking lot for office building	During bad rain storms the parking lots in this area flood pretty bad.
Flooding	Town of Upper Marlboro, streets and surrounding areas along the Collington Branch.	During heavy rains select areas along the Collington Branch flood and roads need to be closed until the water recedes. The areas primarily affected by the water are 202 @ Marlboro Pike and up to Peerless Avenue. The other area is further downstream where the Collington Branch passes under Water Street between Judges Drive and Rt. 4. This is a well-known problem area and may already be part of a mitigation plan.
Flooding	Port towns including Bladensburg, Edmonston, Cottage City, Riverdale, College Park, and Hyattsville	Port towns including Bladensburg, Edmonston, Cottage City, College Park have always flash floods due to the old drainage system.
Flooding	8900 Block 59th Avenue, Berwyn Heights, MD	More incidents of flooding from rain storms.

D. Community Lifelines

Lifelines are systems, like roads and power, that allow critical government and essential business operations to continue. Lifelines are essential to human health and safety, and/or economic security. The framework of lifelines was to give common definitions and terminology when talking about various hazards or incidents and what may or has been affected, and to help formulate a response to an incident, as well as prompt mitigation before such an incident may occur. This framework allows emergency managers to:

- Characterize the incident and identify the root causes of priority issue areas.
- Distinguish the highest priorities and most complex issues from previous incident information.

A lifeline enables the continuing operation of critical government and business functions during a hazard or other incident and is essential to human health and safety, and/or economic security. Lifelines (**Figure 7**) include police and fire departments, hospitals, power plants, arterial roads, grocery stores, and the cellular towers that connect everything. These often-interconnected systems are, simply put, essential for communities to keep the "lights on." Examples of this are:

- The most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
- The integrated network of assets, services, and capabilities that are used day-to-day to support the recurring needs of the community.

- When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required to stabilize the incident.

Figure 7: FEMA Community Lifeline Categories

D.1. BRIC and Community Lifelines

Resilient lifelines help build resilient communities. The goals and objectives of FEMA's Strategic Plan promote using mitigation to reduce risk to lifelines before a disaster and to quickly stabilize a community after disaster by preventing cascading impacts. BRIC mitigation grants can go toward projects which mitigate these structures, facilities, and systems. Lifeline-focused mitigation projects could involve a wide variety of public, private, and non-profit organizations. Framing mitigation projects in the terms of which community lifelines are being improved gives a mitigation project a higher chance to be awarded a BRIC mitigation grant.

Chapter 3. Community Profile

This chapter contextualizes the HMP by providing background on Prince George's County and the City of Laurel.

Prince George's County is part of the greater Washington-Baltimore metropolitan area. The county is approximately 499 square miles (mi^2), 483 mi2 comprised of land and 16 mi^2 of water. Prince George's County is surrounded by Anne Arundel County and the Patuxent River to the east, Calvert County to the southeast, Charles County to the south, Howard County to the north, and Montgomery County to the northwest in Maryland. Washington, D.C. and the Potomac River lie to the west. The county border with Fairfax County and Alexandria, Virginia is the Potomac River shoreline along the Virginia coast.

Although there are 27 separate incorporated municipalities within the boundaries of Prince George's County, only the Cities of Laurel and Bowie retain some degree of land use authority. Only the City of Laurel is recognized separately by FEMA and administers its own floodplain management ordinance, so the City of Laurel's participation has been incorporated into the plan as a separate entity in the planning process with specific community profile information detailed in **Chapter 3**.

A. Physiography

Prince George's County lies in the Atlantic Coastal Plain, and its landscape is characterized by gently rolling hills and valleys, but can be locally quite rugged where short, high-gradient streams have incised steep ravine systems. Along its western border with Montgomery County, Adelphi, Calverton and West Laurel rise into the Piedmont, exceeding 300 feet mean sea level (MSL) in elevation. The Piedmont is characterized by deeply weathered, poorly exposed bedrock and a rolling topography. The Fall Line, which delineates the division between Coastal Plain and Piedmont, is the easternmost extent of rock-filled river rapids, the point at which east- flowing rivers cross from the hard, igneous, and metamorphic rocks of the Piedmont to the relatively soft, unconsolidated strata of the flat Coastal Plain. **Figure 8** shows the States of Maryland and Delaware divided into their respective physiographic provinces.

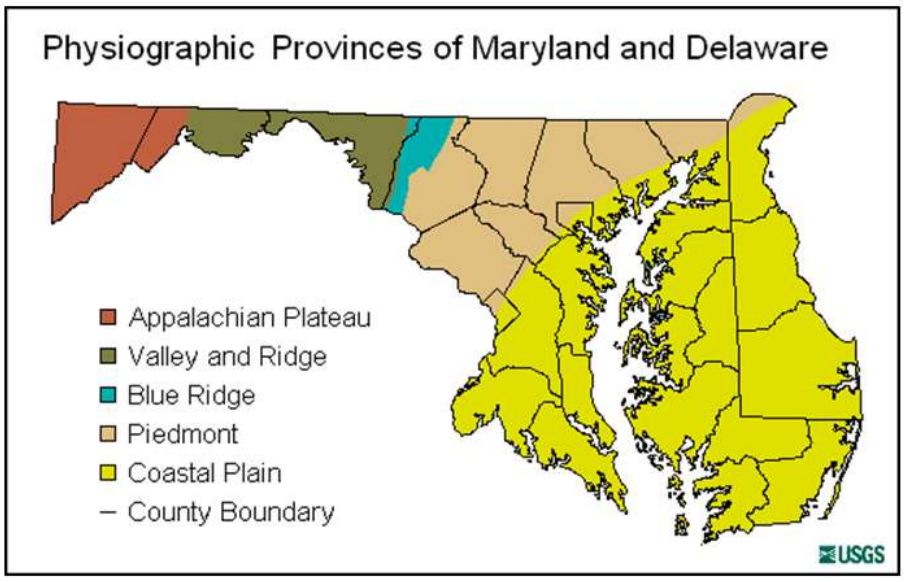


Figure 8: Physiographic Provinces of Maryland and Delaware

B. Hydrology

Prince George's County lies within two watersheds: the Patuxent River and the Potomac River, both of which are a part of the greater Chesapeake Bay Watershed.

The Potomac River Watershed covers 14,670 square miles: Virginia (5,723 mi^2) Maryland (3,818 mi^2)), West Virginia (3,490 mi^2)), Pennsylvania (1,570 mi^2), and the District of Columbia (69 mi^2)). Based on information from the 2019 National Land Cover Database (NLCD) which is the most current land use database, the majority of the basin's land area is covered by forests (53.2% of the land area). Developed land makes up 14.7% of the basin's land area, while agriculture covers 25.2%. Water and wetlands make up 6% of the basin's land area. The Potomac's major tributaries include: the Anacostia River, Antietam Creek, the Cacapon River, Catoctin Creek, Conocoheague Creek, the Monocacy River, the North Branch, the South Branch, the Occoquan River, the Savage River, the Seneca Creek, and the Shenandoah River. The Potomac River watershed is mainly fed by the Anacostia River, Oxon Creek, Piscataway Creek, Mattawoman Creek, Zekiah Swamp, and the Potomac River in Prince George's County.

The Patuxent River Watershed is fed mainly by the Patuxent River, Rocky Gorge Reservoir, and Western Branch in Prince George's County. It covers 908 mi^2 that is mostly forested (43%) with only 10.7% of its acreage developed. The Patuxent River is the largest and longest river entirely within Maryland, and its watershed is the largest completely within the state.

Significant water bodies in Prince George's County include, but are not limited to:

- Bald Hill Branch
- Base Lake
- Bear Branch
- Beaverdam Creek
- Black Swamp Creek
- Carey Branch
- Cash Creek Lake
- Charles Branch
- Chews Lake
- Collington Lake
- Crow Branch
- Greenbelt Lake
- Henson Creek
- Horsepen Branch
- Indian Creek
- Lake Artemesia
- Lake Deborah
- Laurel Lake
- Northampton Lake
- Paint Branch
- Redington Lake
- Sligo Creek
- Walker Branch

C. Climate

The eastern half of Maryland lies on the Atlantic Coastal Plain, with flat topography and sandy or muddy soil. This region has a humid subtropical climate, with hot, humid summers and a short, mild to cool winter. This humid subtropical climate is strongly influenced by the Chesapeake Bay and the Atlantic Ocean, both of which moderate the weather but do not prevent ice formation almost every winter on the

bay's northern tributaries; summer calms can produce high temperatures of up to 107°F, with nearly 100% relative humidity. Average temperatures in eastern Maryland are 75°F in July and 35°F in January.

The Piedmont region has average seasonal snowfall totals generally exceeding 20 inches; temperatures below 10°F are less rare than in the Atlantic Coastal Plain. Land use and development trends in Prince George's County is characterized by highly urbanized areas, high growth areas, and outlying more rural areas in the southern area of the county. Between 2002 and 2010, the County experienced a 7.7% increase in developed land and a 6.3% decrease in natural resource areas—agricultural, forest, and wetlands.

D. Land-Use and Development Trends

The majority of residential growth between 1980 and 2010—measured by the number of issued building permits—occurred in County communities outside of the Capital Beltway (Route 95/495) and more isolated from transit stations. However, approximately 60% of nonresidential growth occurred outside of the Capital Beltway during this period. These trends are problematic because suburban development during the past three decades has not been compact and has, as a result, consumed a disproportionate amount of land and required an extensive new infrastructure investment. Between 2002 and 2011, suburban development outside of the Capital Beltway accounted for 73% of all growth and 59% of all consumed land, while more densely urban areas inside the Capital Beltway accounted for 25% of all growth and only 5% of all consumed land.[7] This is because areas inside of the Capital Beltway have been largely "built out" for several decades. Thus, the areas inside the Beltway are more prone to re-development.

Land use and development trends are documented by the United States Census Bureau and that agency's American Community Survey. In addition, a George Mason University study also characterized county demographics. **Chapter 3.E** relies most strongly on Census Bureau data supplemented by the *Plan 2035 Prince George's Approved General Plan*, May 6, 2014.

As of May 2014, the highest percentage of the county (282,589 acres) is devoted to single-family dwelling units (27%). Land dedicated to agricultural and natural resource activities accounts for 16.7% of the county, while parks and open space, institutional uses, and vacant property consumes approximately 20% of land area. Only 37 acres, or 0.013%, of county land is classified as mixed use. It is anticipated that mix use development will increase with new and re- development projects in the future. **Table 10** provides a comprehensive list and description for each of these land use categories as of May 2014.

Table 10: Existing Land Use for Prince Georges County (2014)

Land Use	Acres	Percent Land Area	Description
Agricultural–Natural Resources	47,134	16.68%	Agricultural or natural resources activities.
Residential–Single-Family	76,412	27.04%	Single-family detached units.
Residential–Attached	1,190	0.42%	Single-family attached units e.g. duplexes or

[7] Maryland Department of Planning 2010 Land Use/Land Cover Product Summary: https://planning.maryland.gov/Pages/OurWork/landuse.aspx

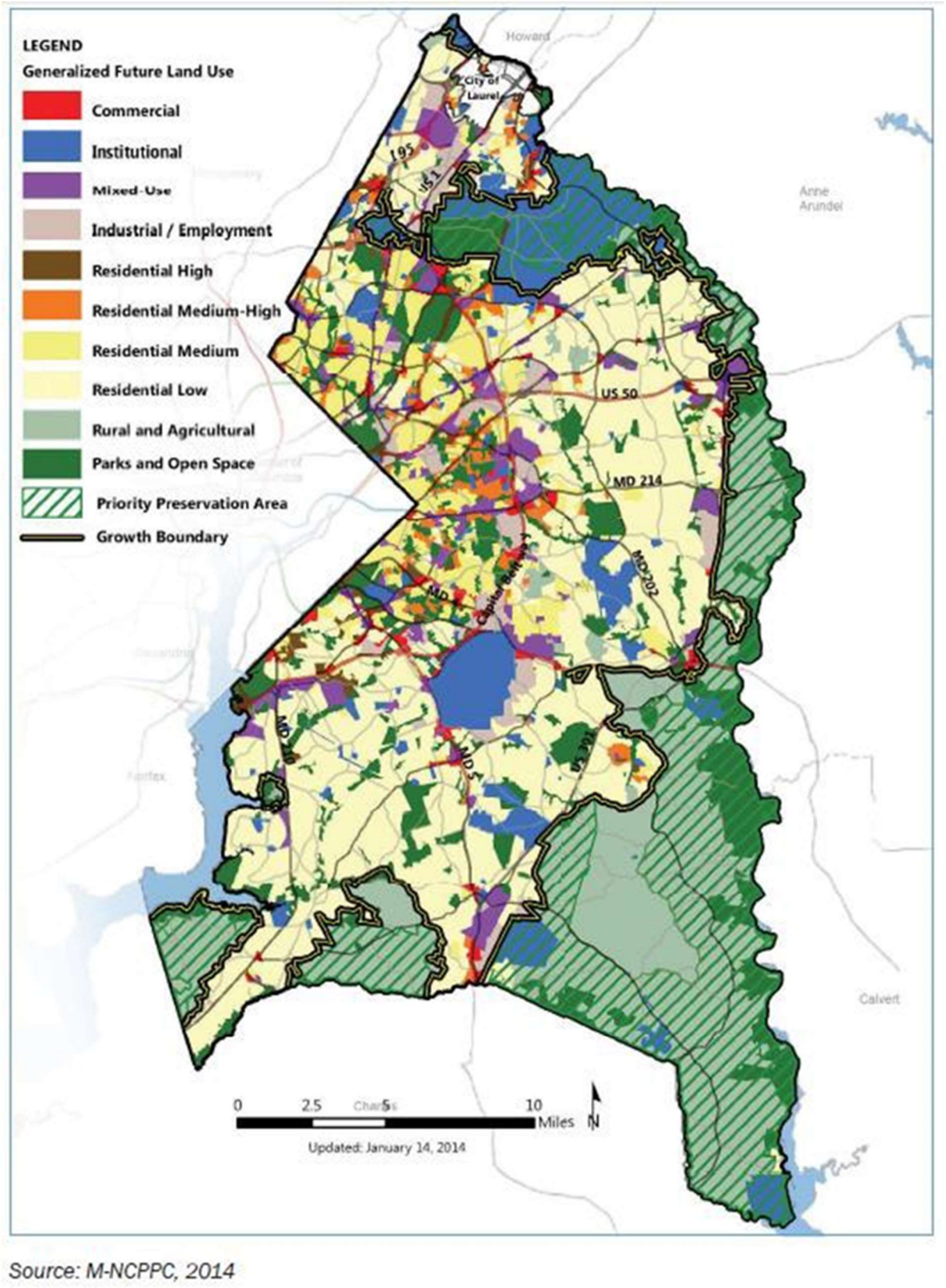
Land Use	Acres	Percent Land Area	Description
			triplexes.
Residential–Townhouse	4,878	1.73%	Single-family townhouse units.
Residential–Multifamily	5,431	1.92%	Multifamily units e.g. apartments or condos.
Commercial	5,832	2.06%	Commercial e.g. shopping, service, trade, or restaurants.
Office	3,446	1.22%	Offices.
Industrial	8,150	2.88%	Industrial, manufacturing, and storage.
Institutional	32,662	11.56%	Social, institutional, or public facilities.
Transportation and Utilities	7,186	2.54%	Transportation and utility-related.
Parks and Open Space	34,475	12.20%	Parks and open space.
Vacant	55,756	19.73%	Undeveloped land.
Mixed Use	37	0.01%	Single lot Mixed-use, typically housing office above retail or retail.
Total	282,589	100.00%	All land area in Prince George's County

Development trends are a notable topic when considering hazard risk. New development in the County has occurred within the Beltway in support of the County's priorities of community and transit-oriented development. Prince George's County's Redevelopment Authority reports recent development occurring in the Brentwood/Mt. Rainier neighborhood area. These recent developments are located outside of the Special Flood Hazard Area, decreasing the communities vulnerability to flood hazards.

Future Prince George's County land use decisions are guided by *Plan 2035*, which prioritizes where future growth and development should be concentrated. Land use areas are characterized by three "tiers." Generalized future land use in the County is shown in **Figure 9**. Plan 2035 delineates Priority Preservation Areas and is committed to maximizing development in its mixed-use Regional Transit Districts, many centered proximate to the county's 15 Metro Stations.[8] A 2011 study by the George Mason University Center for Regional Analysis (GMU) concluded that robust economic growth in the region cannot be guaranteed unless the housing preferences of the workforce have been met. The study recommended that most of the new housing be in compact developments with convenient access to jobs and transportation options to meet growing demand for mixed-use, walkable, transit accessible communities. The density of the Regional Transit Districts is often noticeably greater within a quarter mile of Metro and light rail stations. The County's greatest opportunity to build a strong commercial tax base and generate the type and scale of economic development opportunities that will enhance its competitiveness within the region will rest on creating and enhancing these Districts shown in approved

[8] Metro Stations: https://www.mncppc.org/1698/Metro-Stations

sector and master plans. The County Department of Planning and the Maryland-National Capital Parks and Planning Commission continue to modify community plans and zoning to meet *Plan 2035*'s vision.



Source: M-NCPPC, 2014

Figure 9: Future Land Use Map for Prince George's County

Plan 2035 notes that 90% of approved by unbuilt development is located outside of the Capital Beltway. Land use is characterized by three tiers, shown in **Table 11**.

Table 11: Prince George's County Growth and Consumption by Tier

Tier	Growth Rate	Total Land Consumption
Developed Tier	25%	5%
Developing Tier	73%	59%
Rural Tier	2%	36%

E. Population

The United States Census Bureau's Population Estimates Program states Prince George's County, Maryland's population as 955,306 as of July 1, 2021. This is a -1.2% change from the April 1, 2020 U.S. Census count. Compared to the 2010 U.S. Census, the County has seen a population change of +12.0%. As of December 2020, the Maryland Department of Planning, Projections and State Data Center projects the population of Prince George's County to be about 983,870 by 2045, which would only be a 3.0% increase from the most recent 2021 estimate from the Census Bureau. This projection was created without 2020 Census data, so if the State's 2020 projection of 911,140 is adjusted to reflect the 2020 Census population (967,201) and the same annualized growth rates are then used on the new baseline, a new projection for the County's population in 2045 is 1,043,973.[9] Based on this cumulative information, the population of Prince George's County by 2045 is estimated to be about 7.9% higher than the most current (2021) estimate. **Table 12** shows the population projections for Prince George's County.

Table 12: Population Projections for Prince George's County and the City of Laurel

Statistic	City of Laurel	Prince George's County
Population, Census (April 1, 2010)	25,115	863,420
Population, Census (April 1, 2020)	30,060 (+19.7%)	967,201 (+12.0%)
Population Estimate (July 1, 2021)	29,490 (-1.8%)	955,306 (-1.2%)
Projected Population (2045)	**N/A**	**983,870 (+3.0%)**

Source: United States Census Bureau QuickFacts; Maryland Department of Planning, Projections and State Data Center, December 2020

E.1. Race and Sex

According to 2021 US Census Bureau data, most of the population in Prince George's County was reported to be of a single race (92.5%). Of the total population reporting one race, 59.9% were Black or African American, 12.5% were White, and 3.8% were Asian. The Hispanic or Latino origin population was reported as 20.4%. **Table 13** shows County demographics.

[9] This methodology does not consider any changes in the projected growth rates that may result from incorporating the 2020 Census data into the State's projection methodology.

Table 13: Race Demographics for Prince George's County (2021)

Statistic	Percent	Population
White alone	12.5%	119,011
Black or African American alone	59.9%	572,018
American Indian and Alaska Native percent	0.5%	5,051
Asian alone	3.8%	36,355
Native Hawaiian and Other Pacific Islander alone	0.1%	571
Two or More Races	7.5%	72,039
Hispanic or Latino	20.4%	194,430
White alone, not Hispanic or Latino	11.6%	110,928

Source: US Census Bureau QuickFacts

In Prince George's County, there are more females than males. Females represent 51.7% of the population, or 494,106 people. Male persons make up the remaining 48.3% of the population, or 461,200people. Table 14 shows the gender distribution for Prince George's County.

Table 14: Gender Distribution of Prince George's County (2021)

Statistic	Percent	Population
Female persons	51.7%	494,106
Male persons	48.3%	461,200

Source: US Census Bureau QuickFacts

E.2. Language

About 23.4% of Prince George's County residents were foreign-born according to the 2021 U.S. Census bureau data. In addition, 28.2% of persons aged five or older do not speak English at home. These statistics indicate that there may be a significant portion of the community that may require special consideration when developing hazard reduction and outreach strategies for the community. **Table 15** shows the language statistics for Prince George's County.

Table 15: Language Demographics for Prince George's County (2021)

Statistic	Percent	Population
Foreign born persons	24.0%	228,914
Language other than English spoken at home, persons age 5+ years	28.2%	252,506

Source: US Census Bureau QuickFacts

E.3. Age

The 2021 U.S. Census Bureau data shows that about 6.2% of the population in Prince George's County is under the age of five while approximately 22.1% is under the age of 18. Additionally, approximately 14.5% of the population is age 65 and above. These figures are similar to the Maryland state averages, with the exception of the 65 and over population, being 1.8% below the state average (16.3%). **Table 16** shows the age statistics for Prince George's County.

Table 16: Age Demographics for Prince George's County (2021)

Statistics	Percent	Population
Persons under 5 years	6.2%	59,229
Persons under 18 years	22.1%	210,912
Persons between 18 and 65 years	57.2%	546,563
Persons 65 years and over	14.5%	138,692

Source: US Census Bureau QuickFacts

E.4. Education

Data from the 2021 census estimates shows that about 87.2% of residents in the region graduated from high school and 34.9% received a bachelor's degree or higher. These statistics, coupled with the population characteristics described in the previous paragraphs, are important to inform public outreach programs. The content and delivery of public outreach programs should be consistent with the audiences' needs and ability to understand complex information. **Table 17** summarizes education levels of Prince George's County.

Table 17: Education Levels for Prince George's County (2017-2021)

Statistic	Percent	Population
High school graduate or higher, persons age 25+ years	87.2%	794,000
Bachelor's degree or higher, persons age 25+ years	34.9%	317,782

Source: US Census Bureau QuickFacts

E.5. Income

As of 2021, the average median household income in Prince George's County was approximately $91,124, less than half a percent of the state average according to the 2021 U.S. Census. About 11.5% of residents within Prince George's County live below the poverty line. This rate is relatively close to that of the national rate of 11.6% in 2021 and the state rate of 10.3%. The income levels indicate that some residents in housing at risk may not have the resources available to them to undertake mitigation projects that require self-funding. **Table 18** shows the income data for Prince George's County and the State of Maryland.

Table 18: Income Statistics for Prince George's County and the State of Maryland (2017-2021)

Statistic	Prince George's County	State of Maryland
Median household income (2021 USD)	$91,124	$91,431
Per capita income in past 12 months (2021 USD)	$40,643	$45,915
Persons in poverty	11.5%	10.3%

Source: US Census Bureau QuickFacts

E.6. Housing

As of 2021, there were 362,251 housing units in Prince George's County according to the U.S. Census. When considering mitigation options, special attention should be given to the difference in capabilities between owners and renters. Housing mitigation projects, except for acquisition/demolition or elevation of buildings in extremely high hazard landslide and flood areas. **Table 19** shows the housing statistics for Prince George's County.

Table 19: Housing Demographics for Prince George's County

Statistic	Amount
Housing units, 2021	362,351
Owner-occupied housing unit rate, 2017-2021	62,2%
Median value of owner-occupied housing units, 2017-2021	$337,800
Median selected monthly owner costs -with a mortgage, 2017-2021	$2,212
Median selected monthly owner costs -without a mortgage, 2017-2021	$720
Median gross rent, 2017-2021	$1,593
Building permits, 2021	2,459
Households, 2017-2021	337,366
Persons per household, 2017-2021	2.78

Source: US Census Bureau QuickFacts

F. Business and Labor

The sectors with the most employees in Prince George's County are:

- Educational services
- Federal government
- Transportation and warehousing
- Retail trade
- Information

- Health care
- Accommodation and food services
- Finance and insurance
- Professional services

Table 20 lists the establishments with the highest number of employees in Prince George's County.

Table 20: The Ten Largest Employers in Prince George's County, MD, 2020-2021

Company	Product/Service	Number Employed
University of Maryland System	Higher education	20,250
Joint Base Andrews Naval Air Facility Washington	Military installation	17,500
U.S. Internal Revenue Service	Revenue collection & data processing	4,735
U.S. Census Bureau	Demographic research & analysis	4,605
Washington Metropolitan Area Transit Authority	Public Transportation	3,546
United Parcel Service (UPS)	Mail & package delivery services	3,000
NASA - Goddard Space Flight Center	Space research	3,000
Prince George's Community College	Higher education	2,045
MGM National Harbor	Hotels and Gaming	2,000
Gaylord National Resort Convention Center	Hotels and Conventions	2,000

Source: Maryland Department of Commerce Brief Economic Facts for Prince George's County

Additional "important employers" as provided by Mitigation Advisory Committee members include the following: Giant Food, Version, Safeway, Walmart, Home Depot, McDonalds, Lowe's, Capital One, and Dimension Healthcare System.

The highest paid professions in the county during 2015 average between $75,000 and $90,000 annually:

- Medical
- Architecture and Engineering
- Computer and Mathematical
- Legal
- Management
- Life, Physical, and Social Science

As of 2020, there were a total of 15,716employer establishments and 11,615firms in Prince George's County, according to the U.S. Census. **Table 21** shows business and labor statistics for Prince George's County. As of November 2022, the unemployment rate for Prince George's County was 4.0%, lower than the Maryland State average of 4.3%.

Table 21: Business and Labor Statistics for Prince George's County

Employment	Prince George's County
Total employer establishments, 2020	15,716
Total employment, 2020	274,678
Total annual payroll, 2020 ($1,000)	13,593,029
Total employment, percent change, 2019-2020	+0.4%
Total non-employer establishments, 2019	87,879
All firms, 2017	11,615
Men-owned firms, 2017	6,759
Women-owned firms, 2017	2,490
Minority-owned firms, 2017	4,885
Nonminority-owned firms, 2017	5,269
Veteran-owned firms, 2017	854
Nonveteran-owned firms, 2017	9,385

Source: US Census Bureau QuickFacts

G. Future Growth and Development

Of the many priority policies presented in *Plan 2035,* one compelling strategy is "Policy 1: Direct a majority of projected new residential and employment growth to the Regional Transit District in accordance with the Growth Policy Map and the County's Growth Policy Goals." Table 22 aligns Growth Policy Map Areas with projected new dwelling units and new jobs from 2014 through the *Plan 2035* planning horizon of 2035.

Table 22: Plan2035 Growth Management Goals

Growth Policy Map Areas	Percentage of New Dwelling Units	Projected Dwelling Units	Percentage of New Jobs	Projected New Jobs
Regional Transit District	50%	31,500	50%	57,000
Local Centers	25%	15,750	20%	22,800
Local Transit, Neighborhood & Campus Centers	15%	9,450	15%	17,100
Town Centers	10%	6,300	5%	5,700
Employment Areas	4%	2,520	20%	22,800

Growth Policy Map Areas	Percentage of New Dwelling Units	Projected Dwelling Units	Percentage of New Jobs	Projected New Jobs
Established Communities	20%	12,600	9%	10,260
Future Water & Sewer Service Areas	0%	0	0%	0
Rural and Agricultural Areas	1%	630	1%	1,140
Total County Projected Growth	100%	63,000	100%	114,000

H. Transportation

The County contains a large portion of the Capital Beltway (I-95/I-495). After a decades-long debate, construction began in late 2007 on an east-west toll freeway, the Intercounty Connector (ICC), which extends I-370 in Montgomery County to connect I-270 with I-95 and U.S. 1 in Laurel. The ICC was completed in 2012. Other interstates that service the county include I-95 and I-295. Interstate 95 is a north-south route, being the primary route along the East Coast extending from Maine to Florida. I-295 is an eight-mile spur route connecting I-95/I-495 and Maryland Route 210 near the Potomac River to Interstate 695 and Washington D.C. Route 295 in the Anacostia neighborhood of Washington, DC. Several large U.S. highways also service the region. They include: US 1, US 1 Alternate, US 50, and US 301. There is a total of 38 Maryland state roads that run through Prince George's County.

Fourteen Washington Metro subway system stations are in Prince George's County; four of them are line terminus stations: Greenbelt, New Carrollton, Largo Town Center and Branch Avenue. There has been much debate on the construction of the Purple Line, which will link highly developed areas of both Montgomery and Prince George's Counties. In 2016, the Maryland Transportation Authority selected the Purple Line Transit Partners, a consortium led by Fluor Enterprises, to design and build the Purple Line and to operate and maintain it for 36 years. Construction had been anticipated for late 2016, with service projected to begin in 2022, but a legal challenge had stalled work on the new line. New projections have the Purple Line completed by 2026.

The Maryland Area Rail Commuter Train service has two lines that traverse Prince George's County. The Camden Line runs between Baltimore Camden Station and Washington Union Station and has six Prince George's County stops: Riverdale Park, College Park, Greenbelt, Muirkirk, Laurel, and Laurel Racetrack. The Penn Line runs on the AMTRAK route between Baltimore Penn Station and Washington Union Station. It has three stops in the county: Bowie State, Seabrook, and New Carrollton.

The Washington Metropolitan Area Transit Authority operates Metrobus fixed-route bus service and Metrorail heavy-rail passenger service in and out of the County as well as the regional MetroAccess paratransit system for the handicapped. The Prince George's County Department of Public Works and Transportation also operates TheBus, a County-wide fixed- route bus system, and the Call-A-Bus service for passengers who do not have access to or have difficulty using fixed-route bus service. Call-A-Bus is a demand-response service which generally requires 14-days advance reservations. The County also offers a subsidized taxicab service for elderly and disabled residents called Call-A-Cab in which eligible customers who sign up for the service purchase coupons giving them a 50 percent discount with participating taxicab companies in Prince George's and Montgomery Counties.

The College Park Airport (est. 1909) is the world's oldest continuously operated airport and is home to the adjacent College Park Aviation Museum. Residents also use Ronald Reagan Washington National Airport in Arlington County, Virginia, Baltimore–Washington International Thurgood Marshall Airport near Baltimore, and Dulles International Airport in Dulles, Virginia.

The Central Maryland Regional Transit bus system served the greater Laurel Maryland area and parts of neighboring Ann Arundel, Howard and Prince George's County. It was funded as the Corridor Transportation Corporation in May 1987 by the Baltimore- Washington Corridor Chamber and began its transit operation as "Connect-a-Ride" two years later with nine buses serving five routes. The non-profit organization changed its status and name and rebranded its service in early 2013. During 2014, Howard County initiated its own Regional Transportation Agency of Central Maryland recruiting Anne Arundel County to join. Service through this system will serve citizen in the City of Laurel.

I. Infrastructure

The Public Service Commission of Maryland regulates gas, electric, telephone, water, sewage disposal companies, and telecommunications companies. Infrastructure services are robust in the densely populated areas of the county and within the City of Laurel. Services like solid waste pick up are more limited in the more rural, southern areas of the county.

The following are the providers for the services mentioned:

- **Electric –** Prince George's County is served by five electricity providers: First Energy, Spark Energy, Baltimore Gas and Electric, PEPCO, and SMECO.
- **Natural Gas –** Natural gas is provided to the County by Washington Gas and Baltimore Gas and Electric.
- **Telephone –** Local telephone service is provided throughout Prince George's County by Verizon Communications Inc. and AT&T.
- **Public Water and Wastewater –** In the County, public water and wastewater treatment is provided by the Washington Suburban Sanitary Commission. The City of Bowie has its own water utility, providing water to 50% of Bowie residents. The City of Bowie also has its own waste water treatment plant.
- **Television –** Cable television service is provided within Prince George's County by Verizon FIOS, Comcast, and Xfinity along with satellite and internet providers.
- **Internet –** Internet is provided within Prince George's County by Verizon FIOS, Comcast, and Xfinity.

J. City of Laurel

The City of Laurel features a landscape characterized by change since European settlement. Growth in the City and surrounding areas has rapidly filled in the space between Baltimore and Washington during the past three decades. Even with rapid growth, Laurel is a community with an identity and a particular sense of place. This identity provides a perspective of the past, to which Laurel today and Laurel in the future can relate. Laurel's history defines the character of the City; historic sites in the area provide the opportunity to maintain this character, so that the future as a place of community traces back to early colonial beginnings. Arrowheads, stone hatchets and other artifacts uncovered throughout the City of

Laurel point to Native American habitation long before the colonists. Human civilization occupied the upper reaches of the Patuxent River in and around the site of modern Laurel for more than 250 years.

Charles I of England granted Cecil Calvert the charter establishing the Maryland Colony in 1632. The charter conferred upon Calvert almost complete control over the colony subject to continued allegiance to the crown. In setting up his new colony, Calvert took for his model the existing social economic institutions of England, transferring from the Thames to the Potomac the seventeenth-century manorial system of England.

During World War I, Fort George G. Meade was established as a training camp at its present location. Other federal facilities seeking large tracts of land close to Washington also moved into the area, bringing jobs and business. The Department of Agriculture's Research Center at Beltsville was an important addition to the area's economic base. These new developments did much to break the sense of isolation brought on during the town's industrial decline earlier in the twentieth century.

In 1940 Laurel had a population of fewer than 3,000, but by 1950 the population had risen to nearly 4,500. Between 1950 and 1960 Laurel experienced rapid population growth, with the City's population reaching 8,500 by 1960. This increase was accounted for, in part, by the annexation of land, which extended Laurel's boundary south of Montrose Avenue. The decade of the 1960s brought a more moderate rate of growth, with Laurel's population reaching 10,525 by 1970. With additional annexations to the west and south, the City's population as of July 1, 2014 rose to 24,125. Now, the population of the City of Laurel is estimated at 30,060.[10]

During the 1960s the Laurel mill site and railroad station still delineated the western and eastern extent of the developed portion of Laurel. To the east, a belt of marshland and the Patuxent River defines the City. The City annexed western areas extending a portion of its western boundary to Interstate 95 during 1968. The annexation of property to the east, along MD 197 has evolved into an upper-income housing and office complex, reflecting the rising value Laurel's real estate. The outward expansion of the Washington urbanized area toward Laurel, and Laurel's increasing orientation to Washington has reinforced the southerly direction of growth in the area.

J.1. Location

The City of Laurel is located between the Baltimore and Washington Metropolitan Areas. As these two metropolitan areas have continued to merge, their impact on the City of Laurel has dramatically increased. Located within the northwest corner of Prince George's County, Laurel is also heavily impacted by several other jurisdictions. To the north and northeast are Howard and Anne Arundel Counties respectively with Montgomery County located approximately a mile to the west. Forming a natural boundary to the north is the Patuxent River, which serves as the dividing line between the City of Laurel and the two adjoining counties. A map of the City is shown in **Figure 10**.

[10] United States Census Bureau QuickFacts.
https://www.census.gov/quickfacts/fact/table/laurelcitymaryland,princegeorgescountymaryland/PST045221

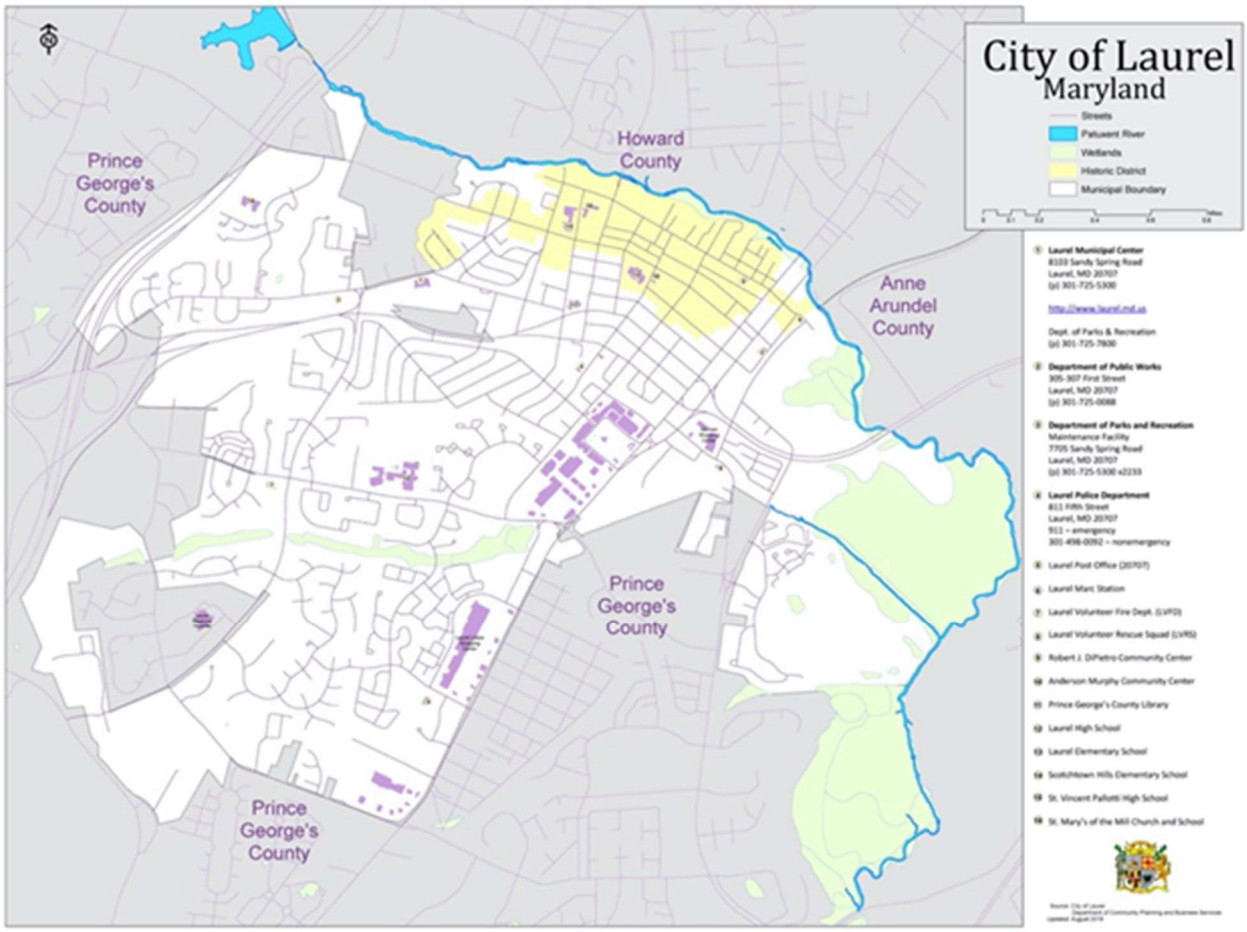


Figure 10. City of Laurel, Maryland

The Baltimore-Washington corridor has continued as the fastest growing region within the State of Maryland. The Baltimore Region consists of Anne Arundel, Baltimore, Carroll, Hartford and Howard Counties and Baltimore City. The Washington Suburban Region includes Frederick, Montgomery and Prince George's Counties. Due to its strategic location and the transportation network serving it, the areas surrounding the City of Laurel have witnessed dramatic growth rates. Since the 1974 Master Plan, the most significant of these growth areas has been in Columbia in Howard County and the US 29 corridor in Montgomery County. The Columbia 14,000-acre planned community located midway between Baltimore and Washington, DC, is approaching build-out and with a 2007 population of almost 100,000 with a planned population of 110,000. Due to development factors including the use of transfer development rights, much of Montgomery County's growth has occurred along US 29, which has been made more accessible to the City of Laurel by improvements to MD 198.

J.2. Community Assets

The following community facilities/assets are vital to the continuity, sustainability, and resilience of the City of Laurel:

- **City Hall Municipal Center** – This facility houses the main City government offices to include the Mayor, City Council, City Administrator, Deputy City Administrator, Emergency Manager, Budget, Finance and Human Resource Office, Fire Marshal & Permit Services Office, Public Information &

Communications Office, Economic & Community Development Office & Information Technology Office and the U.S. Passport Office is within this facility. The City's Emergency Operations Center (EOC) is located within this facility and this facility serves as a backup site for the Laurel Police Department's dispatchers/communications operations.

- **Laurel Police Department** – This facility houses the City's full-service Police Department with a wide variety of police functions, to include prisoner holding cells, dispatch communications office, administrative offices, patrol offices, investigation offices, and special operations offices. This building houses a conference hall which is open to the public and is used to host special events & functions. This facility is used as a storage site for the Laurel Police Department's vehicles, trucks, & specialty vehicles used for both normal & emergency operations. This facility houses several City Continuity of Operations Plan alternate work locations.
- **Laurel Volunteer Fire Department** – This facility is a two-level building with 4 drive-through bays that houses the entire volunteer fire department for the City of Laurel. The upper level of the building is dedicated to the operations branch of the department, while the lower level houses the administrative branch. The facility contains offices, a gym, a kitchen, meeting rooms and bunk rooms for male and female fire fighters.
- **Laurel Volunteer Rescue Squad** – This facility houses a private, nonprofit corporation that provides medical, rescue, and fire services to the Greater Laurel area. The facility houses state of the art heavy rescue equipment, a rescue engine, fire engine, water rescue team gear/equipment, two rescue boats, two Basic Life Support ambulances, and support vehicles. The Laurel Volunteer Rescue Squad utilizes this facility and the contained equipment to respond to over 7,000 calls for help annually.
- **Department of Public Works** – This facility consists of 3 major structures that houses the City's full-service Public Works Department (DPW). Additionally, this site is the storage facility for all the City's fleet of trucks. The City's Office of Emergency Management's emergency response trailers are stored at this facility. Building one houses the main full service DPW offices to include: administrative offices, transportation offices, DPW Emergency Operations Center, vehicle maintenance & repair operations, etc., building two is used to store equipment, materials, and supplies used by DPW to support a wide range of both normal & emergency operations, and building three is DPW's salt dome that stores road salt used during winter weather emergencies and events.
- **Department of Parks and Recreation Operations** – This facility consists of 2 major structures that houses both the City's full-service Parks & Recreation (P&R) operations division and a garage structure for the City's Mobile Command Unit (MCU) and its Rehab/Canteen Vehicle. Building one houses the main full-service P&R offices to include administrative offices, operational offices, emergency support functions office, equipment storage for both normal and emergency operations, etc. This building is used as one of P&R's designated Community Operations Plan sites and building two houses the City's Mobile Command Unit emergency vehicle and Rehab/Canteen emergency vehicle used for local, county and regional emergency incidents and special events.
- **Laurel Armory** – Anderson Murphy Community Center – This Parks & Recreation Department facility consists of a variety of both recreational and office spaces used to support both public and City employee recreational, health & wellness operations. This facility is used as one of the City's designated temporary emergency evacuation shelters during disasters or evacuation operations and this building is used as one of the P&R's designated Community Operations Plan sites. This

site is also the designated Community Operations Plan site for the City's Emergency Relocation Group for Community Operations Plan events.

- **Robert J. DiPietro Community Center** – This Parks & Recreation Department facility consists of a variety of both recreational and office spaces used to support both public and City employee recreational, health & wellness operations. This facility is used as one of the City's designated temporary emergency evacuation shelters during disasters or evacuation operations. This building is used as one of the Parks & Recreation's designated Community Operations Plan sites.
- **Public Schools** – Laurel Elementary School, Scotchtown Hills Elementary School and Laurel High School are all located within the boundaries of the City of Laurel.
- **Gude Mansion** – This historic house is the location of the Parks & Recreation administrative offices. This 3-story is responsible for receiving City business from the public as well as other City departments.

J.3. Land Use and Development Trends

The City of Laurel of Laurel comprises a total of approximately 3,027 acres, or 4.73 square miles per the City of Laurel General Plan, September 26, 2016. This figure represents an increase of 267 acres since 2008 or a total increase of 9.8 percent in area. This increase was due to two Mixed-

Use Transportation annexations; Anderson's Corner, 45 acres and Strittmatter Land, LLC, 62.3 acres. These parcels were "vacant" prior to the annexation.

In 2015, residential land use made up 990 acres (33 percent) of the City's total area. Commercial acreage, which includes retail, office, and service delivery use totaled 433 acres (14 percent).

Public and Institutional land use, which includes active and passive parks and open space, churches, schools, public and quasi-public uses totaled 791 acres (26 percent) while Mixed Use Transportation (M-X-T) use totaled 87 acres (2.9 percent). Industrial land use totaled 154 acres (5 percent) and vacant land totaled 82 acres (2.7 percent). The remaining 490 acres (16 percent) is streets and public rights-of-way.

Nearly 100 percent of the City of Laurel's area is either developed, has received approval for its development, or is in some stage of development approval, as shown in **Table 23**. The City of Laurel land area has increased by 96.58 percent since 1974 through annexation. Since the 1974 General Plan, there has been a significant increase in developed land. This trend is indicative of the suburbanization of the area and the evolving role of the City of Laurel as a full-service core urban area. These figures also reflect land values within the City of Laurel, as well as its strategic location.

One land use type that has increased significantly in both percentage and acreage, is the Public and Institutional Classification. This category includes active and passive parks, open space, churches, schools, public and quasi-public uses. From 2005-2015, the total land devoted to these uses has increased from 475 acres to 791 acres, a 66.5 percent increase. New land development includes Greenview Drive Park, Bear Branch Stream Valley Park at the Greens of Patuxent, and the Stephen P. Turney Recreation Complex. Greenview Drive Park and the Greens of Patuxent are located in the Special Flood Hazard Area, increasing flood vulnerability for new developments in the City of Laurel. Since 2005, land that has been donated to the City of Laurel has been open space, conservation, and forested areas.

Land devoted to transportation, including streets and public rights-of-way, has increased concurrently with development. The 2015 acreage dedicated to transportation use was 490 acres compared to 411 acres in 2005, an 8.45 percent increase.

As land prices have risen, undeveloped land within the City of Laurel has become extremely scarce. There are a few infill lots scattered throughout the City. Residentially zoned land had previously provided the bulk of inventory of vacant land. The 2015 vacant land category includes annexed areas which are now within the City of Laurel since 2005. The City of Laurel's inventory of vacant land has dwindled to a very small proportion, 3 percent.

The analysis of land use presented in the City of Laurel General Plan provides a depiction of current and future trends. Due to robust commercial development and ease of access through various transportation modes, Laurel has become a central business and retail center for areas proximate to the City. Increased commercial office space has leveraged employment opportunities for City residents as well as nearby Prince George's County, Montgomery County, Howard County and City of Baltimore residents. While the growth of Laurel area brings challenges, it has also provided a diverse complement of amenities such as increased public recreation and open space facilities and more diverse retail development. These trends will inform future land use decisions.

There is very little vacant land within the City, but vacant parcels appropriate for infill development are scattered throughout the City. Any sizeable development would require the assemblage of several parcels and the razing of existing structures. To facilitate redevelopment and to create additional economic development opportunities for property, the City Zoning Regulations were amended to create Revitalization Overlay Areas. Revitalization Overlay Areas offer flexibility by offering intensification or increased density of properties in Areas that are targeted for their potential economic development, for superior amenities, land uses, or achieving superior land design.

The Revitalization Overlay to be an alternative form of development designed to facilitate redevelopment and provide for specific land uses and configurations recommended for the continued development and economic health, well-being and stability of city neighborhoods.

The major focus of future growth in proximity to the City is expected to take place in Konterra. A project to build a new Konterra Town Center, a mixed-use shopping, entertainment, residential, and business district is planned to begin construction in the upcoming years. Although the project is in the planning stage, its ultimate build-out over a 20-year period is certain to influence a change in demographics for not only the City but also the region. Specific land use, population and employment projections were not available for the City.

Table 23. City of Laurel Land Use (2015)

Land Use	Total Acres		Percentage of City's Total Acres	
	2005	2015	2005	2015
Single, two and three family	1.092	790	395	26%
Multi-family	319	200	12%	7%
Total Residential	1,411	990	51%	33%
Commercial	327	433	12%	14%
Industrial	136	154	5%	5%
Public & Institutional	475	791	17%	26%
Transportation	411	490	15%	165

Land Use	Total Acres		Percentage of City's Total Acres	
	2005	2015	2005	2015
Mixed-use Transportation	0	87	0%	3%
Vacant	0	82	0%	3%
Total	**2,760**	**3,027**	**100%**	**100%**

Source: City of Laurel General Plan, August 2016

J.4. Population

The population for the City of Laurel is 30,060 as of the 2020 US Census Bureau population estimates. This is a 16 percent increase since the 2010 Census. **Table 24** shows the Population breakdown for the City of Laurel. Projections are not available for the City through the US Census, the Maryland Department of Planning, or in the City of Laurel General Plan.

Table 24. City of Laurel Population

Statistic	Population
Population estimate base, 2020	30,060
Veterans, 2016-2020	1,216

Source: U.S. Census Bureau QuickFacts

J.4.a. Race and Sex

According to the 2020 U.S. Census Bureau data, most of the population in the City of Laurel was reported to be of a single race (83.1 percent). Of the total population reported to be one race, 50.7 percent were Black or African American, 23.5 percent were White, and 8.3 percent were Asian. Only 18.8 percent of the population were reported to be of Hispanic or Latino in origin. **Table 25** shows the demographics for the City of Laurel.

Table 25. City of Laurel Race Demographics

Statistic	Percent of Population	Approximate Population
White alone, percent, 2020	23.5%	7,064
Black or African American alone, percent,20202010	50.7%	15,240
American Indian and Alaska Native alone, percent, 2020	0.6%	180
Asian alone, percent, 2020	8.3%	2,522
Native Hawaiian and Other Pacific Islander alone, percent, 2020	0.0%	0
Two or More Races, percent, 2020	6.6%	1,984
Hispanic or Latino, percent, 2020	18.8%	5,651
White alone, not Hispanic or Latino, percent, 2020	18.4%	5,531

Source: U.S. Census Bureau QuickFacts

According to the U.S. Census Bureau, there are more females than males in the City of Laurel. Female persons account for 52.8 percent of the population, equaling 15,872 persons. Male persons make up the remaining 47.2 percent of the population, equaling 14,188 persons. **Table 26** shows the gender demographics.

Table 26. City of Laurel Gender Distribution

Statistic	Percent of Population	Approximate Population
Female persons, percent, 2010	52.8%	15,872
Male persons, percent, 2010	47.2%	14,188

Source: U.S. Census Bureau QuickFacts

J.4.b. Language

About 28.9 percent of residents in the City of Laurel were foreign-born according to the 2020 U.S. Census bureau data. Census data also reports that 34.3 percent of persons age five and older speak a language other than English at home. These statistics indicate there may be a significant portion of the community that would benefit from developing hazard reduction and outreach strategies in languages other than English. **Table 27** show the language demographics for the City.

Table 27. City of Laurel Language Demographics

Statistic	Percent of Population	Approximate Population
Foreign born persons, percent, 2016-2020	28.9%	8,687
Language other than English spoken at home, percent of persons age 5 years+, 2016-2020	34.3%	10,311

Source: U.S. Census Bureau QuickFacts

J.4.c. Age

The 2020 U.S. Census Bureau data shows that about 7.8 percent of the population in the City of Laurel is under the age of five while approximately 24.7 percent is under the age of 18. Additionally, approximately 10.7 percent of the population is age 65 and above. Population over 65 in the City of Laurel is 5.6 percent lower than Maryland state average of 16.3 percent. The five and under population in the City of Laurel is 2.0 percent greater than the Maryland state average of 5.8 percent. **Table 28** shows age statistics for the City of Laurel.

Table 28. City of Laurel Age Demographics

Statistic	Percent of Population	Approximate Population
Persons under 5 years, percent, 2020	7.8%	2,345
Persons under 18 years, percent, 2020	24.7%	7,425
Persons between 18 and 65 years, percent, 2020	64.6%	19,419
Persons 65 years and over, percent, 2020	10.7%	3,216

Source: U.S. Census Bureau QuickFacts

J.4.d. Education

Data from the 2020 Census estimates shows that about 88.6 percent of residents in the City graduated from high school and 43.8 percent hold bachelor's degrees or higher. These numbers, coupled with the population characteristics described in the previous paragraphs, should be considered when creating public outreach programs. The content and delivery of public outreach programs should be consistent with the audiences' education level. **Table 29** shows the education statistics for the City of Laurel.

Table 29. City of Laurel Education Statistics

Statistic	Percent of Population	Approximate Population
High school graduate or higher, percent of persons age 25 years+, 2016-2020	88.6%	26,633
Bachelor's degree or higher, percent of persons age 25 years+, 2016-2020	43.8%	13,166

Source: U.S. Census Bureau QuickFacts

These statistics are similar to the Maryland State percentages of 90.6 percent of persons graduated from high school and 40.9 percent holding bachelor's degrees or higher.

J.4.e. Income

As of 2020, the average median household income in the City of Laurel was approximately $80,255, which is approximately 7.8 percent less than the state average according to the 2020 U.S. Census estimates. About 9.7 percent of residents within the City of Laurel live below the poverty line. This rate is slightly below the state rate of 10.3 percent. These figures indicate that some families will not have available resources for property mitigation projects requiring self-funding. **Table 30** compares the income statistics for the City of Laurel and the State of Maryland.

Table 30. City of Laurel Income Statistics vs. State of Maryland

Statistic	City of Laurel	State of Maryland
Median household income (in 2015 dollars), 20112015	$80,255	$87,063
Per capita income in past 12 months (in 2020 dollars), 2016-2020	$38,582	$43,352
Persons in poverty, percent	9.7%	10.3%

Source: U.S. Census Bureau QuickFacts

J.4.f. Housing

According to the 2020 U.S. Census, there were 9,647 households in the City of Laurel. When considering mitigation options, special attention should be given to the difference in capabilities between owners and renters. **Table 31** shows the housing statistics for the City of Laurel.

Table 31. City of Laurel Housing Statistics

Statistic	Percent of Population
Owner-occupied housing unit rate, 2016-2020	43.7%
Median value of owner-occupied housing units, 2016-2020	$281.500
Median selected monthly owner costs -with a mortgage, 2016-2020	$1,976
Median selected monthly owner costs -without a mortgage, 2016-2020	$677
Median gross rent, 2016-2020	$1,611
Households, 2016-2020	9,647
Persons per household, 2016-2020	2.65
Living in same house 1 year ago, percent of persons age 1 year+, 2016-2020	78.9%

Source: U.S. Census Bureau QuickFacts

J.5. Business and Labor

The sectors with the most employees in the City of Laurel are:

- Retail trade
- Information
- Health care
- Accommodation and food services
- Finance and insurance
- Professional services
- Community services

Table 32 lists the establishments with the top employers in the City of Laurel.

Table 32. City of Laurel Top Employers (2017)

Company	Product / Service	Total Employed
Booz Allen Hamilton	Management Consulting	825
Safeway	Groceries	716
Domino's	Restaurant	658
Marriott International, Inc.	Hotels & Motels	543
Johns Hopkins University	Medical services	497
Leidos	Research & analysis	471
Harris Teeter	Groceries	436
Y of Central Maryland	Community Services	406
CACI	Information	364
PETSMART	Retail Trade	348

Source: SimplyHired for Laurel, Maryland

As of 2017, there were a total of 760 firms in the City of Laurel, according to the U.S. Census. **Table 33** breaks down business and labor statistics for the City of Laurel. As of September 2022, the unemployment rate for the City of Laurel was 4.8 percent which is higher than the state average of 4.0 percent.

Table 33. City of Laurel Business and Labor Statistics (2017)

Company	Number
All firms	760
Men-owned firms	362
Women-owned firms	180
Minority-owned firms	208
Nonminority-owned firms	405
Veteran-owned firms	41
Nonveteran-owned firms	571

Source: U.S. Census Bureau QuickFacts

J.6. Future Growth and Development

The City of Laurel's location in one of the region's fastest growing areas suggests that the City's population will continue to grow. However, without additional annexations, further growth will be limited to development in existing residential or open space areas and redevelopment.

Future population characteristics can be expected to follow general state and country-wide trends.. With the general decline in birth rates as well as the continued maturing of the population born during the 1950s and 1960s, it is expected that the average age of Laurel residents could rise. This trend creates implications for a variety of public services to support the elderly, including adequate and affordable housing and accessible public transportation.

Trends influencing household size will also continue as an important factor for future land use decisions in the City of Laurel. Census numbers for Prince George's County shows a continued drop in household size from 2.89 in 1980, 2.76 in 1990, 2.74 in 2000, but an increase to 2.78 in 2010, and 2.83 in 2020. Similarly, the City of Laurel household size was 2.4 in 1980, 2.25 in 1990, 2.22 in 2000, 2.37 in 2010, and an increase to 2.65 in 2020. Factors influencing household size include choices in lifestyle, housing preferences, the number of two-income families and the available housing stock. One factor that may partially offset the observed trend in drop in household size is the development of new housing. The declining average household size reflects regional and national trends, which are the result of an aging population and declining birth rates. However, with an increased amount of younger families moving into the City, there will be a corresponding increase in the City's population of 14 years old or younger within the next several years. As these families grow, it will be important to provide a sufficiently wide choice of housing options.

Additional population trends which may be expected to continue to grow in the future include population with more education experience and demand for professionals with higher education level. Other anticipated trends include an increase in the number of two-income families and a relative increase in household and per-capita income, which will be necessary to keep pace with the higher income housing being built within the City.

J.7. Transportation

Laurel is traversed from north to south by U.S. Route 1 (US 1), which links Key West, Florida with the Canada–U.S. border in Maine. On the west, the city is bordered by Interstate 95, and beyond the eastern border lies the Baltimore-Washington Parkway. Crossing all of these highways is the east-west artery Route 198 (MD 198), which intersects with US 1 in the heart of Laurel. Other major state roads in Laurel are MD 216, which connects the city with southern Howard County, and MD 197, which runs from Laurel to Bowie. The eastern terminus of MD 200 (the Intercounty Connector) lies just south of the city limits and connects Laurel with Gaithersburg.

Two Maryland Area Rail Commuter train stations on the Camden Line to Baltimore and Washington, D.C. are located in Laurel: Laurel Station and Laurel Racetrack Station, the latter with minimal service. Laurel Station is a particularly notable example of the stations designed by E. Francis Baldwin for the Baltimore and Ohio Railroad.

The Washington Metropolitan Area Transit Authority Metrobus service provides four lines into Laurel, and local Connect-a-Ride and Howard Transit bus service is available. Several taxicab and shuttle services also support the region.

Suburban Airport, a general aviation airport, is located on Brock Bridge Road, nearby in Anne Arundel County border. This airport provides general aviation access for medivac helicopters, flight training, business travelers, and serves as a relief airport for light traffic into and out of the two major regional airports. Baltimore-Washington International Thurgood Marshall Airport is within 15 miles and Ronald Reagan Washington National Airport is within 25 miles of Laurel.

J.8. Infrastructure

The Public Service Commission of Maryland regulates gas, electric, telephone, water, sewage disposal companies, and telecommunications companies.

The following is provider information for these services:

- **Natural Gas** – Natural gas is provided to the City of Laurel by Washington Gas and Baltimore Gas and Electric.
- **Telephone** – Local telephone service is provided throughout the City of Laurel by Verizon Communications Inc. and AT&T.
- **Public Water and Wastewater** – In the City, public water and wastewater treatment is provided by the Washington Suburban Sanitary Commission.
- **Television** – Cable television service is provided within the City of Laurel by Verizon FIOS, Comcast, and Xfinity along with satellite and internet providers.
- **Internet** – Internet is provided within the City of Laurel by Verizon FIOS, Comcast, and Xfinity.

Chapter 4. Risk Assessment

This chapter provides an overview of the natural hazards that have been identified as potentially affecting Prince George's County and the City of Laurel and an assessment of their risks to the planning area.

A. Introduction

The purpose of the hazard risk assessment is to provide a County-wide overview of how various hazards impact Prince George's County and the City of Laurel. The risk assessment uses an all-natural-hazards identification, classification, and vulnerability indexing process to ensure that the hazard analysis is comprehensive. The purpose of a risk assessment is to characterize hazards that threaten the County and City's people, property, environment, and critical infrastructure, thus enabling the Mitigation Advisory Committee to develop a comprehensive and effective Mitigation Strategy that is designed to reduce risks of identified hazards. While new hazards are unlikely to emerge, evaluation tools and processes will evolve, and hazard mitigation priorities will likely change in future risk assessment revisions.

> **Risk**, for the purpose of hazard mitigation planning, is the potential for damage or loss created by the interaction of natural hazards with assets, such as buildings, infrastructure, or natural and cultural resources.[11]

A natural hazard is defined as an environmental phenomenon that has the potential to impact society and the human environment. It has the potential to cause harm to people, property and infrastructure damage, agricultural losses, damage to natural resources, business interruptions, or other types of harm or loss. In comparison, a manmade hazard includes any disastrous event caused directly and principally by one or more identifiable deliberate or negligent human actions. Technological hazards, a hazard originating from technological or industrial conditions, including accidents, dangerous procedures, or failures, are also considered a type of manmade hazard. Other than the consideration of dam- and levee-related hazards, this plan only addresses natural hazards.

Identifying the hazard risks to a community is critical when determining how to allocate finite resources to carry out appropriate mitigation actions. The risk assessment involves the following steps:

1. **Identify hazards** that can affect Prince George's County and the City of Laurel.
2. **Assess the risk** of each identified hazard with respect to:
    a. Location: where it might affect the planning area,
    b. Extent: its potential magnitude,
    c. Previous occurrences: how often events have happened in the past,
    d. Probability of future events: how likely they are to occur in the future,
    e. Vulnerability: what parts of the community are most likely to be affected, and
    f. Impacts: the potential consequences.

[11] FEMA Local Mitigation Planning Policy Guide (April 19, 2022)

With both this process and the organizational structure of Maryland's *2021 State Hazard Mitigation Plan* in mind, each hazard section is outlined according to the topics below.

Description

General definitions and characteristics of hazards are included in the risk assessment to provide a common understanding as to what the event is and why it is of enough concern to make it a hazard in Prince George's County and the City of Laurel.

Location

Hazards occurring in Prince George's County range from regional to localized with some specifically associated with the geologic attributes of a localized area. The geographic extent for each hazard is presented in the text and supported by tables or maps where available and appropriate.

Extent (Magnitude/Strength)

Assessment of severity is expressed in terms of consequence of impacts, such as injuries and fatalities; damage to personal property, infrastructure, state or local critical assets, and the environment; negative effects on the economy; and the degree and extent to which the hazard affects the ability to provide essential services.

Previous Occurrences

Every District in the County has experienced the adverse effects of hazards. Descriptions of previous occurrences, or known hazard incidents, are included to help frame the extent of the hazard's impact on areas of Prince George's County. In some cases, detailed accounts are provided for significant historic hazard events. Occurrences for every hazard from the 2017 Plan were reviewed and updated. Detailed historic events and associated deaths, injuries, and total damage by county are included for some hazards.

Probability of Future Events (Changing Climate Conditions)

The likelihood of a hazard occurring again looks toward past frequency to assist in determining the probability of future occurrence. For some hazards, the future probability of events is further supported by assumptions that favorable environmental conditions resulting in a hazard event will continue to develop or persist.

FEMA now requires that states evaluate changes to climate conditions that may affect and influence their long-term vulnerability. These changes to climate conditions are described as "climate change" or "future conditions" throughout this Plan. The impact of climate change on location, extent, intensity, frequency, and duration is analyzed for each climate-related natural hazard.

Vulnerability and Impact

Specific characteristics of local jurisdictions may make them more susceptible to damage from a given hazard. It is important to understand the hazards that can have the biggest impact on a jurisdiction and understand the components of vulnerability (people, property, economy, environment, critical infrastructure, etc.) and potential losses.

A.1. Summary of Changes

This plan update refreshes and expands upon content from the 2017 Hazard Identification and Risk Assessment Section. As part of the update, the following changes were made to the risk assessment chapter:

- Changed the chapter title from "Hazard Identification, Risk Assessment, and Vulnerability Analysis" to "Risk Assessment."
- The "Land Movement" section was renamed to "Landslide."
- The "Dam Failure" and "Levee Failure" sections were combined into the "Dam and Levee Failure" section.
- The risk assessment elements from the City of Laurel Flood Addendum were incorporated into the "Riverine Flood" section.
- Incorporated climate impacts (climate model projections) on the future probability of hazards.
- Considered social vulnerability, future population (U.S. Census data modified with annualized growth rates), and future development (Prince George's County Plan 2035) in hazard exposure analyses.
- Completed FEMA Hazus-MH v5.1(also referred to as "Hazus") analyses for the flooding, coastal flooding, hurricane, and earthquake hazard sections. Hazus was not used in previous plans.
- Updated NCEI Historic Event tables for every hazard.
- Created new maps and analyses for dam and levee inundation zones.

In addition, each hazard section was reformatted to improve clarity and increase alignment with Maryland's *2021 State Hazard Mitigation Plan* and the FEMA *Local Mitigation Planning Policy Guide* (April 19, 2022).

A.2. Hazard Identification

Prince George's County and the City of Laurel are exposed to a wide array of hazards that can impact people, property, and the environment. The hazards included in the 2023 plan were identified through the evaluation of:

- Previous versions of the hazard mitigation plan,
- Maryland's *2021 State Hazard Mitigation* Plan,
- Presidentially declared disasters encompassing Prince George's County, and
- National Risk Index data for Prince George's County.

Table 34 shows the identified hazards assessed in this plan (in alphabetical order) and the general descriptions and definitions of each.

Table 34. Descriptions of identified hazards

Hazard	Description
Coastal Flood	Coastal Flooding is when water inundates or covers normally dry coastal land as a result of high or rising tides or storm surges.[12]
Dam and Levee Failure	Dam and levee failure are characterized by a sudden, rapid, and uncontrolled release of water from the containment of a dam or levee, causing nearby land to flood.[13]
Drought	A Drought is a deficiency of precipitation over an extended period resulting in a water shortage.[14]
Earthquake	An Earthquake is a shaking of the earth's surface by energy waves emitted by slowly moving tectonic plates overcoming friction with one another underneath the earth's surface.[15]
Extreme Cold	Extreme cold is characterized by prolonged periods of unusually low temperatures, generally accompanied by high winds.[16]
Extreme Heat	Extreme heat is characterized by prolonged periods of unusually high temperatures, generally accompanied by high humidity.[17]
High Wind	High wind is sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally/regionally defined), on a widespread or localized basis.[18]
Hurricane/Tropical Storm	A Hurricane is a tropical cyclone or localized, low-pressure weather system that has organized thunderstorms but no front (a boundary separating two air masses of different densities) and maximum sustained winds of at least 74 mph.[19]
Landslide	A Landslide is the movement of a mass of rock, debris, or earth down a slope.[20]

[12] FEMA National Risk Index. Coastal Flooding. https://hazards.fema.gov/nri/coastal-flooding
[13] FEMA. Guidance for Flood Risk Analysis and Mapping. Dams/Reservoirs and Non-Dam Features. November 2019. https://www.fema.gov/sites/default/files/2020-02/Dams_Reservoirs_and_Non_Dam_Features_Guidance_Nov_2019.pdf
[14] FEMA National Risk Index. Drought. https://hazards.fema.gov/nri/drought
[15] FEMA National Risk Index. Earthquake. https://hazards.fema.gov/nri/earthquake
[16] CDC. Extreme Cold. https://www.cdc.gov/disasters/winter/pdf/extreme-cold-guide.pdf
[17] NWS. Heat. https://www.weather.gov/bgm/heat
[18] NOAA NHC. Glossary of NHC Terms. https://www.nhc.noaa.gov/aboutgloss.shtml#:~:text=High%20Wind%20Warning%3A,expected%20or%20observed%20over%20land
19 FEMA National Risk Index. Hurricane. https://hazards.fema.gov/nri/hurricane
[20] FEMA National Risk Index. Landslide. https://hazards.fema.gov/nri/landslide

Hazard	Description
Riverine Flood	Riverine Flooding is when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land.[21]
Severe Storm (Flood-Related)	Flood-related severe storms can cause heavy rainfall over an area. Flash floods can be the product of heavy localized precipitation in a short time period.[22]
Severe Storm (Wind-Related)	Wind-related severe storms are associated with the presence of strong winds, hail, and lightning. Wind related to severe storms typically originates from thunderstorms.[23]
Sinkhole	A sinkhole is a depression in the ground that has no natural external surface drainage.[24]
Tornado	A Tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground and is visible only if it forms a condensation funnel made up of water droplets, dust, and debris.[25]
Wildfire	A Wildfire is an unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.[26]
Winter Storm	Winter Weather consists of winter storm events in which the main types of precipitation are snow, sleet, or freezing rain.[27]

The following hazards are characterized as uniformly affecting the entire County, including the City of Laurel: severe storm, high winds, tornado, winter storm, earthquake, and drought. Wildfire occurrence is relatively minor in Laurel because there are no significant agricultural areas in or around the City, and forested and open areas largely are confined to the floodplain and open space along the Patuxent River on the east and Fairland Regional Park on the west side of the City.

[21] FEMA National Risk Index. Riverine Flooding. https://hazards.fema.gov/nri/riverine-flooding
[22] Storm Data Preparation, NOAA National Weather Service Instruction 10-1605,Operations and Services Performance, NWSPD 10-16. March 23, 2016. Available at: https://www.ncdc.noaa.gov/stormevents/pd01016005curr.pdf
[23] FEMA National Risk Index. Strong Wind. https://hazards.fema.gov/nri/strong-wind
[24] United States Geological Survey. What is a sinkhole? https://www.usgs.gov/faqs/what-sinkhole
[25] FEMA National Risk Index. Tornado. https://hazards.fema.gov/nri/tornado
[26] FEMA National Risk Index. Wildfire. https://hazards.fema.gov/nri/wildfire
[27] FEMA National Risk Index. Winter Weather. https://hazards.fema.gov/nri/winter-weather

A.3. Risk Assessment

Once the hazards for Prince George's County and the City of Laurel were identified for assessment, the location, extent, and previous events were analyzed to help determine the probability of future events, vulnerability, and potential impacts. Together, these help illustrate overall risk. The data and analyses used for the risk assessment are described below.

A.3.a. Hazard Data

The hazard assessment used several data sources, including:

- National Centers for Environmental Information Storm Events Database
- FEMA Presidential Disaster Declarations Summary Dataset
- CDC Social Vulnerability Index 2020 data
- FEMA Hazus-MH v5.1
- Climate Mapping for Resilience and Adaptation Assessment Tool
- Prince George's County GIS Open Data Portal
- Dam and levee location and inundation zone GIS data
- County critical facilities GIS data

Select data sources are further described below.

A.3.a.1. Presidential Disaster Declarations

FEMA maintains the Disaster Declarations Summary dataset.[28] The first disaster declared in the dataset was in 1953, and it has been updated on a regular basis into 2022. Events are categorized as "major disaster," "emergency," and "fire management" assistance declarations per the Robert T. Stafford Disaster Recovery Act and related Department of Homeland Security regulations.[29] For an event to be declared a disaster by FEMA, the Governor of Maryland must first declare a state of emergency and then formally request from the President that the Federal government respond to the disaster because the impacted local governments and the State lack adequate resources to respond and recover. **Table 35** shows the FEMA Disaster Declarations Summary data for events declared for Prince George's County, Maryland from 1953 to October 2022. Twelve Major Disaster Declarations were issued since 1971 and six Emergency Declarations were issued since 1993, totaling 18 declarations. These declarations are made at the county level, meaning the City of Laurel is included in these declarations.

Table 35. Declared Disasters for Prince George's County, Maryland (1953-2022)

Disaster Number	Disaster Type	Incident Type (Named Storm)	Incident Begin Date	Program(s) Declared			
				IH	IA	PA	HMGP
3100	Emergency	Snow	13-Mar-1993	-	-	Yes	Yes

[28] OpenFEMA Dataset: Disaster Declarations Summaries - v2. https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2

[29] The Individual and Households Program (IHP) provides assistance to individuals who experienced property loss or damage due to disasters, the Public Assistance Program (PA) supports the repair or replacement of damaged public infrastructure, the Hazard Mitigation Grant Program (HMGP) is available for eligible mitigation projects after the disaster, and HMGP Post Fire is available for eligible mitigation projects after a fire management assistance declaration.

Disaster Number	Disaster Type	Incident Type (Named Storm)	Incident Begin Date	Program(s) Declared			
				IH	IA	PA	HMGP
1016	Major Disaster	Snow	8-Feb-1994	-	-	Yes	Yes
1081	Major Disaster	Snow/Blizzard	6-Jan-1996	-	-	Yes	Yes
1324	Major Disaster	Severe/Winter Storm(s)	25-Jan-2000	-	-	Yes	Yes
3179	Emergency	Severe/Winter Storm(s)	14-Feb-2003	-	-	Yes	-
1492	Major Disaster	Hurricane/Flood (Isabel)	18-Sep-2003	Yes	Yes	Yes	Yes
3251	Emergency	Hurricane/Flood (Katrina)*	29-Aug-2005	-	-	Yes	-
1910	Major Disaster	Snow/Blizzard	5-Feb-2010	-	-	Yes	Yes
3335	Emergency	Hurricane/Flood (Lee)	26-Aug-2011	-	-	Yes	-
4038	Major Disaster	Flood (Lee)	6-Sep-2011	-	-	Yes	Yes
4091	Major Disaster	Hurricane/Flood (Sandy)	26-Oct-2012	Yes	-	Yes	Yes
3349	Emergency	Hurricane/Flood (Sandy)	26-Oct-2012	-	-	Yes	-

Disaster Number	Disaster Type	Incident Type (Named Storm)	Incident Begin Date	Program(s) Declared			
				IH	IA	PA	HMGP
4261	Major Disaster	Snow/Blizzard	22-Jan-2016	-	-	Yes	Yes
3430	Emergency	Biological	20-Jan-2020	-	-	Yes	-
4491	Major Disaster	Biological	20-Jan-2020	Yes	-	Yes	Yes

*Emergency Declaration 3251 was intended to assist Hurricane Katrina evacuees.

A.3.a.2. Building Data

For flooding, earthquake, and hurricane hazards, replacement building values provided by FEMA Hazus were used in scenario (loss estimation) analyses for those hazards. A vulnerability analysis is meant to approximate damages based on exposure and hazard sensitivity. In the case of a real hazard event, the damages may be more or less than what is calculated in the vulnerability analysis sections. For hazard exposure analyses that did not use Hazus data, building footprints and property tax assessment data provided by the County were used to determine value.

Exposure Analysis

An exposure analysis is beneficial in understanding which and how many assets are exposed to hazards with defined hazard areas and the potential damages they may experience. It may result in an overestimate of risk as it does not take into account factors such as a building's elevation, building code adherence, or age, among other factors.

To assess Prince George's County's vulnerability, an inventory of its structures and critical facilities was completed. Critical facilities are those that warrant special attention in preparing for a disaster and that are vital in maintaining community function. Prince George's County has provided an inventory of critical facilities that include emergency services facilities, healthcare, water and wastewater services, and other critical facilities. **Table 36** below shows each critical facility type and general location. **Figure 11** shows the location of each critical facility located in Prince George's County and the City of Laurel.

Table 36. Number of Critical Facilities by Type in Prince George's County and the City of Laurel

Facility Type	Prince George's County Districts 1-9	City of Laurel
Commercial Facilities	109	6
Defense Industrial Base	1	--
Emergency Services	74	4
Government Facilities	377	9
Transportation	41	1
Energy	14	1
Water and Wastewater Systems	11	--
Healthcare and Public Health	23	1
Food and Agriculture	17	--
Chemical	11	--
Communications	3	2
Information Technology	2	--
Nuclear	2	--
Total	**685**	**24**

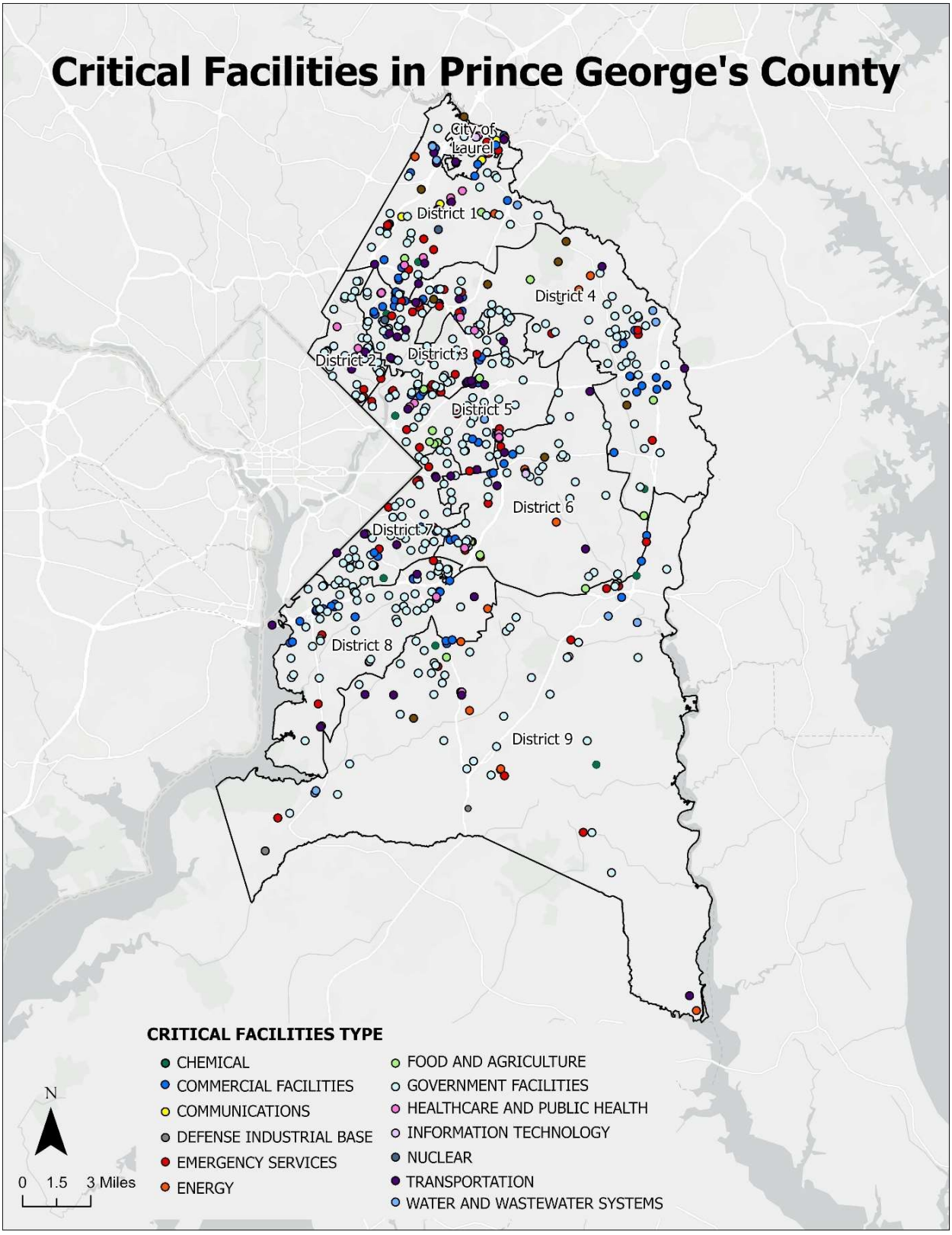


Figure 11. Critical Facilities Location by Type in Prince George's County

A.3.a.3. Climate Data

The Risk Assessment considers the impact of climate change on the hazards outlined in the chapter. The *Fourth National Climate Assessment* (NCA4) published in 2018 summarizes the impacts of climate change on the United States, now and in the future. Key climate data from the NCA4 "Northeast" chapter is included in this section. Additionally, the Climate Mapping for Resilience and Adaptation tool and International Panel on Climate Change Sixth Assessment Report are used for climate-related hazard information and climate projections.

A.3.a.4. Social Vulnerability Data

The Center for Disease Control's (CDC) Social Vulnerability Index as of October 2022 was used to determine areas of social vulnerability within Prince George's County and the City of Laurel. The Social Vulnerability Index uses U.S. Census data to determine vulnerability for four related themes, which when combined create an overall Social Vulnerability Index ranking.

A.3.b. Historical Analysis

The National Centers for Environmental Information (NCEI) Storm Events Database was used to assess hazards affecting Prince George's County and the City of Laurel by annualizing hazard events, damage figures, injuries, and deaths. The data was pulled when events from January 1950 to August 2022 were available, but not all hazards have event data that was collected for the entire period of record. All NCEI monetary figures have been adjusted for inflation to 2022 US Dollars (USD).

Historical hazard event data allows for an estimation of future probability for those events. However, future event probability based on historical occurrences does not account for climate impacts, which can increase or decrease an event's probability. When climate projection data is available, climate impacts are accounted for in each hazard's profile.

Probability

Probability is the likelihood that a hazard event will occur. Low probability was defined as less than 1.25 annualized events per year, while high probability was defined as greater than 4.5 annualized events per year. Medium probability is between low and high probability.

While NCEI data was used to perform historical analyses, it should be noted that only storm and other significant weather phenomenon occurrences that (1) had a sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce; (2) were unusual or noteworthy in the media; or (3) set records and occurred in conjunction with another event, are included in the database. This means that not all events that have affected Prince George's County may be captured in the data and associated analyses. Narrative descriptions of events are included in each hazard section and **Appendix C** to further capture historical conditions.

Table 37 shows the hazards assessed in this plan and their associated hazard(s) from the NCEI database. Note that some hazards, such as severe storms and tropical storms, may be listed in more than one hazard-related category since they include flood- and wind-related hazard elements.

Table 37. Hazards identified in the 2023 HMP and their associated National Centers for Environmental Information hazards

Identified Hazard	Associated NCEI Database Hazard(s)
Riverine Flood	Flood
Coastal Flood	Coastal Flood
	Tropical Storm
Severe Storm (Flood-Related)	Flash Flood
	Heavy Rain
Dam and Levee Failure	--
Tornado	Tornado
Severe Storm (Wind-Related)	Thunderstorm Wind
	Lightning
	Hail
High Wind	High Wind
	Strong Wind
Hurricane/Tropical Storm (Wind-Related)	Hurricane
	Tropical Storm
Winter Storm	Blizzard
	Heavy Snow
	Winter Storm
	Winter Weather
	Ice Storm
Wildfire	Wildfire
Drought	Drought
Earthquake	--
Landslide	--
Sinkhole	--
Extreme Heat	Heat
	Excessive Heat

Identified Hazard	Associated NCEI Database Hazard(s)
Extreme Cold	Cold/Wind Chill
	Extreme Cold/Wind Chill

A.3.c. Exposure Analysis

Maps are included throughout the chapter to illustrate hazard events that can be visualized spatially. Data for hurricane and tropical storm tracks were found on the National Oceanic and Atmospheric Administration International Best Track Archive for Climate Stewardship website and used to create historical path maps. FEMA Digital Flood Insurance Rate Map data was used to depict the Special Flood Hazard Area within the County. Wildfire location data and the Community Wildfire Protection Plan (CWPP) Area were provided by the Forest Service Research Data Archive and the Community Wildfire Protection Plan, respectively. Geologic data was acquired through the United States Geological Survey for earthquakes, Maryland Geological Survey and County 311 data for sinkholes, and Prince George's County for land movement.

Dam and levee inundation area shapefiles were obtained from Prince George's County, the City of Laurel, and the City of Bowie to map potential areas of concern. Associated dam inundation zone exposure values were calculated using building footprints and tax assessment structure value data acquired from the County's Open GIS platform.

The critical facilities exposure analysis was completed using the County's critical facilities GIS layer and spatial hazard extents, with a quarter of a mile buffer around the spatial hazard extent. Dam and levee failure, wildfire, sinkholes, and flooding extents were each intersected with the County's provided critical facilities layers to determine exposure. A full list of critical facilities and the spatial hazard areas they are exposed to can be found in **Appendix D**.

A.3.d. Scenario (Loss Estimation) Analysis

FEMA Hazus software was used to determine the potential losses from future hazard events. Hazus is a computer modeling tool that enables the use of U.S. Census data to determine risk exposure from floods, coastal wind events, and earthquakes. The Hazus Flood Model was used to calculate physical damages and economic losses due to coastal and riverine flooding. Hazus utilized flood depth grids (developed by Dewberry) and functions that relate the depth and type of flooding to the degree of damage for various categories of buildings. The Hazus Hurricane Model was used to estimate physical and economic damage to buildings due to wind and windborne debris. Wind hazard data in Hazus are generated at the census tract level. The model considers peak gusts, terrain roughness, and tree coverage data for incoming hurricanes, historic storms, or probabilistic hazards. Finally, the Hazus Earthquake model was used to evaluate the probability of damage to buildings and infrastructure according to ground shaking data from the United States Geological Survey Shakemap website.

A.3.e. Social Vulnerability Analysis

Prince George's County is made up of diverse communities with varying degrees of social vulnerability. FEMA defines social vulnerability as the potential for loss within an individual or social group, recognizing that some characteristics influence an individual's or group's ability to prepare, respond, cope or recover from an event. These characteristics can overlap within populations to create heightened vulnerability, which may be compounded by infrastructure deficiencies within communities and historic or existing discriminatory government policies.[30]

Social vulnerability can influence a community's ability to mitigate and recover from hazard events. The County is considering social vulnerability factors in the risk assessment chapter to identify communities that should be a priority for implementing mitigation projects and actions before a disaster. As seen in **Figure 12**, The Centers for Disease Control and the Agency for Toxic Substances and Disease Registry

[30] FEMA Local Mitigation Planning Policy Guide. https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf

created a Social Vulnerability Index using U.S. Census data to determine vulnerability on a census tract level. Each tract is ranked by 15 social factors that are grouped into four related themes, which when combined, create a census tract's overall Social Vulnerability Index ranking.

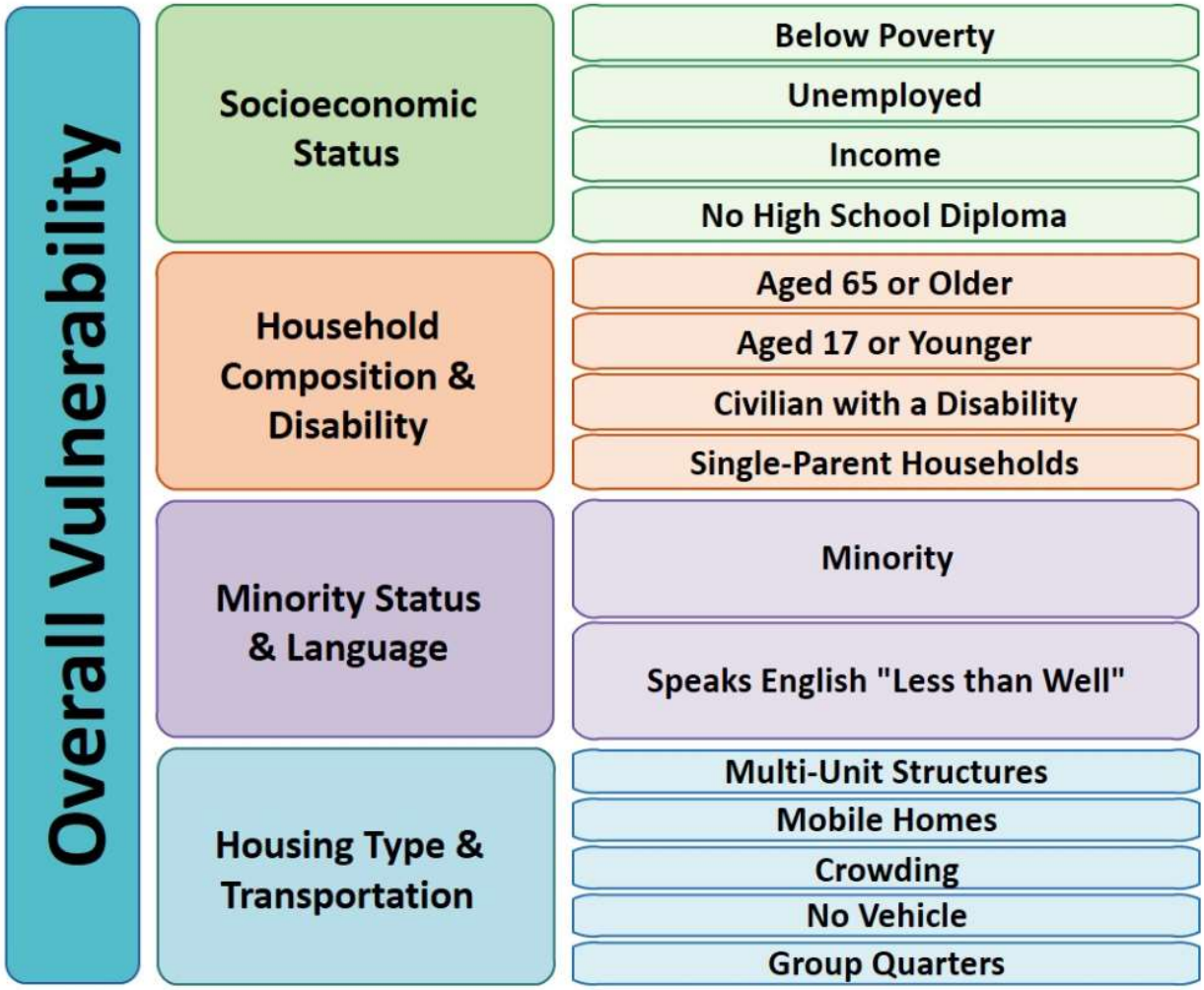


Figure 12. Variables used in Social Vulnerability Index scoring (source: CDC/ATSDR)

According to 2020 Social Vulnerability Index data (as updated in October 2022), Prince George's County has an overall social vulnerability score of 0.81, which is considered a high level of vulnerability. The county has a higher level of social vulnerability that each of the counties it shares a border with, as shown in **Figure 13**. Within the County, census tracts with high social vulnerability scores of 0.75 or higher are located in Districts 1, 2, 3, 5, 6, 7, 8, and the City of Laurel, as shown in **Figure 14**. These areas with high social vulnerability may need support in preparing for hazards and responding to disasters.

Throughout the hazard sections in this chapter, Social Vulnerability Index scores are shown on maps alongside hazard areas to illustrate the overlap between exposure and vulnerability. This analysis helps determine areas that may have the highest overall risk of certain hazards.

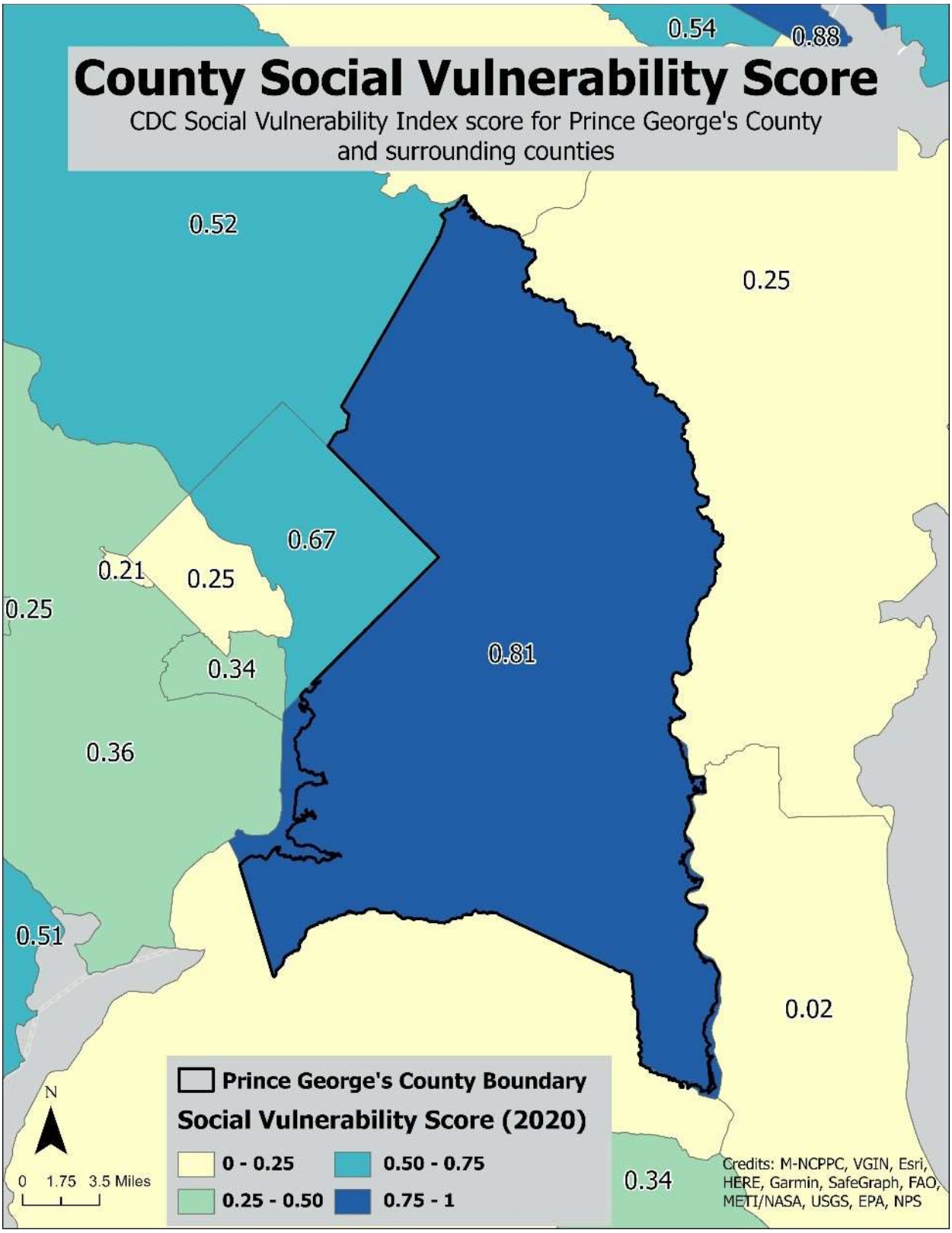


Figure 13. Social Vulnerability Score for Prince George's County and Surrounding Counties

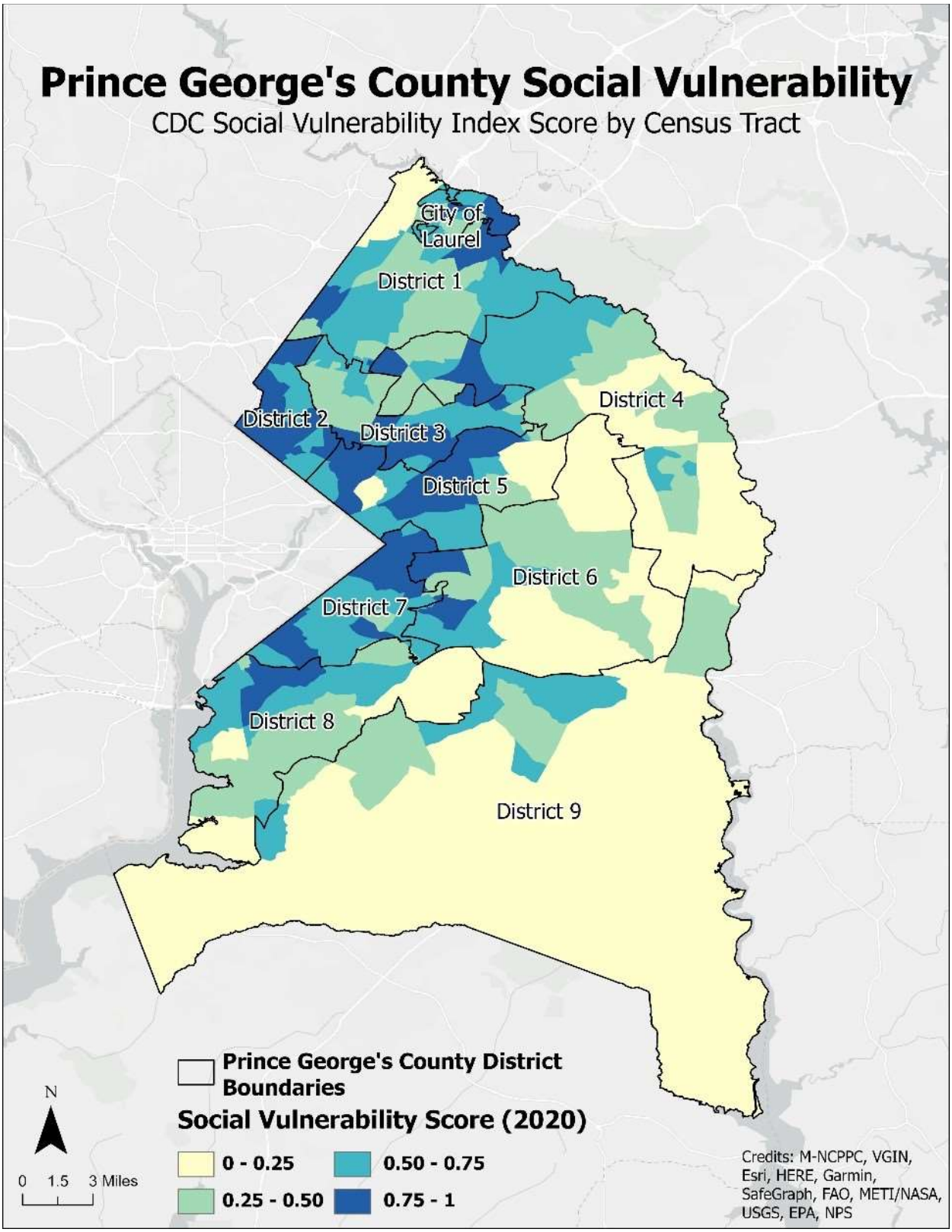


Figure 14. Social Vulnerability Score by Census Tract in Prince George's County

A.3.f. Future Conditions Analysis: Climate

Our world is constantly changing, and our climate is no different. Planning for hazard mitigation involves looking at both historical observations and future projections. Together, they help paint a more complete picture of what actions our communities need to take to become more resilient.

The number of billion-dollar weather and climate disasters is increasing in the United States.[31] This trend reflects the compounded effects of a changing climate along with vulnerable communities and infrastructure exposed to hazards. Understanding the current and future risks face is fundamental to building community resilience in Prince George's County.

Every natural hazard is not directly affected by a changing climate—only those that are sensitive to changes in temperature, precipitation, sea level rise, and storm frequency/intensity. The climate-related hazards most notable for Prince George's County are riverine flood, severe storm, tornado, hurricane/tropical storm, winter storm, high wind, extreme heat, dam and levee failure, extreme cold, drought, coastal flood, and wildfire.

Regional and Local Climate Change Trends and Projections

Prince George's County is *already* facing climate change impacts through extreme weather events, including long periods of extreme heat, devastating flooding, and a series of severe storms. The sections below discuss the climate projections for Prince George's County and the surrounding region.

A.3.f.1. Changes in Temperature

On average, the climate is warming at a rapid rate, causing record-breaking temperatures and heat waves. Temperatures in Maryland have risen about 2.5°F since the beginning of the 20th century, and temperatures are projected to continue increasing.[32] This rise in temperature is leading to an increase in the number of extreme heat days in the state. **In 2021, Prince George's County had 21 extreme heat days between May and September, the highest number of recorded extreme heat days in the past 5 years.**[33] Unfortunately, this trend (**Figure 15**) is expected to continue.

[31] NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2022). https://www.ncei.noaa.gov/access/billions/
[32] NOAA/NESDIS Maryland and the District of Columbia State Climate Summary (2022). https://statesummaries.ncics.org/chapter/md/
[33] Centers for Disease Control (CDC) National Environmental Public Health Tracking Network (2022). https://ephtracking.cdc.gov/DataExplorer/#/

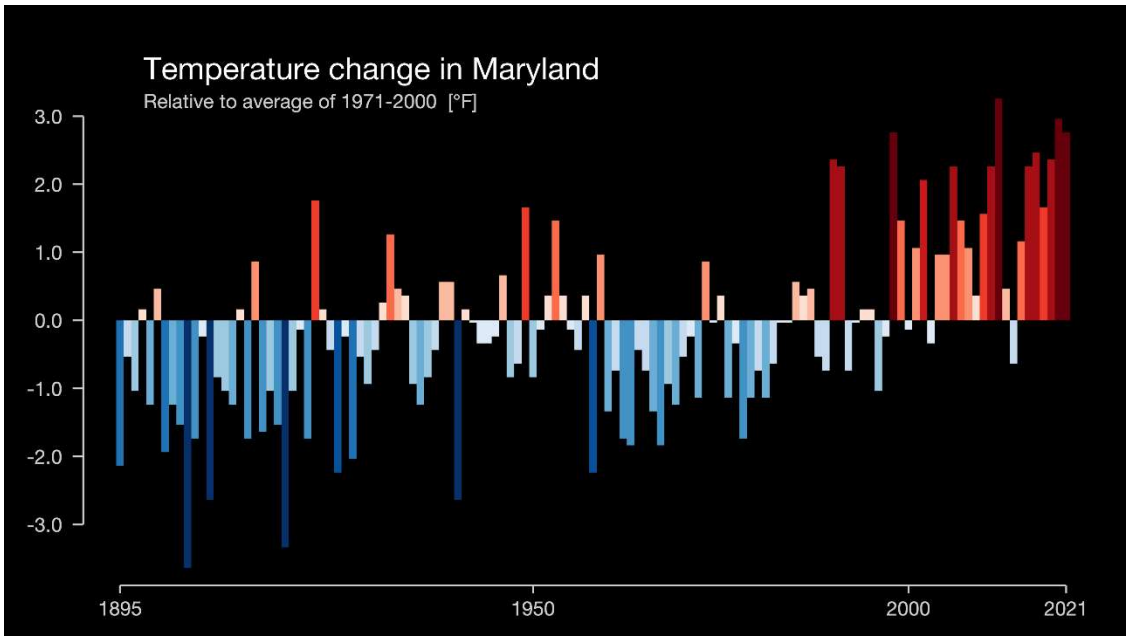


Figure 15. Historic temperature change in Maryland relative to average temperature of 1971-2000[34]

Climate projections from the Climate Mapping for Resilience and Adaptation Assessment Tool show a significant increase in extreme heat days through the end of the early century and into the mid and late centuries.[35] Annual days with temperatures above 90°F are projected to continue to rise, reaching 51.7 days under a lower emissions scenario (RCP 4.5), and 54.1 days under a higher emissions scenario (RCP 8.5) by 2044.

Representative Concentration Pathway

The Representative Concentration Pathways (RCPs) describe four different 21st century pathways of greenhouse gas emissions and atmospheric concentrations, air pollutant emissions, and land use.[36] Basically, they provide a way to envision and plan around four different climate futures. They have an outlook to the year 2100. Projections are described based on two different RCPs (RCP 4.5 and RCP 8.5) to address uncertainty in what our future emissions, and therefore climate, will look like. We are currently tracking within 1% of actual emission with the higher emission scenario (RCP 8.5) based on historical emissions and anticipated outcomes of current global climate policies.[37] **In short, unless drastic action is taken, the climate projections under RCP 8.5 may be more realistic, especially when planning for climate risks and impacts to 2050.**

Figure 16 shows the projected annual days with a maximum temperature of more than 90°F.

[34] University of Reading. Show Your Stripes (2021). https://showyourstripes.info/c/northamerica/usa/maryland
[35] Climate Mapping for Resilience and Adaptation Assessment Tool (2022). https://livingatlas.arcgis.com/assessment-tool/search
[36] International Panel on Climate Change. AR5 Synthesis Report: Climate Change 2014. (2014). https://ar5-syr.ipcc.ch/topic_futurechanges.php
[37] Christopher R. Schwalm, Spencer Glendon, Philip B. Duffy. RCP8.5 tracks cumulative CO2 emissions. Proceedings of the National Academy of Sciences, 2020; 202007117 DOI: 10.1073/pnas.2007117117

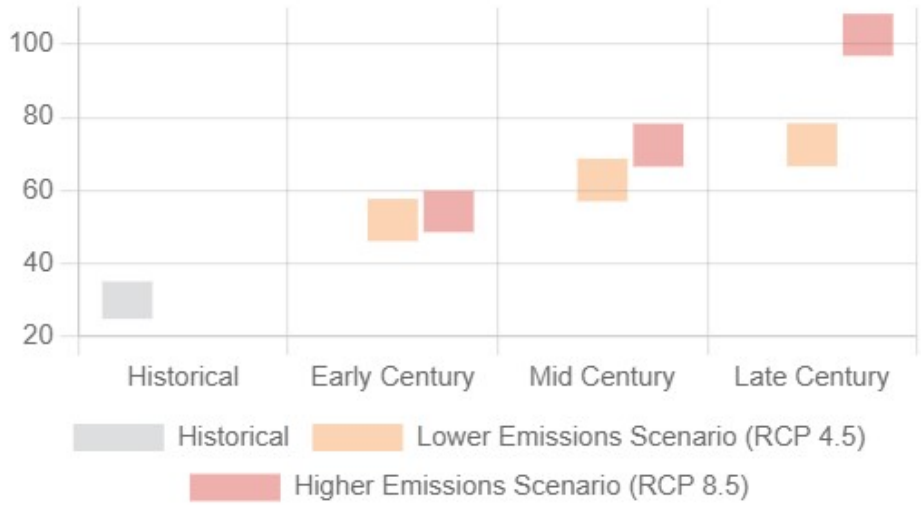


Figure 16. Projected annual days with a maximum temperature of greater than 90°F in Prince George's County (Source: Climate Mapping for Resilience and Adaptation Assessment Tool).

These extreme heat days are especially dangerous for heat-sensitive residents such as outdoor workers, the elderly, residents with respiratory illnesses, and households without air conditioning. Urban heat island areas within the County, such as heavily developed areas with less tree canopy cover and green space, will feel the impacts of extreme heat days more severely. Additionally, when periods of extreme heat coincide with dry conditions, the County could expect to experience more droughts and brushfires. The effects of these natural hazards are intensified due to climate change and can cause strains on the water supply and water quality, increased roadside erosion, heat strokes, and increased food costs. **The average rise in annual temperatures will also result in milder winters with fewer extreme cold days, with the projected days with a maximum temperature below 32°F to decrease to near 0 by 2044** according to the climate models used in the Fourth National Climate Assessment. A winter warming trend has been observed in Maryland with a below average number of very cold nights since the mid-1990s (**Figure 17**). Warmer temperatures in winter months will also result in greater amounts of moisture in the atmosphere leading to an intensification of winter storm events such as nor'easters and snowstorms.

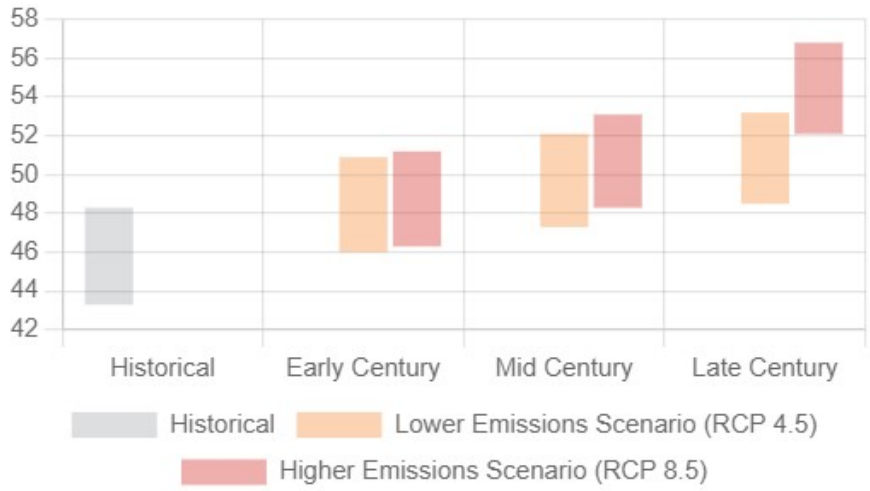


Figure 17. Projected average daily minimum temperature °F in Prince George's County (Source: Climate Mapping for Resilience and Adaptation Assessment Tool)

A.3.f.2. Changes in Precipitation

Climate change is causing an increase in annual precipitation amounts and annual precipitation events, which will increase flooding potential in Prince George's County. **Average annual total precipitation in Prince George's County is projected to continue to increase in upcoming years** (**Figure 18**), aligning with the general precipitation trends in Maryland and the Northeast region.

Figure 18. Projected average annual total precipitation in Prince George's County (Source: Climate Mapping for Resilience and Adaptation Assessment Tool)

The Northeast region has experienced a greater recent increase in extreme precipitation than any other region in the United States, with a 70% increase in the amount of precipitation falling in very heavy events.[38] Illustrating this point, there is projected to be a decrease in the total "wet" days, but an

[38] U.S. Global Change Research Program. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II (2018). https://nca2018.globalchange.gov/chapter/18/

increase of 1.4 inches of annual precipitation by 2044 in the County.[39] **Figure 19** shows that expected increase in heavy precipitation days per year.

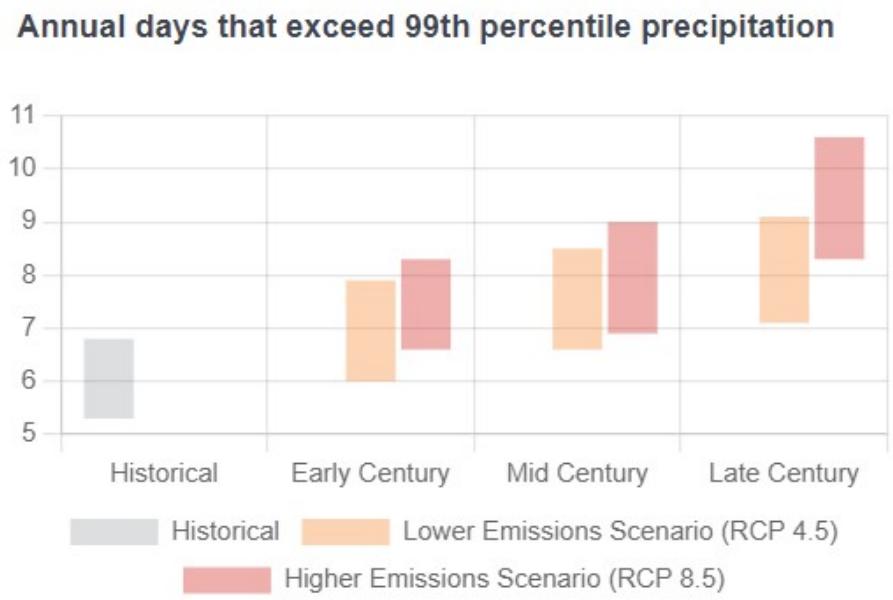


Figure 19. Projected annual days that exceed the 99th percentile precipitation in Prince George's County (Source: Climate Mapping for Resilience and Adaptation Assessment Tool)

Flash floods and riverine flooding are intensified by higher volume precipitation events. This overall increase in precipitation amounts in the Northeast region will impact Prince George's County by causing more frequent incidents of flooding to infrastructure and housing, crop destruction, and health concerns from standing water. Additionally, increased volume of precipitation will cause flooding in low-lying areas and urbanized areas with more impervious surfaces and can overwhelm the County's stormwater systems. From 2018-2021, there were 4,362 water-related complaints to the County's 311 hotline, including flooded basements, backyards, and neighborhood streets. With the amount of precipitation and flooding expected to increase in the coming years due to climate change, more County residents will be exposed to flooding and at risk of flood-related damage and hazards.

A.3.f.3. Sea Level Rise

Global rise in sea level is caused, in part, by a warming ocean and melting glaciers and ice sheets. **The climate models used in the Fourth National Climate Assessment project that within the next twenty years, 0.2% of the County will be impacted by global sea level rise regardless of the greenhouse gas emissions scenario** (**Figure 20**). By late century, 0.9% of the County is projected to be impacted by global sea level rise as shown in **Figure 21**. Prince George's County is located between the Potomac River and the Patuxent River, which are both tidally influenced by the Atlantic Ocean. This location places the County at risk for coastal flooding from sea level rise and storm surge, as well as tidal flooding during high tide. Sea level rise increases the water level for storm surges and high tides, which can make coastal floods more severe and more frequent.

[39] Climate Mapping for Resilience and Adaptation Assessment Tool (2022). https://livingatlas.arcgis.com/assessment-tool/search

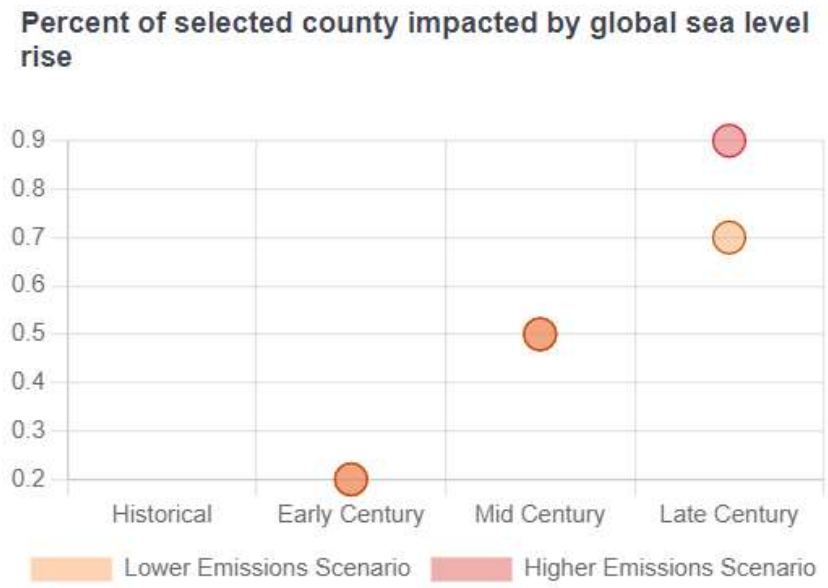


Figure 20. Projected percent of Prince George's County impacted by global sea level rise (Source: Climate Mapping for Resilience and Adaptation Assessment Tool)

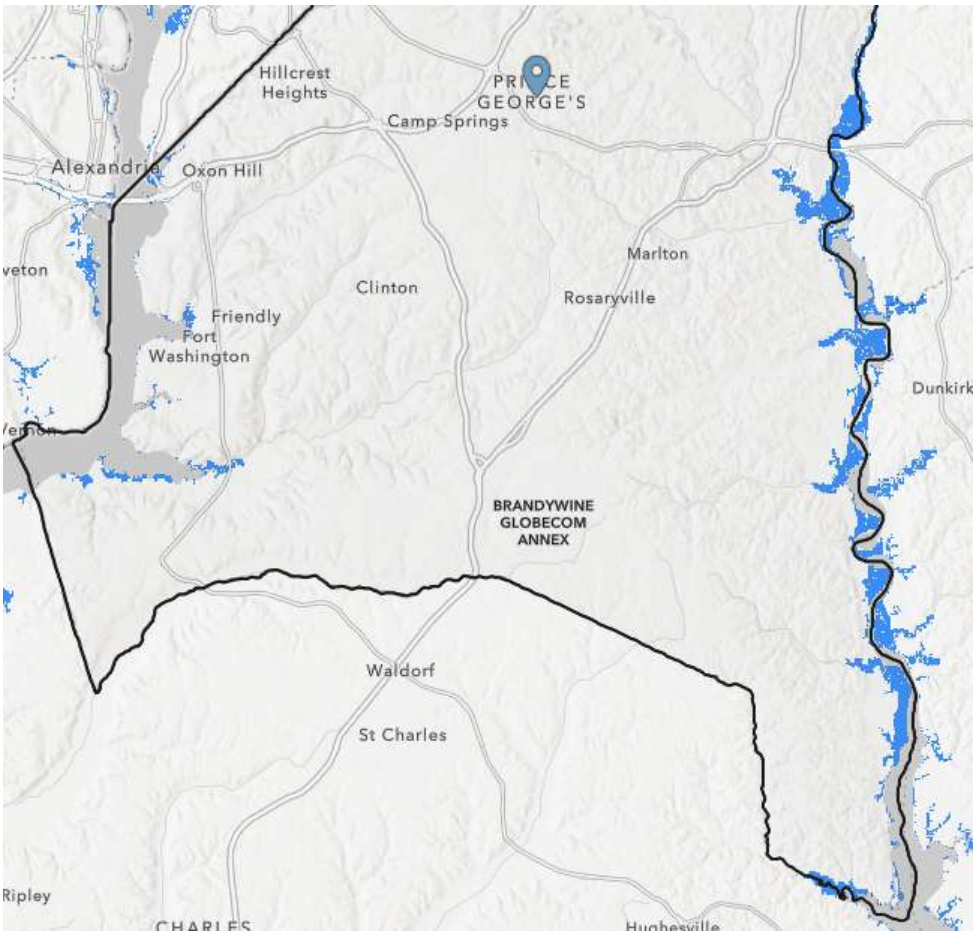


Figure 21. Areas projected to experience coastal flooding due to sea level rise by late century (2070-2099) (Source: Climate Mapping for Resilience and Adaptation Assessment Tool)

A.3.f.4. Changes in Severe Storms

The International Panel on Climate Change reports that it is very likely that ocean surface temperature will increase in the Atlantic Ocean. This would provide more energy for Atlantic storms to strengthen, which could lead to an increased frequency of thunderstorms, tornadoes, hurricanes, and nor'easters. Sea surface temperatures in the tropical Atlantic, known as the Main Development Region for tropical systems have risen 1.85°F in the last century, and the likelihood of tropical cyclones reaching Category 3 status has increased since 1979.[40] **Climate change is projected to magnify the impact of hurricanes and tropical storms through increasing both precipitation amounts and extreme wind speeds.**

Additionally, due to weakening winds coming from inland areas toward the Atlantic, the speed of land falling storms may slow, which would allow hurricanes to rapidly intensify—especially within the 24 hours before landfall—and stall, dropping more rain on a limited area. Prince George's County may also see the coastal region at severe risk from tropical storms expand northward to include it.[41] Overall, severe storms can bring heavy rain and lightning, leading to flooding and power outages. Severe wind events can also cause power outages and dangerous conditions due to downed power lines, trees, and road obstructions due to wind-blown debris.

A.3.f.5. Conclusion

The outlook illustrated above is alarming, but there are actions we can begin today that will help mitigate the risks we face. Research shows that every $1 invested in climate hazard mitigation can save up to $13 in post-disaster recovery costs.[42] Less recovery costs mean that people and infrastructure suffered less damage during hazard events—an outcome that is better for everyone. Our current and future risks are highlighted below so we can integrate them into the Risk Assessment and mitigate them through the projects and actions outlined in the Mitigation Strategy.

Climate Projections Summary for Prince George's County

- Increase in the number of annual extreme heat days
- Milder winters, with fewer extreme cold days
- Increased risk of extreme heat and dry conditions overlapping, leading to an increased risk of droughts and wildfires
- Increased average total annual precipitation
- More extreme precipitation events, with more rain falling in shorter amounts of time, which can lead to more flash floods, riverine flooding, and pluvial flooding
- 0.2% of the County's land is expected to be impacted by sea level rise within the next 20 years
- Intensified winter storm events
- Stronger hurricanes that bring more rain, stronger winds, intensify quickly, and move slower over land

A.3.g. Future Conditions Analysis: Development

In 2014, Prince George's County published and adopted the Plan Prince George's 2035 Approved General Plan (Plan 2035), a comprehensive 20-year general plan for the county. This plan articulates a

[40] NOAA National Centers for Environmental Information (NCEI) Climate at a Glance (2022). https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/atlanticMdr/land_ocean/6/11/1880-2019?trend=true&trend_base=10&begtrendyear=1880&endtrendyear=2020
[41] International Panel on Climate Chang. Sixth Assessment Report. *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Chapter 14. Page 1938. 2022.
[42] National Institute of Building Sciences (NIBS) Mitigation Saves (2020). http://2021.nibs.org/files/pdfs/ms_v4_overview.pdf

vision for making Prince George's County a competitive force in the regional economy, a leader in sustainable growth, a community of strong neighborhoods and municipalities, and a place where residents are healthy and engaged. The plan includes a Growth Policy Map (**Figure 22)**, which reflects the Plan 2035 vision to concentrate future growth to promote sustainable development and minimize development impacts to the County's natural resources. The Growth Policy Map visually communicates where the County should grow and outlines which parts of the county will not experience substantial change.[43] It is important to view these planned growth areas from the County's Growth Policy Map in the context of hazard risk.

A.3.g.1. Proposed Future Development

The Growth Policy Map, shown in **Figure 22** designates areas of proposed growth as well as areas of restricted growth. Growth areas include Regional Transit Districts, Local Centers, Employment Areas, Established Communities, Future Water and Sewer Service Areas, and Rural and Agricultural Areas. The Growth Boundary designates the areas that are eligible to receive public water and service, which impacts where the County can grow. Rural and Agricultural Areas are not eligible for public water and sewer service, and therefore are recommended to be protected without any development. The Regional Transit Districts shown on the Growth Policy Map are recommended as locations for the majority of future residential and commercial development in Prince George's County. Local Centers and Employment Areas also are designated as ideal locations for future residential and commercial development, respectively. The Established Community and Future Water and Sewer Service Areas on the Growth Policy Map are areas where the Plan recommends only context-sensitive development or near-term development that is being deferred until residential capacity is required.

[43] Plan Prince George's 2035 Approved General Plan. The Maryland-National Capital Park and Planning Commission. 2014.

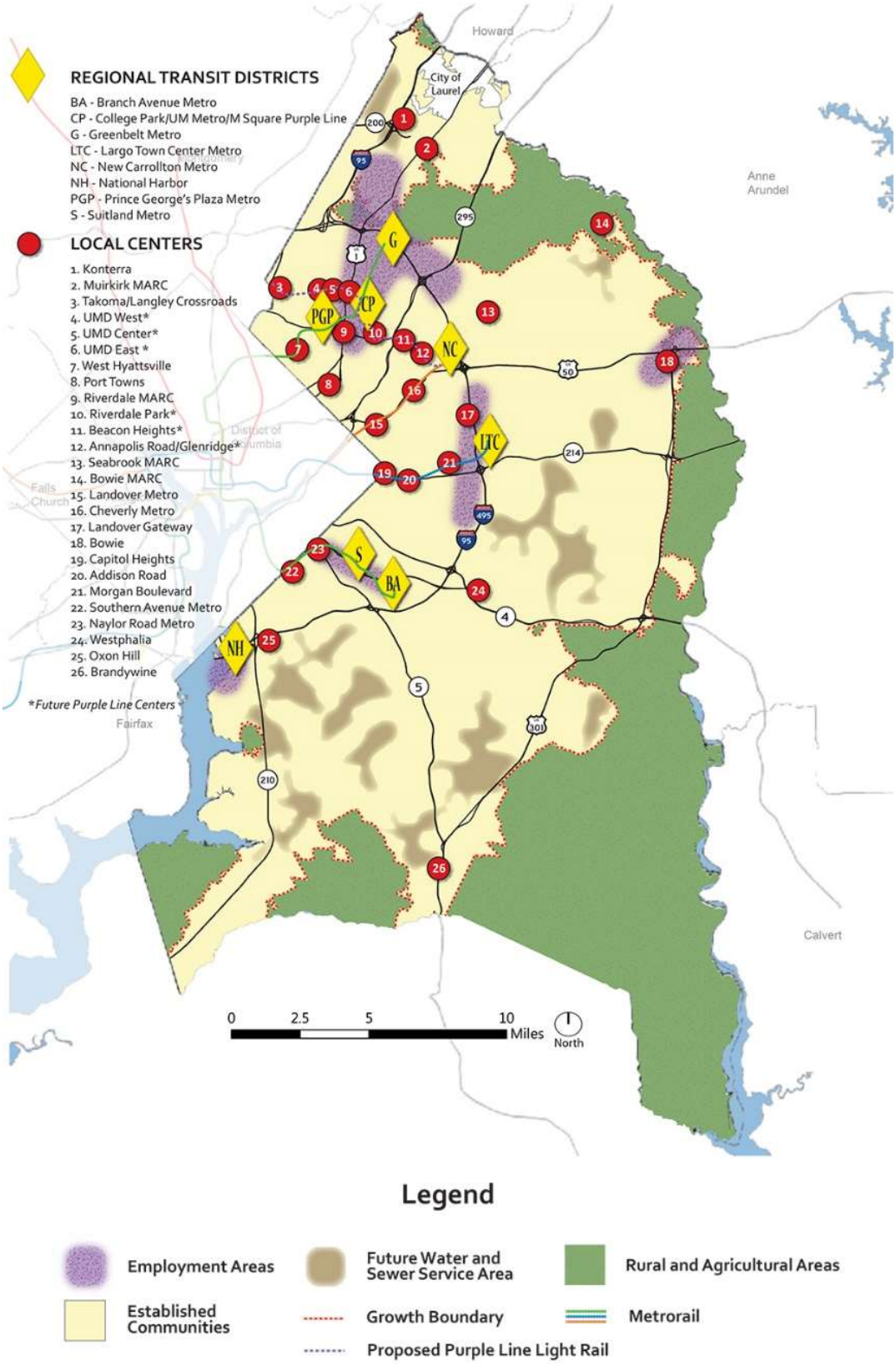


Figure 22. Plan 2035 Growth Policy Map

A.3.g.2. Hazard Risk to Future Development

As development increases, risk and exposure to hazards increases. To mitigate the effects of hazards, future land use planning must consider the locations and impacts of hazard events. Select hazards in this chapter include future development maps that depict the future development areas of Regional Transit Districts, Local Centers, and Employment Areas outlined in the Plan 2035 Growth Policy Map overlaid with various hazard risk areas.

Overall, as future planning and development occurs throughout Prince George's County, it is useful to identify areas that are at risk from hazards. Areas such as Local Centers, Employment Areas, and Regional Transit Districts are all described in the County's Plan 2035 as areas that will experience growth in development in the upcoming years, so there will be increased potential consequences of natural hazards. Identifying areas at risk of hazards can be used to help identify development projects that should be considered for additional hazard mitigation actions.

A.3.h. Future Conditions Analysis: Population

The United States Census Bureau's Population Estimates Program states Prince George's County, Maryland's population as 955,306 as of July 1, 2021. This is a -1.2% change from the April 1, 2020 U.S. Census count. Population clusters are located around the Town of Bowie, the City of Laurel, and the combined metro area of Hyattsville, College Park, and Greenbelt. Compared to the 2010 U.S. Census, the County has seen a population change of +12.0%. As of December 2020, the Maryland Department of Planning, Projections and State Data Center projects the population of Prince George's County to be about 983,870 by 2045, which would only be a 3.0% increase from the most recent 2021 estimate from the Census Bureau. This projection was created without 2020 Census data, so if the State's 2020 projection of 911,140 is adjusted to reflect the 2020 Census population (967,201) and the same annualized growth rates are then used on the new baseline, a new projection for the County's population in 2045 is 1,043,973.[44]

Based on this cumulative information, the population of Prince George's County by 2045 is estimated to be about 7.9% higher than the most current (2021) estimate. It is assumed that most of this change will occur in and around the development areas highlighted in A.3.g.1 Proposed Future Development. The City of Laurel has seen a similar population trend, as shown in **Table 38**.

Table 38. Population Changes in Prince George's County and the City of Laurel since 2010

	City of Laurel	Prince George's County
Population, Census (April 1, 2010)	25,115	863,420
Population, Census (April 1, 2020)	30,060 (+19.7%)	967,201 (+12.0%)
Population Estimate (July 1, 2021)[45]	29,490 (-1.8%)	955,306 (-1.2%)
Projected Population (2045)[46]	**N/A**	**983,870 (+3.0%)**

[44] It should be noted that this methodology does not take into account any changes in the projected growth rates that may result from incorporating the 2020 Census data into the State's projection methodology.
[45] United States Census Bureau QuickFacts.
https://www.census.gov/quickfacts/fact/table/laurelcitymaryland,princegeorgescountymaryland/PST045221
[46] Maryland Department of Planning, Projections and State Data Center, December 2020.
https://planning.maryland.gov/MSDC/Documents/popproj/TotalPopProj.pdf

B. Riverine Flood

B.1. Description

Flooding is the most frequent and costly natural hazard in the United States, causing more than 10,000 deaths since 1900. Nearly 90 percent of Presidential Disaster Declarations result from natural events where flooding was a major component. Floods generally result from excessive precipitation and are classified in two categories: general floods due to precipitation within a watershed for an extended time period which includes storm-induced wave or tidal action; and flash floods, the product of heavy precipitation in short duration impacting a localized area. The severity of a flood event is typically determined by a combination of several major factors, to include stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface.

Riverine flooding occurs when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land. Heavy rain and large amounts of snow melt can cause riverine flooding. Riverine flooding is a longer-term event and can last days or weeks. Riverine floods are defined in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence.

Periodic flooding of lands adjacent to rivers, streams and shorelines (floodplains) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of floods that are large enough to cover them. For example, the 10-year floodplain will be impacted by a flood with a 10% probability of occurring at any time; the 100-year floodplain represents the area inundated by a 1% probability flood. Flood frequencies, such as the 1% probability (100-year) flood, are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Flood frequencies are used to characterize flood modeling by FEMA and its floodplain management regulations, stormwater management design requirements, and local floodplain management building standards.

FEMA Flood Insurance Rate Maps

FEMA-published Flood Insurance Rate Maps (FIRMs) are one way that communities can see which areas have the highest risk of riverine and coastal flooding. Areas with a 1% or higher chance of experiencing a flood each year is considered to have a high risk. Those areas have at least a one-in-four chance of flooding during a 30-year mortgage.

Flash flooding that is not associated with an overflowing body of water (also known as pluvial flooding) from extreme rainfall is assessed in **Section C**. Coastal flooding is assessed in **Section Q**.

B.2. Location and Extent

Prince George's County is bordered by the Patuxent River to the east and the Potomac River to the west. The City of Laurel is in the northeast section of the County and borders the Patuxent River. Most tributaries, branches, and creeks in the area flow into either of these two rivers. The effective FEMA Flood Insurance Rate Maps for the County were updated September 16, 2016. They show one-percent annual chance floodplains associated with the rivers and streams in the Potomac and Patuxent watersheds. The Flood Insurance Rate Map identifies high flood hazard risk areas as part of the one-percent annual chance (100 year) floodplain, moderate risk areas as part of the 0.2-percent annual chance (500 year) floodplain, or minimal risk areas outside the 500-year floodplain. Approximately 10.7% of the land in Prince George's County (including the City of Laurel) is located within the 100-year floodplain. Depth of flooding varies across the County based on location in the flood zone. The average Base Flood Elevation of the 100-year floodplain in Prince George's County is 9.3 feet. Velocity of flood waters can be determined using local flood gauges. **Figure 23** shows the 100-year floodplain within Prince George's County and **Figure 24** similarly shows the 100-year floodplain in the City of Laurel.

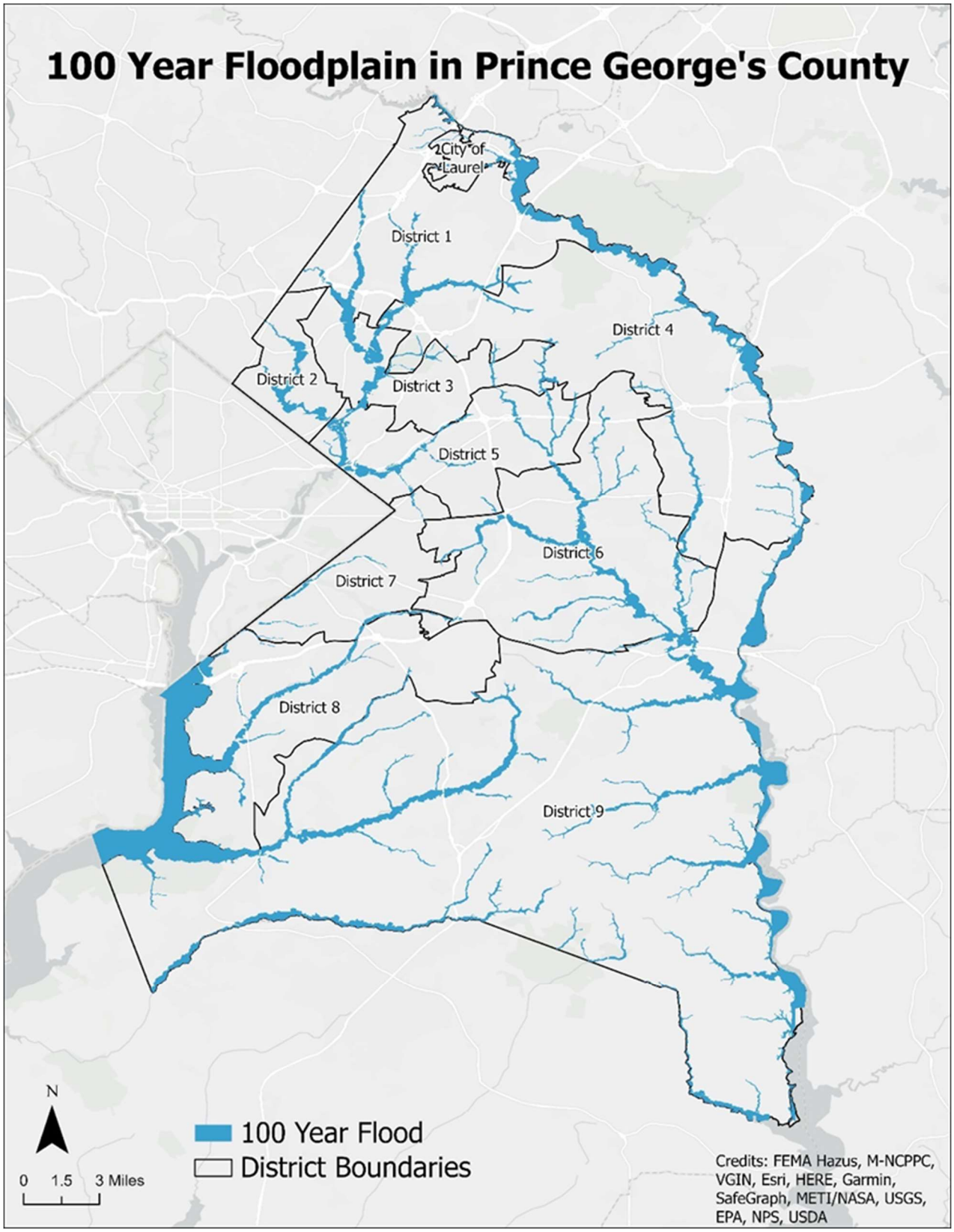


Figure 23: 100-Year Floodplain; Prince George's County, Maryland

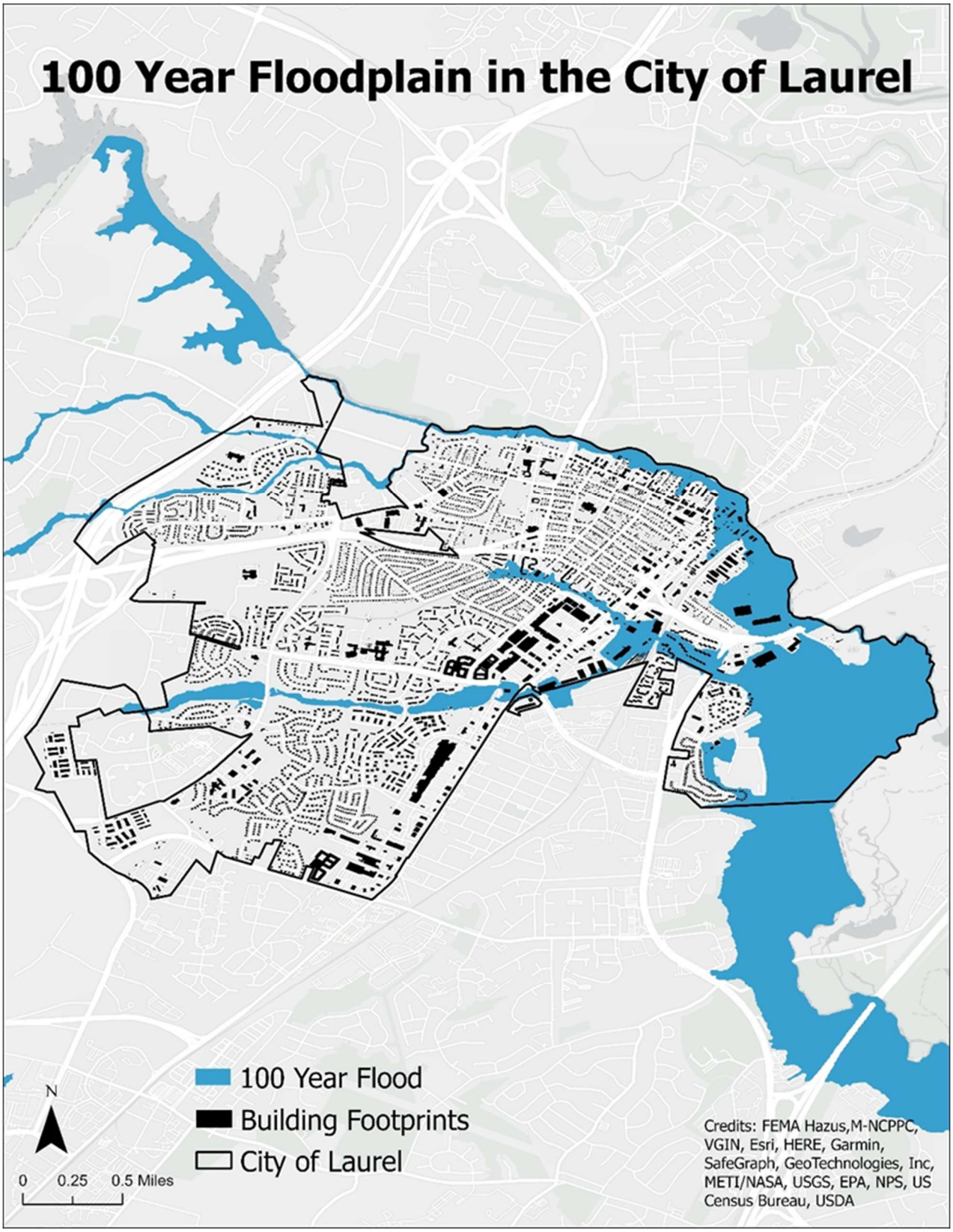


Figure 24: 100-Year Floodplain; City of Laurel, Maryland

In addition to the 100-year floodplain, riverine flood extent in Prince George's County is represented by the Riverine Climate Ready Action Boundary Inundated Zone. This zone was created by the Maryland Department of Planning in 2021 and expands the FEMA floodplain by vertically adding 3 feet of water on top of the Special Flood Hazard Area elevations and pushing this volume of water out horizontally. **Figure 25** and **Figure 26** show Riverine Climate Ready Action Boundary extent in Prince George's County and the City of Laurel.

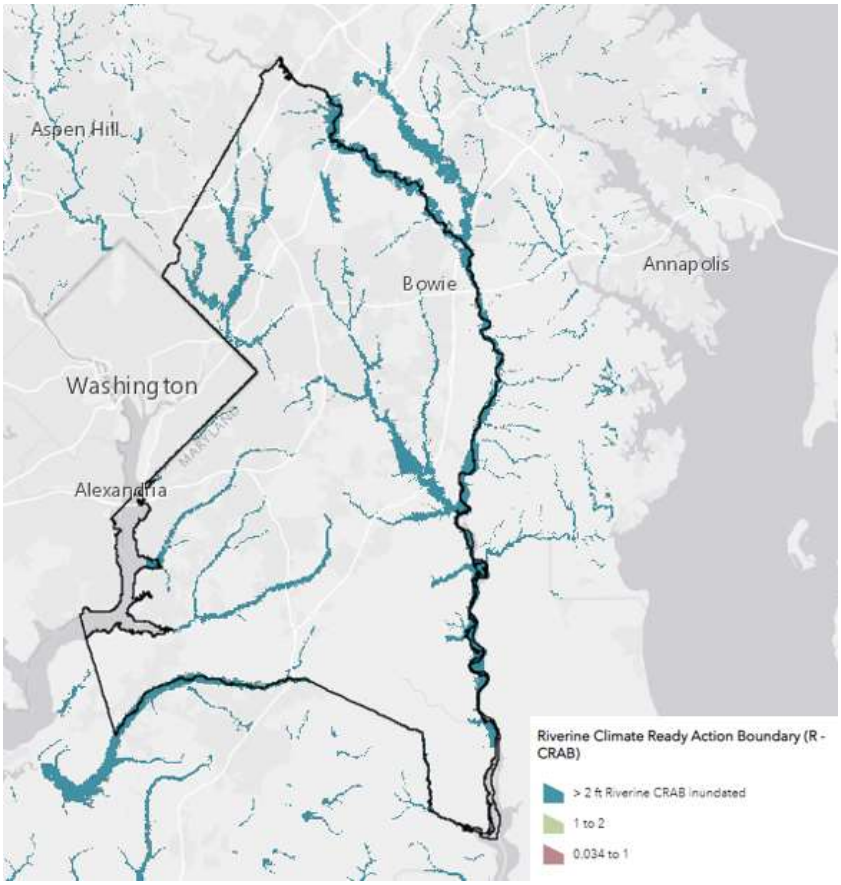


Figure 25: Riverine Climate Ready Action Boundary, Prince George's County

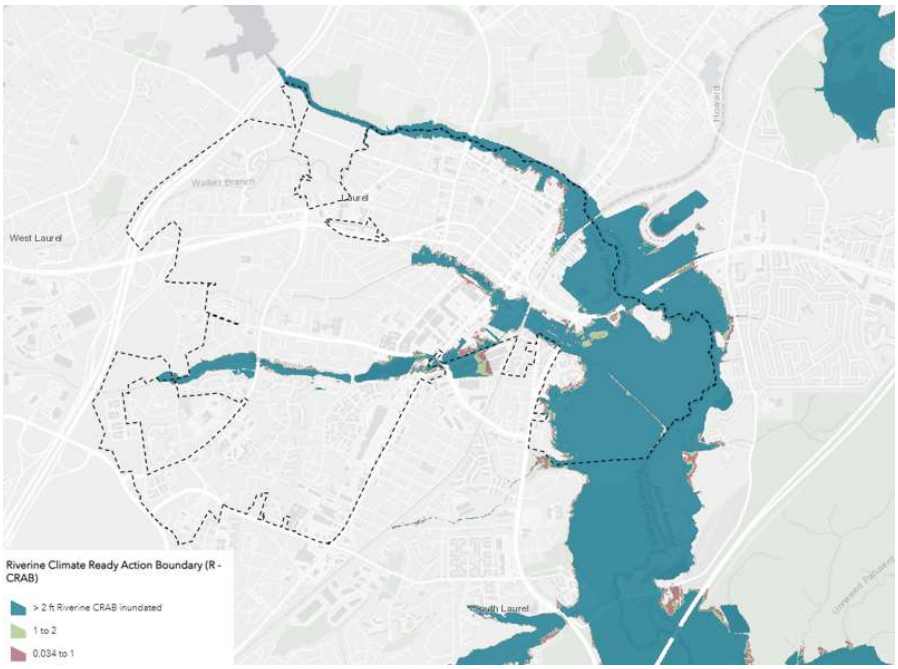


Figure 26: Riverine Climate Ready Action Boundary, City of Laurel

Several factors contribute to the relative severity of a flood. Development, or the presence of people and property in the hazard areas, is a critical factor in determining a flood's relative severity. Additional factors that contribute to flood severity range from specific characteristics of the floodplain to characteristics of the structures located within the floodplain. The following is a brief discussion of some of these factors and how they may relate to the area.

- **Flood depth:** The greater the depth of flooding, the higher the potential for significant damage.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage. Floodwater may linger because of the low relief of the area, but the degree varies.
- **Velocity:** Flowing water exerts force on the structural members of a building, increasing the likelihood of significant damage. A one-foot depth of water, flowing at a velocity of five feet per second or greater, can knock an adult over and cause significant scour around structures and roadways.
- **Elevation:** The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage due to flooding.
- **Construction type:** Certain types of construction are more resistant to the effects of floodwater than others. Masonry buildings, constructed of brick or concrete blocks, are typically the most resistant to flood damage simply because masonry materials can be in contact with limited depths of water without sustaining significant damage. Wood frame structures are more susceptible to flood damage because the construction materials used are easily damaged when inundated with water.

B.2.a. City of Laurel

A major natural feature within the City is the Patuxent River, which runs along the northern City boundary. Three major tributaries, Walker, Crow and Bear Branches connect to the River. Walker Branch traverses the northwest portion of the City and drains into the Patuxent River west of Main Street. Bear Branch originates west of Sweitzer Lane and feeds into Laurel Lakes, and eventually into Crow's Branch within the Greens of Patuxent. A large portion of those areas immediately adjacent to the tributaries is a steep slope. Water flowing through the Patuxent River is impounded between Brighton Dam in Montgomery County and the T. Howard Duckett Dam just west of Interstate 95. Drinking water for the City is pumped from the Rocky Gorge Reservoir to the Patuxent Water Filtration Plant.

A drainage basin for the area extends along a ridgeline west of the City and runs easterly to the Patuxent River near the Baltimore-Washington Parkway. The system includes direct drainage into the Patuxent River as well as into the three major tributaries. Natural drainage for the City is generally poor, due to the relative flatness of the topography.

In 1980 the Maryland General Assembly enacted the Patuxent River Watershed Act. The purpose of this Act was to create a coordinated land management strategy for controlling non-point pollution within the Patuxent River Watershed. The State and all seven counties within the watershed subsequently adopted a policy plan.

As part of this effort, the City is a member of Prince George's County's Patuxent River Watershed Advisory Committee. As Laurel becomes progressively more developed and as more of the ground surface is covered with impervious materials, the amount of storm water runoff is continually increasing. Without effective countermeasures, increased pollution to the river occurs. Consequences of this pollution include silt build-up in riverbeds, brownish water from sediment runoff and debris and litter being washed into the water and along the banks.

In conjunction with this effort, the City has implemented a Patuxent River Primary Management Area, in the form of an open-space (R-OS) zoning category. The purpose of this zone is to implement the water quality and environmental protection goals of the Patuxent Policy Plan and Addendum, and other established natural resource programs, and policies for streams and their streamside environments within the City's Patuxent River Watershed. As part of this zone, minimum setbacks from the river or tributaries are enforced. The desired effect of this effort is to improve water quality through prevention of non-point source sedimentation and pollution. Mandatory increased vegetative cover will also serve to reduce both the velocity and quantity of storm water runoff, slowing the process of erosion and sedimentation.

The City is involved in three other facets of the Patuxent Policy Plan and Addendum:

1. A program undertaken to retrofit several existing storm drainage facilities, which drain into the Patuxent. These infiltration devices help mitigate the pollution impact from urban water runoff.
2. On a larger scale, the Laurel Lakes Planned Development was constructed so as to use the lake system as a regional storm water management system. Benefits of this system include storm water control and improved water quality, in addition to aesthetic and recreational considerations.
3. An ongoing program involves the Department of Parks and Recreation's Riverfront Park. Acquisition of lands adjacent to the River is continuing through the subdivision dedication process for the creation of a largely undisturbed passive park.

B.3. Previous Occurrences

Prince George's County and the City of Laurel have experienced many flood events that have caused damage since the 2017 Hazard Mitigation Plan. **Table 39** summarizes several notable flood events that have occurred.[47] Many of these flood instances are related to remnants of tropical storms and hurricanes that have also affected many other areas of the United States.

Table 39: Notable Historic Flood Events in Prince George's County and the City of Laurel

Event Date	Description
September 2018	The remnants of Hurricane Florence slowly tracked through the area with thunderstorms and rain showers, leading to instances of flooding.
October 2018	As Hurricane Michael passed south of the County, heavy rain caused flooding.
August 2020	Tropical Storm Isaias passed through Prince George's County, bringing flooding rain. Heavy rain also led to incidents of flash flooding.
September 2020	Flash flooding due to heavy rainfall flooded U.S. Route 50 in Prince George's County with up to five feet of water.
August 2021	Thunderstorms produced isolated instances of flash flooding in Prince George's County.
July 2022	A cold front dropped down from the north, causing showers and thunderstorms to develop. This led to instances of flooding and flash flooding.
August 2022	Thunderstorms caused heavy rainfall, and with a slow storm motion this led to instances of flooding and flash flooding. Multiple 911 calls were received for water rescues.

According to the NOAA NCEI Storm Events Database, there have been 99 reported flood events in Prince George's County since 1950. According to the data shown in **Table 40**, total damage since 1950 was divided by the number years in the Period of Record, to determine that there was an average of $3,125 in annual damages (all property damage with no reported agricultural damage) due to flooding in the County. There were no deaths, and no injuries reported to the database during this period. Historical flood events can be found in **Appendix C**.

Table 40: NCEI Historic Flood Event Data

Event Type	Number of Events	Period of Record	Total Annual Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Flood	99	1950-2022	$3,125	0.0	0.0	1.4

[47] NOAA NCEI Storm Events Database. https://www.ncdc.noaa.gov/stormevents/

B.3.a. Historic Summary of Insured Flood Losses

The National Flood Insurance Program (NFIP) enables property owners in participating communities to purchase Federally backed insurance for flood losses. For a community to participate in the NFIP they must adopt floodplain management regulations that reduce future flood damages, adopt the FEMA Flood Insurance Rate Maps and Flood Insurance Study for the jurisdiction and manage a floodplain management program which enforces Federal, State and local floodplain regulations affecting development in the designated Special Flood Hazard Area (1-percent annual chance floodplains depicted on the Flood Insurance Rate Maps). Flood insurance backed by the Federal government is designed to provide an alternative to disaster assistance so that the high costs associated with repairing damage to buildings and their contents caused by floods is reduced. Flood insurance is available to property owners and contents coverage is available to renters in communities in good standing with FEMA in terms of their local floodplain management ordinance.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for insurers to actuarially rate structures for flood insurance coverage.

Communities that participate in the NFIP are required to adopt and enforce local floodplain management regulations that meet or exceed the minimum Federal NFIP floodplain management regulations. These regulations apply to all types of floodplain development and ensure that development activities will not cause an increase in future flood damages. Buildings are required to be reasonably safe from flooding which usually requires the finished floor elevation to be elevated at or above the corresponding Base Flood Elevation. The Base Flood Elevation is determined based on modeling and mapping identified within a community's Flood Insurance Study. The Flood Insurance Study and its corresponding Flood Insurance Rate Maps provide information on areas of flood risk per the NFIP standards.

The maps identify areas that have a 1-percent annual chance of flooding as well as those areas with a 0.2 percent-annual chance of flooding. When new structures are built, they are required to adhere to regulations and flood risk information provided by the NFIP. If a structure is within the regulated floodplain (Special Flood Hazard Area)backed by a federally insured mortgage, flood insurance coverage is mandatory. The requirement for high-risk structures to be insured through the NFIP or another flood hazard specific insurance policy is how the government minimizes flood recovery costs to the public.

Participation in the NFIP is shown in **Table 41**, which includes the dates the Flood Hazard Boundary Maps (FHBMs) were issued, when the first Flood Insurance Rate Maps (FIRMs) became effective, the date of the current FIRMs used for insurance purposes, and the date the community entered the NFIP.

Table 41: FEMA NFIP Participation Dates[48]

Jurisdiction	Community Number	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date
City of Laurel	240053	9 Aug 1974	1 Nov 1978	16 Sep 2016
Prince George's County	245208	N/A	4 Aug 1972	16 Sep 2016

[48] FEMA. Community Status Book Report. Maryland. https://www.fema.gov/cis/MD.pdf

Table 42 shows that the City of Laurel and Prince George's County have a combined total of 2,402 policies and their associated insurance value and premiums as of December 2, 2022.

Table 42: NFIP Policies in Force (as of 12/2/2022)

Jurisdiction	Policies in Force	Total Coverage	Total Premiums
City of Laurel	108	$31,425,000	$53,657
Prince George's County	2,294	$657,655,800	$1,523,128
Total	**2,402**	**$689,080,800**	**$1,576,785**

Table 43 summarizes the NFIP policy and claim statistics for the County and City. Losses (claims) include any flood damage where water crossed a property line. It should be emphasized that these values include only those losses to structures that were insured through the NFIP policies, and for losses where insurance claims were filed and received. It is likely that many additional instances of flood losses in Prince George's County and the City of Laurel were either uninsured, denied claims payment, or not reported.

Table 43: NFIP Claims (as of 12/2/2022) Since 1978

Jurisdiction	Number of Losses	Substantial Damage Paid Losses	Total Payments
City of Laurel	21	0	$101,216
Prince George's County	1,072	6	$7,325,288
Total	**1,093**	**6**	**$7,426,504**

B.3.b. NFIP Repetitive Loss Structures

A Repetitive Loss structure is defined under both the NFIP and Flood Mitigation Assistance. The HMP primarily focuses on the NFIP definition, which identifies a Repetitive Loss structure as a structure that meets one of the two following qualifiers:

4. Two or more claims of more than $1,000 paid by the NFIP within any rolling 10-year period, since 1978; or
5. Two or more claims (building payments only) that, on average, equal or exceed 25 percent of the market value of the property.[49]

Similarly, Severe Repetitive Loss refers to a structure that meets one of the two following qualifiers:

[49] This definition is based on the definitions for Repetitive Loss used by the NFIP program. See 44 C.F.R. § 209.2 and pt. 61, Appendices A(1)-A(3); see FEMA, National Flood Insurance Program, Flood Insurance Manual, Appendix A, pg. 11-12, and Appendix E, pg. 5 (Apr. 2021); and see FEMA, National Flood Insurance Program, Community Rating System Coordinator's Manual, pg. 120-7 (2017).

1. Received four or more separate claim payments of more than $5,000 each (including building and contents payments); or
2. Received two or more separate claim payments (building payments only) where the total of the payments exceeds the current value of the property.[50]

The identification of Repetitive Loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Nationwide, repetitive loss structures constitute 2% of all NFIP insured structures but are responsible for 40% of all NFIP claims. Therefore, mitigation for Repetitive Loss properties is a high priority for FEMA, and the areas in which these properties are located typically represent the most flood prone areas of a community. A primary goal of FEMA is to reduce the numbers of structures that meet these criteria, whether through elevation, acquisition, relocation, or a flood control project that lessens the potential for continual losses.

According to FEMA, there are currently 82 Repetitive Loss properties that have not been mitigated within Prince George's County (one of which is in the City of Laurel) accounting for 179 losses. This is an increase of 40 Repetitive Loss structures and 87 losses as compared with the statistics from the last plan update in 2017. The majority of these Repetitive Loss properties are residential. The causes of flooding for these properties include drainage issues, riverine flooding, groundwater intrusion, stormwater intrusion, and coastal flooding. The two main causes of repetitive loss in the County are riverine flooding and drainage issues. The addresses of the properties are maintained by FEMA, Maryland Department of Emergency Management, and the Prince George's County Department of Environment, and they are deliberately not included in this plan as required by the Privacy Act. **Figure 27** shows the general locations of Repetitive Loss structures in Prince George's County and their proximity to the FEMA Special Flood Hazard Area. Due to map scale limitations, some points on the map represent clusters of repetitive loss properties located in close proximity, such as being located in the same neighborhood.

More than $3 million has been paid in claims, with an average claim of $17,546. Only one Repetitive Loss structure was identified in the 2010 Plan and 42 were identified in the 2017 Plan. **Table 44** shows the total number of properties, total number of losses experienced, and losses paid for Prince George's County and the City of Laurel by building type.

A Severe Repetitive Loss property has one of the following: (1) at least four NFIP claims payments of more than $5,000 each, with the cumulative amount of such claims payments exceeding $20,000; or (2) at least two separate claims payments with the cumulative amount exceeding the market value of the building. **There are no Severe Repetitive Loss properties within Prince George's County or in the City of Laurel.**

Table 44. NFIP Repetitive Loss/Severe Repetitive Loss Overview

Jurisdiction / Building Type	# of RL	RL Losses	# Mitigated	Building Payments	Contents Payments	Total Payments
Prince George's County	**81**	**176**	**0**	**$2,617,397**	**$517,125**	**$3,134,522**
2-4 Family	3	9	0	$66,459	$321	$66,780

[50] This definition is based on the definitions for SRL used by the NFIP program. See 42 U.S.C. § 4014(h); see FEMA, National Flood Insurance Program, Flood Insurance Manual, Appendix I, pg. 1, and Appendix L, pg. 8 (Apr. 2021); and see FEMA, National Flood Insurance Program, Community Rating System Coordinator's Manual, pg. 120-8 (2017).

Jurisdiction / Building Type	# of RL	RL Losses	# Mitigated	Building Payments	Contents Payments	Total Payments
Business, Non-Residential	2	4	0	$520,779	$169,441	$690,219
Other Residential	1	2	0	$212,295	$0	$212,295
Other Non-Residential	3	7	0	$118,810	$208,607	$327,417
Single-Family	72	154	0	$1,699,054	$138,757	$1,837,811
City of Laurel	**1**	**1**	**0**	**$1,345**	**$0**	**$1,345**
Single Family	1	1	0	$1,345	$0	$1,345
GRAND TOTAL	**82**	**179**	**0**	**$2,618,742**	**$521,945**	**$3,140,687**

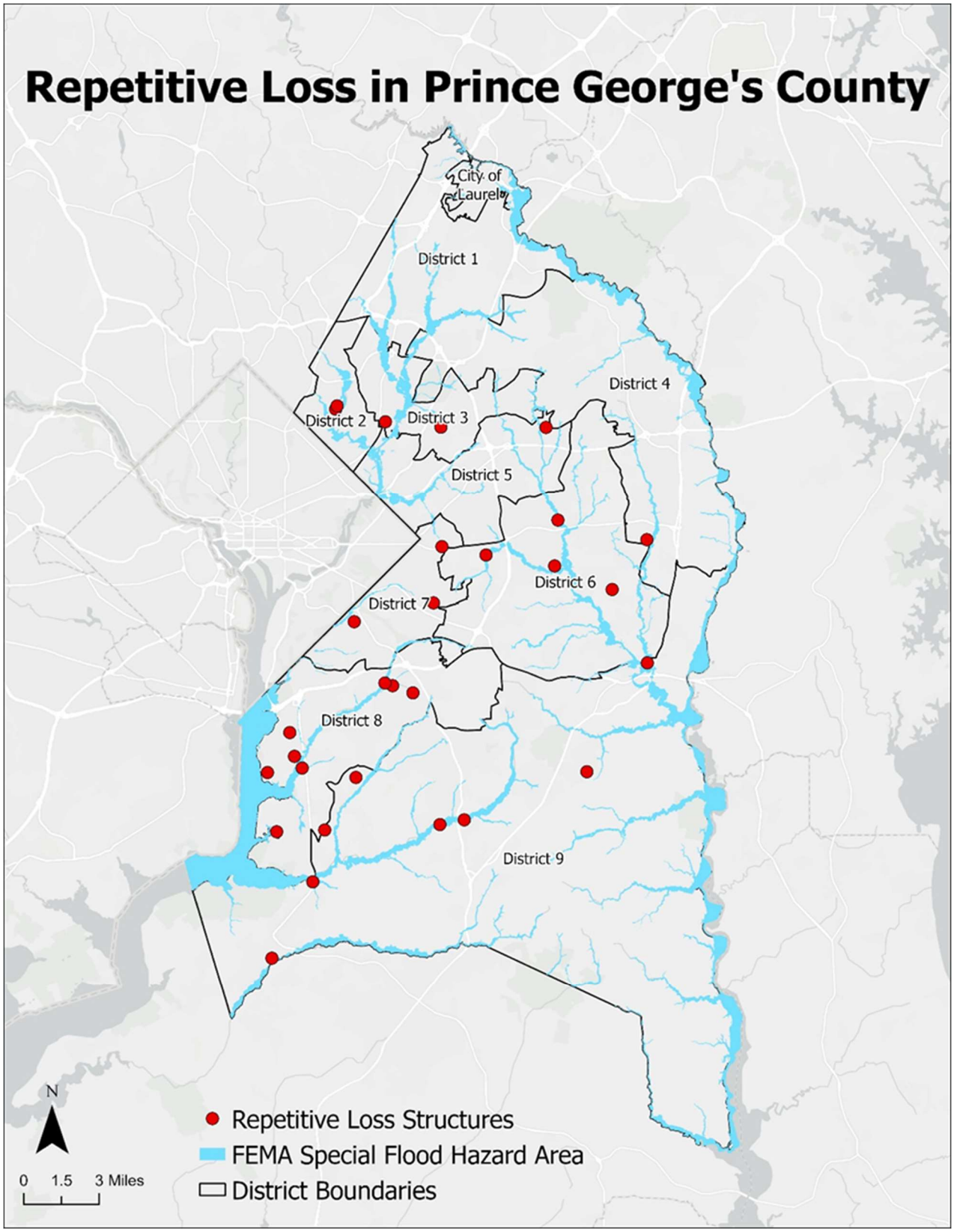


Figure 27: Repetitive Loss Structures in Prince George's County

B.3.c. Community Rating System

The NFIP Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risks. There are ten CRS classes: Class 1 requires the most credit points and gives the largest flood insurance premium reduction; Class 10 does not receive a premium reduction. These discounts are applied per each CRS community and apply to all flood insurance policyholders. For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community receives a 45% premium discount, while a Class 9 community receives a 5% discount.[51]

Prince George's County currently participates in the CRS program. Prince George's first entered the CRS on October 1, 1991 and the current effective date for the program is October 1, 2001. Participation in this program allows residents within the Special Flood Hazard Area to receive a discount on their flood insurance premiums for policies purchased under the NFIP. Residents within the non- Special Flood Hazard Area also receive a discount on their policies. The County's current class is ranked as 5, which gives a 25% premium discount to properties in the Special Flood Hazard Area, or regulated floodplain, and 10% premium discount for non- Special Flood Hazard Area properties. The City of Laurel entered the CRS on April 1, 2022, and the current effective date for the program is April 1, 2022. The City's class is ranked as 7, which gives a 15% premium discount to properties in the Special Flood Hazard Area, or regulated floodplain, and 5% premium discount for non- Special Flood Hazard Area properties.[52] Each community's current CRS status is shown in **Table 45**.

Table 45. FEMA CRS Status[53]

Jurisdiction	CRS Entry Date	Current Effective Date	Current Class	Discount Within Special Flood Hazard Area	Discount Outside of Special Flood Hazard Area
City of Laurel	1 April 2022	1 April 2022	7	15%	5%
Prince George's County	1 Oct 1991	1 Oct 2001	5	25%	10%

B.4. Probability of Future Events

All of Prince George's County and the City of Laurel is vulnerable to some degree of flooding. Based on historical flood event data, flood events can be expected to occur frequently in Prince George's County and the City of Laurel. The probability of future flood events based on the magnitude and according to best available data is illustrated by flood zones shown in **Figure 28** and **Figure 29**. Each of the FEMA Flood Zones represents the probability of a flood event occurring in that area. It is also highly likely that Southern Prince George's County may be subject to coastal flooding associated with possible sea level rise due to climate change. In addition to sea level rise, precipitation events are expected to increase in intensity with seasonal variations due to climate change. With the Northeast Region experiencing a 70% increase in the amount of precipitation falling in very heavy precipitation events, Prince George's County

[51] FEMA Community Rating System https://www.fema.gov/national-flood-insurance-program-community-rating-system
[52] FEMA. N.d. "Community Status Book Report- Maryland".
[53] FEMA. Community Status Book Report. Maryland. https://www.fema.gov/cis/MD.pdf

can be expected to experience a similar increase in amount of precipitation.[54] Changes in precipitation patterns in Maryland are likely to intensify floods and bring more short duration high-intensity rain events in spring and summer than historically experienced. According to the FEMA Climate Mapping for Resilience and Adaptation tool, the County is projected to experience an increase of 1.4 inches of annual precipitation by 2044.[55] In addition, precipitation is expected to increase during the winter months. However, due to warming air temperatures, this is expected to fall more frequently as rain or freezing rain versus snow. Increased precipitation will increase the probability of rain-induced flooding (i.e., pluvial) and riverine flooding events in low-lying areas and in areas with impervious surfaces that do not have adequate mitigation measures in place.

[54] U.S. Global Change Research Program. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II (2018). https://nca2018.globalchange.gov/chapter/18/
[55] Climate Mapping for Resilience and Adaptation Assessment Tool (2022). https://livingatlas.arcgis.com/assessment-tool/search

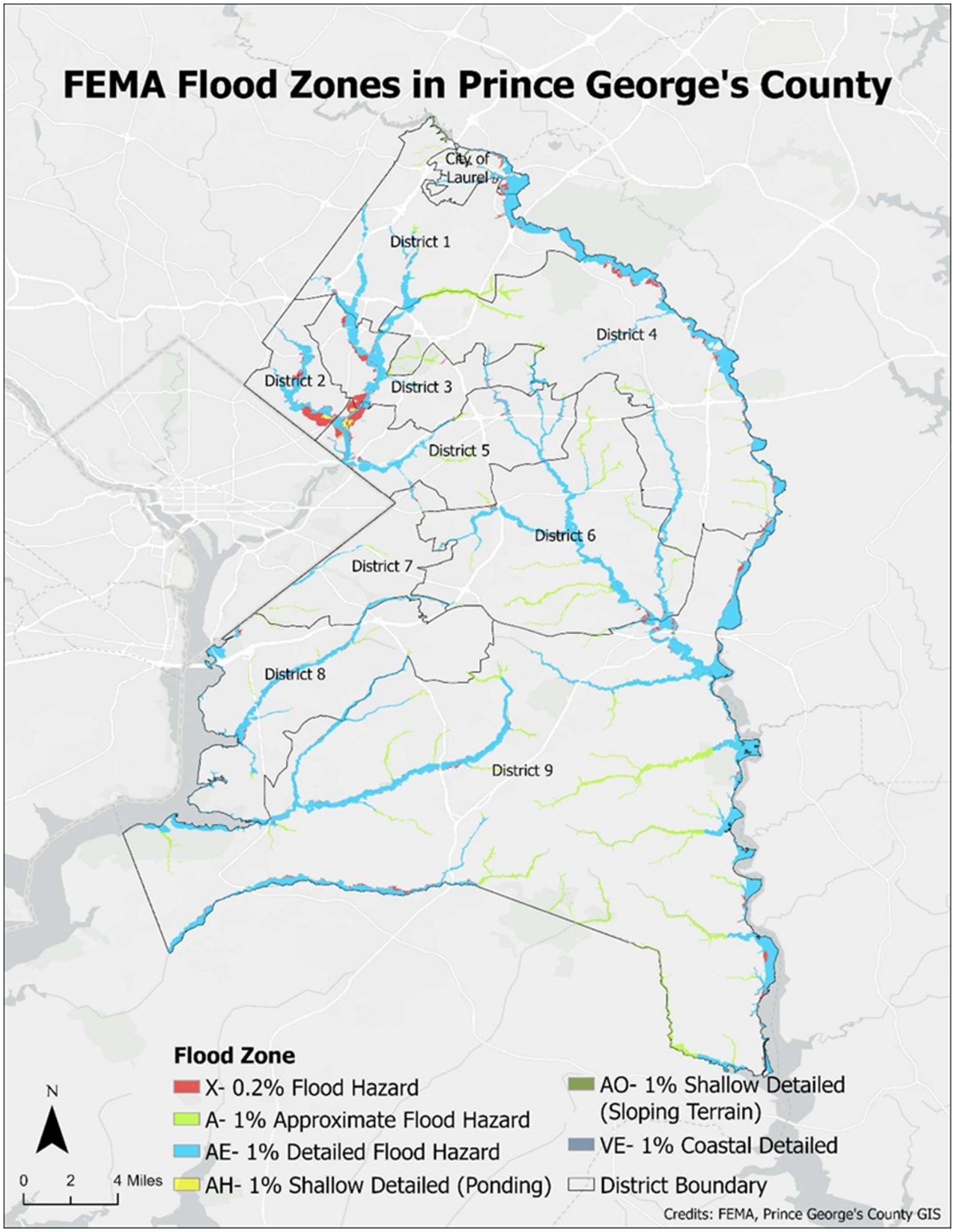


Figure 28: FEMA Flood Zones in Prince George's County

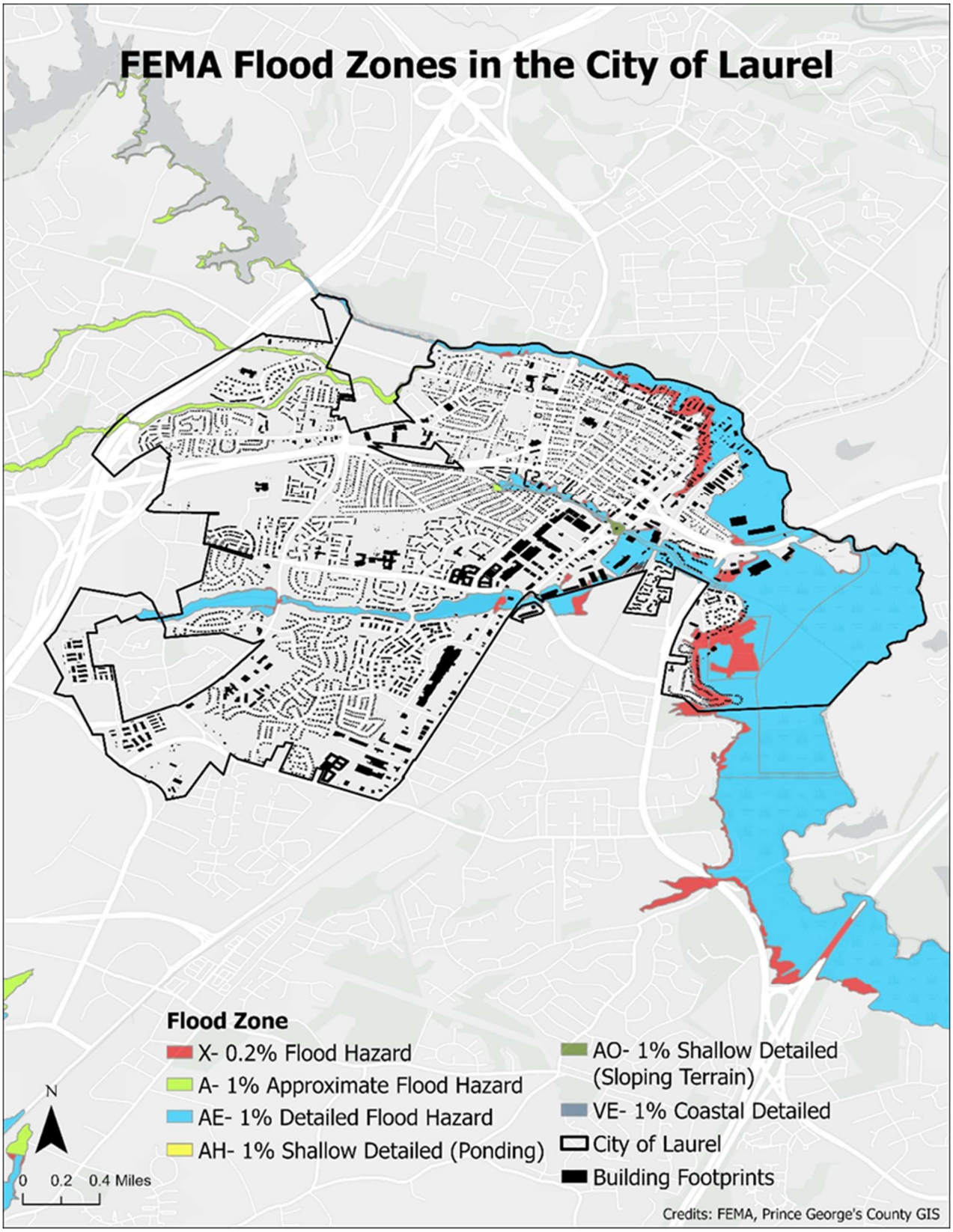


Figure 29: FEMA Flood Zones in the City of Laurel

B.5. Vulnerability and Risk Assessment

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for flooding, including a statewide Hazus analysis. These scores and ranks are shown in **Table 46**, which shows the State's ranking for flood vulnerability in Prince George's County (including the City of Laurel) as high. The State's ranking for coastal flood is shown in **Table 119** in **Section Q**.

Table 46. 2021 State of Maryland Flood Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	3
Crop Damage	1
Geographic Extent	1
Events	2
Local Plan Ranking (2017)	4
Overall Weighted Risk Rating[56]	**25**
Overall Ranking	**High**

Historic flood damages include foundation and wall damage to structures, contents damage, loss of utilities, infrastructure damage to roads, and shore erosion. Damages from storm water runoff events also include wall damage due to "wicking", mildew damage, damage to contents, minor foundation damage, damage to water distribution systems, and potable water contamination. Public related costs include debris clearance; equipment, material and labor expenses related to emergency response and recovery; and building or facility repair or replacement (County parks, utilities, communications, buildings, vehicles, etc.).

Flooding can also impact the County's economy and major employers. Flood damage to businesses can lead to loss of inventory, lack of communication with customers, and may force a business to completely shut down operations. Employers may be disrupted regardless of their location within the floodplain when customers and clients cannot reach their location due to flood damage to roads. The County economy may be impacted by lack of purchases being made during a flood event. Agricultural exports may also be impacted by flooding due to loss of crops. As with flooded roads, public expenditures on flood recovery, repairs to damaged public property affect all residents of the city, not just those in the floodplain.

[56] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5),

B.5.a. Assets Exposed

Exposure analysis shows the total value of buildings in a mapped floodplain. It is not an estimation of loss from a particular event. Using County-provided parcel data, an exposure analysis was performed to see the value at risk if flooding were to occur across the entire county. This parcel data was used in conjunction with the FEMA flood hazard areas to assign parcels to a specific flood zone. Results of the exposure analysis are shown in **Table 47**. Overall, 9.7% of the total properties in Prince George's County and the City of Laurel are exposed to flooding in the 1% or 0.2% chance floodplains. Of properties within Laurel, 2.6% are exposed to the 100-year and 500-year flood scenarios.

Table 47: Building Value Exposure in FEMA Floodplains

Jurisdiction	Total Value	Building Value Exposure in Floodplain			% Value Exposed
		AE - 1%	X - 0.2%	Grand Total	
Prince George's County	$82,364,235,096	$4,908,200,664	$2,576,953,262	$7,485,153,926	9.10%
City of Laurel	$2,749,392,079	$410,752,492	$313,248,832	$724,001,324	2.60%
Total	**$84,828,483,354**	**$5,318,953,156**	**$2,890,202,094**	**$8,209,155,250**	**9.70%**

B.5.b. Critical Facilities Exposed

Critical facilities are essential to fulfilling important public safety, emergency response, and disaster recovery functions. Flooding impacts to critical facilities could severely impact vital functions in a community, putting citizens at risk. Some facilities such as hospitals also house large numbers of people who would have trouble if required to evacuate before or during a severe flood.

An exposure analysis was performed to determine critical facilities located within the 0.2-percent and 1-percent annual chance FEMA floodplain. Results of this exposure analysis are shown in **Table 48**. Twenty-five total critical facilities are located in either the 0.2-percent or 1-percent annual chance floodplain. Six of the total critical facilities in the 0.2-percent or 1-percent annual chance floodplain are located in the City of Laurel. **Appendix D** contains the full, structure-by-structure critical facility hazard analysis.

Table 48: Critical Facilities in FEMA Floodplains

Jurisdiction	All Facilities	Critical Facilities in Floodplain	
		AE- 1%	X- 0.2%
Prince George's County	685	8	11
City of Laurel	24	3	3
Total	**709**	**11**	**14**

B.5.c. Loss Estimation

Riverine flooding loss estimates for each jurisdiction were derived using the FEMA Hazus-MH v5.1 Flood Module for riverine hazards. Flood hazard is defined by a relationship between depth of flooding and the

annual chance of inundation to that depth. Annualization is the mathematical method of converting individual losses to a weighted average that may be experienced in any given year. Annualized loss is the preferred measure with which to express potential risk for hazard mitigation planning as it is useful for creating a common denominator by which different types of hazards may be compared. Annualized losses compared across a region may indicate targeted areas for prioritization of hazard mitigation actions. Areas with significant annualized losses may be subject to not only local flooding (nuisance flooding) but also frequent storm event flooding.

Riverine flood exposure is shown in **Table 49**. Riverine flood losses calculated in the Hazus Flood Module for the City of Laurel and Prince George's County are shown in **Table 50** and **Table 51**, respectively. The Hazus results show that loss to residential structures makes up approximately 75% of the total losses due to flooding. Since residential structures were shown to have the highest damage, homeowners should be educated on flood risks to homes and proper clean up following flood events. Annual total flood loss by census tract for Prince George's County and the City of Laurel is shown in **Figure 30** and **Figure 31**. Census tracts with total loss over $100,000,000 are located in Districts 2, 3, 9, and the City of Laurel. Due to population growth and increased development, all estimates of the numbers of vulnerable structures and losses may under-estimate risk at the present time. Flood damage due to flash flooding (stormwater or pluvial flooding) is not accurately reflected in the Hazus results.

Table 49: Riverine Flood Exposure (based on Hazus-MH v5.1)

Municipality	Residential	Commercial	Industrial	Other	Total Exposure
City of Laurel	$3,973,423,000	$1,268,890,000	$134,076,000	$151,776,000	**$5,528,165,000**
Prince George's County	$130,144,361,000	$26,242,415,000	$5,564,076,000	$7,454,437,000	**$169,405,289,000**
Total Exposure	**$134,117,784,000**	**$27,511,305,000**	**$5,698,152,000**	**$7,606,213,000**	**$174,933,454,000**

Table 50: City of Laurel Riverine Flood Losses (based on Hazus-MH v5.1)

City of Laurel	100-Year Riverine Flood Losses				
	Residential	Commercial	Industrial	Other	Total
Total Exposure					
City of Laurel	*$3,973,423,000*	*$1,268,890,000*	*$134,076,000*	*$151,776,000*	*$5,528,165,000*
Direct Losses					
Building	$86,152,000	$65,358,000	$5,733,000	$3,088,000	$160,331,000
Contents	$41,332,000	$79,086,000	$8,887,000	$3,566,000	$132,871,000

City of Laurel	100-Year Riverine Flood Losses				
	Residential	Commercial	Industrial	Other	Total
Inventory	$0	$1,598,000	$1,070,000	$33,000	$2,701,000
Subtotal	$127,484,000	$146,042,000	$15,690,000	$6,687,000	$295,903,000
Business Interruption					
Income	$859,000	$50,428,000	$318,000	$1,107,000	$52,712,000
Relocation	$9,000,000	$16,431,000	$224,000	$601,000	$26,256,000
Rental Income	$7,416,000	$12,255,000	$38,000	$48,000	$19,757,000
Wage	$2,013,000	$48,478,000	$290,000	$4,509,000	$55,290,000
Subtotal	$19,288,000	$127,592,000	$870,000	$6,265,000	$154,015,000
TOTAL	**$146,772,000**	**$273,634,000**	**$16,560,000**	**$12,952,000**	**$449,918,000**

Table 51: Prince George's County Riverine Flood Losses (based on Hazus-MH v5.1)

Prince George's County	100-Year Riverine Flood Losses				
	Residential	Commercial	Industrial	Other	Total
Total Exposure					
Prince George's County	*$130,144,361,000*	*$26,242,415,000*	*$5,564,076,000*	*$7,454,437,000*	*$169,405,289,000*
Direct Losses					
Building	$834,296,000	$323,906,000	$73,819,000	$72,724,000	$1,304,745,000
Contents	$392,305,000	$408,446,000	$125,548,000	$93,673,000	$1,019,972,000
Inventory	$0	$10,790,000	$19,217,000	$298,000	$30,305,000

Prince George's County	100-Year Riverine Flood Losses				
	Residential	Commercial	Industrial	Other	Total
Subtotal	$1,226,601,000	$743,142,000	$218,584,000	$166,695,000	$2,355,022,000
Business Interruption					
Income	$2,398,000	$232,281,000	$2,882,000	$28,440,000	$266,001,000
Relocation	$111,416,000	$76,858,000	$2,826,000	$17,990,000	$209,090,000
Rental Income	$57,472,000	$57,232,000	$543,000	$3,069,000	$118,316,000
Wage	$5,694,000	$260,289,000	$4,002,000	$269,408,000	$539,393,000
Subtotal	$176,980,000	$626,660,000	$10,253,000	$318,907,000	$1,132,800,000
TOTAL	**$1,403,581,000**	**$1,369,802,000**	**$228,837,000**	**$485,602,000**	**$3,487,822,000**

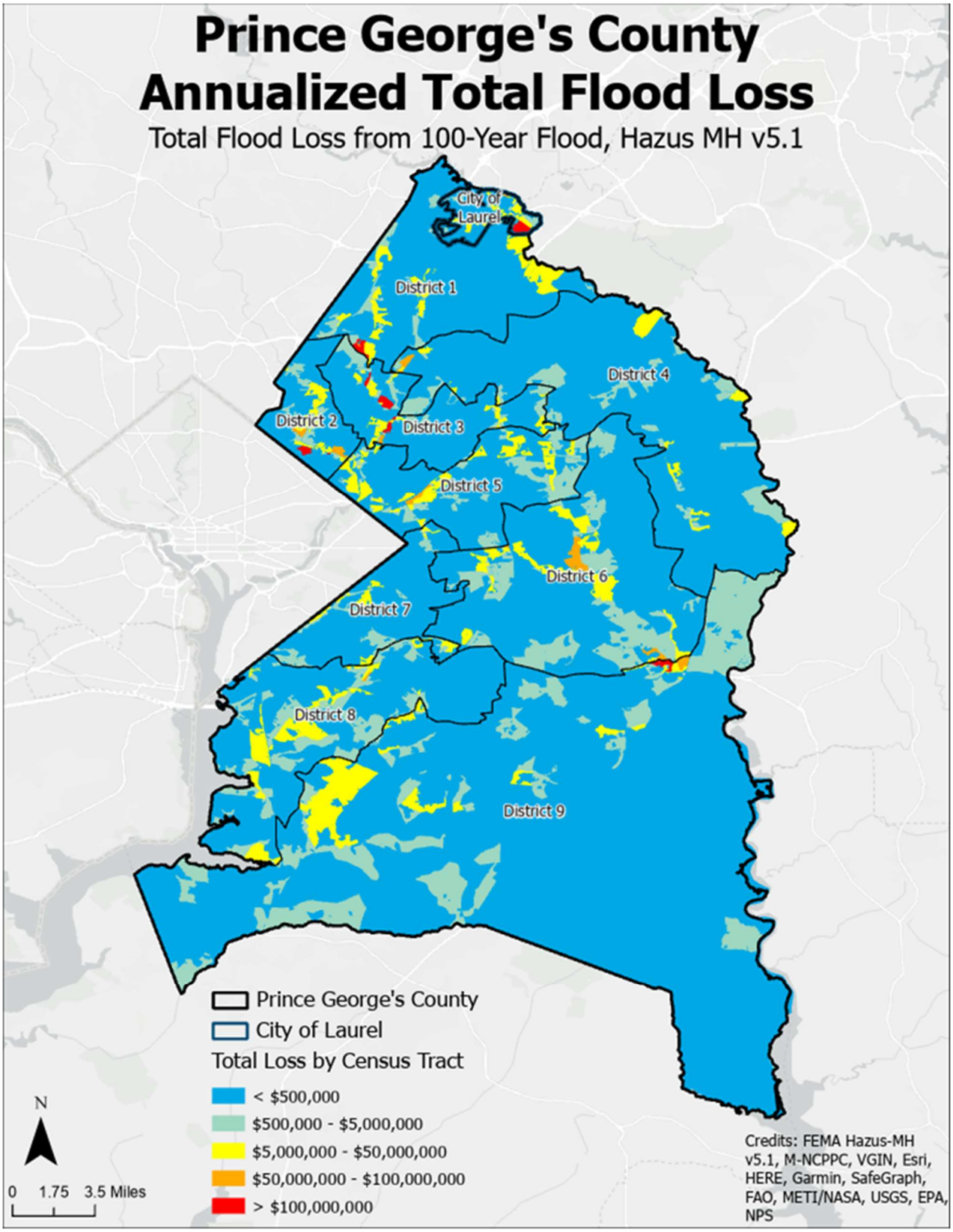


Figure 30: Annualized Total Flood Loss by Census Tract in Prince George's County

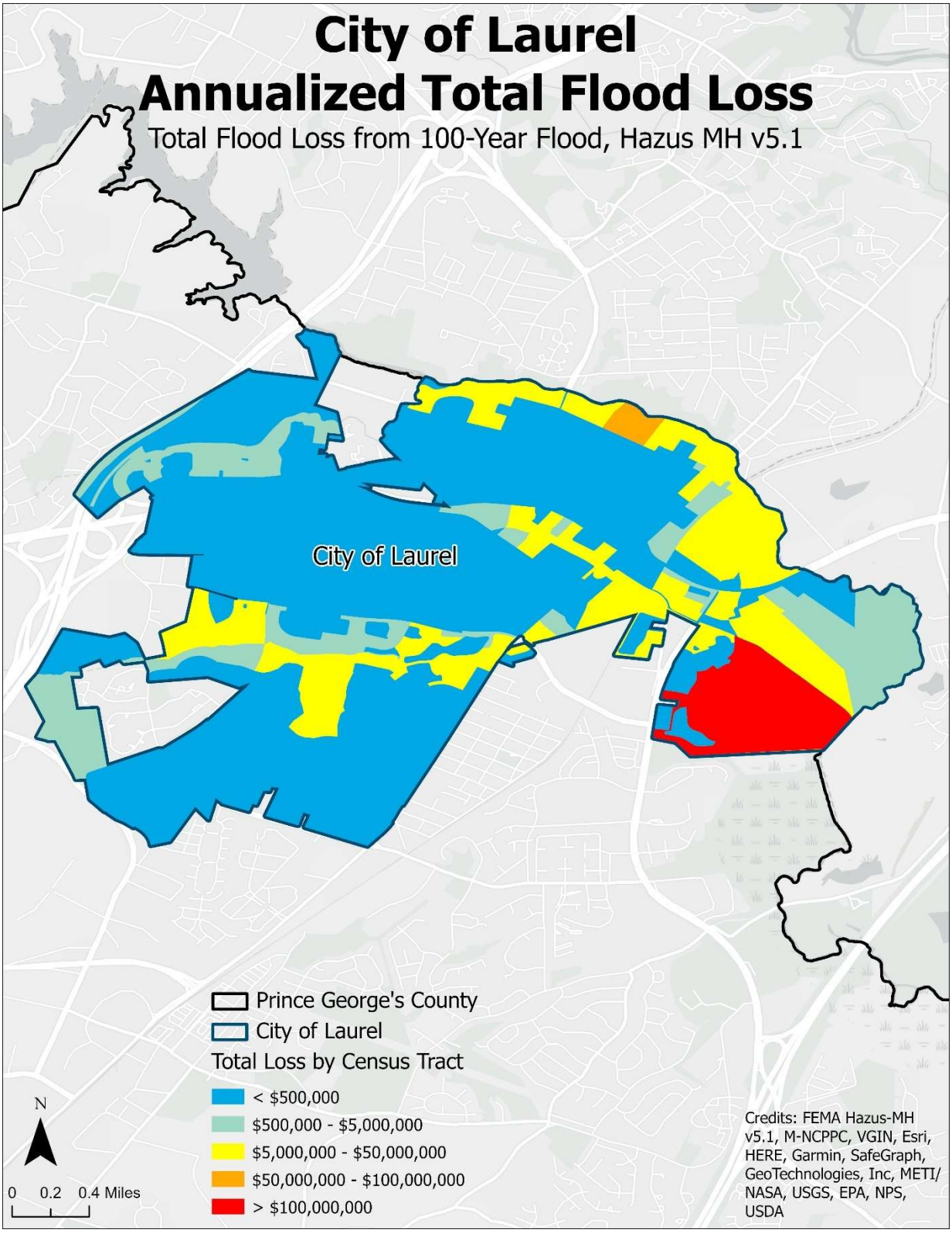


Figure 31: City of Laurel Annualized Total Flood Loss by Census Tract

B.5.d. City of Laurel Critical Facilities Flood Vulnerability Assessment

Outside of this 2023 hazard mitigation planning effort, the City of Laurel staff also performed a more detailed risk assessment from flooding by analyzing the vulnerability of critical facilities within the City. Of the data gathered about these facilities, the factors directly affecting the facility's susceptibility to damage and/or loss from flooding are the building's construction date and flood zone. Critical facilities constructed prior to 1976 were built before the first Flood Insurance Rate Map (pre- Flood Insurance Rate Map) and therefore were not designed with flood protection in mind. This leaves those structures more vulnerable to future flooding than those constructed post- Flood Insurance Rate Map which increases the risk of future damage. The designated flood zone in which each facility lies also greatly affects the likelihood that flooding will occur at that location. **Table 52** below summarizes the flood event vulnerability of critical facilities in the City of Laurel, in order of greatest risk.

The following definitions were used to assign a level of exposure and vulnerability to the critical facilities listed in **Table 52** below.

- **Zone Exposure**:
  - 1 = Structures located in an effective "X" zone
  - 2 = Structures located in an effective "AE" zone
- **Pre/Post- Flood Insurance Rate Map Vulnerability**:
  - 1 = Structures built after 1975 and located in an effective "X" zone
  - 2 = Structures built after 1975 and located in an effective "AE" zone; or structures built prior to 1976 and located in an effective "X" zone

Those levels were combined to assign an overall **flood risk** to each critical facility as described below:

- Low (1-2): These structures were built after the development of community Flood Insurance Rate Maps and were therefore designed with flood protection in mind. They are also located in an effected "X" zone which further reduces the likelihood of future damage/loss.
- Moderate (3-4): These structures are at an increased level of risk due to their combined Zone and Pre/Post Firm Risk. Those built post- Flood Insurance Rate Map are located in an effective "AE" zone which puts them at a higher risk, and those located in an effective "X" zone were built pre-Flood Insurance Rate Map and are at an equally elevated risk.
- High (5-6): These structures are the most vulnerable of those inventoried and carry the greatest damage/loss risk from future flood events. They are all located within an effective "AE" zone which in itself poses a larger flood threat. Structures given a "High" level of risk were constructed pre- Flood Insurance Rate Map and are located in an effective "AE" zone.

Critical Facility Flood Risk

Of the 11 public facilities assessed, **7 have a moderate to high risk for a future 100-year flood event** as assessed through comparison with the 2016 Flood Insurance Rate Map data and structure construction date.

Table 52: City of Laurel Critical Facilities Flood Vulnerability Assessment

Name of Facility	Purpose	Address	Year Built	Effective Zone	Zone Exposure	Pre/Post FIRM Vulnerability	Flood Risk
Laurel Volunteer Rescue Squad	P	14910 Bowie Rd.	1952	AE-EL 142	2	3	High
Laurel Police Department	P	811 Fifth St.	1988	AE-EL 165	2	2	Moderate
City Hall Municipal Center	A	8103 Sandy Spring Rd.	1945	X	1	2	Moderate
Department of Parks and Recreation Operations	A, P	7705 Sandy Spring Rd.	1962	X	1	2	Moderate
Laurel Armory-Anderson Murphy Community Center	R	422 Montgomery St.	1927	X	1	2	Moderate
Laurel Elementary School	E	516 Montgomery St.	1973	X	1	2	Moderate
Laurel High School	E	800 Cherry Ln.	1965	X	1	2	Moderate
Laurel Volunteer Fire Department	P	7411 Cherry Ln.	1990	X	1	1	Low
Department of Public Works	P	305-307 First St.	1988	X	1	1	Low
Robert J. DiPietro Community Center	R	7901 Cypress St.	1993	X	1	1	Low
Scotchtown Hills Elementary School	E	15950 Dorset Rd.	1980	X	1	1	Low
Parks & Recreation Administrative Offices	A	13910 Laurel Lakes	1799	X	1	3	Low

A= Administration P= Public Safety R= Recreation E= Education

B.5.e. Population Exposed

People that live within or near floodplains are more likely to experience flooding compared to those that do not. Using population data from the 2020 American Community Survey, census tracts in Prince George's County were overlaid with the effective FEMA Special Flood Hazard Areas to identify areas where residents may be exposed to flooding. Census tracts identify total population, but do not indicate whether within these boundaries that residents live. **Figure 32** shows population in Prince George's County by census tract and FEMA Flood Zones. Every District and the City of Laurel have populous areas near or within a flood zone. As development occurs, floodplain ordinances will be essential to ensure that future development and residents within flood zones are able to withstand future flood events.

Flooding creates many risks to human population. Flooding can cause fatalities and serious injuries when people do not evacuate areas that are flooded and enter floodwaters or when people are not careful in the dangerous environment after the flood has passed. Prince George's County has an alert system called Alert Prince George's in place to protect its population that provides accurate and timely

information before, during, and after an emergency or disaster.[57] This alert system can provide flood warnings to allow for residents to prepare for a flood event and evacuate if necessary. The State of Maryland has an evacuation zone tool called "Know Your Zone" for residents living in a hurricane evacuation zone. These zones are primarily in coastal areas and are typically used for hurricanes or tropical storms which cause flooding events.[58] The County also provides an Emergency Preparedness Guide on their Office of Homeland Security website that has information on what to do before, during, and after a flood.[59]

In addition to direct risks to human life, there may be further impacts to public health due to flooding. Critical services such as may be forced to close due to flood damage, and floodwater is often contaminated with sewage which can lead to illness and affect drinking water. If untreated sewage enters drinking water systems, widespread gastrointestinal illness could occur. Flooding creates damp environments for mold to grow. Unless the mold is removed quickly, its presence can lead to respiratory illnesses. This is especially true for the elderly and people with disabilities. In addition to the more visible damage to property and infrastructure, flood disasters can disrupt vital health services like dialysis and breathing machines if power outages occur due to flooding.[60] Hazard impacts are also known to cause inequitable impacts on vulnerable populations. For example, low income persons may have a harder time recovering from direct flood impacts, and those reliant on public transportation may face hardships due to access or delays.

[57] Prince George's County. Alert Prince George's. https://www.princegeorgescountymd.gov/794/Alert-Prince-Georges
[58] State of Maryland. Know Your Zone. https://mdem.maryland.gov/Pages/know-your-zone-md.aspx
[59] Prince George's County. Emergency Management Guide. https://www.princegeorgescountymd.gov/DocumentCenter/View/11637/Full-Emergency-Preparedness-Guide-PDF
[60] FEMA. Guide to Expanding Mitigation; Making the Connection to Public Health. https://www.fema.gov/sites/default/files/documents/fema_mitigation-guide_public-health.pdf

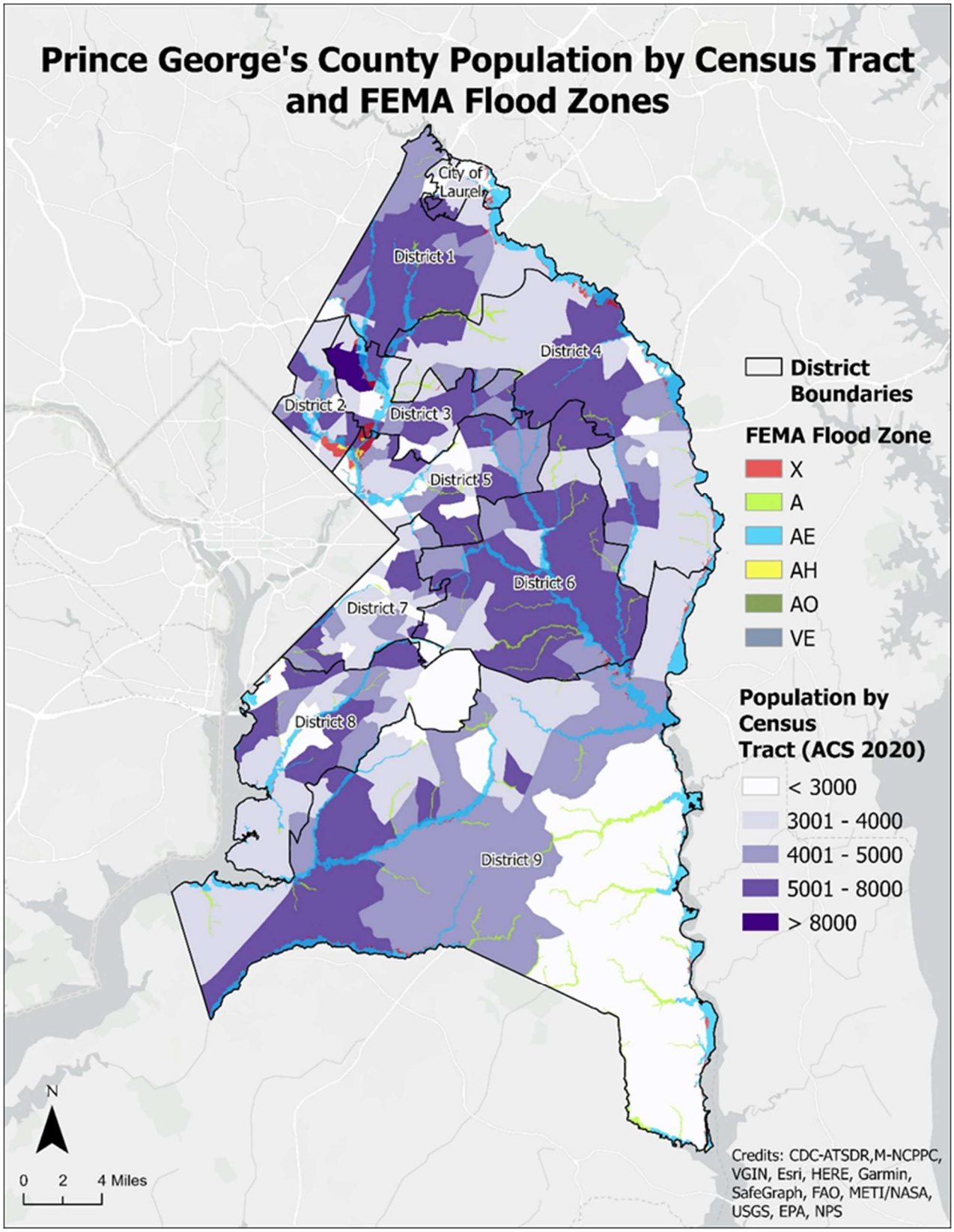


Figure 32: Prince George's County Population by Census Tract and FEMA Flood Zones

B.5.f. Future Development

Development located within the FEMA Special Flood Hazard Area faces increased risk. Development located within this area has an increased risk of flooding, which can impact homes, businesses, and transportation in the area. Additionally, developed areas have more impervious surfaces where water cannot be absorbed into the ground and must be managed through stormwater and drainage systems. Pluvial flood events can be intensified in developed areas with low stormwater and drainage system capacity where water accumulates and floods streets, homes, and businesses.

Figure 33 shows the FEMA Special Flood Hazard Area in Prince George's County and the future growth areas from the Growth Policy Map. There is overlap between Local Centers, Employment Areas, and Regional Transit Districts and the Special Flood Hazard Area. Future development in those areas should take potential flooding impacts into consideration and consider mitigation actions.

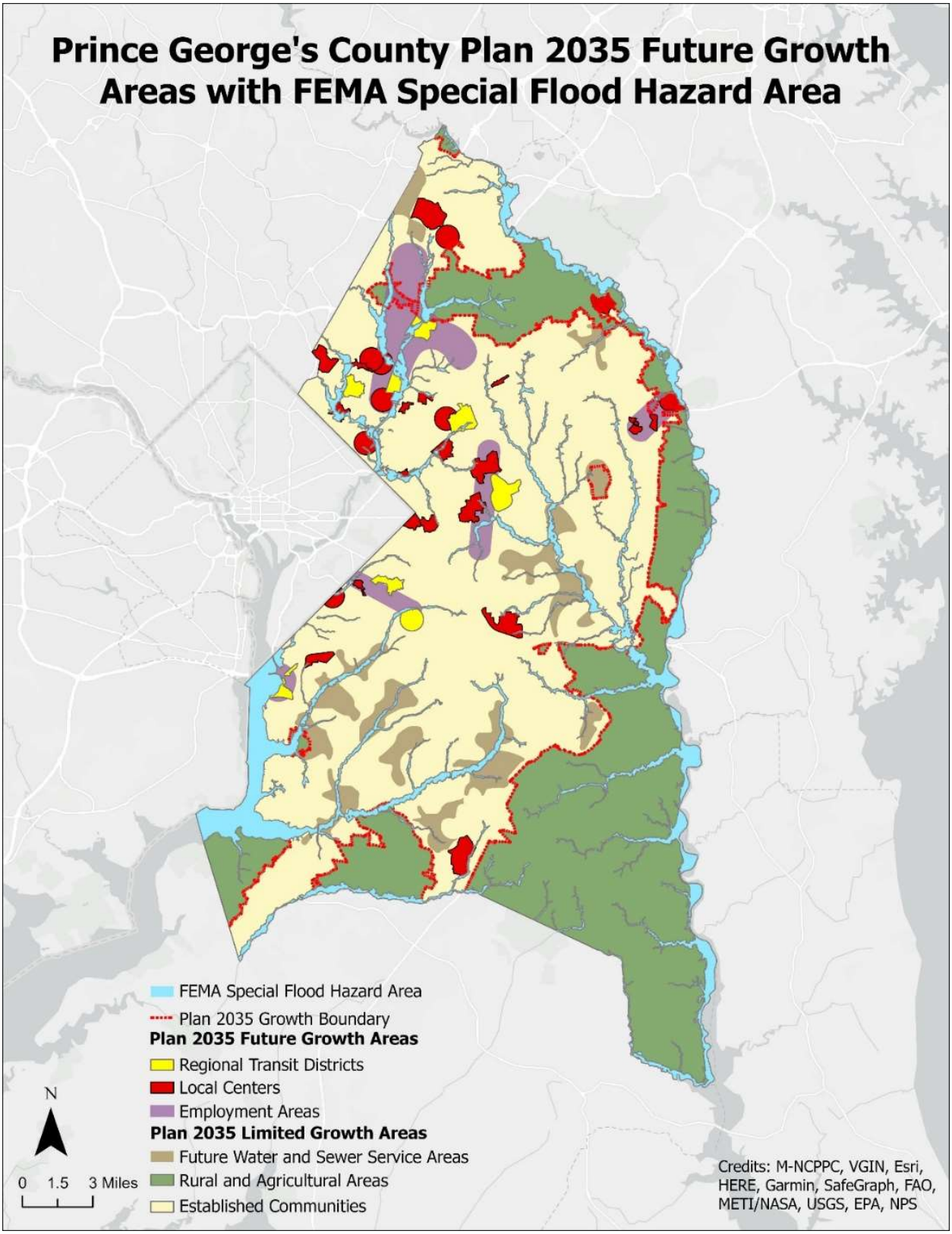


Figure 33. Prince George's County Plan 2035 Future Growth Areas with FEMA Special Flood Hazard Area

B.5.g. Social Vulnerability

Flood risk is higher for socially vulnerable populations. Property values within floodplains are lower, and many floodplain areas have been developed for multi-family housing and single-family low-income neighborhoods.[61] Therefore, socially vulnerable populations are more likely to live in floodplains and have reduced capacity to respond to and recover from flood events. **Figure 34** shows social vulnerability by census tract in Prince George's County using the CDC Social Vulnerability Index 2020 data. Residents living in areas with high social vulnerability in flood zones may be at higher risk for flood impacts such as damage to homes, power outages, and death or injuries due to flooding.

B.6. Consequence Analysis

A consequence analysis (refer to **Table 53**) has been done to better understand the range of impacts that a riverine flood event can have on several features of the planning area and the population within it.

Table 53. Riverine Flood Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Flooding can cause injury or loss of life. Flood conditions necessitate warnings, such as flash flood warnings, road closure warnings, and flood advisories to allow residents to remain safe during hazardous floods. Evacuations may also be necessary during large-scale flood events.
Public Health	Floodwaters often contain contaminants such as bacteria and chemical hazards. Flooding can also result in sewer overflows, resulting in sewage in floodwaters. Individuals traversing floodwaters or children playing in floodwaters are at risk of contracting diseases, injuries, and infections. Structures exposed to flooding may develop mold or wood rot. People with asthma, allergies, or breathing conditions may be at a higher risk to mold.
Critical Facilities and Infrastructure	Critical facilities, such as hospitals may flood and lose power during flood events, forcing them to operate on backup generators. Infrastructure may experience impacts in the form of damage from flooding, debris blockages, temporary closure of transportation routes, and the potential inability of the stormwater system to handle floodwater in a severe event.
Economy	A major flood event would be costly for local governments in terms of emergency response, delivery of services, disaster cleanup, and future mitigation projects. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event.
Buildings	Home and landowners within the FEMA 100-year flood zone are most at risk to impacts from a flood event. They may experience damage to or loss of property depending upon the severity of flooding in the area. Structures that are impacted by flooding may have structural damage, damaged electrical systems and gas tanks, or develop mold or wood rot.

[61] Lee D, Jung J. 2014. The growth of low-income population in floodplains: a case study of Austin. https://doi.org/10.1007/s12205-014-0205-z

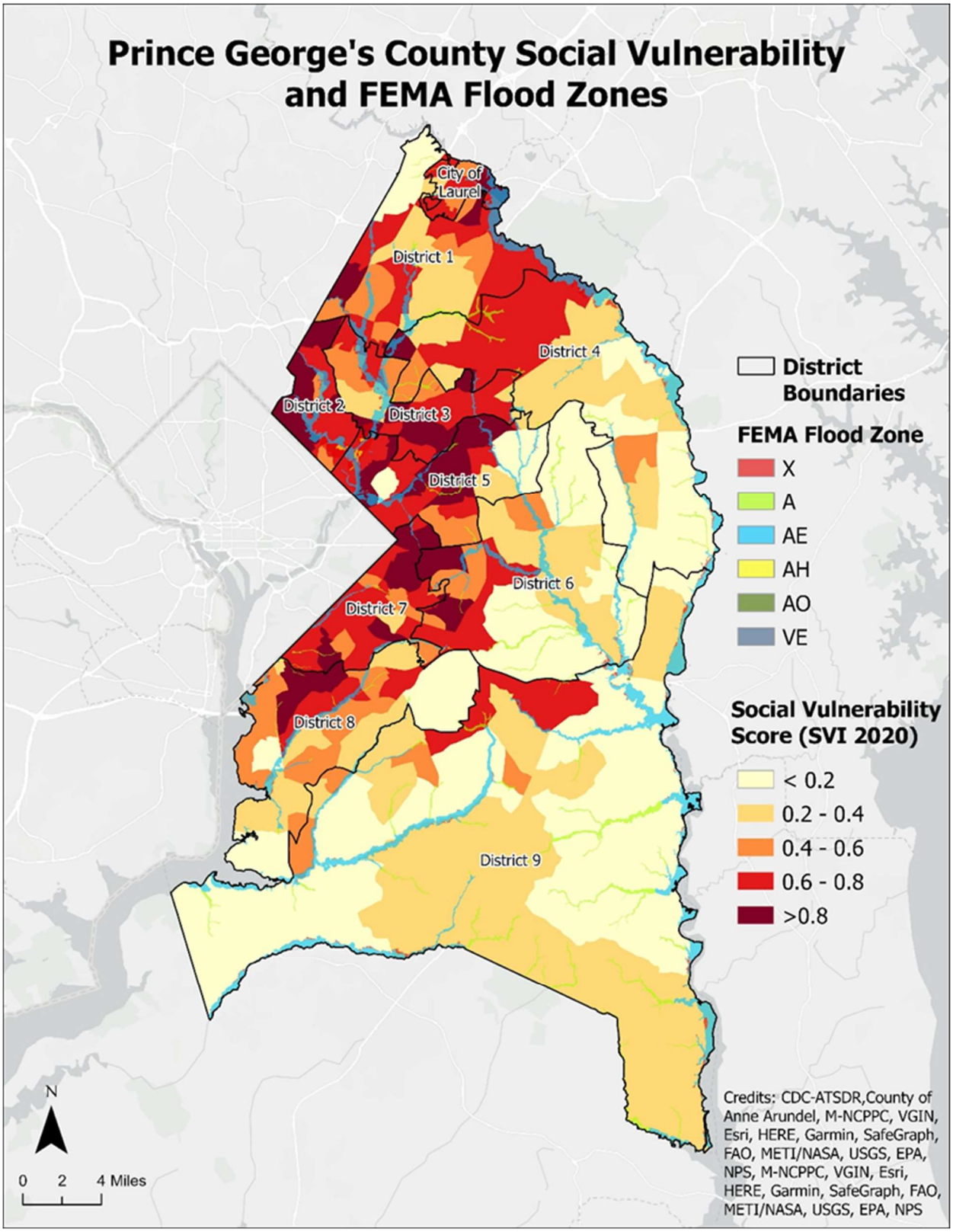


Figure 34: Prince George's County Social Vulnerability and FEMA Flood Zones

C. Severe Storm (Flood-Related)

C.1. Description

Severe storms are formed when warm, moist air pushes upwards into the atmosphere, cools, and forms into cumulonimbus clouds. As the air continues to cool, it starts to form water droplets or ice, and as these droplets or ice start to fall, they may collide and combine repeatedly into larger forms before reaching the Earth's surface. Severe storms can form in any geographic region and are sometimes the cause of other natural phenomena.

Flood-related severe storms can cause heavy rainfall over an area, causing urban (pluvial) flooding. Urban flooding occurs when heavy rainfall creates a surface water flood event independent of an overflowing water body. Prince George's County defines urban flooding as "...the inundation of property in a built environment, particularly in more densely populated areas, caused by rain falling on increased amounts of impervious surfaces and overwhelming the capacity of drainage systems."[62] The Maryland Department of the Environment is working to more consistently define flooding events, such as urban flooding, as used in statutes.

One type of pluvial flooding is flash flooding. Flash floods can be the product of heavy localized precipitation in a short time period. Flash floods consist of a rapid rise of water along a water channel or low-lying urban area and are usually a result of an unusually large amount of rain and/or high velocity of water flow (particularly in hilly areas) within a very short period of time. Flash floods can occur with limited warning.

Common causes of pluvial flooding include overflowing drainage or stormwater systems or when ground is oversaturated and cannot absorb excess water, causing surface water to flood an area. Areas with high amounts of impervious surfaces, such as urban areas can experience intensified pluvial flooding events due to a lack of ability for water to absorb into the ground.

C.2. Location and Extent

A number of factors contribute to the extent (strength and magnitude) of a flood and the relative vulnerabilities of certain areas. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood extent include:

- Flood depth: The greater the depth of flooding, the higher the potential for significant damages.
- Flood duration: The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage. Floodwaters may linger because of the low relief of the area, but the degree varies.
- Velocity: Flowing water exerts force on the structural members of a building, increasing the likelihood of significant damage. A one-foot depth of water, flowing at a velocity of five feet per second or greater, can knock an adult over and cause significant scour around structures and roadways.

[62] Drainage and Flooding in Prince George's County. Presentation by Prince George's County DPIE, DPW and DER. (2021)

- Elevation: The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage due to flooding. Data on the specific elevations of structures in Frederick County has not been compiled for use in this analysis.
- Construction type: Certain types of construction are more resistant to the effects of floodwaters than others. Masonry buildings, constructed of brick or concrete blocks, are typically the most resistant to flood damages simply because masonry materials can be in contact with limited depths of water without sustaining significant damage. Wood frame structures are more susceptible to flood damage because the construction materials used are easily damaged when inundated with water.

Rainfall associated with flash flooding is intense and the waters are fast moving, so it is not as easy to predict when a flash flood will occur or how severe it will be. Specific extent of flash flooding is difficult to determine in advance because local terrain, soil conditions, and construction play a role in how much stormwater can percolate into the soil, be accommodated by waterways, or cause flash flooding. Depth and velocity of flash flooding is difficult to determine, but local stream gauges could be used to mark velocity of floodwaters. To help alleviate the difficulty around predicting urban flooding issues, the Maryland Department of the Environment is working with local jurisdictions, the Maryland Departments of Emergency Management, Planning, Natural Resources, the Department of Transportation, and other state agencies to collect flood event data and identify locations where flooding has occurred after January 1, 2000.[63] The result of this work will be more comprehensive information on urban flooding locations, including within Prince George's County. Without specific information, all areas in the County and City of Laurel should be considered at risk to storm-related flooding.

C.3. Previous Occurrences

According to the NCEI, there have been 108 flash flood events and 102 heavy rain events recorded in the database. These records range from 1950 to 2022. Some events were associated with massive tropical weather systems, but most were associated with storms occurring from April through August. Additionally, it should be noted that some NCEI heavy rain events occurred on the same day or within a few days of NCEI flash flood events. The NCEI database reports $55,695 in annual damages (all property damage) for flash flood and heavy rain occurrences and 2.9 annualized events. **Table 54** summarizes these results by hazard event type.

Table 54: NCEI Historic Flash Flood and Heavy Rain Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Flash Flood	108	1950-2022	$55,653	0	1.5	1.5
Heavy Rain	102	1950-2022	$42	0	0.0	1.4
Total	**210**	**1950-2022**	**$55,695**	**0**	**1.5**	**2.9**

[63] Maryland Department of the Environment. Advancing Stormwater Resiliency in Maryland (A-StoRM): Maryland's Stormwater Management Climate Change Action Plan. 2021. https://mde.maryland.gov/Documents/A-StorRMreport.pdf

C.4. Probability of Future Events

The probability of future occurrences of severe storm events impacting Prince George's County and the City of Laurel is high. It is extremely difficult to determine the probability of future occurrence in a specific area within the county with any degree of accuracy. All areas within Prince George's County are at risk of heavy rain and flash floods, especially the heavily urbanized areas with high amounts of impervious surfaces in the northern part of the County, Upper Marlboro, and in the City of Laurel. Based on past occurrences, Prince George's County and the City of Laurel have a high probability of future severe storm occurrence, averaging approximately 3 events annually.

According to the *Fourth National Climate Assessment* (NCA4), climate change will impact general flood hazards. NCA4 projects continued increases in the frequency and intensity of heavy precipitation in many regions of the United States, including the northeast. The strongest hurricanes are expected to "become both more frequent and more intense," and result in more rainfall.[64]

C.5. Vulnerability and Risk Assessment

Severe storm events have a high correlation with riverine flooding. Vulnerability to severe storm flooding events is similar to vulnerability to riverine flooding, presented in **Chapter 4.B.5**. In the future, as precipitation patterns change, flood risks will intensify in areas adjacent to water bodies and, more specifically, flash flooding risks will elevate in more developed areas, where there are more impervious and paved surfaces. If development and population growth encroach into flood-prone areas, Prince George's County and the City of Laurel's vulnerability to flooding will increase.

The topography and elevation of an area, development and extent of impervious surfaces, and precipitation movement and patterns correlate to the vulnerability of the region to severe storm flooding events. With flash flooding comes flooded roads, homes, and structures which can lead to safety hazards—an in extreme cases, loss of life. Consistent rainfall and flash flooding can wash out roads and cause erosion, which can lead to landslides and agricultural damages. Lastly, flash floods have been and will continue to be a significant threat to the economic and social well-being of the more developed areas of Prince George's County and the City of Laurel. In particular, the towns that have concentrated structures, assets, and populations are vulnerable to flood damages. Flash floods can affect the economy and commerce of the county through flooded roads and economic losses for local businesses.[65]

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for thunderstorm. These scores and ranks are shown in **Table 55**, which shows the State's ranking for thunderstorm vulnerability in Prince George's County (including the City of Laurel) as high. The State's ranking for riverine flood is shown in **Table 46** in **Section B**.

Table 55. 2021 State of Maryland Thunderstorm Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3

[64] The Fourth National Climate Assessment. Volume II, Impacts, Risks, and Adaptation in the United States. U.S. Global Change Research Program, 2018.; Revised February 2020. Available at: https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

[65] 2021 Draft Maryland Hazard Mitigation Plan

Risk Factors	Rank
Injuries	2
Deaths	4
Property Damage	2
Crop Damage	1
Geographic Extent	3
Events	3
Local Plan Ranking (2017)	4
Overall Weighted Risk Rating[66]	**26**
Overall Ranking	**High**

C.6. Consequence Analysis

A consequence analysis (refer to **Table 56**) has been done to better understand the range of impacts that a severe storm flood event can have on several features of the planning area and the population within it.

Table 56. Severe Storm (Flood-Related) Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Severe storm events with flooding can cause injury or loss of life. Flood conditions necessitate warnings, such as flash flood warnings, road closure warnings, and flood advisories to allow residents to remain safe during hazardous floods. Evacuations may also be necessary during large-scale severe storm events.
Public Health	Floodwaters associated with severe storms often contain contaminants such as bacteria and chemical hazards. Flash flooding can also result in sewer overflows, resulting in sewage in floodwaters. Individuals traversing floodwaters or children playing in floodwaters are at risk of contracting diseases, injuries, and infections. Structures exposed to flooding may develop mold or wood rot. People with asthma, allergies, or breathing conditions may be at a higher risk to mold.
Critical Facilities and Infrastructure	Severe storms can cause flash flooding that can damage electrical systems to critical facilities. Infrastructure may experience impacts in the form of damage from flooding, debris blockages, temporary closure of transportation routes, and the potential inability of the stormwater system to handle floodwater in a severe event.
Economy	Flash floods can affect the economy and commerce of the county through flooded roads and economic losses for local businesses. Additionally, flash flooding can cause erosion, impacting agricultural productivity.

[66] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Community Feature	Impacts
Buildings	Towns with concentrated structures, assets, are more vulnerable to flood damages. Flash flooding can impact buildings in urban areas and rural areas. Homeowners may experience damage to or loss of property depending upon the severity of flooding in the area. Structures that are impacted by flooding may have structural damage, damaged electrical systems and gas tanks, or develop mold or wood rot.

D. Severe Storm (Wind-Related)

D.1. Description

Wind-related severe storms are associated with the presence of strong winds, hail, and lightning. Wind related to severe storms typically originates from thunderstorms. Thunderstorms are caused when air masses of varying temperatures and moisture content meet. It is also possible to experience storms without precipitation, which can increase wildfire risk during periods of dry weather or drought. Thunderstorms can form in any geographic region and are sometimes the cause of other natural phenomena such as downburst winds, heavy rain, flash floods, large hailstones, tornadoes, and waterspouts.

A severe thunderstorm includes damaging winds of 58 mph (50 knots) or greater and hail one inch or larger in diameter. High winds have been further broken down into three categories by the National Weather Service Storm Events database: High wind, strong wind, and thunderstorm wind.

A "high wind" is a sustained non-convective winds of 35 knots (40 mph) or greater lasting for one hour or longer or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally/regionally defined), on a widespread or localized basis. In some mountainous areas, the above numerical values are 43 knots (50 mph) and 65 knots (75 mph), respectively.[67]

A "strong wind" is a non-convective wind gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph) resulting in a fatality, injury, or damage.[68]

A "thunderstorm wind" is a wind arising from convection (occurring within 30 minutes of lightning being observed or detected) with speeds of at least 50 knots (58 mph), or winds of any speed (non-severe thunderstorm winds below 50 knots) producing a fatality, injury, or damage. Events with maximum sustained winds or wind gusts less than 50 knots (58 mph) should be entered as a Storm Data event only if they result in fatalities, injuries, or serious property damage.

Hail is precipitation in the form of ice that occurs in thunderstorms between currents of rising air (updrafts) and currents of descending air (downdrafts). These storms typically occur in late spring through early summer. As defined by the National Weather Service, thunderstorms must feature hail that is 1 inch in diameter (quarter-size) or larger to be classified as "severe." **Figure 35** shows how hail is formed in the atmosphere. The Tornado and Storm Research Organization Hailstorm Intensity Scale, shown in **Table 57** ranks intensity or damage potential related to hail size (distribution and maximum), texture, numbers, fall speed, speed of storm translation, and strength of the accompanying wind. Evidence indicates that maximum hailstone size is the most important parameter relating to structural damage, especially towards the more severe end of the scale. It must be noted that hailstone shapes are also an important feature, especially as the "effective" diameter of non-spheroidal specimens should ideally be an average of the co-ordinates. Spiked or jagged hail can also increase some aspects of damage.

Table 57: Tornado and Storm Research Organization Hailstorm Intensity Scale

Scale	Intensity Category	Typical Hail Diameter (mm)*	Typical Damage Impacts
H0	Hard hail	5	No damage

[67] High Winds are addressed under the "High Winds" section
[68] Strong Winds are addressed under the "High Winds" section

Scale	Intensity Category	Typical Hail Diameter (mm)*	Typical Damage Impacts
H1	Potentially damaging	5-15	Slight general damage to plants, crops
H2	Significant	10-20	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60	Bodywork of grounded aircraft dented; brick walls pitted
H7	Destructive	50-75	Severe roof damage, risk of serious injuries
H8	Destructive	60-90	Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

*Approximate range (typical maximum size in bold), since other factors (e.g. number and density of hailstones, hail fall speed and surface wind speeds) affect severity.

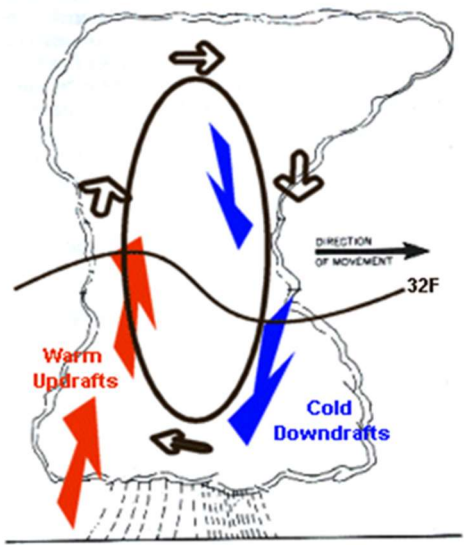


Figure 35: Formation of Hail (Source: NOAA)

Lightning is generated by the buildup of charged ions in a thundercloud. When this buildup intersects with the best conducting object or surface on the ground, the result is a discharge of a lightning bolt. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air cause thunder.

D.2. Location and Extent

All of Prince George's County and the City of Laurel could be impacted by a thunderstorm event that causes high wind, lightning, and hail. All structures and assets in Prince George's County and the City of Laurel should be considered vulnerable to these hazards. While impacts may vary based on location and severity and asset characteristics, the potential impacts in each jurisdiction are the same.

Using the National Weather Service definition for a severe thunderstorm, dime-sized hail is considered a minimum hazard, and quarter-sized hail is considered a major hazard. Quarter-sized hail can cause significant damage to property such as automobiles, aircraft, and roofs as well as agricultural crops and livestock. Damage to shingled roofs may go undetected until leaks and cracks start forming. Damage to metal roofs is more noticeable due to dents and damage to exterior finishes. Automobiles may be dented or have their windshields and windows shattered. Although rare, large hailstones may even cause injury or death. The amount of cover available during a hailstorm can greatly affect the risk to human health during these events.

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed the city is uniformly exposed to lightning. Lightning flash data compiled by Vaisala, Inc. with data from 2015 through 2020 shows total lightning density per county, shown in **Figure 36**.[69] Prince George's County had a total lightning density of 32 to 64 events/km^2/year.

[69] Vaisala, Inc. Total lightning statistics. https://www.vaisala.com/sites/default/files/documents/WEA-MET-2021-Annual-Lightning-Report-B212465EN-A.pdf

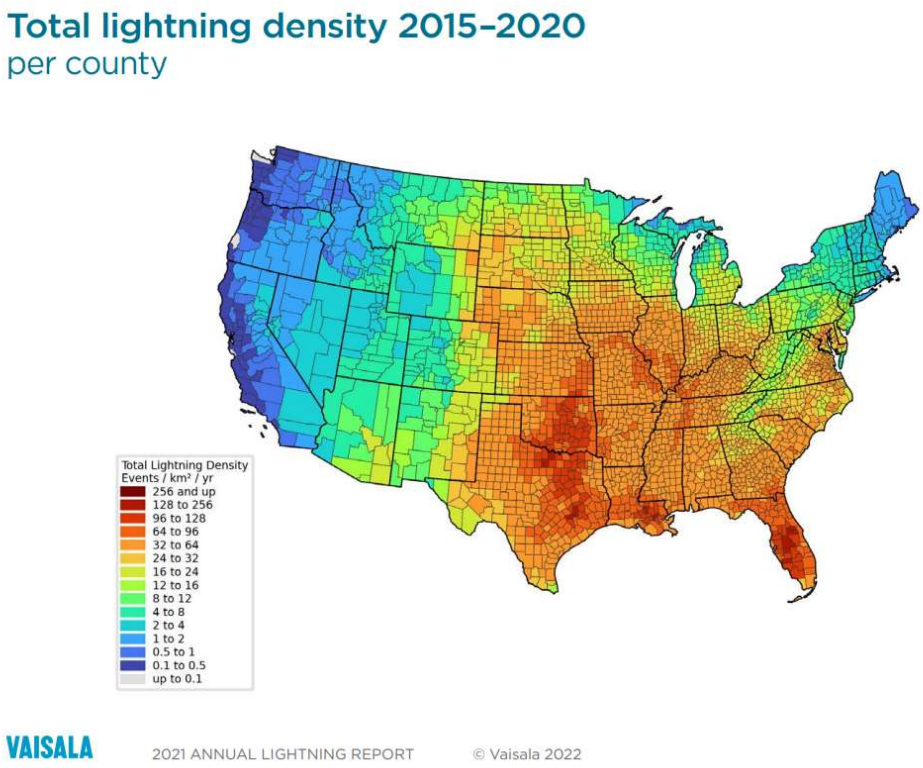


Figure 36: Vaisala, Inc. Total Lightning density 2015-2020

While there is no established index for lightning, a lightning strike is considered to be of minimum severity when it has limited impacts on infrastructure (e.g., only hitting tree limbs, if anything other than the ground) and major severity when it causes extensive damage (e.g. loss of life, fire, structural damage). The potential damages resulting from lightning strikes are primarily loss of life, business interruption, fire, and minor structural damage. A false sense of security often leads people to believe that they are safe from a lightning strike because it may not appear to be near their location. However, lightning can strike 10 miles away from a rain column, which puts people outside of the storm cloud at risk.

Using the National Weather Service high wind categories listed above, sustained non-convective winds of 40 mph or greater lasting for one hour or longer or winds (sustained or gusts) of 58 mph for any duration, on a widespread or localized basis, are considered a minimum severity event. A major severity event would be wind events of greater than 58 mph or wind events resulting in death, injury, or significant damage.

D.3. Previous Occurrences

When using the combined NCEI thunderstorm wind, lightning, and hail events, there are a total of 619 events recorded in Prince George's County. Since 1950, there have been 501 thunderstorm wind events, 13 lightning events, and 105 hail events recorded in the database. Annualized deaths, injuries, damages, and number of events are summarized in **Table 58**.

Table 58: NCEI Historic Hail, Lightning, and Thunderstorm Wind Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Thunderstorm Wind	501	1950-2022	$72,982	0.00	0.11	6.96
Lightning	13	1950-2022	$9,652	0.01	0.07	0.18
Hail	105	1950-2022	$166	0.00	0.00	1.46
Total	**619**	**1950-2022**	**$82,800**	**0.01**	**0.18**	**8.60**

D.4. Probability of Future Events

Based on the NCEI database, Prince George's County and the City of Laurel have a high probability of experiencing these types of hazards. Severe thunderstorm wind events occur seven to nine times annually (9.20 annual occurrences), hail events occur once or twice each year (1.20 annual occurrences), and a damaging lightning strike is a rare occurrence.

As ocean surface temperature increases in the Atlantic Ocean due to climate change, there will be more energy for Atlantic storms to strengthen, which could lead to an increased frequency of thunderstorms and other severe storms in Prince George's County. Additionally, as the temperature and amount of moisture in the air increases due to climate change, there is a higher risk of severe thunderstorms occurring.

D.5. Vulnerability and Risk Assessment

The primary hazard caused by thunderstorm winds is the transport of debris, which can cause casualties and property loss or even the dislodging of mobile homes from their foundation. Lightning can also cause fires, hailstorms can cause damage to structures and cars, and can put people's lives at risk. Additionally, high winds may also cause damage to poles and lines carrying electric, telephone, and cable television service.

All of the County's population is vulnerable to severe storms. The number of people affected by storms and to what degree will depend on the type of storm that occurs, as well as its severity and tenure. Residents that live in remote areas with limited road or transportation access may be temporarily isolated if roads become impassable due to debris or fallen trees or extended power outages occur.

Because all areas of Prince George's County and the City of Laurel are susceptible severe storm events, it can be assumed that all structures are exposed and potentially vulnerable. Taller structures are the most exposed to lightning, while structures that are not surrounded by others are more likely to be damaged by wind. All structures are in danger of hail damage. Older structures built before 1940 are often more susceptible to all types of damage related to severe storms. Older critical facilities are vulnerable to wind damage due to the age of construction and poor condition due to age and lack of maintenance, especially in the more rural and isolated areas of the County. It is important to identify specific critical facilities and assets that are most vulnerable to severe weather. Evaluation criteria include

the age of the building (and what building codes may have been in effect at the time of construction), type of construction, and condition of the structure (i.e., how well the structure has been maintained).

Figure 37 shows buildings constructed before 2002 (the first year that the Building Codes from 2000 were required in the County) and are broken up into three date categories and levels of possible vulnerabilities:

- 1600 to 1899 (Dark Orange): Highly Vulnerable
- 1900-1949 (Light Orange): Moderately Vulnerable
- 1950-2002 (Light Yellow): Slightly Vulnerable

Buildings that are shown in dark orange suggest that they may be more susceptible to wind damage than buildings in yellow; However, all buildings shown could be susceptible to damage. There is a possibility that these buildings may have been renovated to improve structural integrity for protecting against wind damage. Nonetheless, this map is intended to give an overview of areas that are of higher risk. The trend shown in the map is that most highly vulnerable buildings are in the Eastern part of the county.

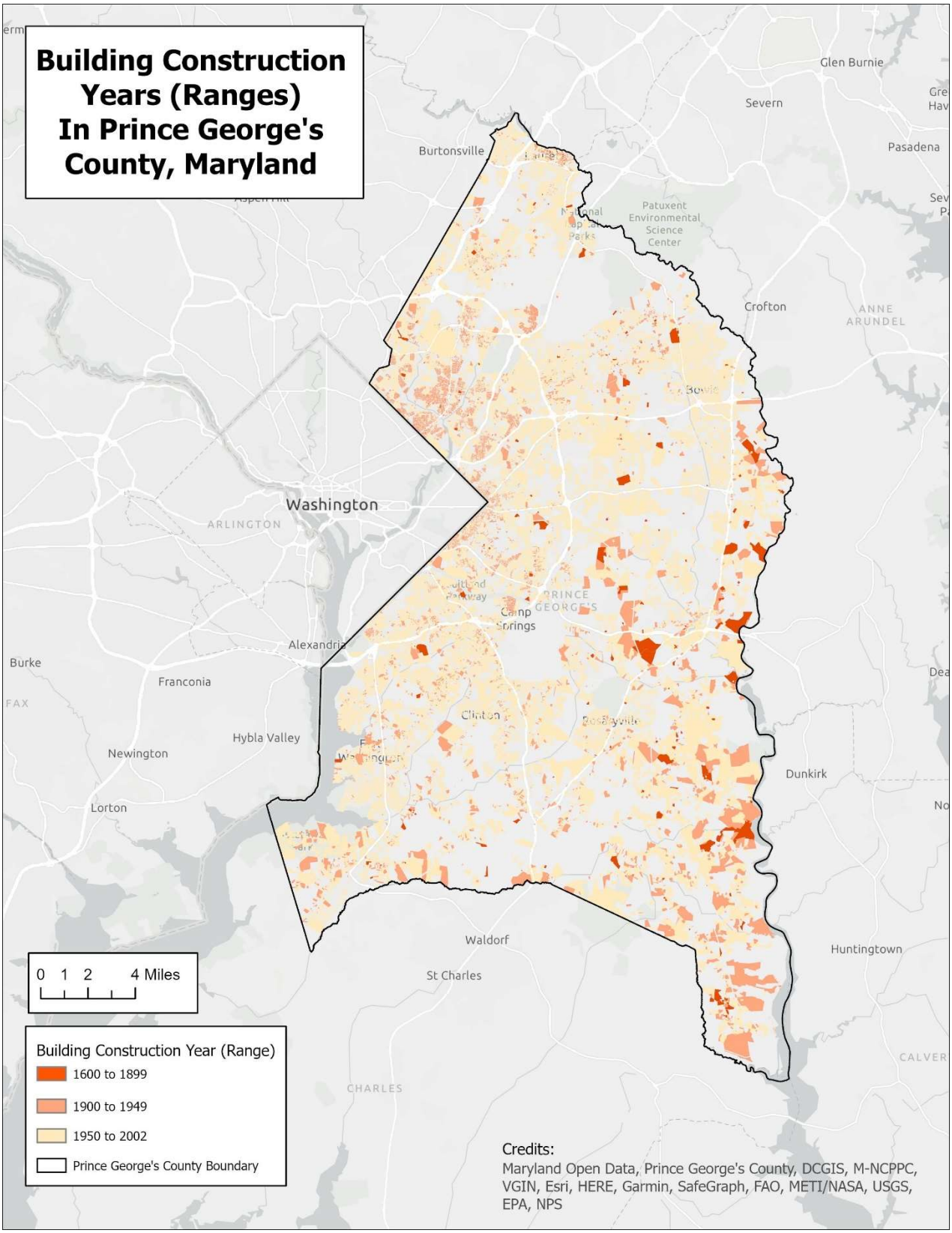


Figure 37: Buildings Constructed before 2002 in Prince George's County

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for wind. These scores and ranks are shown in **Table** 59, which shows the State's ranking for wind vulnerability in Prince George's County (including the City of Laurel) as high.

Table 59. 2021 State of Maryland Wind Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	3
Crop Damage	1
Geographic Extent	2
Events	4
Local Plan Ranking (2017)	4
Overall Weighted Risk Rating[70]	**26.5**
Overall Ranking	**High**

D.6. Consequence Analysis

A consequence analysis (refer to **Table 60**) has been done to better understand the range of impacts that a severe storm wind event can have on several features of the planning area and the population within it.

Table 60. Severe Storm (Wind-Related) Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Home and landowners throughout the state are at risk to impacts from a wind-related severe storm event in the form of lightning and hail. Lightning is very dangerous, even when observed at several miles away. As such, members of the public should seek shelter immediately. In addition, hail poses the threat of personal injury, particularly for hail stones of larger sizes.
Public Health	Lightning can put people's lives at risk due to fires or electrocution. Hail can also endanger the public when hail size is large enough to cause injury if hit. Residents in the County that live in remote areas with limited road or transportation access may be temporarily isolated and cut off from critical facilities if roads become impassable due to debris or fallen trees or extended power outages occur, putting their health at risk in case of an emergency.

[70] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Community Feature	Impacts
Critical Facilities and Infrastructure	Infrastructure may experience impacts in the form of fire caused by lightning strikes, roof and crop damage from hail, and interruptions to above-ground power and communication systems.
Economy	A major storm event would be costly for state and local governments because of the potential for damages associated with property, debris generation, and loss of power. Delivery of services may also be slowed or halted in affected areas as a result of momentary losses in power and communications.
Buildings	Home and landowners throughout the state may experience damage to property depending upon the amount of lightning strikes and severity of hail in the area.

E. High Wind

E.1. Description

High wind events occur when there is a large difference in air pressure between two locations. NCEI defines high wind events as:

> *Sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally/regionally defined), on a widespread or localized basis. In some mountainous areas, the above numerical values are 43 knots (50 mph) and 65 knots (75 mph), respectively.*

In addition to high winds, the NCEI dataset includes strong wind events as defined below:

> *Non-convective winds gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph) resulting in a fatality, injury, or damage.*

This sub-set of wind type does not include wind during severe storm events, winter storms and blizzards, or tropical/sub-tropical cyclones. Those wind effects are described in sections addressing those specific hazards.

E.2. Location and Extent

High wind events can occur anywhere throughout Prince George's County and the City of Laurel, though the impacts will vary depending on infrastructure characteristics. Sometimes these high wind events originate from microbursts. Microbursts (also known as downbursts) are powerful downdrafts associated with heavy precipitation events such as thunderstorms, rain showers, and particularly hailstorms. In some cases, dry microbursts can be triggered by virga (rain that evaporates before it reaches the ground). According to the National Oceanic and Atmospheric Administration (NOAA), microbursts occur when the weight of heavy precipitation or hail accelerates downward winds to very high velocities as it falls from the upper levels of the atmosphere. Approximately five percent of all thunderstorms are estimated to produce a microburst. These microbursts can result in significant wind damage similar to a weak tornado. Although microbursts are more common in the western United States, they also occur in the eastern United States, including Maryland.

Downdrafts associated with microbursts are typically only a few hundred to a few thousand feet across. When the downdraft reaches the ground, it spreads out horizontally and may form one or more horizontal vortex rings around the downdraft. Microburst events typically last 15 to 20 minutes.

According to NOAA, a derecho is a widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. If the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho. Derechos can occur anywhere in Prince George's County and the City of Laurel.

E.3. Previous Occurrences

Since 1950, there have been 15 high wind and 24 strong wind events recorded by the NCEI database in Prince George's County. **Table 61** shows the combined annualized NCEI data that was recorded from these 39 wind events. 11 of these 39 wind events occurred within the last ten years. The most damaging high wind event occurred on February 12, 2017 when low pressure rapidly intensified as it moved up the New England coast. A strong pressure gradient between the low and high pressure over the Midwest caused high winds. Estimated wind gusts of 63 mph caused damage. The highest wind gust was measured at 72 mph at Andrews Air Force Base. The one strong wind event took place on October 11, 2018 after Hurricane Michael. A record of the 11 events that occurred within the last ten years and their subsequent damages, deaths, and injuries can be found in **Appendix C**. Most of the damage was to residential properties for both high and strong wind events. Only one event in the past 10 years affected crops in the County ($3,000 of damage).[71]

Table 61: NCEI Historic High Wind and Strong Wind Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
High Wind	15	1950-2022	$46,041	0.00	0.07	0.21
Strong Wind	24	1950-2022	$2,161	0.01	0.00	0.10
Total	**39**	**1950-2022**	**$48,202**	**0.01**	**0.07**	**0.31**

E.4. Probability of Future Events

High wind events are considered medium probability and random events that can occur at any time of year, so all areas within Prince George's County and the City of Laurel are equally at risk. The NCEI Storm Events data were annualized by taking the total number of damaging wind events (high and strong winds) and dividing them by the length of the record, as seen in **Table 61**. The annualized values should only be used as an estimate of what can be expected in any year. Using historic records, it can be estimated that Prince George's County and/or the City of Laurel will experience at least one event every three to four years.

As stated in the 2021 HMP, "Wind events happen frequently, occur year-round and stem from multiple hazard types. Therefore, the probability of a wind event each year is highly likely. While some hazard events, such as hurricanes, are expected to become more frequent and intense, the future probability of wind events is unclear. According to the *Fourth National Climate Assessment*, "projections of future changes in severe thunderstorms, tornadoes, hail, and strong wind events are uncertain." The difficulty

[71] NOAA Storm Events Database. https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+High+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=2012&endDate_mm=07&endDate_dd=31&endDate_yyyy=2022&county=PRINCE%2BGEORGE%2527S%3A33&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=24%2CMARYLAND

projecting future events can be attributed, in part, to a need for further research and lack of historical data.[72]

E.5. Vulnerability and Risk Assessment

The impact of high winds can be measured in financial terms, as well by fatalities and injuries. As shown in **Table 61**, damages from these events can be approximated at $48,202 for property and minimal crop damages annually. Injuries and fatalities are unlikely, with one death occurring in the County in the past 20 years of high or strong wind events recorded in the NCEI Storm Events database.

High wind events can also impact buildings and infrastructure in the County. Severe wind can blow shingles, siding, awnings, and other features off buildings. Falling trees and tree limbs can damage structures. Objects picked up by wind can be hurled through the air, damaging structures and breaking windows when contact is made. In some cases, structures can be blown off foundations. Additionally, utility poles and above ground power lines can be knocked down by severe winds, impacting populations who rely on those power lines. Populations at risk include people over 65, persons in poverty, and non-native English speakers that have lower capacity to adapt to loss of power or damage to their homes. The homeless population in the County may also be more vulnerable due to a lack of adequate shelter during high or strong wind events. Finally, transportation in the County may be affected by high or strong winds. These events could cause delays or closures of bridges in the county.[73]

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for wind. These scores and ranks are shown in **Table 62**, which shows the State's ranking for wind vulnerability in Prince George's County (including the City of Laurel) as high.

Table 62. 2021 State of Maryland Wind Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	3
Crop Damage	1
Geographic Extent	2
Events	4
Local Plan Ranking (2017)	4

[72] The Fourth National Climate Assessment. Volume II, Impacts, Risks, and Adaptation in the United States. U.S. Global Change Research Program, 2018.; Revised February 2020. Available at: https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

[73] Maryland Transportation Authority Wind Warnings and Restrictions: https://mdta.maryland.gov/Emergency/Emergency_Info.html

Risk Factors	Rank
Overall Weighted Risk Rating[74]	**26.5**
Overall Ranking	**High**

E.6. Consequence Analysis

A consequence analysis (refer to **Table 63**) has been done to better understand the range of impacts that a high wind event can have on several features of the planning area and the population within it.

Table 63. High Wind Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Impacts to the public include potential for injury or loss of life, and destruction of property due to high winds. Populations at risk include people over 65, non-native English speakers, and low-income households that have lower capacity to adapt to loss of power or damage to their homes. The homeless population in the County may also be more vulnerable due to a lack of adequate shelter during high or strong wind events.
Public Health	There are limited impacts of high wind on public health. Indirect impacts include power outages, which can lead to electrocution, fires and burns and carbon monoxide poisoning from gasoline powered electrical generators.
Critical Facilities and Infrastructure	High wind events can impact critical facilities and infrastructure in the County. Falling trees and tree limbs can damage critical facilities or block roadways. Transportation in the County may be affected by high or strong winds. These events could cause delays or closures of bridges in the county
Economy	A major wind event would be costly for local governments because of the potential for damages associated with property, debris generation, and loss of power. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event.
Buildings	High wind events can impact buildings in the County. Severe wind can blow shingles, siding, awnings, and other features off buildings. Falling trees and tree limbs can damage structures.

[74] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

F. Tornado

F.1. Description

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground and is visible only if it forms a condensation funnel made up of water droplets, dust, and debris. Data from the NOAA website indicates the path of a tornado is generally less than half of a mile wide, but the path length can vary from a few hundred yards to dozens of miles. A tornado moves at speeds from 30 to 125 mph, but can generate winds exceeding 300 mph.[75]

Tornado season typically occurs from March through August; however, tornadoes can happen in any month. In the United States, tornadoes have been classified on the Fujita Scale, assigning numeric scores from zero to five (or higher) based on the severity of observed damages. The traditional Fujita (F) scale, introduced in 1971, was used to rate the intensity of tornadoes thereafter and previously documented tornadoes. Starting in February of 2007, an "enhanced" Fujita (EF) scale was implemented, with somewhat lower wind speeds at the higher F-numbers, and more thoroughly refined structural damage indicator definitions.

Table 64 shows the Enhanced Fujita Tornado Damage Scale with corresponding wind speeds, typical damages, and relative frequency.

Table 64: Enhanced Fujita Tornado Damage Scale

Enhanced Fujita Scale (EF)	Wind Speeds (mph)	Typical Damage	Frequency
EF0	65 – 85	**Light**: Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.	29%
EF1	86 – 110	**Moderate**: Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored mobile homes are overturned, attached garages may be destroyed.	40%
EF2	111 – 135	**Considerable**: Roof structures are damaged, mobile homes are destroyed, debris becomes airborne, (missiles are generated), large trees are snapped or uprooted.	24%
EF3	136 – 165	**Severe**: Roofs and some walls are torn from structures, some small buildings are destroyed, nonreinforced masonry buildings are destroyed, most trees in forest are uprooted.	6%
EF4	166 – 200	**Devastating**: Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars are blown some distance, large debris becomes airborne.	2%

[75] NOAA Tornado Definition. https://www.weather.gov/phi/TornadoDefinition

Enhanced Fujita Scale (EF)	Wind Speeds (mph)	Typical Damage	Frequency
EF5	Over 200	**Incredible**: Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized missiles become airborne, trees are completely debarked.	Less than 1%

Source: NOAA National Weather Service. The Enhanced Fujita Scale. https://www.weather.gov/oun/efscale

In 2021, there were there were 1,376 tornadoes in the United States, compared with 1,075 in 2020, according to preliminary data from the National Oceanic and Atmospheric Administration (NOAA). Tornadoes killed over 100 people in 2021, including about 90 in the December 10 series of tornadoes. In 2020, 76 people perished in tornadoes.[76] Tornadoes have the potential to create total destruction of structures—especially mobile homes, businesses, and cars—causing many deaths, extensive tree damage along roadways (which may inhibit or block access), extensive damage to electric and telephone lines, utility line breaks, and damaged or destroyed radio and television towers.

F.2. Location and Extent

A tornado is a hazard event that threatens all of Prince George's County and the City of Laurel. Prince George's County has experienced tornadoes ranging from EF0 (minimum severity) to EF3. However stronger tornadoes, up to strongest classification of an EF5, are possible as shown in **Table 64** above. A tornado with a classification of EF1 or above could cause moderate damage at a minimum, resulting in overturned automobiles and uprooted trees.

Figure 38 summarizes tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles. Prince George's County and the City of Laurel are in a zone where they may experience one to five tornados every 1,000 square miles per year.

[76] Insurance Information Institute: https://www.iii.org/fact-statistic/facts-statistics-tornadoes-and-thunderstorms

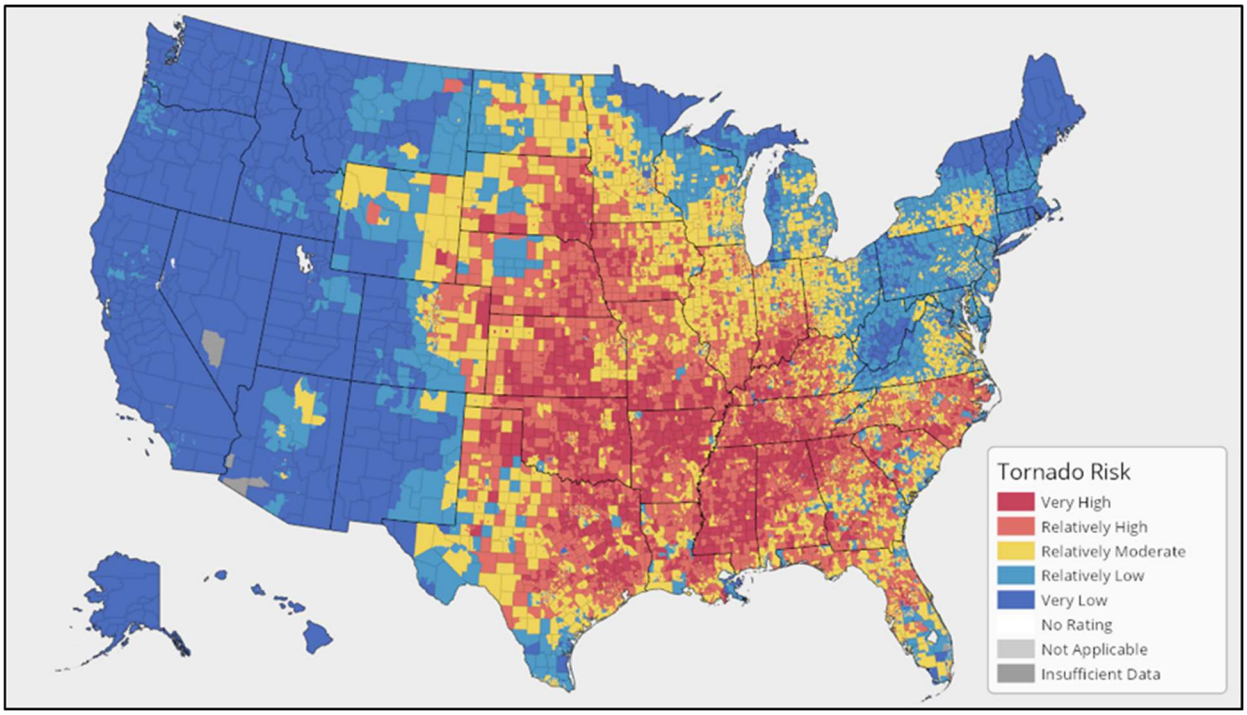


Figure 38: Tornado Activity in the United States[77]

Buildings must be designed to withstand both external and internal wind pressures on the structural framing and exterior elements. The level to which these structures are designed, as expected, directly correlates with the building's ability to resist damage due to high winds. The community's building code dictates the design wind speed to which a structure must be designed; both Prince George's County and the City of Laurel have adopted the 2018 International Building Code.[78] For some building types, the structures constructed after the adoption of the updated building code are likely to be the most resistant to damage from extreme wind.

Tornado damage to a given structure depends on several factors, including the condition of the exposed structures, their design and construction, and the quality of the building materials and connections. The 2015 International Building Code references the American Society of Civil Engineers Standard 7-10, which requires most residential structures to be constructed to withstand a design wind speed of 115 mph (three-second peak gust). However, most structures within the County, including the City of Laurel, were built prior to the adoption of the current building code and current standards. Older buildings, certain construction materials and techniques, manufactured housing, and poorly designed buildings are more vulnerable to tornadoes. When homes are destroyed by tornadoes, residents are impacted by the requirement to rebuild to current standards, which may come at a higher cost. Destruction of commercial buildings and infrastructure could cause employers to move their facilities and operations elsewhere, resulting in a loss of jobs and employees relocating to other areas outside of the County. Major damage to an employer could force temporary or permanent relocation outside of Prince George's County or the City of Laurel negatively impacting employees and tax revenues.

[77] FEMA National Risk Index – Tornadoes: https://hazards.fema.gov/nri/tornado
[78] 2015 International Building Code and Subtitle 4 Prince George's County Building Code. http://www.princegeorgescountymd.gov/1436/Building-Codes-Bulletins

Buildings must be designed to withstand both external and internal wind pressures on the structural framing and exterior elements. The level to which these structures are designed, as expected, directly correlates with its ability to resist damages due to high winds. The community's building code dictates the design wind speed to which a structure must be designed. For some building types, the structures constructed subsequent to the adoption of the building code are the most likely to be the most resistant to damages from wind.

Vulnerability to tornadoes is dependent on the geographic extent and magnitude of the event. Damages from lower-intensity tornadoes (EF0) can range from chimney damage to uprooted shallow trees. A significant tornado (EF2) would cause considerable damage to the roofs of frame houses, complete destruction of mobile homes, and large trees and utility lines snapping. A devastating tornado (EF4) would result in well-constructed houses being leveled, weak foundations being blown down, and cars being thrown.

F.3. Previous Occurrences

Since 1950, there have been 26 recorded tornadoes in the planning area, ranging in intensity from EF0 to EF3.[79] On July 1, 2013 a weak tornado touched down in Prince George's County in an area south of Clinton and west of Brandywine and reached a maximum speed of 60 mph. This tornado earned an EF-0 ranking, traveled 2.3 miles, and was about 75-yards wide.[80] More recently, an EF-1 tornado touched down in Bowie on July 5, 2022. This tornado's peak winds were measured at 90 mph and was measured to be 125 yards wide. This 2022 tornado traveled 1 mile before dissipating.[81]

Table 65 describes tornado events, intensity rating, deaths, injuries, and damages within the past ten years from the NCEI Storm Events Database. **Table 66** summarizes all the annualized NCEI historic data for tornadoes since 1950 in Prince George's County. Previous occurrences, including the most recent July 2022 tornado in Bowie, may be found in **Appendix C**. There are two reported deaths and 60 reported injuries due to tornadoes in Prince George's County between 1950-2022 recorded in the NCEI database. Both of these deaths and 55 of the total injuries occurred during a tornado in September 2001, which also caused $100 million in damages. As illustrated in the table, most tornadoes occur in the spring, and tornado outbreaks can occur which spawn several tornadoes in the same day.

Table 65: NCEI Recent Tornado History 2012-2022

Fujita Scale	Date	Community Affected	Deaths	Injuries	Total Property Damages	Total Damages
EF1	05 Jul 2022	Bowie	0	0	$250,000	$250,000
EF0	29 Sep 2015	Laurel	0	0	$0	$0
EF0	01 Jul 2013	Crestview Manor	0	0	$500	$100,000

[79] NWS/NOAA Storm Events Database: https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=07&endDate_dd=31&endDate_yyyy=2022&county=PRINCE%2BGEORGE%2527S%3A33&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=24%2CMARYLAND
[80] WTOP News: https://wtop.com/news/2013/07/weak-tornado-confirmed-in-prince-georges-co/
[81] Washington Post: https://www.washingtonpost.com/weather/2022/07/06/bowie-tornado-formation-prince-georges/

Fujita Scale	Date	Community Affected	Deaths	Injuries	Total Property Damages	Total Damages
EF0	19 Apr 2013	Westphalia	0	0	$25,000	$30,000
EF0	01 Jun 2012	Buena Vista	0	0	$2,000	$2,000

Table 66: NCEI Historic Tornado Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Tornado	26	1950-2022	$1,548,020	0.03	0.83	0.36

F.4. Probability of Future Events

Based on the NCEI historic records of tornado activity in Prince George's County, it is estimated that the County will experience about one tornado event approximately every three or four years.

Climate change may affect the possibility of future tornadoes, but a lack of reliable historical data tracking affects the measurement of this possibility. According to the US Fourth National Climate Assessment, tornadoes are exhibiting changes that may be linked to climate change, but scientific understanding is not yet detailed enough to confidently project the direction and magnitude of future change.[82] There is a need for further research into the effect of climate change on tornado probability.

F.5. Vulnerability and Risk Assessment

A tornado manifests as a high-impact, low-probability hazard whose effect is dependent on its intensity and the type of development in its path. Tornado vulnerability is based on building construction standards, the availability of shelters or safe rooms, and advanced warning capabilities. Even well-constructed buildings are vulnerable to the effects of a stronger (generally EF2 or higher) tornado. Identifying assets within the County and City exposed to tornado events is virtually impossible since tornadoes are so unpredictable. It can be assumed that every structure has an equal chance of exposure to a tornado event. Therefore, all of the assets of Prince George's County and the City of Laurel are included in the current and future tornado hazard area.

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for tornado. These scores and ranks are shown in **Table 67**, which shows the State's ranking for tornado vulnerability in Prince George's County (including the City of Laurel) as high.

[82] US Global Change Research Program's Fourth National Climate Assessment: https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf

Table 67. 2021 State of Maryland Tornado Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	4
Crop Damage	1
Geographic Extent	4
Events	2
Local Plan Ranking (2017)	5
Overall Weighted Risk Rating[83]	**30**
Overall Ranking	**High**

The Federal Emergency Management Agency's (FEMA) National Risk Index rates the risk level of a location for different types of disasters. This index breaks the rating down into three components: expected annual loss, social vulnerability, and community resilience. For a tornado disaster, FEMA's risk assessment for the County is rated as "relatively moderate." **Figure 39** shows the County's tornado Risk Index rating and the surrounding County's ratings. The breakdown of this risk for Prince George's County is as follows:

- Expected Annual Loss: Relatively Moderate
- Social Vulnerability: Relatively Low
- Community Resilience: Relatively Moderate

Prince George's County's risk level is relatively high when compared to both the state and national levels.[84] According to the Nation Risk Index, 81.7% of U.S. counties have a lower Risk Index and 83.3% of counties in Maryland have a lower Risk Index for tornadoes than Prince George's County.

[83] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)
[84] FEMA National Risk Index. https://hazards.fema.gov/nri/map

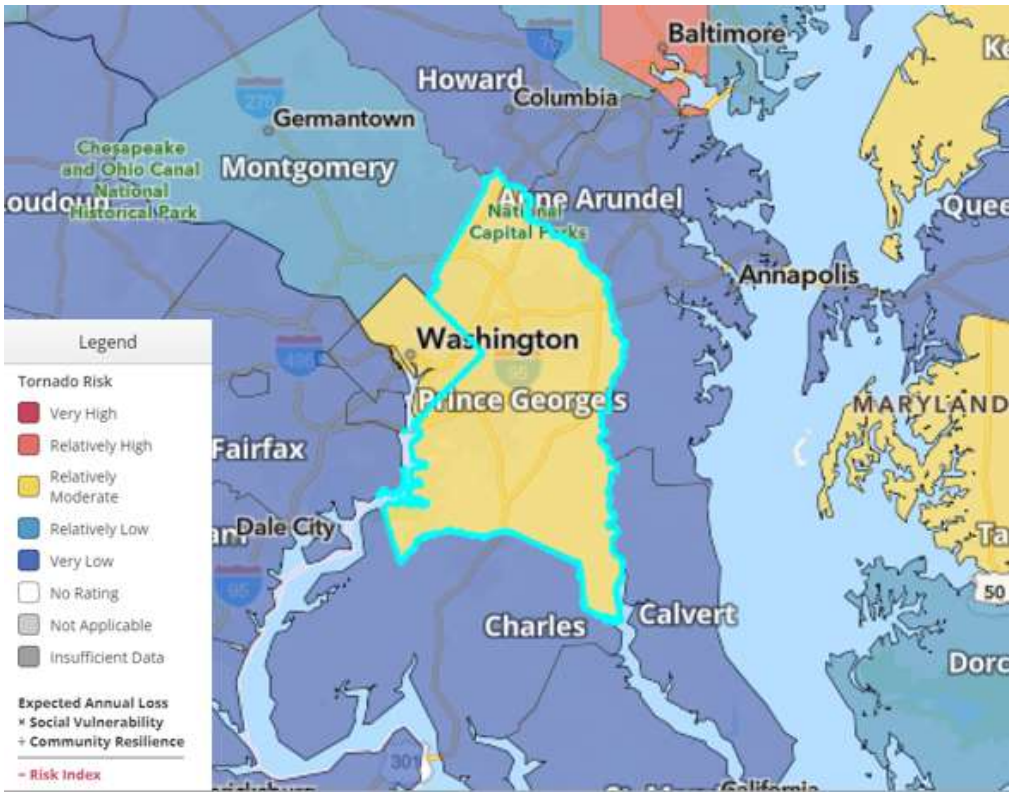


Figure 39: FEMA National Risk Index for Tornadoes in Prince George's County

A generalized loss estimate for the County was derived from NCEI Storm Events data. The data were annualized by taking the total number of damaging tornado events and dividing it by the length of the record (2012 to 2022 - 10 years). The annualized values should only be utilized as an estimate of what can be expected each year since they are averaged from historical occurrences. As shown in **Table 66**, above, the NCEI data illustrates that, on average, $38,200 could be lost in annual damages (nearly all of it property damage).

As evidenced in the loss figures, tornadoes have the potential to be very destructive. The NCEI estimates are believed to be an underrepresentation of the actual losses experienced, as numerous losses from events are not reported or are difficult to quantify. In this way, the NCEI database, and any similar databases, are incomplete.

Often tornadoes come with little to no warning; Therefore, most of the affected population should shelter-in-place when possible. The Maryland state government website recommends seeking shelter in a nearby sturdy building (preferably in a basement) or storm shelter if a person is in a mobile home or outdoors. If a person is in a building with multiple floors, then they should go to the lowest floor or basement.[85]

F.6. Consequence Analysis

A consequence analysis (refer to **Table 68**) has been done to better understand the range of impacts that a tornado event can have on several features of the planning area and the population within it.

[85] Maryland State Government. https://mdem.maryland.gov/Pages/resources-Tornadoes.aspx

Table 68. Tornado Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Tornadoes can have severe impacts on life safety. Tornadoes can occur without warning, and reaction time may be short. Injuries or loss of life can result when people out in the open are in or near a tornado's path; exposed individuals can be picked by tornado winds or struck by debris. People inside structures that are impacted by tornadoes may suffer injuries or death if trapped in a collapsed building or struck by flying or falling objects. If possible, residents should evacuate prior to a tornado.
Public Health	Public health issues from tornadoes can include water contamination, as well as potential for fire and gas leaks. Damages to certain exposed infrastructure, such as pipelines or septic tanks, can result in hazardous materials spills and leaks.
Critical Facilities and Infrastructure	All critical facilities and infrastructure in the County is considered at-risk to tornadoes. Above-ground infrastructure in the path of a tornado can suffer extensive damage and/or complete destruction. When roads close, other transportation routes must be determined.
Economy	A major tornado event would be costly for local governments because of the potential for damages associated with property, debris generation, and loss of power. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event.
Buildings	Home and landowners throughout the state may experience varying levels of damage to property depending upon the severity of winds in the area. Infrastructure may experience impacts in the form of blowing debris, and interruptions to above ground power and communication systems.

G. Extreme Heat

G.1. Description

Prolonged periods of unusually high temperatures, generally accompanied by high humidity, characterize the hazard of extreme heat in the Mid-Atlantic region. The "heat index" is a measure of the combined effects of temperature and relative humidity to produce the perceived temperature. For example, a temperature of 100°F "feels like" 109°F when the relative humidity is 40%. The National Weather Service heat index chart is shown in **Figure 40**, and indicates the potential for heat-related disorders under prolonged exposure and/or strenuous physical activity.

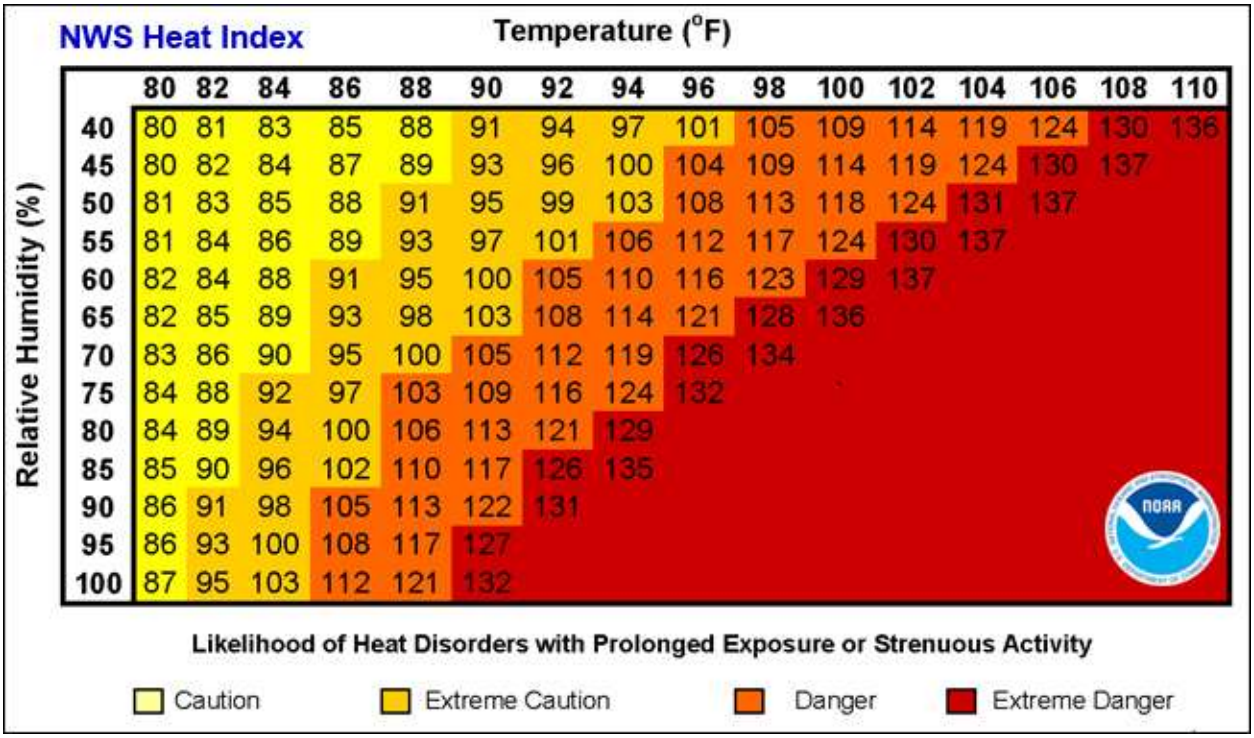


Figure 40: National Weather Service Heat Index Chart

G.2. Location and Extent

Although extreme heat events will impact the entire county, the impact of extreme heat is most prevalent in urban areas, where the urban heat-island effect prevents densely developed areas from releasing the heat that is built up during the day. Secondary impacts of extreme heat are a severe strain on the electrical power system and potential brownouts or blackouts.

Extreme heat combined with high relative humidity slows evaporation, limiting the body's ability to cool itself efficiently. Overexposure may result in heat exhaustion or stroke, which could lead to death. The

Centers for Disease Control and Prevention state that excessive heat exposure caused 15,707 deaths in the United States between 1999 and 2020.[86]

For excessive heat, the National Weather Service uses heat index thresholds as criteria for the issuance of heat advisories and excessive heat warnings. National Weather Service heat advisory bulletins inform citizens of forecasted extreme heat conditions. The bulletins are based on projected or observed heat index values and include:

- Excessive Heat Outlook: there is a potential for an excessive heat event within three to seven days.
- Excessive Heat Watch: conditions are favorable for an excessive heat event within 12 to 48 hours, but some uncertainty exists regarding occurrence and timing.
- Excessive Heat Warning/Advisory: an excessive heat event is expected within 36 hours.[87]

These products are usually issued when confidence is high that the event will occur. A warning implies that conditions could pose a threat to life or property, while an advisory is issued for less serious conditions that may cause discomfort or inconvenience but could still lead to threat to life and property if caution is not taken. The record heat temperature in Maryland was 109 degrees Fahrenheit in 1936, and higher is possible in Prince George's County.[88]

Urban areas with less tree canopy cover and high amounts of heat absorbing surfaces such as pavement and buildings are more likely to experience higher temperatures during heat events. These urban areas can become heat islands, with higher daytime temperature, reduced nighttime cooling, and higher air-pollution levels. Heat islands can also exacerbate the impact of naturally occurring heat waves, which are periods of abnormally hot, and often humid, weather. Sensitive populations are particularly at risk during these events. Urban heat island severity in the City of Laurel is shown in **Figure 41**. Severity is measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the mean for the city), and 5 being a severe heat area (significantly above the mean for the city).

[86] National Center for Environmental Health, Centers for Disease Control. QuickStats: Deaths Involving Exposure to Excessive Heat, by Sex — National Vital Statistics System, United States, 1999–2020 (cdc.gov)
[87] National Weather Service. Heat Watch vs. Warning. https://www.weather.gov/safety/heat-ww
[88] NCEI. State Climate Extremes Committee. Records. https://www.ncei.noaa.gov/access/monitoring/scec/records

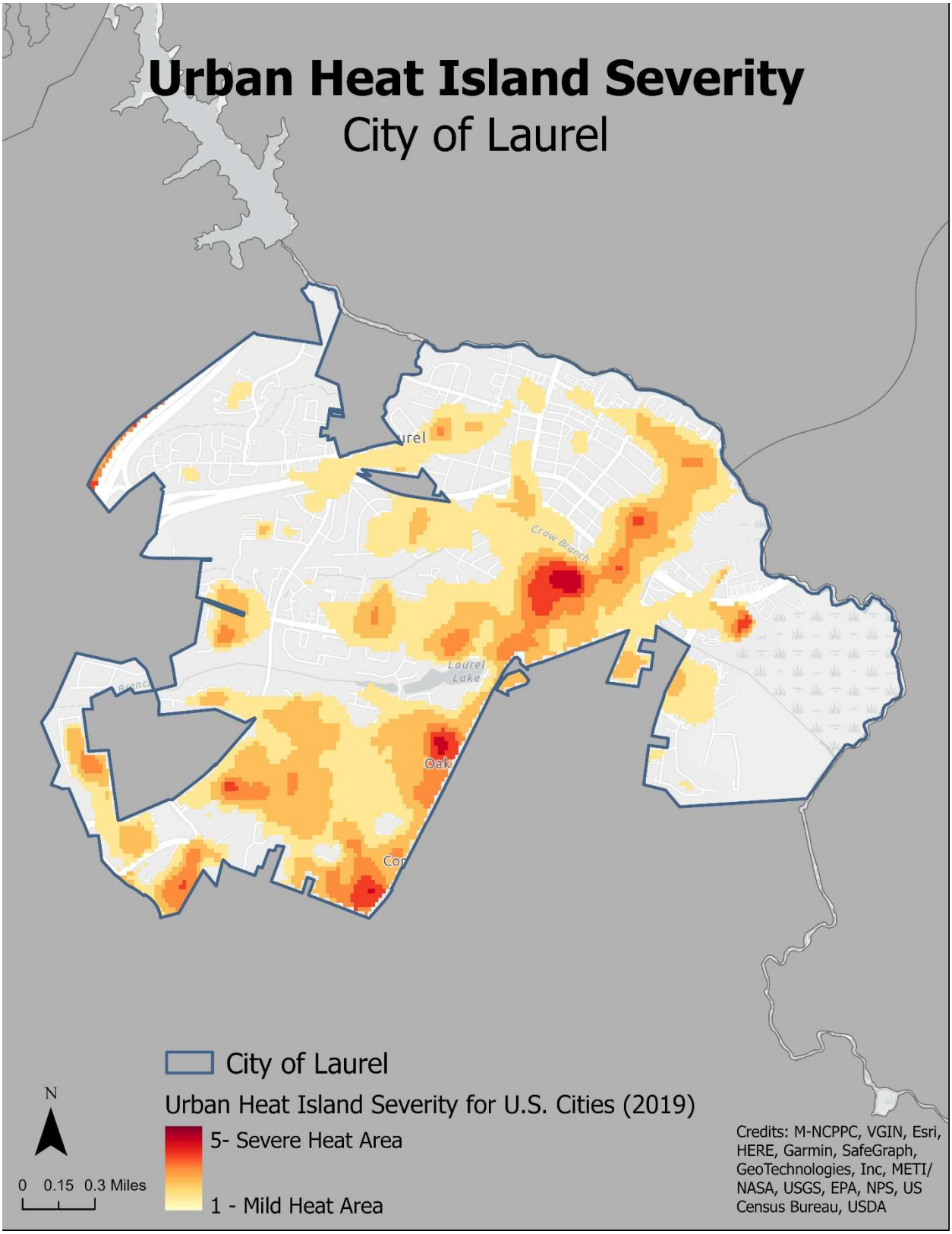


Figure 41: Urban Heat Island Severity in the City of Laurel

G.3. Previous Occurrences

According to National Centers for Environmental Information (NCEI) data on "heat" and "excessive heat" events, there are a total of 68 extreme heat events that have been recorded in Prince George's County between 1950 and 2022, including 59 heat events and nine excessive heat events. An "excessive heat" event results from a combination of high temperatures (well above normal) and high humidity. An "excessive heat" event occurs and is reported in the NCEI Storm Events Database whenever heat index values meet or exceed locally or regionally established excessive heat warning thresholds. A "heat" event is defined as period of heat resulting from the combination of high temperatures (above normal) and relative humidity. A "heat" event occurs and is reported in the NCEI Storm Events Database whenever heat index values meet or exceed locally or regionally established advisory thresholds.[89] The total annualized damages, deaths, injuries, and the number of events are summarized in **Table 69**.

Table 69: NCEI Historic Heat and Excessive Heat Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Heat	59	1950-2022	$0	0.14	0.56	0.82
Excessive Heat	9	1950-2022	$0	0.03	0.00	0.10
Total	**68**	**1950-2022**	**$0**	**0.17**	**0.56**	**0.92**

A closer review of the NCEI Storm Events Database reveals four notable periods of extreme heat within the last twenty years:

- In July 2010, a ridge of high pressure aloft along with a southwest flow around surface high pressure resulted in hot and humid conditions during the Fourth of July through the 8th. Temperatures on the 6th and 7th of July soared past 100 degrees. Prince George's County authorities reported that twenty-eight people were taken to the hospital due to heat-related illnesses from July 4th through July 8th.
- In July 2011, a strong upper-level high pressure build-up over Prince George's County led to heat indices as high as 120 degrees. Hot and humid conditions led to numerous reports of heat-related illnesses in the region. Heat indices up to 118 degrees were reported at Andrews Air Force Base. Unfortunately, one fatality was reported due to the high heat in the County.
- In July 2018, a southerly flow caused hot and humid conditions over a two-day period. The Maryland Department of Health reported two fatalities in Prince George's County due to the heat over a two-day period when heat indices were close to 100 degrees.
- In July 2020, the County had the hottest summer on record, with 26 straight days of 90-degree heat or higher.

[89] National Weather Service. Storm Data Preparation (2021). NWSI 10-1605, Storm Data Preparation (noaa.gov)

G.4. Probability of Future Events

Based on the NCEI historic records of heat-related events in Prince George's County, it is estimated that that county will experience about three extreme heat or excessive heat events annually. According to climate projections from Climate Mapping for Resilience and Adaptation Assessment Tool, there will be a significant increase in extreme heat days in Prince George's County and the City of Laurel through the end of this century due to climate change, increasing by 21 days from early century to late century under the lower emissions scenario and 48 days under the higher emissions scenario.[90] As extreme heat days increase, the frequency of extreme heat events will also increase, putting County residents at a higher risk of heat-related death and illnesses.

G.5. Vulnerability and Risk Assessment

Extreme heat has social, economic, and environmental impacts. People, especially the elderly, outdoor laborers, children, and individuals in poor physical health, are more vulnerable to heat-related illnesses (e.g., heat exhaustion) and death (heat stroke). The most at-risk districts which contain the largest population of elderly residents are Districts 1, 5, 6, and 8. These districts, therefore, have a greater vulnerability to heat as well; this can be seen in **Figure 42**. Prolonged periods of extreme heat would lead to agricultural/horticultural losses. NCEI's online data indicate 12 deaths and 40 injuries attributed to extreme heat in Prince George's County between 1997 and 2022.

[90] Climate Mapping for Resilience and Adaptation Assessment Tool (2022)

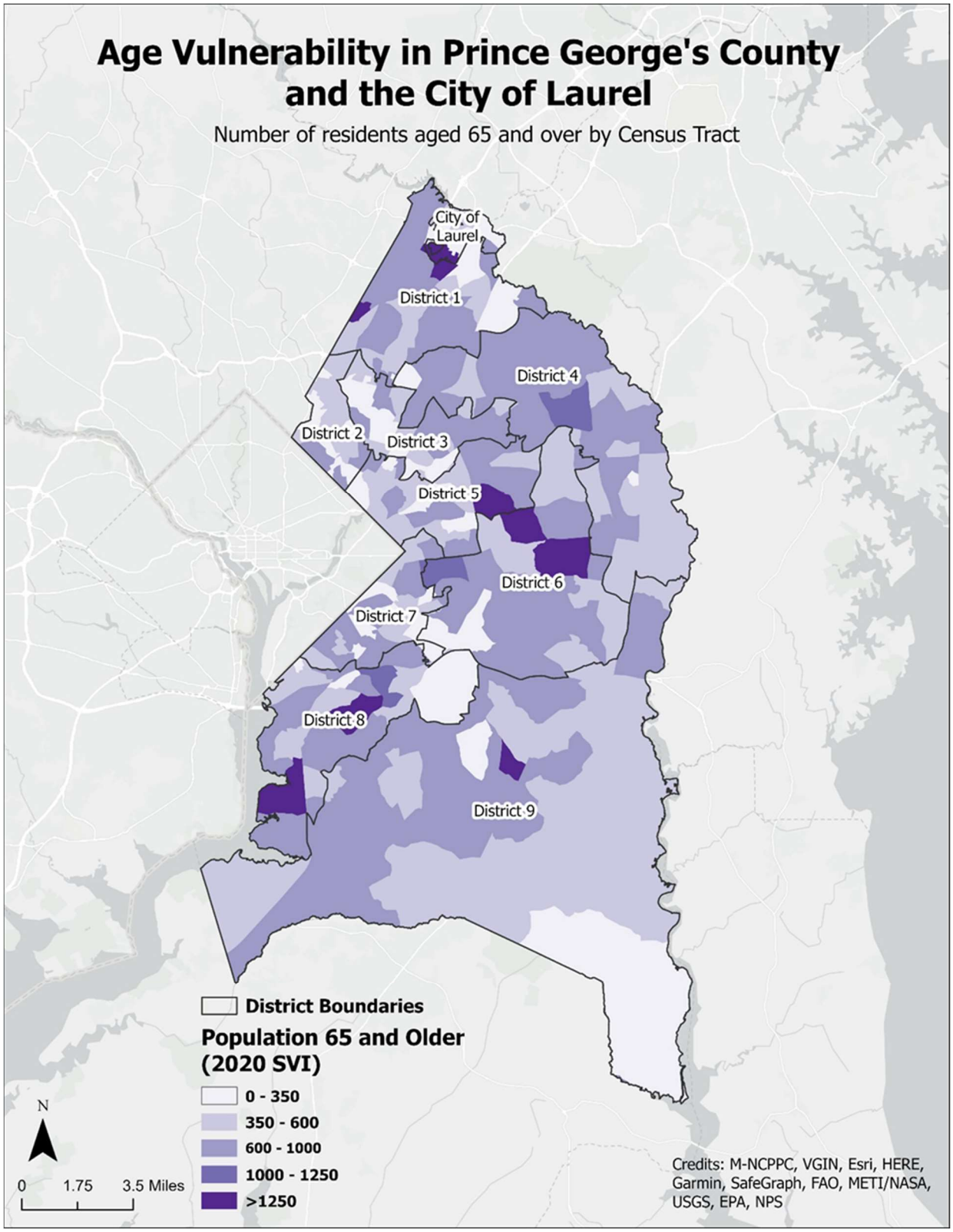


Figure 42: Age Vulnerability in Prince George's County and the City of Laurel

The relative vulnerability of different planning areas may be derived by combining a measure of the population of seniors with estimated agricultural losses. The results indicate the following planning areas have relatively higher vulnerability to extreme heat: Langley Park; Greenbelt; Bladensburg- New Carrolton; Bowie; Landover; Largo-Lottsford; Suitland-District Heights; The Heights; and Henson Creek.

Environmental impacts of extreme heat include damage to crops, impacts to wildlife, and increased propensity towards drought. Extreme heat events can also impact the economy through loss of crops and business disruption from direct and cascading high temperature impacts. Heat waves and extreme heat events also often lead to poor air quality. The extreme heat and stagnant air during a heat wave increases the amount of ozone pollution and particulate pollution in the air. Poor air quality can lead to health problems, including difficulty breathing and chest pain.

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for extreme temperature (heat and cold are considered together by the State). These scores and ranks are shown in **Table 70**, which shows the State's ranking for extreme temperature vulnerability in Prince George's County (including the City of Laurel) as medium-high.

Table 70. 2021 State of Maryland Extreme Temperature Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	1
Property Damage	1
Crop Damage	1
Geographic Extent	3
Events	2
Local Plan Ranking (2017)	3
Overall Weighted Risk Rating[91]	**18.5**
Overall Ranking	**Medium-High**

G.5.a. Population Exposure

All of Prince George's County and the City of Laurel are vulnerable to extreme heat. Residents with respiratory illnesses or other underlying health conditions, children, and the elderly are all more vulnerable to extreme heat than others. Outdoor workers in the County are also more vulnerable to extreme heat and have a higher chance of suffering heat-related illnesses on extreme heat days.

[91] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Residents that live in structures with limited air conditioning or ventilation may also be at higher risk during extreme heat events, especially when an event lasts for several days.

Populations living in areas with low tree cover are also more vulnerable to the impacts of extreme heat. In cities in America, trees have historically been planted along race and class lines. A Tree Equity Score can be used as a metric to help cities assess how well they are delivering equitable tree canopy cover to all residents. The score combines measures of tree canopy cover need and priority for trees in urban neighborhoods (defined as Census Block Groups). It is derived from tree canopy cover, climate, demographic and socioeconomic data. **Figure 43** shows tree equity score by municipality in Prince George's County and the City of Laurel. The majority of the County has a high Tree Equity Score, which indicates that there is no gap in the tree canopy in those areas, and people living in those areas would be less likely to experience extreme heat impacts that may arise due to lack of tree canopy cover.

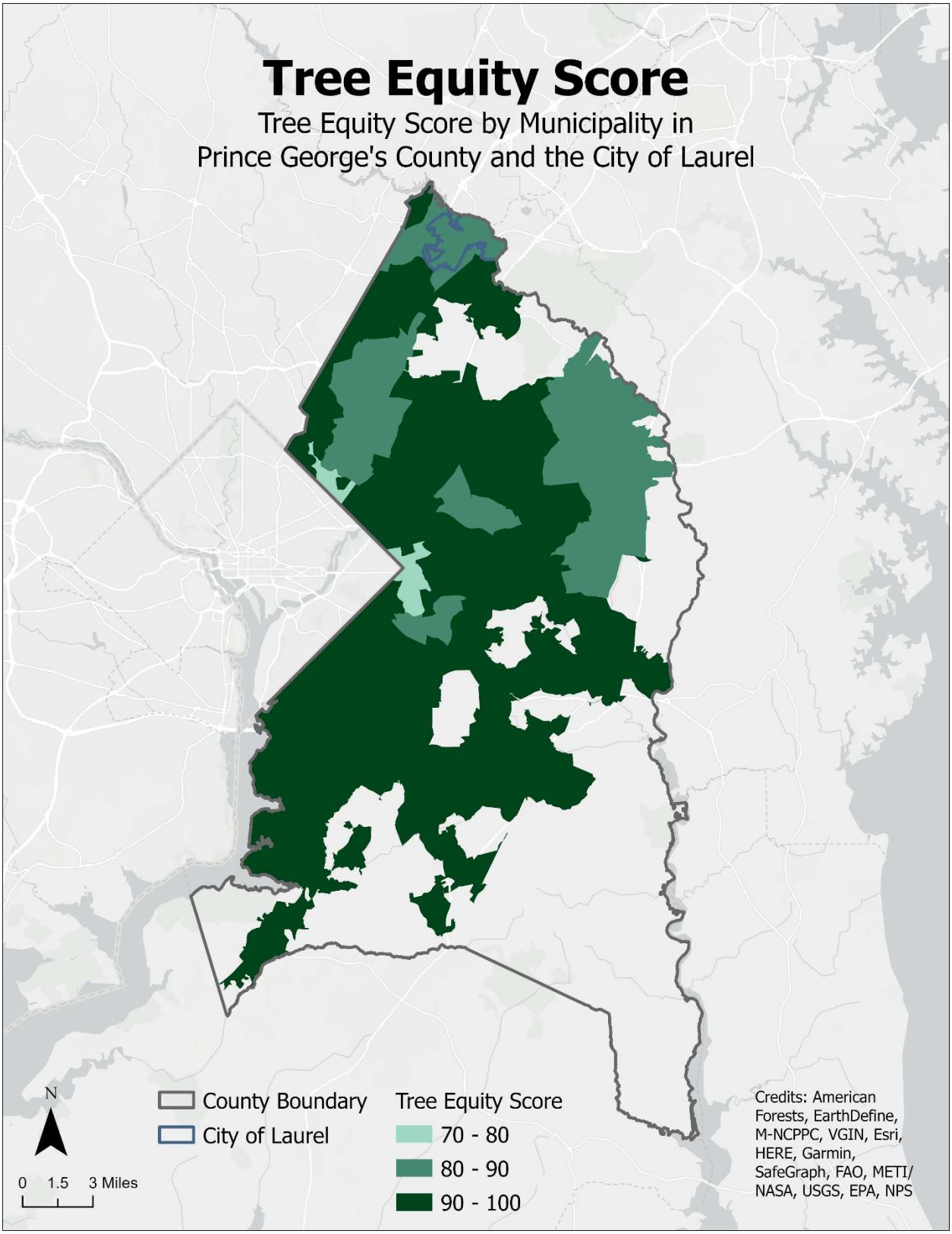


Figure 43: Prince George's County Tree Equity Score

The County offers cooling stations for vulnerable residents who may not have air conditioning or are sensitive to heat on days when temperatures reach 90 degrees or higher. These cooling stations are primarily located at parks throughout the County, and can be located on an online map viewer tool, shown in **Figure 44**. Residents can also call 3-1-1 to learn more about cooling center hours of operation and location.

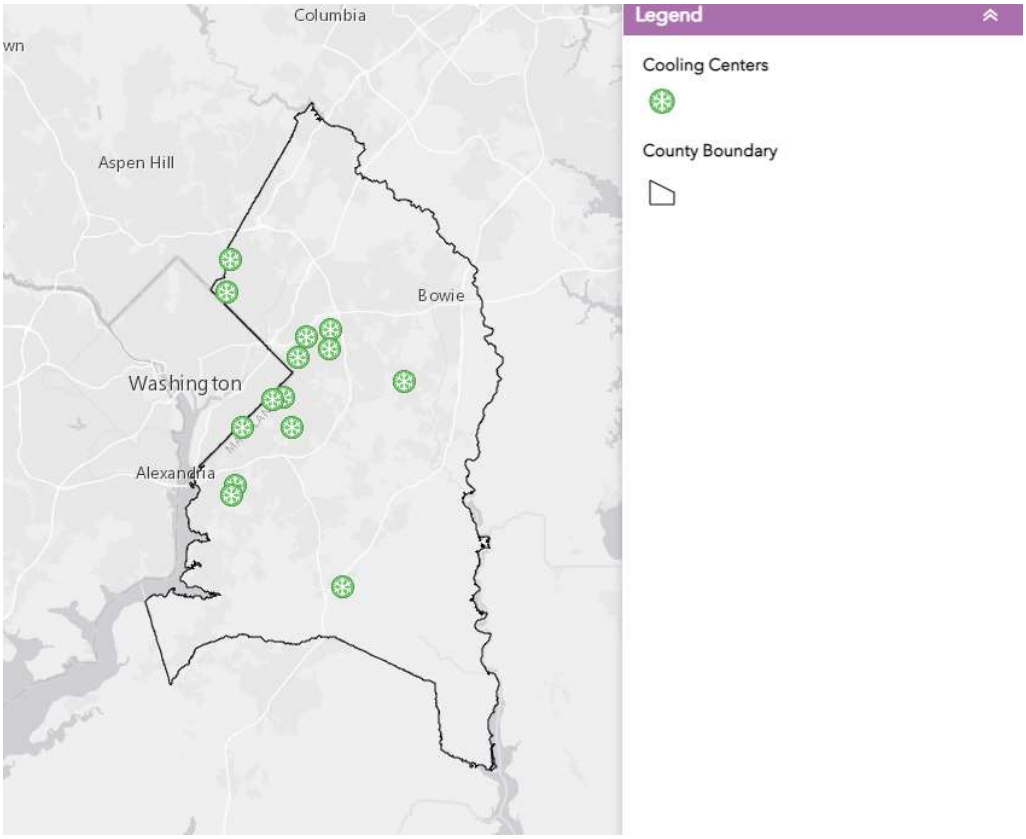


Figure 44: Cooling Centers in Prince George's County

G.5.b. Future Development

As future development occurs, residents that live in developed and urban areas with low tree canopy cover and high amounts of heat-absorbing surfaces, such as pavement, are more likely to be affected by extreme heat. These developed areas can become urban heat islands, which have higher average temperatures than areas with more tree cover and less heat-absorbing surfaces. Heat-absorbing surfaces such as roadways and railroads can also be impacted by extreme heat events, such as when asphalt surfaces soften or buckle or rails deform.

As seen in **Figure 45**, tree canopy cover is less dense in the more populated areas of the County, including Districts 1, 2, 3, 4, 5, 7, and the City of Laurel. There is an additional large gap in the tree canopy cover at Andrews Airforce Base, as expected. These areas with low tree canopy cover and high development are at an increased risk of extreme heat impacts.

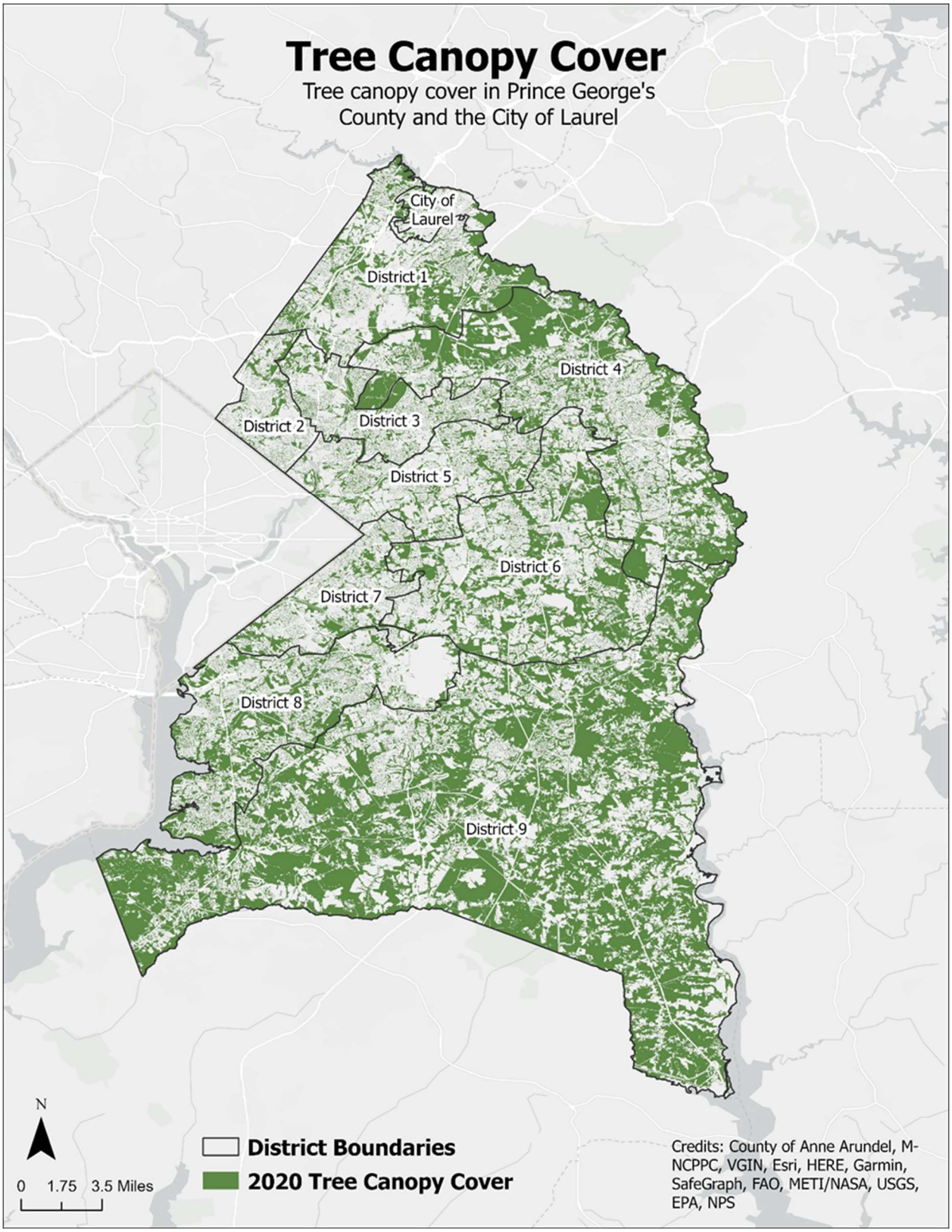


Figure 45: Tree Canopy Cover in Prince George's County and the City of Laurel

G.6. Consequence Analysis

A consequence analysis (refer to **Table 71**) has been done to better understand the range of impacts that an extreme heat event can have on several features of the planning area and the population within it.

Table 71. Extreme Heat Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	All of Prince George's County and the City of Laurel are vulnerable to extreme heat. Urban areas are exposed more acutely to the dangers of extreme heat due to the urban heat island effect.
Public Health	Residents with respiratory illnesses or other underlying health conditions, children, and the elderly are all more vulnerable to extreme heat than others. Additionally, extreme heat negatively impacts air quality by increasing the amount of ground-level ozone (or smog). Worsened air quality can aggravate existing respiratory illnesses, and long-term exposure can result in decreased lung function.
Critical Facilities and Infrastructure	Critical facilities may be impacted by extreme heat if the structure collapses or buckles. Infrastructure may be impacted when asphalt surfaces soften or buckle, or rails deform due to the heat. Additionally, power consumption for air-conditioned environments may increase, stressing utility infrastructure, and resulting in blackouts.
Economy	Extreme heat can lead to decreased agricultural productivity. Indirect losses due to business interruption in the case of a power outage or road buckling during an extreme heat event. Increasing temperatures will increase the demand for electricity, increasing electricity costs.
Buildings	Extreme heat events generally have limited impact on buildings. However, in some rare cases extreme heat can cause structures to collapse or buckle.

H. Winter Storm

H.1. Description

Winter storms come in many forms and can include heavy snow, freezing rain, and/or high winds. Snow typically maintains its crystalline structure from the clouds where it forms until it reaches the ground surface. Freezing rain may have started in the clouds as either rain or snow but reaches the surface as a liquid that freezes on contact with power lines, tree limbs, vehicles, buildings, and the ground when temperatures are below freezing. Freezing rain can accumulate on these surfaces resulting in an ice coating. Sleet reaches the surface in the form of clear pellets of ice that bounce upon contact. Winter winds can produce extremely low temperatures and create snow drifts which can impact mobility in the region.

The severity of a winter storm is often relative to the conditions that the area of focus is accustomed to. There are some standardized tools that can be used to provide estimates on expected storm impacts, such as the National Weather Service's Winter Storm Severity Index. The Winter Storm Severity Index shows extent by communicating how disruptive a storm will be to a community based on the significance of impacts.[92] The relative conditions of the area are considered, such as population, location, and storm characteristics. **Table 72** shows the Winter Storm Severity Index.

Table 72: NOAA Winter Storm Severity Index

Impact Level	Potential Impacts
No Impacts	Impacts not expected.
Limited Impacts	Rarely a direct threat to life and property. Typically results in little inconveniences.
Minor Impacts	Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.
Moderate Impacts	Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.
Major Impacts	Extensive property damage likely, lifesaving actions needed. Will likely result in major disruptions to daily life.
Extreme Impacts	Extensive and widespread severe property damage, lifesaving actions will be needed. Results in extreme disruptions to daily life.

[92] NOAA. Winter Storm Severity Index. https://www.wpc.ncep.noaa.gov/wwd/wssi/wssi.php

H.2. Location and Extent

Winter storms affect the entirety of Prince George's County including the City of Laurel. While the probability of a winter storm occurring is roughly the same in all parts of the region, the risk of damage will vary depending on infrastructure and population density. During and following winter storm events, there is a high probability for traffic accidents and traffic jams due to snow and ice. Roads may become impassable, inhibiting the ability of emergency equipment to reach trouble spots and the accessibility of medical and shelter facilities.

H.3. Previous Occurrences

Between 1950 and 2022, the NCEI database has recorded a total of 132 events that involve blizzard, heavy snow, winter storm, winter weather, and ice storm in Prince George's County.[93] There have been 3 blizzard events, 10 heavy snow events, 31 winter storm events, 84 winter weather events, and 4 ice storms. Annualized damages, deaths, injuries, and number of events are summarized in **Table 73**.

Table 73: NCEI Historic Winter Weather Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Blizzard	3	1950-2022	$417	0.01	0.00	0.04
Heavy Snow	10	1950-2022	$278	0.00	0.00	0.14
Winter Storm	31	1950-2022	$13,958	0.00	0.13	0.43
Winter Weather	84	1950-2022	$0	0.00	0.00	1.17
Ice Storm	4	1950-2022	$486	0.00	0.00	0.06
Total	**132**	**1950-2022**	**$15,139**	**0.01**	**0.13**	**1.84**

Based on data from the National Centers for Environmental Information, the total average annual snowfall within Prince George's County between 2006 and 2020 was 15.2 inches.[94]

[93] For this section the following NCEI database event types were used to generalize the winter storms section: blizzard, heavy snow, winter storm, winter weather, and ice storm.
[94] National Centers for Environmental Information. U.S. Climate Normals 2020: U.S. Monthly Climate Normals (2006-2020) - Beltsville, MD. National Centers for Environmental Information (NCEI). Retrieved October 31, 2022, from https://www.ncei.noaa.gov/access/search/data-search/normals-monthly-2006-2020?bbox=40.386%2C-77.727%2C37.250%2C-74.591&pageNum=1

However, as shown during the blizzard of 1996 and other events, winter storms producing higher snowfall amounts are possible. Over the past three decades, areas of Prince George's County have recorded 24-hour snowfall totals as high as 22 inches.[95]

H.4. Probability of Future Events

Based on the NCEI database, Prince George's County and the City of Laurel have a high probability of experiencing all types of winter weather events. NCEI winter weather events occur about four times annually (4.7 annual occurrences), winter storm events occur once or twice each year (1 annual occurrences), heavy snow events rarely occur (0 annual occurrences), and blizzards and ice storms happen about once every three to five years (0.3 and 0.2 annual occurrences, respectively).

According to the *Fourth National Climate Assessment* (NCA4) chapter on the Northeast, "winters have warmed three times faster than summers" in recent years and this trend is expected to continue, likely resulting in a shorter and less pronounced cold season with fewer frost days and a longer transition out of winter into the growing season. Moreover, the NCA4 projects a shorter snow season, fewer days below freezing, and more winter precipitation falling as rain rather than snow. Despite these trends, the future probability of winter weather events remains highly likely.[96]

H.5. Vulnerability and Risk Assessment

The entire county can be impacted by winter storm events. Severe winter storms can cause loss of utilities, increases in traffic accidents, and impassable roads. Snow and ice can be extremely hazardous to drivers because visibility is reduced, and surface accumulation reduces traction and strains power lines, roofs, and other structures. Populations without access to shelter or heat may be more vulnerable to the impacts of winter storm events. Severe winter storms have been and will continue to be a significant threat to the economic and social well-being of Prince George's County and the City of Laurel. Disruptions of emergency and other essential services and critical facilities are the main threats to people and property.

Vulnerability to the effects of winter storms on buildings depends on the age of the building (and the building codes in effect at the time of construction), type of construction, and condition of the structure (i.e., how well it has been maintained, materials used, etc.). The impacts of winter storms are usually minimal in terms of property damage and long-term effects. The most notable impact from winter storms is damage to power distribution networks and utilities and the impacts on transportation, debris removal and utility restoration. Severe winter storms have the potential to inhibit community services. Government costs for these events include overtime personnel wages and equipment, or contractors for road clearing. Private-sector losses are attributed to time lost when employees are unable to travel. Homes and businesses suffer damage when electric service is interrupted for long periods of time. After several severe winter storms during the plan update period the Potomac Electric Power Company (PEPCO) reorganized its response structure to improve power restoration after severe events.

Health threats can become severe when frozen precipitation makes roadways and walkways very slippery, prolonged power outages occur, and fuel supplies are jeopardized. Occasionally, buildings may be damaged when snow loads exceed the design capacity of their roofs or trees fall due to excessive ice

[95] National Oceanic and Atmospheric Administration. (2022, March 3). NOWData - NOAA Online Weather Data. Climate. Retrieved October 31, 2022, from https://www.weather.gov/wrh/climate?wfo=lwx
[96] Fourth National Climate Assessment, Volume II, Impacts, Risks, and Adaptation in the United States, Chapter 18: "Northeast." U.S. Global Change Research Program. 2018; revised February 2020. Available at: https://nca2018.globalchange.gov/chapter/18/

accumulation on branches. The water content of snow can vary significantly from one storm to another and can drastically impact the degree to which damage might occur. In snow events that occur at temperatures at or even above freezing, the water content of the snowfall is generally higher. Higher water content translates into a heavier, "wet" snowfall that more readily adheres to power lines and trees, increasing the risk of their failure. Roof collapse is also more of a concern with wetter, heavier snowfall.

Clearing of roadways and sidewalks is usually easier with drier, more powdery snow which is also less likely to accumulate on power lines and trees. This type of snow generally occurs in temperatures below freezing, as water content decreases with temperature. The primary impact of excessive cold is an increased risk for frostbite, and potentially death, as a result of over-exposure to extreme cold. Secondary effects of extreme/excessive cold include frozen water pipes in homes and businesses.

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for winter storm. These scores and ranks are shown in **Table 74**, which shows the State's ranking for winter storm vulnerability in Prince George's County (including the City of Laurel) as high.

Table 74. 2021 State of Maryland Winter Storm Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	2
Crop Damage	2
Geographic Extent	4
Events	4
Local Plan Ranking (2017)	4
Overall Weighted Risk Rating[97]	**29.5**
Overall Ranking	**High**

H.6. Consequence Analysis

A consequence analysis (refer to **Table 75**) has been done to better understand the range of impacts that a winter storm event can have on several features of the planning area and the population within it.

[97] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Table 75. Winter Storm Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	The primary life safety impact of excessive cold is an increased risk for frostbite, and potentially death, as a result of over-exposure to extreme cold. Health hazards related to walking and snow removal, including falling on ice or slippery surfaces, are frequent and can be life-threatening.
Public Health	Power outages and road closures due to winter weather can result in limited access to food, basic supplies, and an adequate heat source. Health threats can become severe when frozen precipitation makes roadways and walkways very slippery, prolonged power outages occur, and fuel supplies are jeopardized.
Critical Facilities and Infrastructure	Winter storms can cause damage to power distribution networks and utilities and the impacts on transportation, debris removal and utility restoration. If critical facilities lose power, they may become inoperable.
Economy	Government costs for these events include overtime personnel wages and equipment, or contractors for road clearing. Private-sector losses are attributed to time lost when employees are unable to travel.
Buildings	Vulnerability to the effects of winter storms on buildings depends on the age of the building (and the building codes in effect at the time of construction), type of construction, and condition of the structure (i.e., how well it has been maintained, materials used, etc.). Occasionally, buildings may be damaged when snow loads exceed the design capacity of their roofs or trees fall due to excessive ice accumulation on branches.

I. Hurricane/Tropical Storm

I.1. Description

Hurricanes and tropical storms are two types of tropical cyclones. A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or sub-tropical waters and has a closed low-level circulation. Hurricanes and tropical storms are differentiated by wind speed. Tropical storms refer to tropical cyclones that have maximum sustained surface wind speeds of 39 to 73 miles per hour. Hurricanes are those tropical storms with maximum sustained surface wind speeds exceeding 74 miles per hour. Hurricanes specifically refer to tropical cyclones that form in the North Atlantic and central and eastern North Pacific.[98] The Atlantic hurricane season begins June 1 and ends November 30 each year. Most hurricanes occur between mid-August and late September.

Hurricanes and tropical storms bring high winds, heavy rainfall, and storm surge, which can last for several days. These storms have the potential to cause significant damage, with most damages resulting from extreme winds and prolonged intense rainfall.

I.2. Location and Extent

The entire planning area of Prince George's County and the City of Laurel are at risk to tropical storm and hurricane impacts. Coastal areas are more likely to be affected by tropical storms and hurricanes (especially winds and coastal flooding), meaning coastal of areas of the county may experience more severe impacts from these hazards. However, inland areas can also be affected by intense precipitation caused by these storms or the remnants of the storm event. Prolonged rainfall can also cause flash flooding and riverine flooding, which has previously affected Prince George's County and the City of Laurel.

The Maryland Department of Emergency Management's Know Your Zone tool identifies areas where residents may need to evacuate in an emergency or shelter at home, depending on where they live or the severity of a hurricane or tropical storm.[99] Prince George's County has both A and B Evacuation Zones within the County. Residents living within those zones are at a higher risk of impact from hurricanes.

Hurricane extent is measured on the Saffir-Simpson Hurricane Wind Scale. It categorizes a hurricane on a scale of 1 to 5 based on its sustained wind speed, which provides an estimate for potential for property damage. **Table 76** is adapted from the National Hurricane Center and Central Pacific Hurricane Center of NOAA and displays the Saffir-Simpson Hurricane Wind Scale categories and associated types of damage due to the hurricane winds.[100]

[98] NOAA. n.d. "Glossary of National Hurricane Center Terms: Tropical Cyclones." https://www.nhc.noaa.gov/aboutgloss.shtml
[99] Maryland Department of Emergency Management. n.d. "Know Your Zone". https://maryland.maps.arcgis.com/apps/InformationLookup/index.html?appid=abef1ee97e254dd7a8b55cc179e29d6c
[100] Saffir-Simpson Hurricane Wind Scale. n.d. "NOAA National Hurricane Center and Central Pacific Hurricane Center." https://www.nhc.noaa.gov/aboutsshws.php

Table 76: Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129 mph	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130-156 mph	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 mph or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Many tropical depressions and hurricanes degrade in the Mid-Atlantic and manifest as Nor'easters over Prince George's County and the City of Laurel. A Nor'easter is a storm along the East Coast of North America, so called because the winds over the coastal area are typically from the northeast. These storms may occur at any time of year but are most frequent and most violent between September and April.[101] Nor'easters are large-scale cyclones that cause hurricane force winds. Nor'easters can cause extensive damage from high winds and excessive precipitation or snow.

I.3. Previous Occurrences

In the NCEI database, there are four tropical storm and hurricane events with recorded dates and damages since 1950. Each of these events caused significant damages affecting property. Hurricane Isabel in 2003 caused crop damages as well. **Table 77** summarizes these events and their total damages in current dollars (nearly all property damages) while **Table 78** shows the combined annualized NCEI data that was recorded from those three events. There were no deaths or injuries reported directly in this database. Additionally, one hurricane is recorded outside the NCEI database as a presidentially declared disaster. Hurricane Sandy in October 2012 impacted the County with strong winds and heavy rainfall.

[101] NOAA National Weather Service. What is a Nor'easter? What is a Nor'easter? (weather.gov)

Table 77: Historical Tropical Storm Event Damages

Date	Name	Current Total Damages
16 Sep 1999	Hurricane Floyd	$173,290
18 Sep 2003	Hurricane Isabel	$3,999,420
27 Aug 2011	Hurricane Irene	$1,984,750
Oct 2012	Hurricane Sandy	---
04 Aug 2020	Tropical Storm Isaias	$1,875,000

Table 78: NCEI Tropical Storm Annualized Event Damages

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Tropical Storms	4	1950-2022	$60,694	0.00	0.00	0.06

Prince George's County (along with the rest of Maryland) has an extensive history of exposure and damage from Nor'easters and hurricanes. **Figure 46** shows tropical storm and hurricane tracks that have affected Maryland since 1980.[102] Most of the storms were tropical storms or tropical depressions as they passed through or near the State. Note that some of the larger hurricanes that have affected Prince George's County may not be shown on this map for the sake of clarity, as the extent of their influence was larger than 200 miles outside of the State.

[102] 21 NCAR UCAR. Climate Data Guide. https://climatedataguide.ucar.edu/climate-data/ibtracs-tropical-cyclone-best-track-data

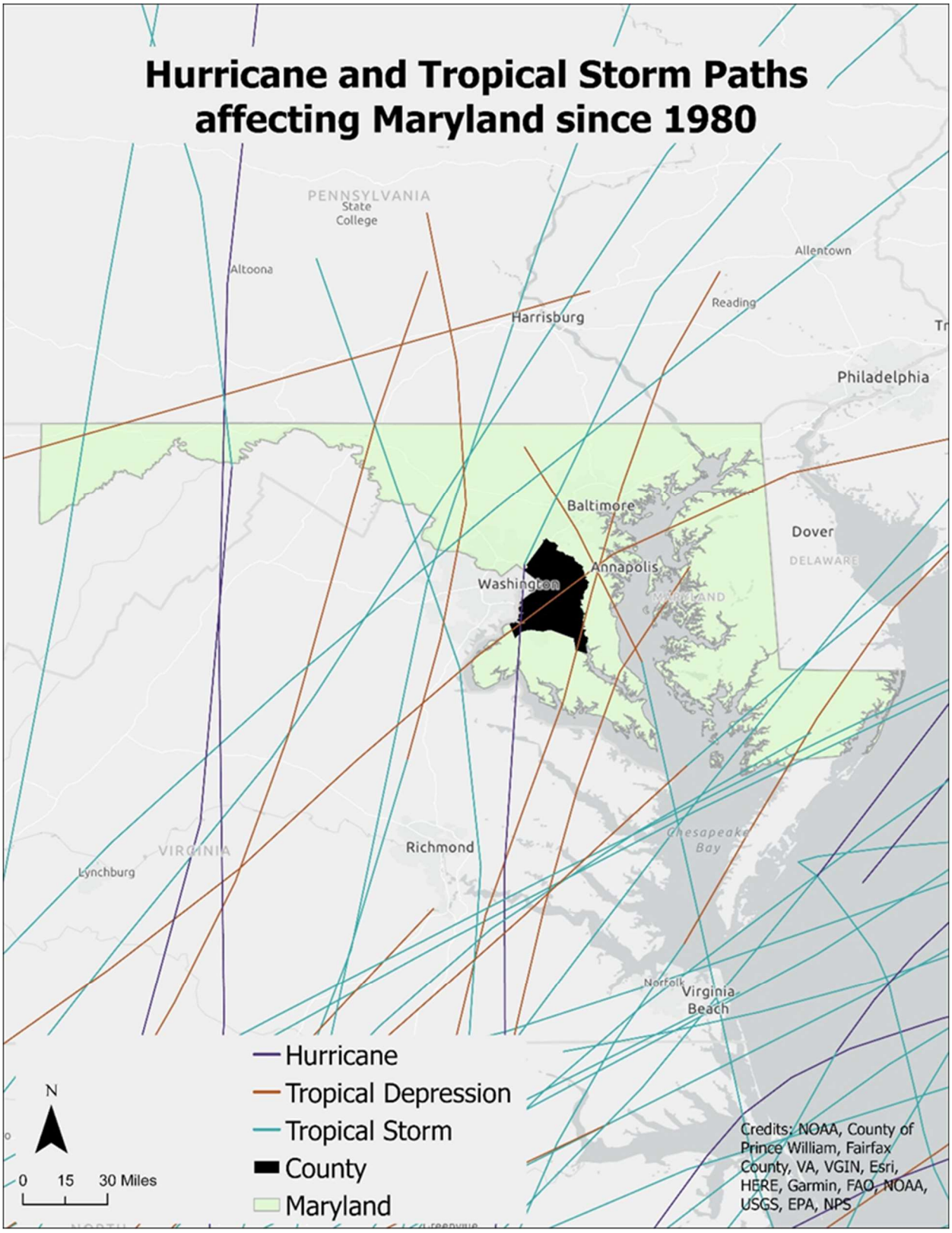


Figure 46: Historic Hurricane and Tropical Storm Paths affecting Maryland since 1980

I.4. Probability of Future Events

Based on the NCEI database, Prince George's County and the City of Laurel have a low probability to experience these destructive types of hazards. As shown in **Table 78**, hurricanes and tropical storms destructively affect Prince George's County and the City of Laurel about once every 20 years (0.06 annual occurrences), even though the Atlantic hurricane season occurs every year between June and November.

Although the probability of hurricanes impacting Prince George's County and the City of Laurel have historically been low, there is an increased probability of hurricanes and tropical storms occurring in the future due to climate change. Climate change is projected to magnify the impact of hurricanes and tropical storms through increasing both precipitation amounts and extreme wind speeds. Sea surface temperatures in the tropical Atlantic, known as the Main Development Region for tropical systems have risen 1.85°F in the last century, and the likelihood of tropical cyclones reaching Category 3 status has increased since 1979.[103] Therefore, the County and the City may be more likely to experience a hurricane or tropical storm as sea surface temperatures warm.

I.5. Vulnerability and Risk Assessment

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for coastal hazards (hurricane and tropical storms are one of several coastal hazards considered jointly by the State). These scores and ranks are shown in **Table 79**, which shows the State's ranking for coastal hazard vulnerability in Prince George's County (including the City of Laurel) as high. The State's ranking for wind is shown in **Table** 59 in **Section D**.

Table 79. 2021 State of Maryland Coastal Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	3
Crop Damage	1
Geographic Extent	1
Events	2
Local Plan Ranking (2017)	4

[103] NOAA National Centers for Environmental Information (NCEI) Climate at a Glance (2022). https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/atlanticMdr/land_ocean/6/11/1880-2019?trend=true&trend_base=10&begtrendyear=1880&endtrendyear=2020

Overall Weighted Risk Rating[104]	**23**
Overall Ranking	**High**

I.5.a. Loss Estimate

FEMA's Hazus-MH Hurricane Model v5.1 was used to determine the potential losses from a hurricane that made landfall on the East Coast for Prince George's County and the City of Laurel. As summarized in **Table 80**, nearly all building related economic loss from a hurricane in Prince George's County is expected to be a minor loss. As shown in **Table 81**, building loss would account for the majority of economic loss following a hurricane, followed by content loss. **Table 82** shows other impacts of hurricanes, such as debris generated, people displaced, and individuals seeking shelter. According to Hazus v5.1, only during the 1,000-year hurricane wind event would we expect any households to be displaced.[105] These two households are located in the unincorporated areas of the County.

Table 80: Hurricane Building Related Economic Loss by Damage Level (from Hazus-MH v5.1)

Jurisdiction	Return Period	Minor	Moderate	Severe	Destruction	Total
City of Laurel	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$11,800	$100	$0	$0	$11,900
	100-year	$19,600	$400	$0	$0	$20,000
	200-year	$92,300	$6,100	$0	$0	$98,400
	500-year	$363,200	$34,800	$100	$0	$398,100
	1,000-year	$500,300	$50,500	$200	$0	$551,000
Prince George's County	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$255,400	$800	$0	$0	$256,200
	100-year	$586,500	$8,300	$100	$0	$594,900
	200-year	$2,361,300	$96,200	$200	$0	$2,457,800
	500-year	$13,736,300	$950,700	$4,300	$1,000	$14,692,300
	1,000-year	$30,403,600	$2,947,700	$23,100	$21,300	$33,395,700
Total	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$267,200	$900	$0	$0	$268,100
	100-year	$606,100	$8,700	$100	$0	$614,900
	200-year	$2,453,600	$102,300	$200	$0	$2,556,200
	500-year	$14,099,500	$985,500	$4,400	$1,000	$15,090,400

[104] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)
[105] The "households displaced" and "individuals seeking temporary shelter" Hazus v5.1 estimates in Table 82 may be higher than shown. Hazus v6.0 has since made changes to the sheltering algorithm which often resulted in very conservative estimates.

Jurisdiction	Return Period	Minor	Moderate	Severe	Destruction	Total
	1,000-year	$30,903,900	$2,998,200	$23,300	$21,300	$33,946,700

Table 81: Hurricane Building Related Economic Loss by Type of Loss (from Hazus-MH v5.1)

Municipality	Return Period	Building Loss	Content Loss	Inventory Loss	Other Loss	Total Loss
City of Laurel	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$5,100	$50,400	$0	$100	$55,700
	100-year	$1,432,400	$206,900	$0	$1,200	$1,640,500
	200-year	$6,458,400	$770,400	$0	$83,400	$7,312,200
	500-year	$16,437,800	$1,841,700	$200	$929,100	$19,208,800
	1,000-year	$20,310,100	$2,337,400	$800	$1,302,900	$23,951,200
Prince George's County	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$5,462,100	$3,335,200	$0	$1,200	$8,798,500
	100-year	$69,406,200	$13,043,700	$0	$48,200	$82,498,100
	200-year	$216,153,200	$36,505,300	$0	$735,500	$253,394,000
	500-year	$629,343,900	$100,034,900	$71,700	$31,125,300	$760,575,700
	1,000-year	$1,050,214,600	$169,899,300	$453,200	$57,533,500	$1,278,100,600
Total	10-year	$0	$0	$0	$0	$0
	20-year	$0	$0	$0	$0	$0
	50-year	$5,467,200	$3,385,600	$0	$1,300	$8,854,200
	100-year	$70,838,600	$13,250,600	$0	$49,400	$84,138,600
	200-year	$222,611,600	$37,275,700	$0	$818,900	$260,706,200
	500-year	$645,781,700	$101,876,600	$71,900	$32,054,400	$779,784,500
	1,000-year	$1,070,524,700	$172,236,700	$454,000	$58,836,400	$1,302,051,800

Table 82: Hurricane Other Impacts (from Hazus-MH v5.1)

Municipality	Return Period	Debris Generated (Tons)	Households Displaced	Individuals Seeking Temporary Shelter
City of Laurel	10-year	0	0	0
	20-year	0	0	0
	50-year	0	0	0
	100-year	100	0	0
	200-year	600	0	0

Municipality	Return Period	Debris Generated (Tons)	Households Displaced	Individuals Seeking Temporary Shelter
	500-year	1,500	0	0
	1,000-year	1,900	0	0
Prince George's County	10-year	0	0	0
	20-year	0	0	0
	50-year	2,300	0	0
	100-year	15,400	0	0
	200-year	30,200	0	0
	500-year	126,500	0	0
	1,000-year	194,500	2	2
Total	10-year	0	0	0
	20-year	0	0	0
	50-year	2,300	0	0
	100-year	15,500	0	0
	200-year	30,800	0	0
	500-year	128,000	0	0
	1,000-year	196,400	2	2

Annualized hurricane loss by census tract, as determined by Hazus is shown in **Figure 47** and **Figure 48**. Districts 1, 5, 6, 8, and 9 all have census tracts that would have over $15,000 annualized loss due to hurricane according to the Hazus Hurricane Model. These areas are more vulnerable to hurricanes than areas of the County that are expected to have less economic loss due to a hurricane.

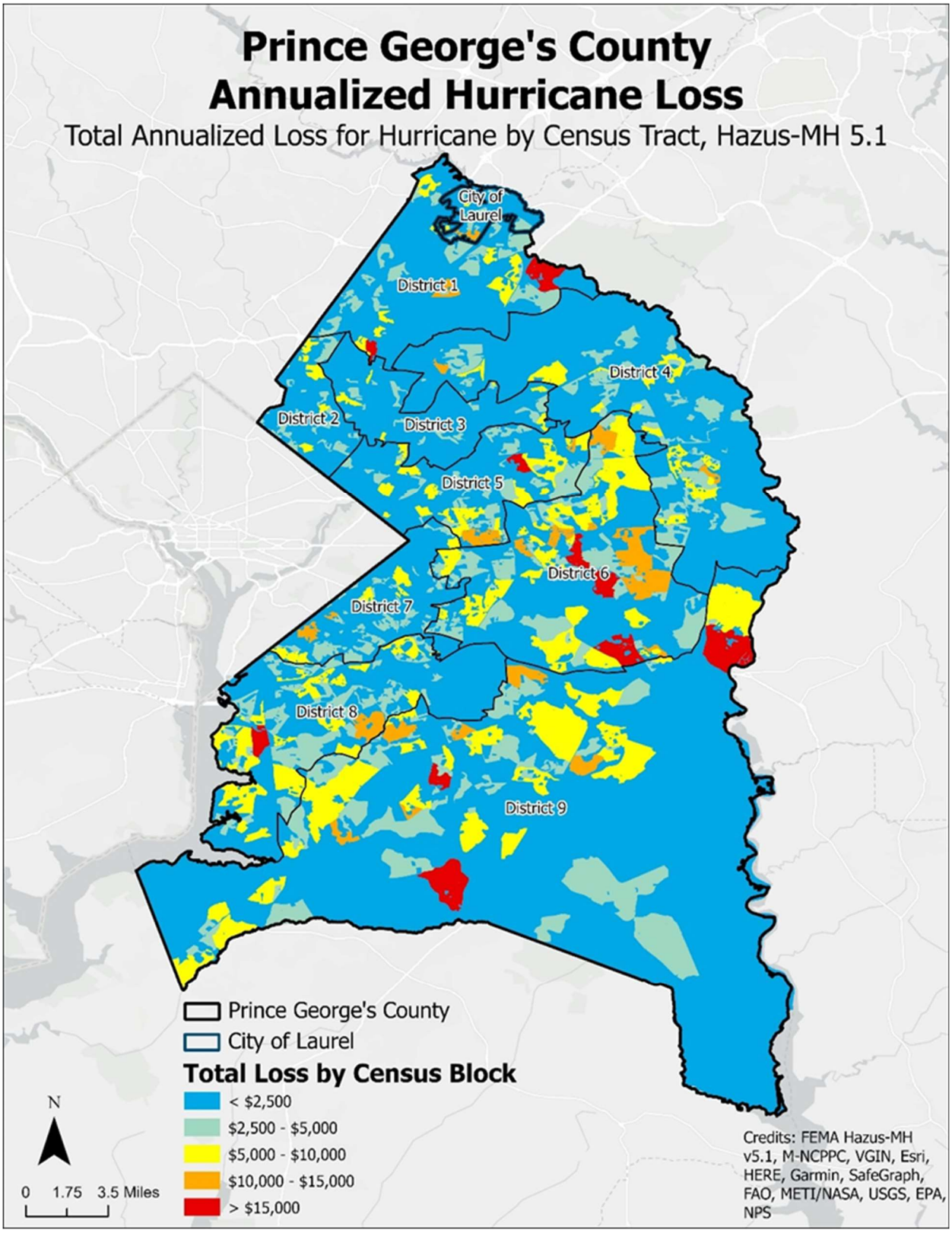


Figure 47: Hurricane Annualized Loss by Census Tract in Prince George's County

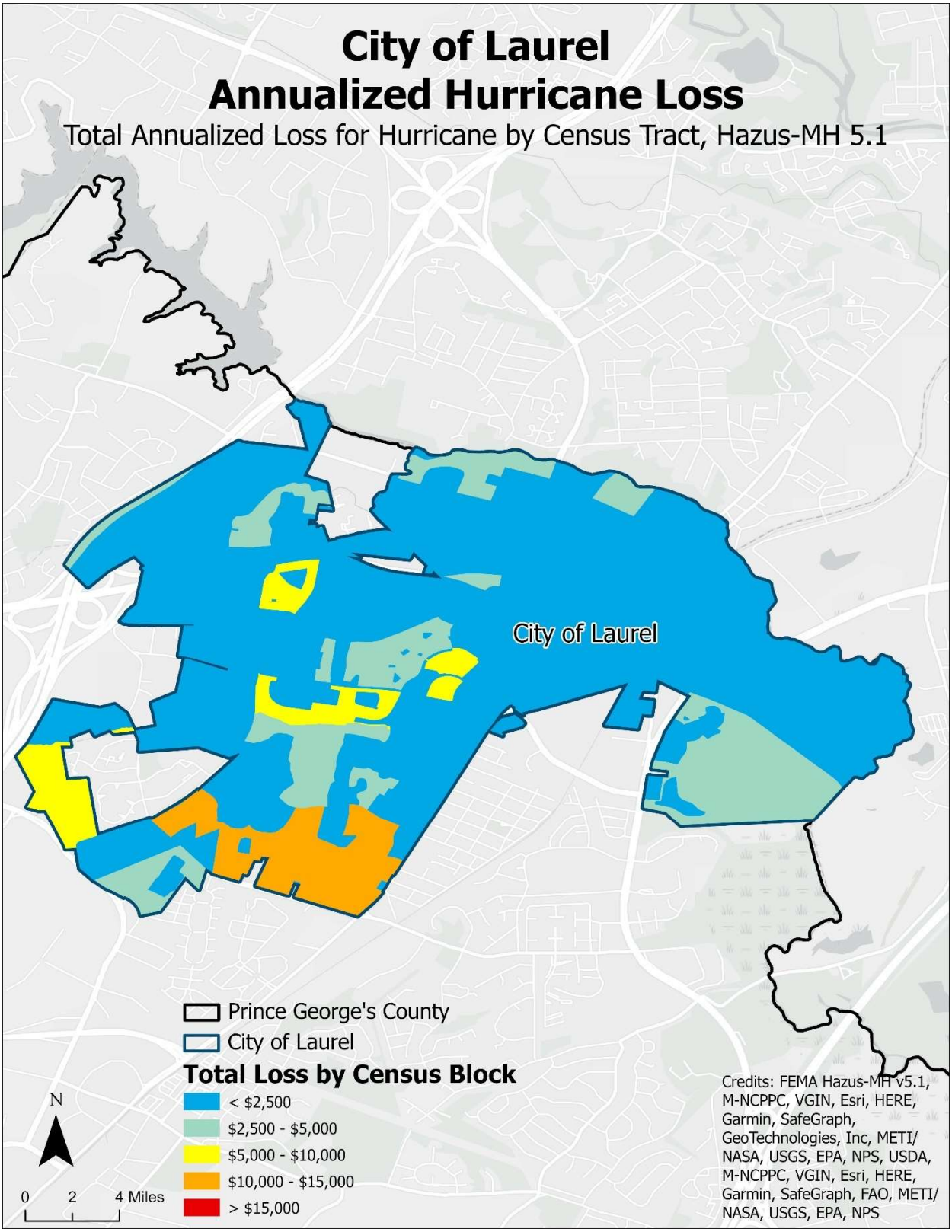


Figure 48: City of Laurel Hurricane Annualized Loss by Census Tract

I.5.b. Population Exposed

The number of people affected by hurricanes and tropical storms depends on the scale and duration of a particular event. Residents living within hurricane evacuation zones have more exposure to hurricanes and tropical storms than those living further inland in the County. Hurricane evacuation zones A and B are located in Districts 8 and 9, along the Potomac and Patuxent Rivers. Powerful hurricanes may require local or regional evacuations if buildings are not expected to withstand the high winds. Residents living in urban areas with significant impervious surfaces may witness pluvial flooding and even ponding of water, which can last several days after a storm.

Hurricanes and tropical storms have primary impacts to population through high winds that stir up airborne debris and downed trees, both of which can lead to significant building damage and power outages. Residents living in mobile homes may be especially vulnerable to damage from high winds, if the home is improperly installed or anchored. Extreme wind events can also blow over tractor trailers on the highway and make driving difficult. Wind-caused flying debris, broken tree limbs or branches, and falling objects can also cause serious injuries and death.

I.5.c. Social Vulnerability

The potential for prolonged power outages due to hurricanes and tropical storms raises risks to public health. Tropical storms and hurricanes typically occur during the summer months when humidity and heat levels are highest. Socially vulnerable populations, such as lower-income households, the elderly, children under the age of four, and people with disabilities are at a higher risk of heat-related illnesses and may be impacted by a loss of power during summer months due to a hurricane or tropical storm. Additionally, socially vulnerable populations may have decreased ability to cope with loss of perishable food, lack of water, or the need to find temporary shelter.

I.6. Consequence Analysis

A consequence analysis (refer to **Table** 83) has been done to better understand the range of impacts that a hurricane or tropical storm event can have on several features of the planning area and the population within it.

Table 83. Hurricane/Tropical Storm Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	The number of people affected by hurricanes and tropical storms depends on the scale and duration of an event. Residents living within hurricane evacuation zones have more exposure to hurricanes and tropical storms than those living further inland in the County. Powerful hurricanes may require local or regional evacuations if buildings are not expected to withstand the high winds.
Public Health	The potential for prolonged power outages due to hurricanes and tropical storms raises risks to public health. Tropical storms and hurricanes typically occur during the summer months when humidity and heat levels are highest. Socially vulnerable populations, such as lower-income households, the elderly, children under the age of four, and people with disabilities are at a higher risk of heat-related illnesses and may be impacted by a loss of power during summer months due to a hurricane or tropical storm.

Community Feature	Impacts
Critical Facilities and Infrastructure	Hurricanes and tropical storms can cause flooding or wind damage to critical facilities and infrastructure. Wind-caused flying debris, broken tree limbs or branches, and falling objects can cause structural damage and power loss to critical facilities and impact infrastructure such as bridges and utilities.
Economy	Economic impacts resulting from hurricanes include supply chain disruption from flooded roads and economic losses for local businesses that have incurred storm or flood damage.
Buildings	Hurricanes and tropical storms can have high winds that stir up airborne debris and downed trees, both of which can lead to significant building damage and power outages.

J. Dam and Levee Failure

J.1. Description

J.1.a. Dam Failure

Dams serve as barriers to hold back water and can be used to regulate water supply, control floods, provide hydroelectric power, or create recreational opportunities. Dams can cause serious harm when they fail, putting lives and properties at risk. Dam failure is characterized by a sudden, rapid, and uncontrolled release of water. Dams can fail for several reasons, including overtopping due to floods that exceed the capacity of the dam, aging of the dam, inadequate maintenance, or a deliberate act of sabotage. Due to the risk posed by a dam failure, it is important to evaluate dam inundation zones by calculating the flood hazard exposure.

J.1.b. Levee Failure

FEMA defines a levee as "a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to reduce risk from temporary flooding." Levees are typically built parallel to a waterway, most often a river, to reduce the risk of flooding on the landward side.[106]

Levee failure occurs when the levee fails or is breached, causing the water previously contained in the levee to flood nearby land. Man-made levees can fail in several ways, including breaching, foundation failure due to erosion or a subsurface failure of the levee, or overtopping, which can lead to erosion of the levee and cause breaching.

J.2. Location

J.2.a. Dams

Prince George's County has 47 dams within its jurisdiction. Of these 47 dams, 19 are classified as high-hazard potential, 16 are significant-hazard, and 14 are low-hazard dams. The County owns four high-hazard potential dams within the County, and is responsible for the routine monitoring, inspection, and maintenance of the dams. These four County-owned high-hazard potential dams include: Laurel Lakes, Indian Creek #2, Indian Creek #3, and Lake Arbor dams. Each of the high hazard dams has an Emergency Action Plan to reduce the risk of human life loss and minimize property damage during an unusual or emergency event. The County provided a list of 15 of the high-hazard potential and significant-hazard potential dams that are owned by the County, and the other 32 dams were found on the National Inventory of Dams.[107] Out of the 15 high-hazard potential dams, only 5 have inundation zone mapping completed. **Figure 49** shows the dams by hazard potential. **Table 84** details information for all the dams in Prince George's County and the City of Laurel.

[106] FEMA. N.d. What is a Levee Fact Sheet. https://www.fema.gov/sites/default/files/2020-08/fema_what-is-a-levee_fact-sheet_0512.pdf
[107] National Inventory of Dams (NID). 2022. https://nid.sec.usace.army.mil/#/

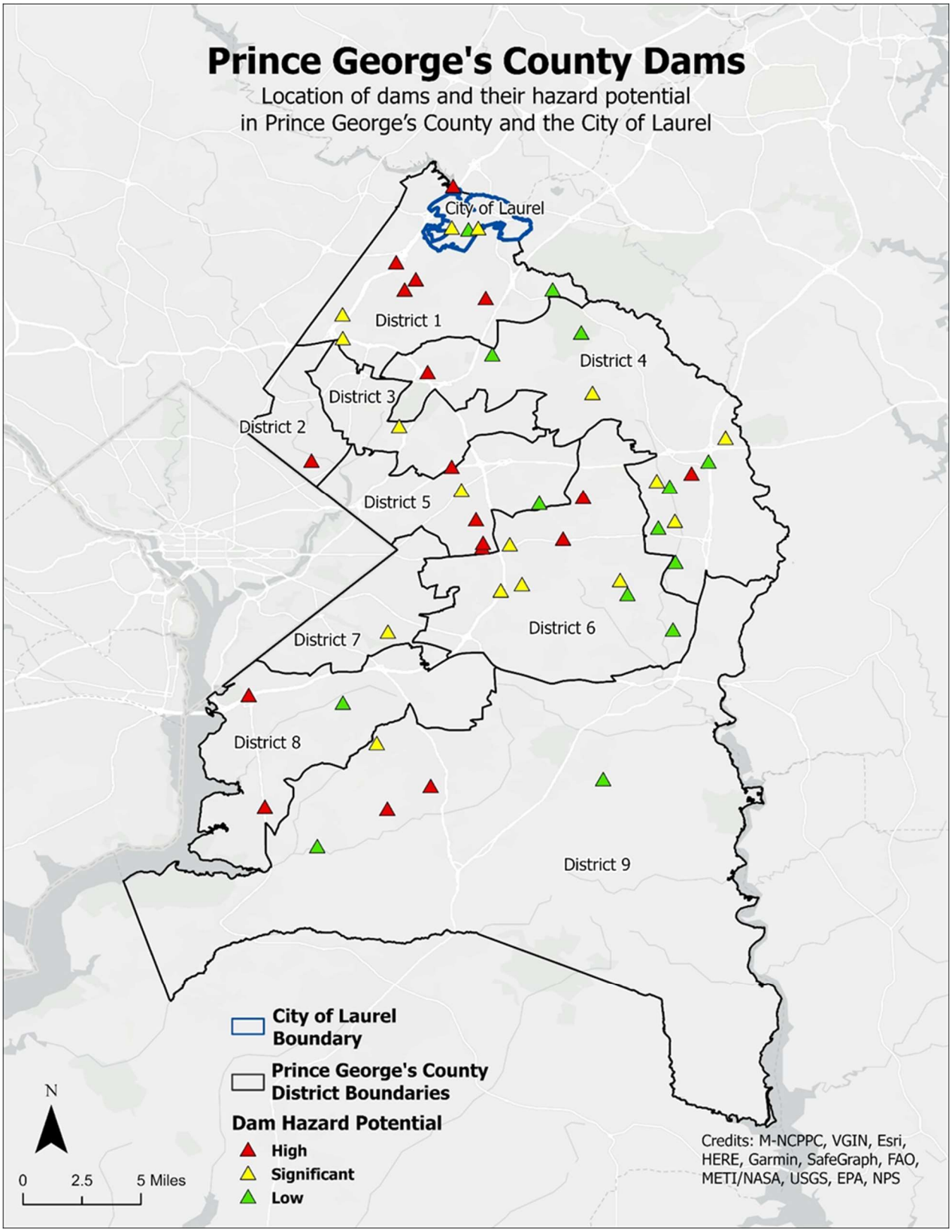


Figure 49: Location of Dams and their Hazard Potential in Prince George's County and the City of Laurel

Table 84: Dams located in in Prince George's County and City of Laurel

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
T. Howard Duckett Dam	MD00020	Patuxent River	Regional	Washington Suburban Sanitary Commission	Water Supply, Recreation	139 ft	1953	High	Fair	Yes	5/01/21
Aragona Village	MD00623	Tributary to Broad Creek	County	Prince George's County Department of the Environment	Flood Risk Reduction	15.4 ft	1995	High	Fair	Yes	12/02/21
Prince George Country Club Dam	MD00272	Northeast Branch	Private	Woodmore Country Club	Recreation, Irrigation	19 ft	1982	High	Poor	Yes	4/21/22
FedEx Field Pond No. 1	MD00329	Southwest Branch	Private	WFI Stadium, Inc.	Flood Risk Reduction	35 ft	1997	High	Fair	Yes	5/01/21
New Bald Eagle Road SWM	MD00591	Oxon Creek	State	Maryland DOT State Highway Administration	Flood Risk Reduction	43.5 ft	2006	High	Poor	Yes	5/01/21
Contee Main Settling Pond	MD00081	Indian Creek	Private	Laurel Sand and Gravel, Inc.	Tailings	41 ft	1973	High	Unsatisfactory	Yes	4/29/20
Lake Arbor (Lake Arbor Way)	MD00082	Western Branch	County	Prince George's County	Recreation	38 ft	1971	High	Fair	Yes	5/27/20

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Cosca Regional Park Dam	MD00064	Butler Branch	Local Gov.	Maryland-National Capital Park and Planning Commission-Cosca Park	Recreation, Fire Protection, Stock, or Small Fishpond	28 ft	1970	High	Fair	Yes	5/05/21
Indian Creek Site 3	MD00265	Indian Creek	County	Prince George's County	Flood Risk Reduction	28 ft	1983	High	Fair	Yes	5/27/20
Summerfield SWM Pond No. 1 (Chatsfield Way)	MD00324	Southwest Branch	County	Prince George's County	Flood Risk Reduction	23 ft	1994	High	Poor	Yes	7/29/20
Indian Creek Site 2	MD00260	Indian Creek	County	Prince George's County	Flood Risk Reduction	22 ft	1983	High	Fair	Yes	5/27/20
Greenbelt Dam	MD00008	Indian Creek	City	City of Greenbelt	Recreation	22 ft	1936	High	Satisfactory	Yes	6/25/21
Hanson Oaks SWM	MD00622	Beaverdam Creek	County	Prince George's County	Flood Risk Reduction	20 ft	1900	High	Poor	No	--
Cash Lake Dam	MD00013	Patuxent River	Federal	US Fish & Wildlife Service	Fish and Wildlife Pond	20 ft	1939	High	Fair	Yes	12/11/20

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Bowie Town Center Lake	MD00490	Mill Branch	City	City of Bowie	Flood Risk Reduction & Recreation	20 ft	1990	High	Fair	Yes	4/30/21
Ashcroft Drive-Woodbridge Pond	MD00614	Beaverdam Creek	County	Prince George's County	Flood Risk Reduction	20 ft	--	High	Poor	Yes	5/27/21
Summerfield SWM Pond No. 2	MD00625	Southwest Branch	County	Prince George's County	--	15 ft	--	High	Poor	No	3/11/22
Allison Street Levee	MD00583	Northwest Branch	County	Prince George's County	Flood Risk Reduction	15 ft	1988	High	Fair	Yes	5/01/13
Summit Creek- Mount Auburn Dr.	MD00617	Piscataway Creek	Private	Summit Creek Homes Association	Flood Risk Reduction	15 ft	2000	High	Poor	No	--
UMSTC Lower Dam	MD00348	Patuxent River	City	City of Bowie	Flood Risk Reduction	38 ft	2001	Significant	Fair	Yes	5/01/21
Northridge SWM Pond	MD00515	Horsepen Branch	City	City of Bowie	Flood Risk Reduction	28 ft	1989	Significant	Satisfactory	Yes	4/29/21
Frost Pond	MD00584	Beaverdam Creek	County	Prince George's County	Flood Risk Reduction	27 ft	1988	Significant	Fair	No	--

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Lake Largo Town Center Dam (Kings Way)	MD00373	Southwest Branch	County	Prince George's County	Recreation	26.7 ft	1973	Significant	Poor	Yes	11/23/20
Van Dusen Road	MD00615	Bear Branch	County	Prince George's County	Stormwater Management	23 ft	1988	Significant	Fair	Yes	3/11/22
Laurel Lakes No. 1 (Lower)	MD00232	Bear Branch	County	Prince George's County	Recreation	21 ft	1986	Significant	Satisfactory	Yes	11/23/20
Collington Facility 9 Dam	MD00511	Collington Branch	County	Prince George's County	Flood Risk Reduction	20.8 ft	1990	Significant	Satisfactory	No	--
Madison Hill SWM Pond 1 (Silk Tree Drive)	MD00327	Brier Ditch, Northeast Branch	County	Prince George's County	Irrigation, Recreation	18 ft	1994	Significant	Satisfactory	No	--
Tinkers Creek Regional SWM Pond No. 8	MD00498	Tinkers Creek	County	Prince George's County DER	Flood Risk Reduction	17.5 ft	1991	Significant	Satisfactory	Yes	5/31/20
Perrywood	MD00605	Collington Branch	Private	Perrywood Manor HOA, Inc.	--	16.3 ft	1984	Significant	Fair	No	--
Ritchie Hill SWM Pond	MD00402	Ritchie Branch	State	MD DOT State Highway Administration	--	15 ft	2008	Significant	Satisfactory	Yes	5/01/21

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Hensen Creek Flood Control Dam #17	MD00575	Henson Creek	Local Gov.	Maryland-National Capital Park and Planning Commission – Prince George's County Parks	Flood Risk Reduction	22 ft	1992	Significant	Unsatisfactory	Yes	5/27/21
Tall Oaks Crossing	MD00381	Collington Branch	City	City of Bowie	Recreation	14 ft	1985	Significant	Not Rated	Yes	5/13/20
Cherry Hill Park Dam	MD00430	Paint Branch	Private	Cherry Hill Campcity, Inc.	Flood Risk Reduction	13 ft	1986	Significant	Satisfactory	Yes	4/14/21
Heritage Glen Dam	MD00377	Southwest Branch	County	Prince George's County	Flood Risk Reduction	12 ft	2004	Significant	Satisfactory	Yes	5/19/20
Cherryvale Neighborhood Park Pond	MD00487	Paint Branch	County	Maryland-National Capital Park and Planning Commission - Prince George's County Parks	Fish and Wildlife Pond	10 ft	1960	Significant	Unsatisfactory	Yes	5/11/20
Beechtree Dam	MD00361	East Branch, Collington Branch	Private	Lake Presidential Golf Club	Irrigation, Recreation	50 ft	2002	Low	Fair	N/A	--
Parker Farms Dam	MD00302	Piscataway Creek	Private	Parker Farms	Recreation	32 ft	1978	Low	Not Rated	N/A	--

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Bowie Gateway SWM Pond Dam	MD00436	Green Branch	City	City of Bowie	--	28 ft	1992	Low	Not Rated	N/A	--
Stonegate SWM Dam	MD00512	Hensen Creek	County	Prince George's County DER	Flood Risk Reduction	25 ft	2003	Low	Satisfactory	N/A	--
Collington Life Care Center Lake	MD00491	Patuxent River West Branch	Private	Collington Kendal	Flood Risk Reduction	25 ft	1986	Low	Not Rated	N/A	--
Marlton South SWM Dam	MD00352	Southwest Branch	County	Prince George's County	Recreation	24 ft	2000	Low	Fair	N/A	--
Snowden Pond	MD00418	Patuxent	Federal	US Fish and Wildlife Service	Fish and Wildlife Pond	21 ft	1947	Low	Unsatisfactory	N/A	--
Perrywood (Waterfowl Way)	MD00604	Collington Branch	Private	Perrywood Community Association	--	18.8 ft	2003	Low	Not Rated	N/A	--
Soil Conservation Service Lake	MD00111	Beck Branch	Federal	United States Department of Agriculture Natural Resources Conservation Science	Water Supply	17 ft	1939	Low	Not Rated	N/A	--

Dam	National Inventory of Dams Number	River	Owner Type	Owner Name	Primary Purpose	Height	Year Built	Hazard Potential	Condition Assessment	EAP*	EAP Approval Date
Collington Facility 14 SWM Dam	MD00527	Western Branch-Patuxent River	County	Prince George's County	Flood Risk Reduction	16 ft	1992	Low	Satisfactory	N/A	--
Allen Pond	MD00129	Collington Branch	City	City of Bowie	Recreation	16 ft	1972	Low	Not Rated	N/A	--
Karington SWM Dam	MD00528	Collington Branch-Western Branch	Private	Tom Milbourne	Flood Risk Reduction	15 ft	2007	Low	Not Rated	N/A	--
Laurel Lakes No 2	MD00231	Bear Branch	County	Prince George's County	Flood Risk Reduction	14 ft	1986	Low	Not Rated	N/A	--
Redington Lake Dam	MD00112	Patuxent	Federal	US Fish and Wildlife Service	Fish and Wildlife Pond	13 ft	1940	Low	Poor	N/A	--

* EAP = Emergency Action Plan

Eleven dams in Prince George's County have inundation zone GIS maps available, as shown in **Figure 50**. There is one large dam in Prince George's County located on the Patuxent River; the Duckett Dam, if breached, would have a significant impact on the northeast section of the County and specifically the City of Laurel. Inundation mapping has been completed for the Duckett Dam, as well as ten smaller dams: Laurel Lakes 1, Tinker Creek, Indian Creek 2, Indian Creek 3, Lake Arbor, Heritage Glen, Bowie Town Center, Tall Oaks Crossing, Northridge, Melford Center Lower, and Largo Town Center Dams. For each dam, the downstream inundation zones were analyzed and mapped to show potential flood exposure due to dam failure or breach.

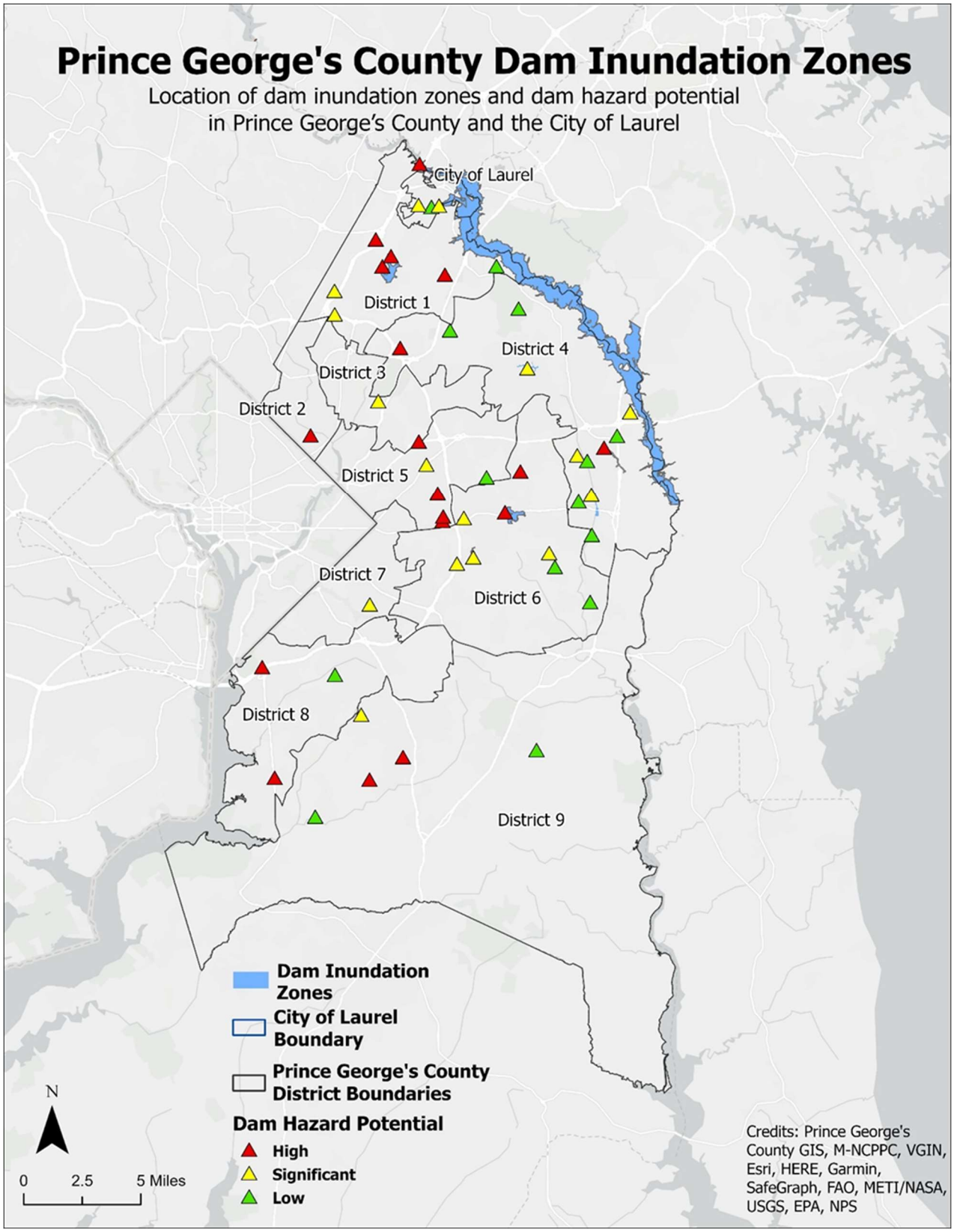


Figure 50: Location of Dam Inundation Zones in Prince George's County

J.2.b. Levees

There are eight levee systems in Prince George's County. The Allison Street Levee System and the Brentwood Levee are located in District 2. The Bladensburg Levee and the Colmar Manor Levee are located in District 5. The Riverdale-Hyattsville Levee System spans across a portion of both District 3 and 5. A map of levees located in Districts 2, 3, and 5 is shown in **Figure 51**. The Collington Branch Upper Marlboro Levee is located in District 6, and the Western Branch Upper Marlboro Levee is located in District 9. **Figure 52** shows a map of the two Upper Marlboro Levees. The Forest Heights Levee is located in District 8, as shown in **Figure 53**.

Figure 51: Allison Levee System, Brentwood Levee, Riverdale-Hyattsville Levee, Bladensburg Levee, Colmar Manor Levees and Extents

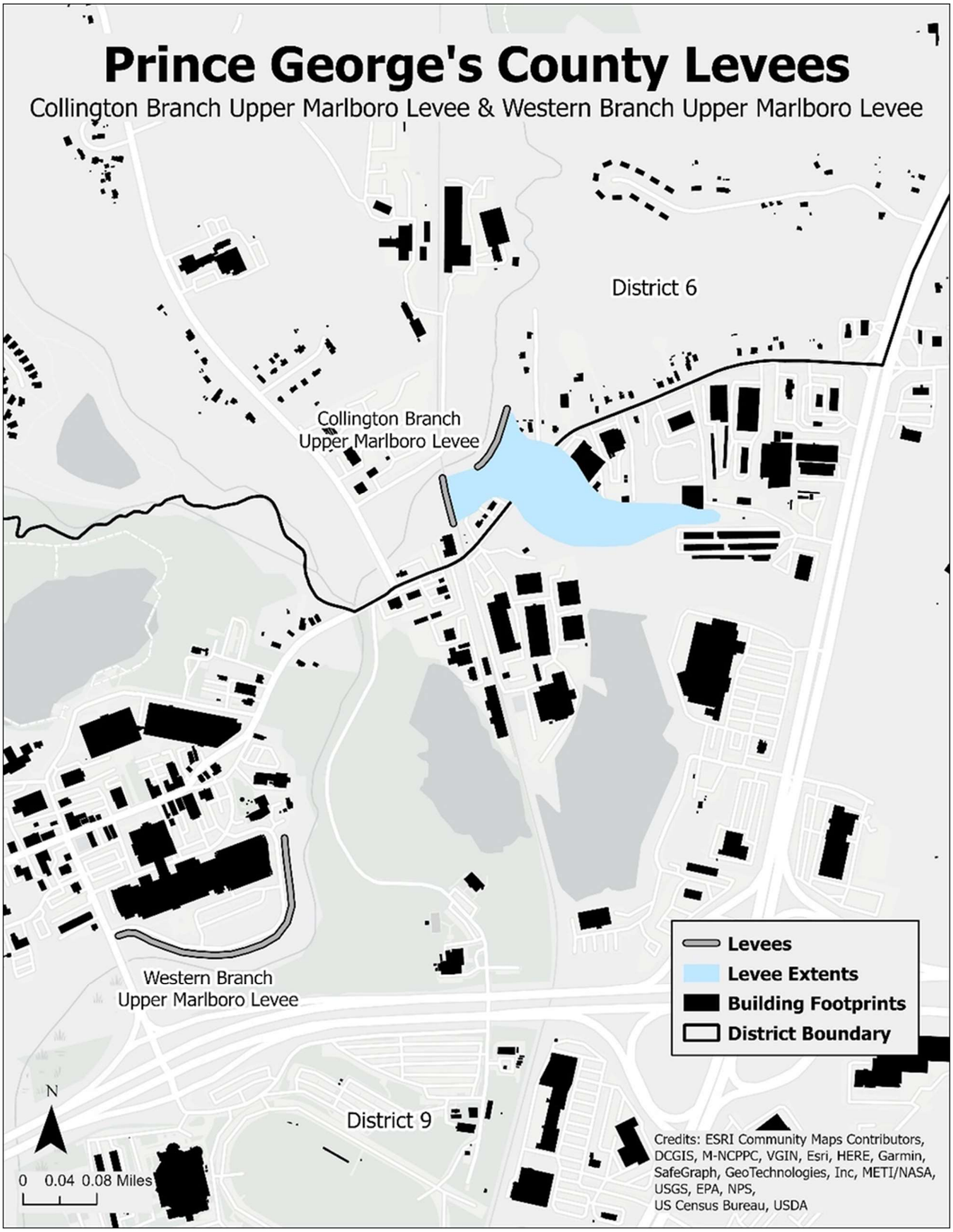


Figure 52: Upper Marlboro Levees and Extents

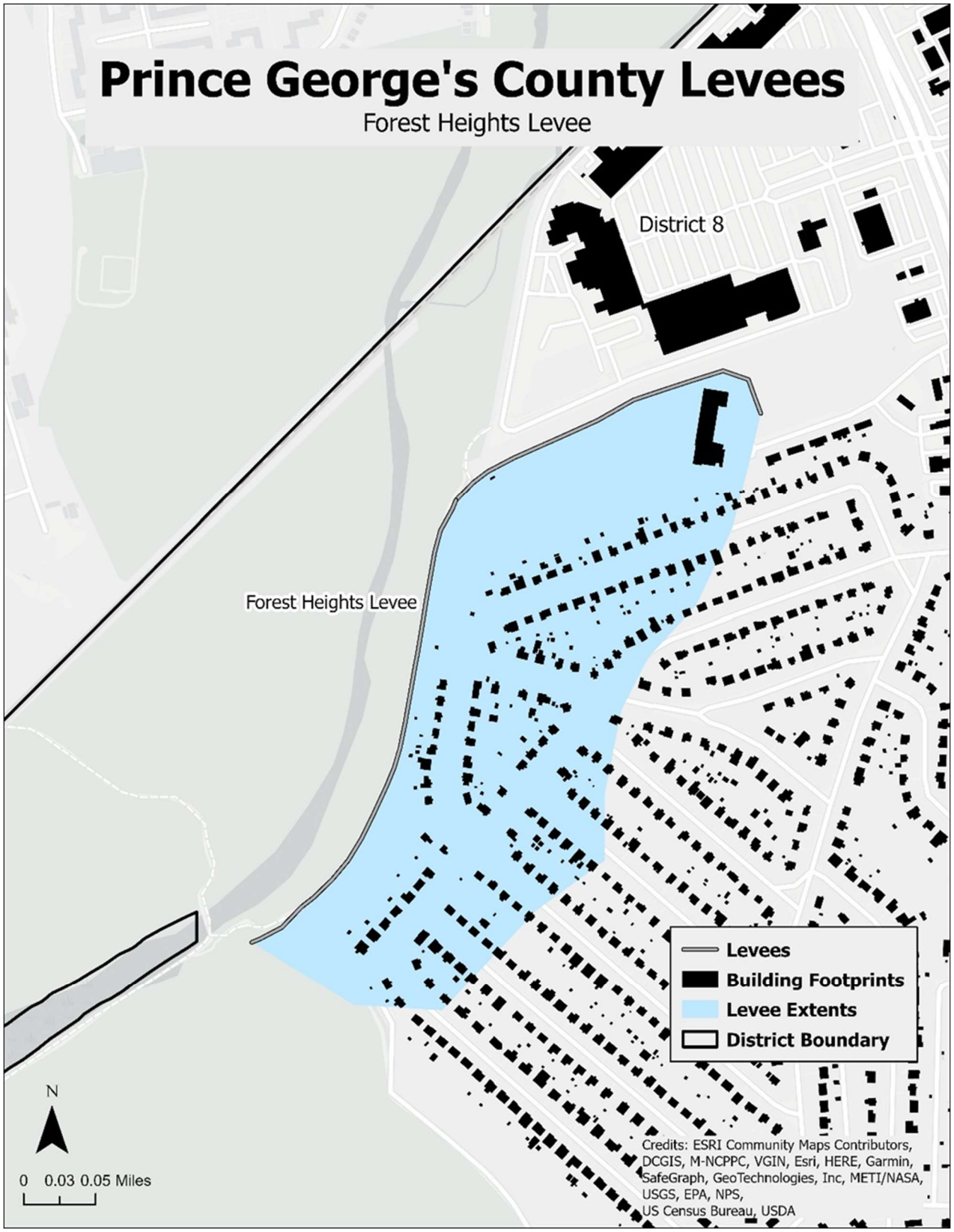


Figure 53: Forest Heights Levee and Extent

The Allison Street Levees, Bladensburg, Colmar Manor, and Riverdale-Hyattsville levees along the Anacostia River were designed by the U.S. Army Corps of Engineers, which started construction in 1954. In 1959, the levees were turned over to the Washington Suburban Sanitary Commission for maintenance. Subsequently, the maintenance responsibilities were assumed by Prince George's County. The Prince George's County Department of Public Works and Transportation (DPW&T) partners with U.S. Army Corps of Engineers to conduct annual inspections. Routine maintenance includes cutting, mowing, trimming and repair annually.

During the mid-1990s, the Prince George's County Department of Environmental Resources prepared a watershed study that examined anticipated flood discharges and flood levels. Due to decades of upland development that changed rainfall-runoff patterns, the 100-year flood was determined to be larger than the design flood used by U.S. Army Corps of Engineers to design the levees. Therefore, the County expressed concern that the levees no longer provided the intended level of protection. A study determined that in some places, levee height is lower than required by current standards. Three areas could be affected by levee overtopping which puts more than 2,100 structures at risk to flooding.

In 2009, U.S. Army Corps of Engineers and the County held discussions regarding a plan to remove trees that had not previously been identified as problematic and to address vegetation and high grass that obstruct the identification of potential erosion and burrowing animals that may weaken the levees.

J.3. Extent

J.3.a. Dam Hazard Classification

The extent or magnitude of a dam failure event can be measured in terms of the classification of the dam. In the County, there are 19 high-hazard potential, 16 significant-hazard potential, and 14 low-hazard potential dams. The hazard potential classification system should be utilized with the understanding that the failure of any dam could represent a danger to downstream property or life. As described in **Table 85**, dams in Maryland are classified by the State into three hazard categories, which align with the FEMA classification and the National Inventory of Dams hazard classification.

Table 85: Maryland Dam Hazard Classification

Hazard Classification	Description
High Hazard	Failure would likely result in loss of human life, extensive property damage to homes and other structures, or cause flooding of major highways such as State roads or interstates
Significant Hazard	Failure could possibly result in loss of life or increase flood risks to roads and buildings, with no more than 2 houses impacted and less than six lives in jeopardy
Low Hazard	Failure is unlikely to result in loss of life and only minor increases to existing flood levels at roads and buildings is expected.

Source: Maryland Department of Environment. https://mde.maryland.gov/programs/water/DamSafety/Documents/FactSheet-HazardClassificationOfDams.pdf

J.3.a.1. Dam Failure Risk

The hazard classifications are based on overall risk. There are three major flood risks that can be applied to any dam, including incremental risk, non-breach risk, and residual risk:[108]

- **Incremental risk** refers to the risk to the pool area and downstream floodplain occupants attributed to a dam breach both prior to and following overtopping, or if a dam component malfunctions. The consequences due to incremental risk are typically due to downstream inundation, but if there is a loss of the pool, there can be consequences upstream of the dam as well.
- **Non-breach risk** refers to the risk to the pool area and the downstream affected floodplains even if the dam functions as intended. This is due to 'normal' dam operation of the dam or 'overtopping of dams without breach' scenarios.
- **Residual risk** refers to the risk in the pool area and downstream of the dam and the landside area behind a levee at any point in time.

Additional risks that may lead to dam failure include landslides into reservoirs, which causes surges that may cause overtopping, as well as earthquakes, which may cause longitudinal cracks at the top of embankments, weakening entire structures. High winds can also cause significant wave action and result in erosion to the dam structure. These environmental risks can have cascading impacts that may affect up and downstream flooding if they cause dam failure. As demonstrated by Maryland's classification of dams, vulnerabilities from high-hazard potential dams can include loss of human life, property damage to homes and other structures, flooding of major highways, and increased flood risk, among others, depending on what is located downstream of the dam. Depending on the use of the dam, a dam failure or incident could also impact the water supply. Storms, landslides, earthquakes, and other natural hazards may have cascading impacts that may affect up and downstream flooding potential of high-hazard potential dams.

J.3.a.2. Levee Failure Risk

Levee system failure or overtopping can cause severe flooding and high-water velocities. A failure of a levee system could be devastating to the communities that are protected by the system. A levee failure caused by structural failure can be sudden, and perhaps with little to no warning. If a levee failure is caused by overtopping, the community protected by the levee may or may not be able to recognize the impending failure and evacuate. If a levee failure occurs suddenly, evacuation may not be possible.

Levee failure risk may also be affected by the impacts of climate change. One major concern is the impact of rising sea level on levee systems. As sea levels rise, there may be additional pressure put on tidal levee systems, thus increasing the potential for failure. Additionally, as intensity and frequency of storms and extreme precipitation events increase due to climate change, levee structural integrity will be tested, and levee systems may have to retain more water, which could lead to failure.

J.3.b. Dam Condition Assessment

In addition to hazard classifications, dams are also assigned a condition assessment by the National Inventory of Dams. Condition assessments describe the condition of the dam at the time of inspection. Condition assessments are subjective, as they are assigned by individual inspectors. **Table 86** shows a description of each of the National Inventory of Dams condition assessments.

[108] United States Bureau of Reclamation. Best Practices and Risk Methodology: Chapter A-9 Risk Guidelines Presentation. 2019. https://www.usbr.gov/damsafety/risk/BestPractices/Chapters/A9-GovernanceAndGuidance.pdf

Table 86: Dam Condition Assessment Classification

Condition Assessment	Description
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.
Poor	A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. "Poor" may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are necessary.

Danger reach is an additional measure of dam failure extent. This refers to the area below a dam that would be flooded as a result of dam failure. Maps of the danger reach, referred to as "inundation maps," are prepared by an engineer based on hydrologic and hydraulic analyses and topography of the affected area. Danger reach inundation maps serve as the basis of Emergency Action Plans (EAPs).[109] Emergency Action Plans are written documents that identify incidents that can lead to potential emergency conditions at a dam, identifies the areas that can be affected by the loss of reservoir, and specifies pre-planned actions to be followed to minimize property damage, potential loss of infrastructure and water resource, and potential loss of life because of failure or mis-operation of a dam.[110]

J.4. Previous Occurrences

As of November 2022, there have been no major dam or levee failures in Prince George's County.

J.5. Probability of Future Events

While there have been no historical dam or levee failures in Prince George's County, any single dam or levee breach event in the future may lead to catastrophic and expensive consequences. Without a historical basis, quantifying the probability of future dam failure is not currently possible. However, as climate change increases the frequency of severe storms and amount of extreme rainfall, there is an increasing risk of floodwaters overtopping dams. An increased risk of overtopping increases all types of risk associated with dam failures. High hazard potential dams are especially at risk of failure that causes severe damages to people and property.

[109] Maryland Department of the Environment. Maryland's Dam Safety Program. https://mde.maryland.gov/programs/Water/DamSafety/Documents/FactSheetHazardClassificationsofDams.pdf
[110] Association of State Dam Safety Officials. Emergency Action Planning. https://damsafety.org/dam-owners/emergency-action-planning

J.6. Vulnerability and Risk Assessment

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for dam failure (the State includes levees under "dam failure"). These scores and ranks are shown in **Table 87**, which shows the State's ranking for dam failure vulnerability in Prince George's County (including the City of Laurel) as medium-high.

Table 87. 2021 State of Maryland Dam Failure Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	1
Property Damage	1
Crop Damage	1
Geographic Extent	3
Events	2
Local Plan Ranking (2017)	3
Overall Weighted Risk Rating[111]	**18.5**
Overall Ranking	**Medium-High**

J.6.a. Infrastructure Exposed to Dam Failure

In total, $1,411,313,712 in property value is exposed between the eleven dam inundation areas that were provided by the County. Property exposure was determined by intersecting a County-provided property value GIS layer with each dam's inundation zone GIS layer. **Figure 54** through **Figure 64** below show each dam's inundation zone and the building footprints exposed. **Table 88** shows exposed property values for properties within each of the inundation zones.

The Duckett Dam poses the highest risk of exposure, both in terms of buildings in the inundation zone and property exposure. Almost $700 Million is exposed, with the inundation zone containing 964 buildings, and spanning across parts of the City of Laurel, District 1, and District 4. The Largo Town Center Dam has the least amount of buildings in its inundation zone, but has the third least amount of property exposure, with $44,463,996 exposed.

[111] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Table 88: Property Exposure by Dam

Dam	Hazard Potential	Buildings in Inundation Zone	Property Exposure
Duckett Dam	High	964	$692,272,613
Tinker Creek Dam	Significant	10	$669,767
Heritage Glen Dam	Significant	17	$6,005,665
Indian Creek 2 & 3	High	182	$151,537,770
Lake Arbor Dam	High	126	$50,393,250
Largo Town Center Dam	Significant	3	$44,463,996
Laurel Lakes No 1 Dam	Significant	103	$327,589,022
Bowie Town Center Dam	High	37	$105,287,663
Northridge Dam	Significant	6	$10,292,166
Tall Oaks Crossing Dam	Significant	9	$6,067,400
Melford Center Lower Dam	Significant	0	$16,734,400
Total	**--**	**1457**	**$1,411,313,712**

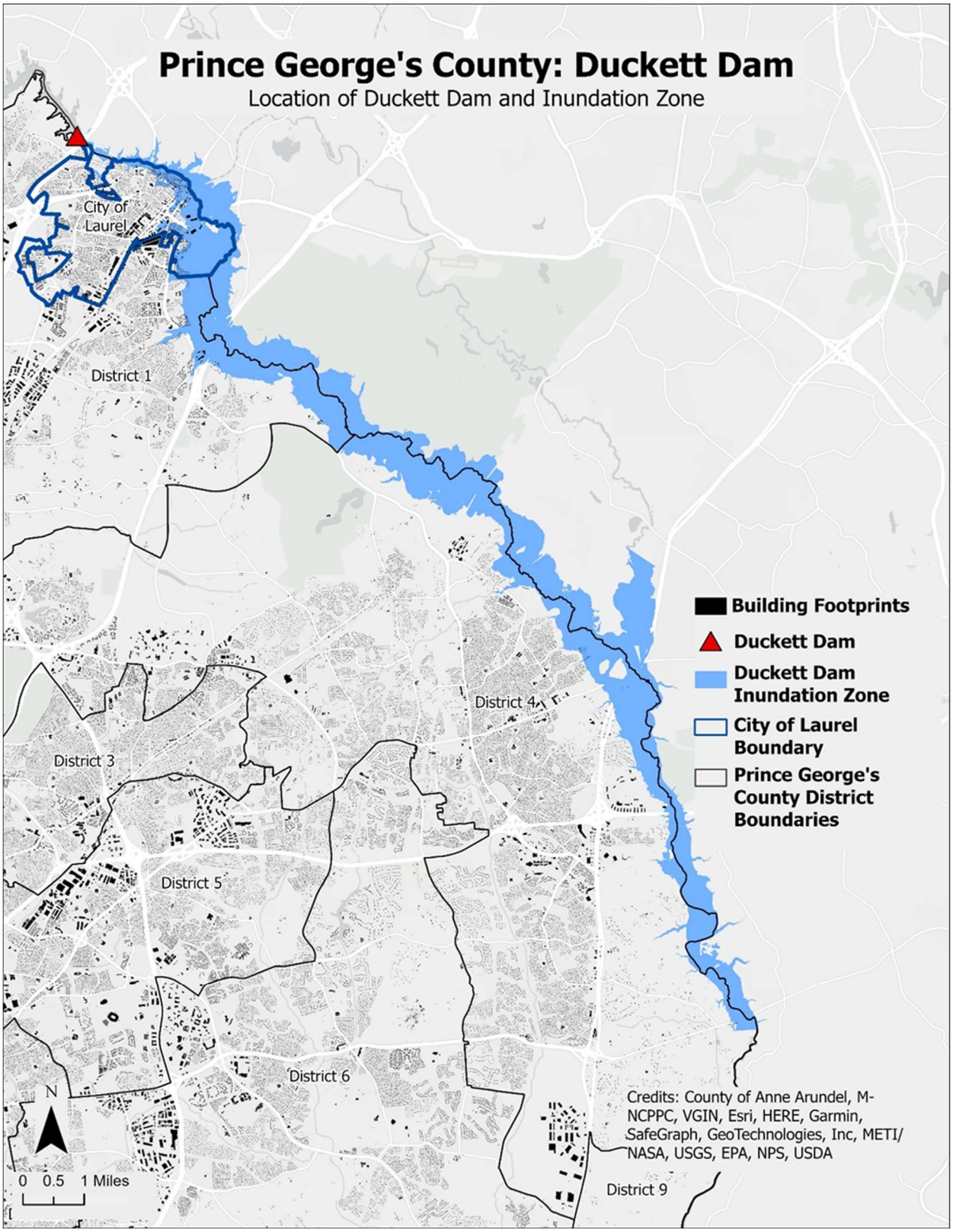


Figure 54: Duckett Dam Location and Inundation Zone

Figure 55: Largo Town Center Dam Location and Inundation Zone

Figure 56: Heritage Glen Dam Location and Inundation Zone

Figure 57: Indian Creek Dam Sites 2 & 3 Locations and Inundation Zone

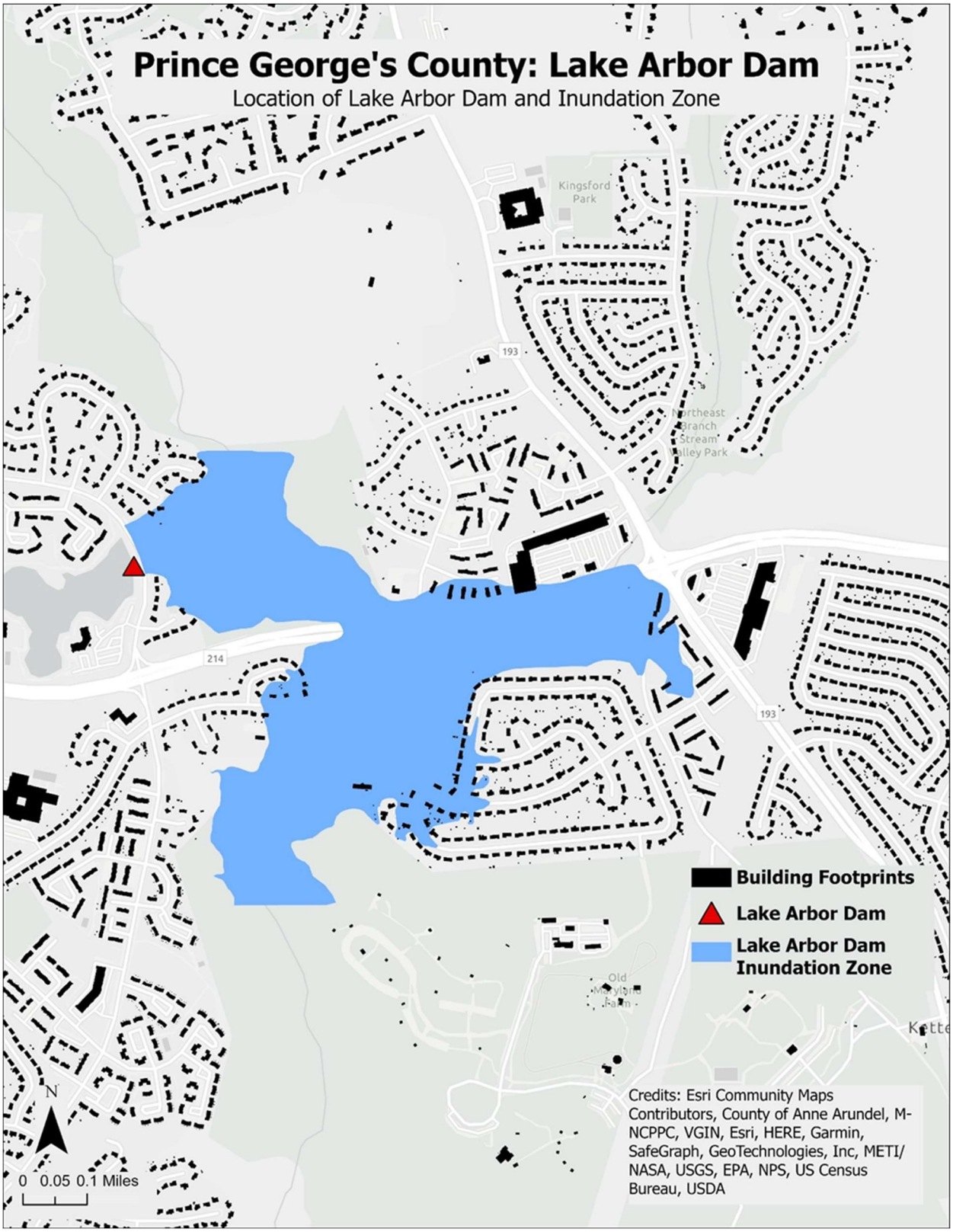


Figure 58: Lake Arbor Dam Location and Inundation Zone

Figure 59: Laurel Lakes Dam No 1 Location and Inundation Zone

Figure 60: Tinker Creek Dam Location and Inundation Zone

Figure 61: Bowie Town Center Dam and Inundation Zone

Figure 62: Northridge Dam Location and Inundation Zone

Figure 63: Tall Oaks Crossing Dam Location and Inundation Zone

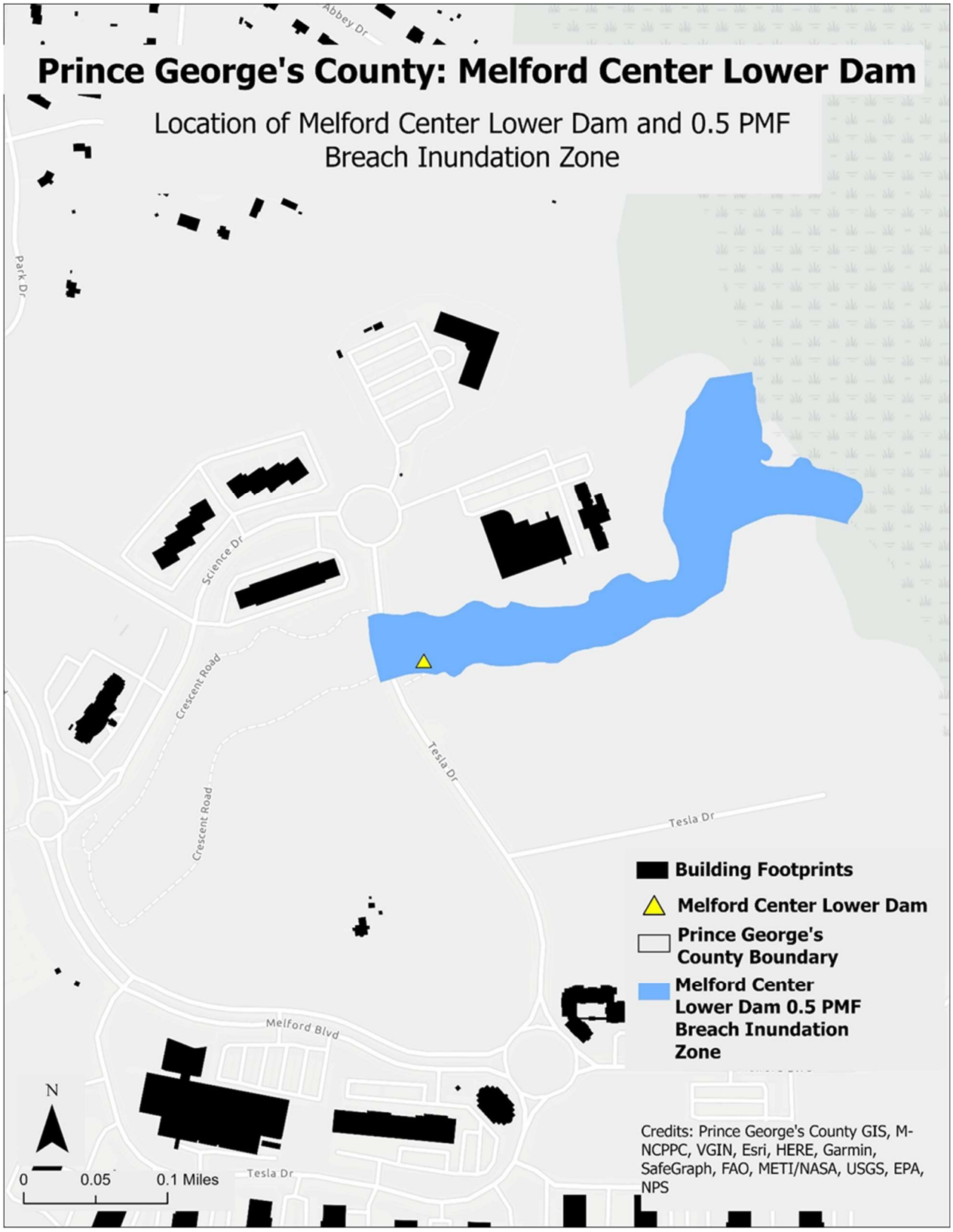


Figure 64: Melford Center Lower Dam Location and 0.5 Probable Maximum Flood Break Inundation Zone

J.6.a.1. Large Dams – Duckett

The Duckett Dam is a large, high-hazard potential dam located on the Patuxent River. An analysis was completed using inundation zone GIS data for the Duckett Dam to evaluate property exposure in the case of a dam break. This inundation zone layer depicts a "sunny day" scenario, where the Duckett Dam fails, the reservoir is full, and there is no inclement weather to add additional water to the event. The inundation zone from the dam was intersected with a property value GIS map layer to determine the exposure during the "sunny day" dam failure scenario. This dam failure scenario put $692,272,613 in property value at risk. A breach of a dam of this size would cause extensive property damage to properties within the inundation zone and put residents in the inundation zone at risk.

J.6.a.2. Small Dams

Each of the small dams were analyzed for their possible property exposure. Property values were intersected with each dam inundation zone layer to determine property exposure. Laurel Lakes No 1 Dam had the highest exposed property value, with $327,589,022 of exposed property at risk in its inundation zone. Indian Creek Dam Sites 2 & 3 had the second highest exposed property value, with $151,537,770. Bowie Town Center Dam has $105,287,663 in exposed property. Lake Arbor Dam had $50,393,250 in exposed property value. Largo Town Center Dam had $44,463,996 of exposure for the property in its inundation zone. Melford Center Lower Dam had $16,734,400 and Northridge Dam had $10,292,166 in exposed property. Tall Oaks Crossing Dam had $6,067,400 in exposed property. Heritage Glen Dam had an exposed property value of $6,005,665. Tinker Creek Dam had the lowest exposed property value, with $669,767.

J.6.a.3. Properties Exposed to Dam Failure

Each of the dams were analyzed to determine the impact on the number and types of properties located in each inundation zone. Number and type of exposed properties located within the dam inundation zones are shown in **Table 89**.

Table 89: Types of Properties Exposed to Dam Failure

Dam	Residential-Single Family	Residential-Townhouse	Residential-Multi-Family	Residential-Attached	Commercial	Parks & Open Space	Institutional	Office	Industrial	Church	Vacant
Duckett Dam	360	119	34	15	78	71	37	36	24	8	411
Tinker Creek Dam	6	0	0	0	0	2	2	0	0	0	2
Heritage Glen Dam	24	0	0	0	0	5	0	0	0	0	1
Indian Creek 2 & 3	39	0	0	0	7	2	9	8	58	0	1
Lake Arbor Dam	73	31	0	0	1	5	3	0	0	1	0
Largo Town Center Dam	0	0	4	0	2	1	0	1	0	0	3
Laurel Lakes No 1 Dam	1	1	7	0	22	0	3	0	11	0	24
Bowie Town Center Dam	14	65	9	0	5	8	6	0	0	0	7

Dam	Residential-Single Family	Residential-Townhouse	Residential-Multi-Family	Residential-Attached	Commercial	Parks & Open Space	Institutional	Office	Industrial	Church	Vacant
Northridge Dam	25	0	0	0	0	11	0	0	0	0	6
Tall Oaks Crossing Dam	24	1	0	0	1	12	0	0	0	0	2
Melford Center Lower Dam	0	0	0	0	0	2	0	0	1	0	4

J.6.a.4. Critical Facilities Exposed to Dam Failure

Only 14 of the 708 critical asset facilities in Prince George's County and the City of Laurel are within the County's provided dam inundation zones. Seven of those 12 facilities fall within the Duckett Dam inundation zone, three are within the Laurel Lakes No 1 Dam inundation zone, two are within the Bowie Town Center Dam inundation zone, one is in the Lake Arbor Dam inundation zone, and one is within the Largo Town Center Dam inundation zone. **Table 90** and **Table 91** show the critical facilities located within inundation zones by dam inundation zone, as well as by type of critical facility. Critical facilities exposure was determined by intersecting the County's critical facilities points GIS layer with each Dam Inundation Zone GIS layers. **Appendix D** contains the full, structure-by-structure critical facility hazard analysis.

Table 90: Prince George's County Critical Facilities Located in Dam Inundation Zones

Dam	Critical Facilities in Inundation Zone
Duckett Dam	7
Tinker Creek Dam	0
Heritage Glen Dam	0
Indian Creek 2 & 3	0
Lake Arbor Dam	1
Largo Town Center Dam	1
Laurel Lakes No 1 Dam	3
Bowie Town Center Dam	2
Northridge Dam	0
Tall Oaks Crossing Dam	0
Melford Center Lower Dam	0
Total	**14**

Table 91: Prince George's County Critical Facilities Located in Dam Inundation Zones

Critical Facility Type	Facilities in Inundation Zone	Facilities Outside Inundation Zone	Percent in Inundation Zone
Commercial Facilities	5	110	4.50%
Emergency Services	2	76	2.60%
Government Facilities	2	382	0.50%
Transportation	2	40	5%

Critical Facility Type	Facilities in Inundation Zone	Facilities Outside Inundation Zone	Percent in Inundation Zone
Energy	1	14	7.10%
Water and Wastewater Systems	1	10	10%
Healthcare and Public Health	0	24	0%
Food and Agriculture	1	16	6.30%
Chemical	0	11	0%
Communications	0	5	0%
Information Technology	0	3	0%
Nuclear	0	2	0%
Defense Industrial Base	0	1	0%
Total	**14**	**694**	**2.02%**

J.6.b. Infrastructure Exposed to Levee Failure

The exposure values were approximated for this analysis using the same building footprints and property values as the dam failure exposure assessment. Property exposure and buildings in inundation extent were determined by intersecting a property value GIS layer and building footprint GIS layers with levee inundation extent GIS layers. **Table 92** summarizes the total building exposure in Prince George's County to potential levee failure within each levee's inundation extent. The total property exposure for the County is approximately $644 million. The Brentwood Levee has the highest exposure risk, with approximately $212 Million in property exposure, with 1074 buildings in the levee inundation area.

Table 92: Summary of Individual Levee Risk Exposure

Levee	District	Buildings in Inundation Zone	Property Exposure
Allison Street Levee System	District 2	362	$109,339,700
Bladensburg Levee	District 5	486	$118,512,532
Brentwood Levee	District 2	1074	$212,527,000
Upper Marlboro Levees (Collington Branch and Western Branch)	District 9	14	$9,189,432
Colmar Manor Levee	District 5	349	$45,487,938
Forest Heights Levee	District 8	209	$22,817,500
Riverdale-Hyattsville Levee	Districts 3 & 5	834	$125,749,000

Levee	District	Buildings in Inundation Zone	Property Exposure
Total	**--**	**3328**	**$643,623,102**

J.6.c. Population Exposed to Dam Failure

Only four districts and the City of Laurel are affected by dam inundation zones, as seen in **Figure 65**. Although these are the only districts with pre-existing inundation zone maps, each of the nine districts and the City of Laurel have at least one dam within its boundaries. Mapping of the remaining high hazard dams in the county without existing inundation maps would support additional analysis of population exposure to dam failure in the County.

According to 2020 census-tract CDC Social Vulnerability Data, the Duckett Dam and Indian Creek 2 & 3 Dams have the only dam inundation zones that impacts populations with a Social Vulnerability Index score of 0.6 or higher. **Figure 66** shows a map of social vulnerability in the County and dam inundation areas.

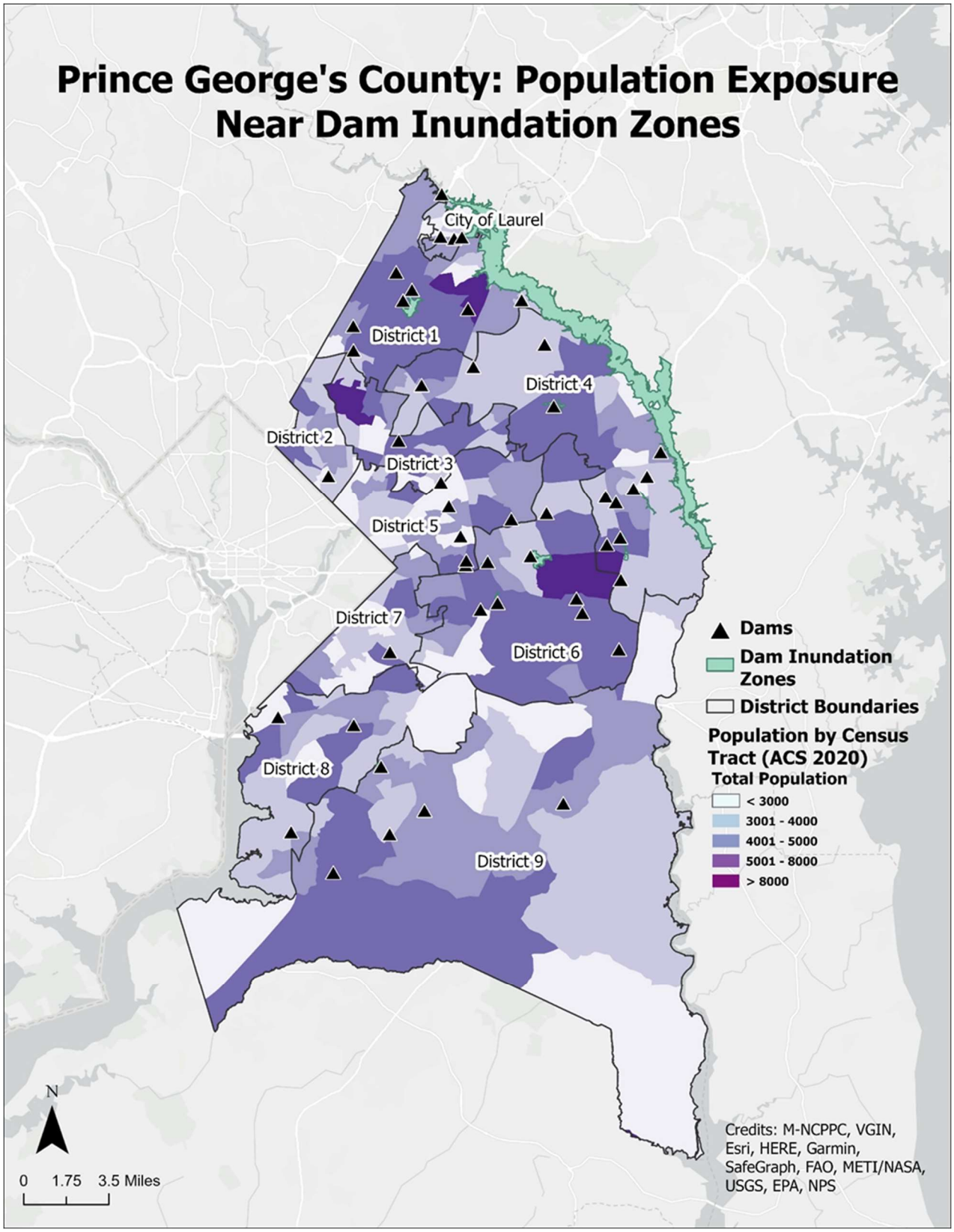


Figure 65: Prince George's County Population and Dam Inundation Zones

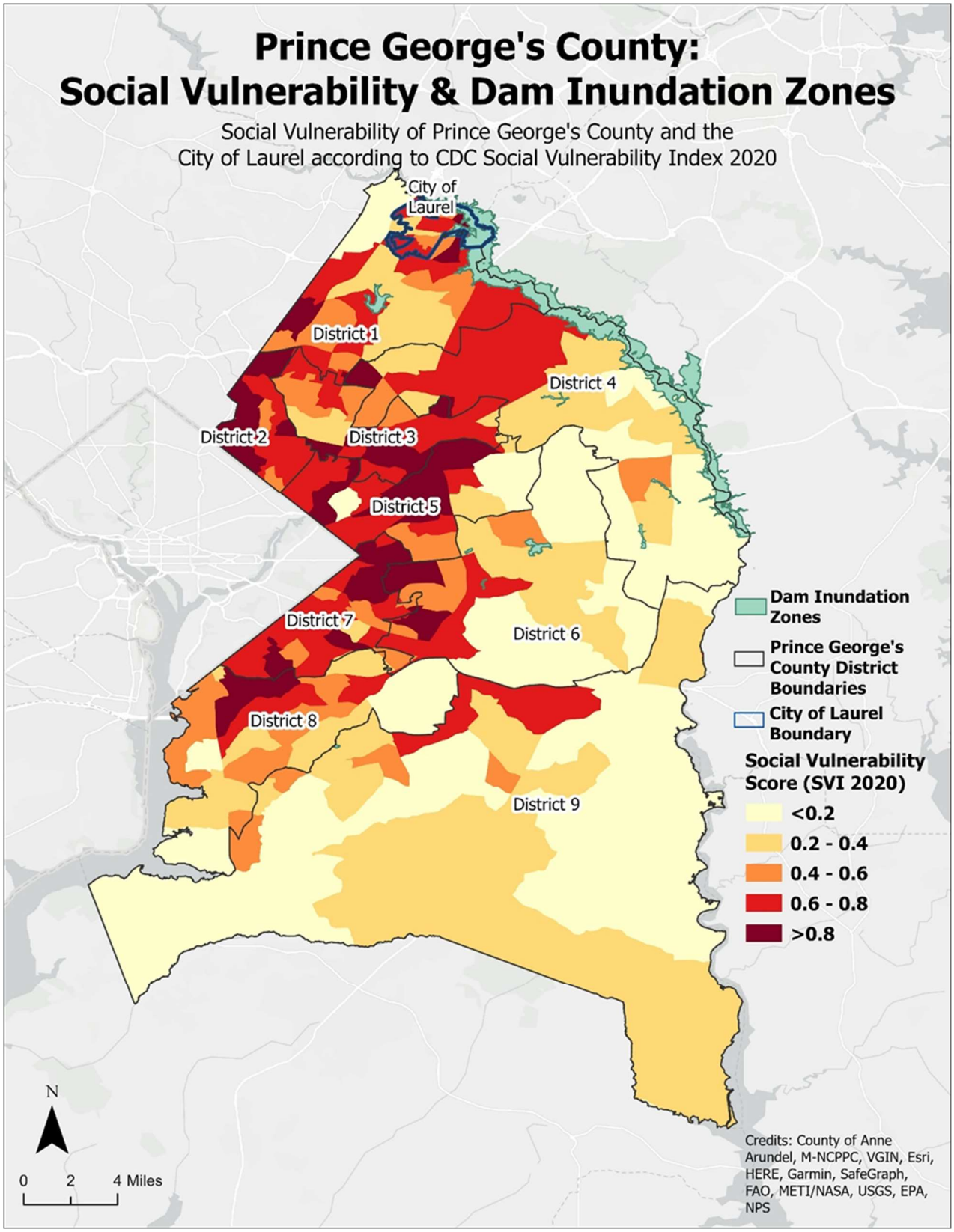


Figure 66: Prince George's County Social Vulnerability and Dam Inundation Zones

J.6.d. Future Development

An increase in development increases the potential for risk associated with dam and levee failure in Prince George's County and the City of Laurel. Downstream development increases the potential consequences of a dam or levee's failure due to an increased number of structures and population in the inundation zone. There will be increased economic, social, and environmental impacts as development increases downstream from dams. Additionally, more dams will be re-classified as significant-hazard potential and high- hazard potential, which will increase the need for Emergency Action Plans and planning to avoid disruption to essential facilities as well as prevent loss of life.

To reduce the vulnerability from high-hazard potential dams and the potential consequences associated with dam failure incidents, Prince George's County and the City of Laurel should reduce the number of high-hazard potential dams. Future development should include projects to build community resilience to dam-related flooding from existing high-hazard potential dams, such as flood-proofing or acquiring structures downstream of dams.

As shown in **Figure 67**, there is overlap between dam and levee inundation zones and Local Centers and Employment Areas, which means and increase in exposure and, therefore, an increase in risk to those developed areas in the case of dam or levee failure.

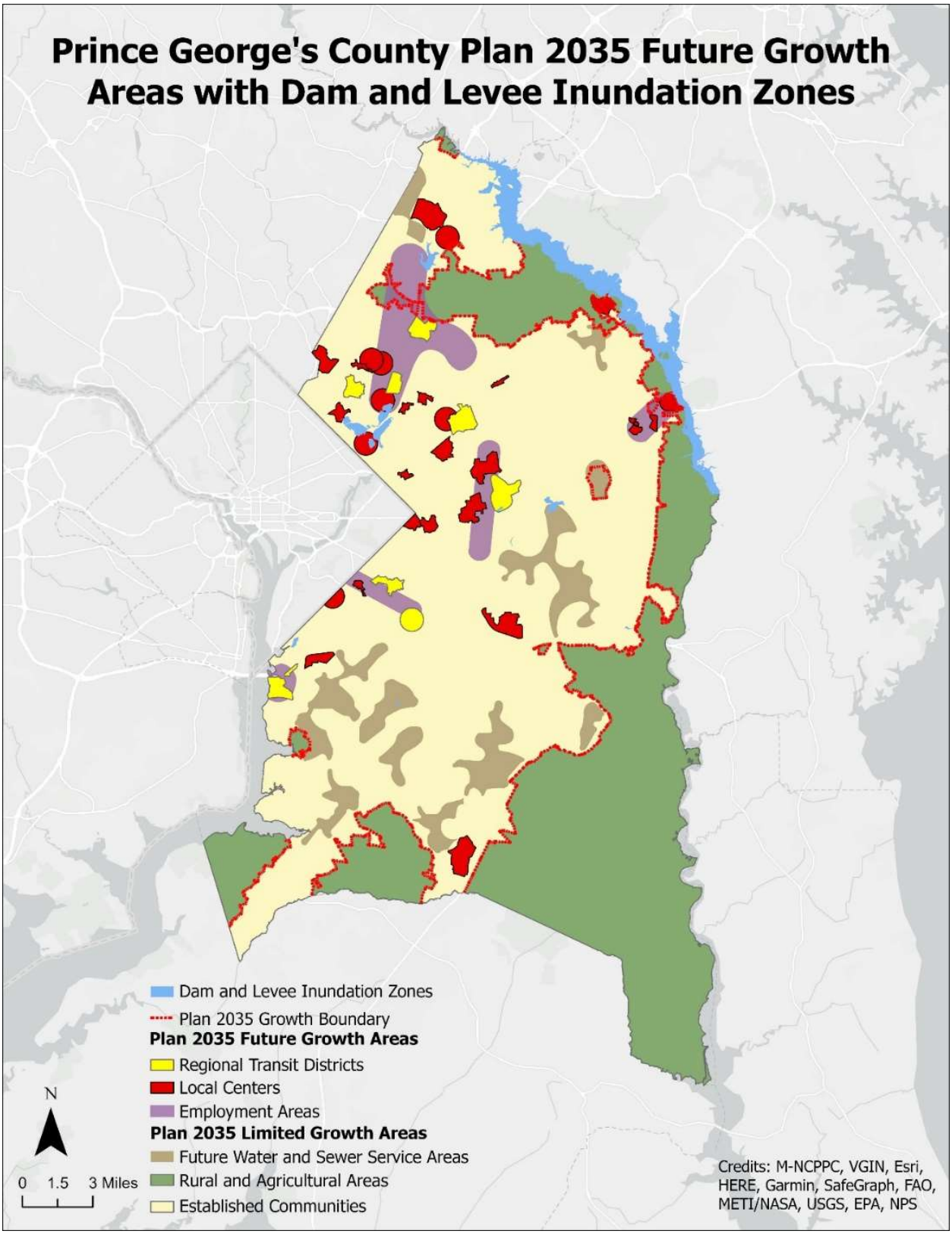


Figure 67. Prince George's County Plan 2035 Future Growth Areas with Dam and Levee Inundation Zones

J.7. Consequence Analysis

Dam failure incidents can have significant economic, environmental, and social impacts on an area. Direct economic impacts can occur following a dam failure event through closure of businesses and need to repair or rebuild infrastructure and structures. Indirect economic impacts include loss of employment due to flooded businesses, and lower property tax revenues for impacted properties. Environmental impacts of dam failure pollution of groundwater and surface water, as well as soil pollution. Dam failure can also degrade environmentally sensitive areas through flooding. Social impacts include changes to quality of life for populations living in dam inundation zones, as well as loss of services from critical facilities within inundation zones, including medical and transportation facilities.

Additionally, there are multiple FEMA Community Lifelines that are vulnerable to dam failure. FEMA's Community Lifelines have been developed to reframe incident information, communicate incident impacts, and organize response efforts across a community. The FEMA Community Lifelines at risk in the case of dam failure include the Food, Water, and Shelter Lifeline, and the Transportation Lifeline.

A consequence analysis (refer to **Table 93**) has been done to better understand the range of impacts that a dam or levee failure event can have on several features of the planning area and the population within it.

Table 93. Dam or Levee Failure Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	All populations within dam inundation areas are considered at-risk to dam failure. Dam failure can result in injuries and loss of life, and evacuations may be necessary to protect life safety.
Public Health	Dam failure can have negative impacts on public health. Impacts are similar to the public health issues associated with flooding (see **section B.6**). Additionally, having water and wastewater treatment facilities within dam inundation areas increases vulnerability to sewage spills and water contamination.
Critical Facilities and Infrastructure	Dam failure can cause loss of services from critical facilities within inundation zones, including medical and transportation facilities. Infrastructure can also be impacted by dam failure by washed-out or flooded roads.
Economy	Direct economic impacts can occur following a dam failure event through closure of businesses and need to repair or rebuild infrastructure and structures. Indirect economic impacts include loss of employment due to flooded businesses, and lower property tax revenues for impacted properties.
Buildings	All buildings located in dam inundation areas are at risk from dam failure. Dam failure may cause flooding to structures, and lead to flood damages such as structural degradation or mold.

K. Earthquake

K.1. Description

The earth's surface is covered by solid rock that is approximately 50 miles thick, referred to as the lithosphere. The lithosphere is made up of the Earth's crust, which ranges in size from about 22 miles thick for continents to about five miles thick for the oceans, and the upper mantle which is composed of solidified magma. This lithosphere "floats" above a thick layer of molten rock known as the lower mantle. The lithosphere is divided into large and small sections that geologists call plates. Earthquakes occur when those geologic plates slide against or move under each other, resulting from the sudden release of energy that creates seismic waves. Most movements between plates are extremely small, generating tiny earthquakes that cannot be sensed by people. Other, less frequent movements between plates can be quite large, generating powerful earthquakes that can shake the ground surface and cause widespread damage.

In its most general sense, the term "earthquake" is used to describe any seismic event — whether natural or caused by humans — that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by other events such as volcanic activity, landslides, mine blasts, "fracking" supporting the oil and natural gas industries and nuclear tests. An earthquake's point of initial rupture is called its focus or hypocenter. The epicenter is the point at ground level directly above the hypocenter.

Most earthquakes occur at weak points in the earth's crust along surfaces where two or more geologic plates meet, called faults. Large faults within the Earth's crust result from the action of plate tectonic forces, with the largest forming the boundaries between the plates. The location of faults can provide an indication of where future earthquakes are likely to occur. Some of the more active earthquake faults in the United States include the San Andreas Fault in California and the New Madrid Fault in the Midwest.

The potential effects of an earthquake are dependent on the magnitude of the event, the distance from the epicenter, and the local geology. At the Earth's surface, earthquakes manifest themselves by shaking and sometimes displacement of the ground. Typical impacts of a major earthquake include damages to buildings, transportation networks, and utility systems due to earthquake ground shaking and displacements. Intensities are generally greater on soft soils such as Marlboro Clays than solid rock. Seismic shaking of some poorly compacted alluvial soil can lead to liquefaction; which occurs when soil is shaken to the point where it can no longer support the weight of any object that is located on it. Other geologic impacts of strong earthquakes may include landslides, fissuring and slumping at the ground surface. When the epicenter of a large earthquake is located offshore near a subduction zone (where one geologic plate moves under another), the seabed may be displaced sufficiently to cause a tsunami. Tsunami waves can travel across the ocean at very high speeds, depending on the location and source of the seismic event.

K.2. Location and Extent

Earthquakes in the United States occur most frequently along the West Coast, where several geologic plate boundaries converge. Earthquakes also occur along the East Coast of the United States, but the

mechanisms causing these earthquakes are not well understood, as these earthquakes occur within the plate rather than at plate boundaries.[112]

All of Prince George's County and the City of Laurel is at risk for earthquakes. The mid-Atlantic and central Appalachian region, including Maryland, is characterized by a moderate amount of low-level earthquake activity, but their cause or causes are not well-known. In Maryland, there are numerous faults, but none are known or suspected to be active. Because of the relatively low seismic energy release, this region has received relatively little attention from earthquake seismologists. Earthquakes can range in size and impact, and are most commonly measured by magnitude, intensity, and peak ground acceleration:

- **Magnitude** is a measure of the strength of an earthquake or energy released by it. Magnitude is measured by a device known as a seismograph. The scale used to measure earthquake magnitude was originally defined by Charles Richter in the 1930s, and is commonly referred to as the Richter Scale, which assigns a magnitude number to quantify the strength of an earthquake. Since January 2002, the Moment Magnitude Scale has been used by seismologists in the United States Geological Survey to calculate and report magnitudes for all modern large earthquakes. The Moment Magnitude Scale was developed in the 1970s and measures the size of earthquakes in terms of its energy released.
- **Intensity** is a measure of the effects of an earthquake at a particular place on people, structures, or the land itself. Earthquake intensity is most commonly measured in the United States using the Modified Mercalli Intensity (MMI) scale. The intensity at a point depends not only upon the strength of the earthquake, but also upon the distance from the earthquake to the point and the local geology at that point.
- **Peak Ground Acceleration** (PGA) is another common measure of earthquake shaking along the earth's surface. PGA expresses acceleration along the earth's surface as a percentage of g, the acceleration due to gravity (32.2 ft. / s^2).

The most common form of scale is the Modified Mercalli Intensity Scale. This scale is summarized in **Table 94**.[113]

Table 94: Modified Mercalli Intensity Scale for Earthquakes

Scale	Intensity	Earthquake Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	< 4.2
II	Feeble	Felt by a few	
III	Slight	Felt by several; like a truck rumbling by	< 4.8
IV	Moderate	Felt by many	

[112] United States Geological Survey. The Science of Earthquakes. https://www.usgs.gov/programs/earthquake-hazards/science-earthquakes#:~:text=An%20earthquake%20is%20what%20happens,the%20fault%20or%20fault%20plane.

[113] United States Geological Survey. Modified Mercalli Intensity Scale. https://www.usgs.gov/media/images/modified-mercalli-intensity-scale

Scale	Intensity	Earthquake Effects	Corresponding Richter Scale Magnitude
V	Slightly Strong	Felt by nearly all. Trees and bushes shaken noticeably	
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	< 5.4
VII	Very Strong	People move unsteadily; walls crack; plaster falls	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged	< 6.9
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	> 8.1

K.3. Previous Occurrences

Between 1950 and 2022, Prince George's County has not experienced an earthquake that had its epicenter within the County. However, recently the County has felt the effects of nearby earthquakes. On August 4, 2021, the U.S. Geological Survey reported that a magnitude 2.1 earthquake was centered in Clarksville, Maryland, at 2:11 a.m. with a depth of about 1.8 miles. This earthquake was felt in Prince George's County as well as Howard, Montgomery, Carroll, and The District.[114] Similarly, the region felt the August 23, 2011 5.8 magnitude earthquake that occurred in Louisa County, Virginia – which affected many structures and buildings in the Northern Virginia, Washington D.C., and Maryland.[115] Following the 2011 earthquake, nearly 200 public schools in Prince George's County were shut for inspections, officials said 32 would remain closed until later in the week because of safety concerns.

There have been 175 Earthquakes of various sizes that have affected Prince George's County and the City of Laurel since 1900. This indicates about 0.7 annualized events. Although no earthquakes have originated in the County area, earthquakes can travel very far depending on their size. Many of the earthquakes felt in Prince George's County have originated from the Virginia Seismic Zone. **Figure 68** illustrates earthquake epicenters near Prince George's County since 1758.

[114] WTOP "Small earthquake shakes Central Maryland: Did you feel it?": https://wtop.com/maryland/2021/08/earthquake-hits-the-dc-region-overnight/
[115] Washington Post "Region tallies earthquake damage, mostly uninsured": https://www.washingtonpost.com/local/region-tallies-earthquake-damage-mostly-uninsured/2011/08/24/gIQAFdxScJ_story.html

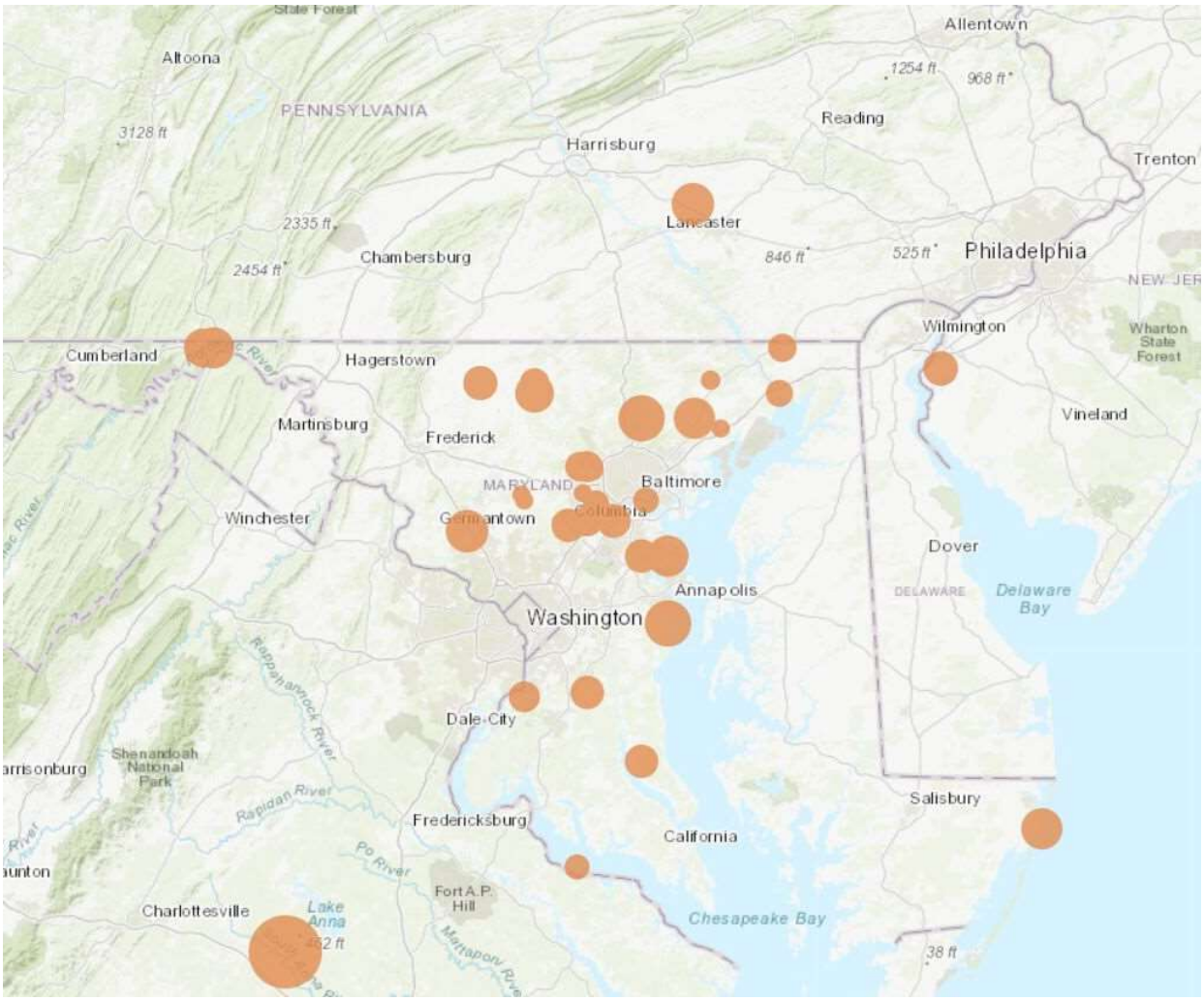


Figure 68. Approximate epicenters of Maryland earthquakes since 1758 [116]

K.4. Probability of Future Events

Earthquakes are high-impact, low-probability events. Earthquakes and tsunamis are not considered as significant hazards in Prince George's County and the City of Laurel, and the probability of such events occurring within Prince George's County and the City of Laurel appears to be extremely low. However, the County could be indirectly affected by earthquakes occurring outside the County.

There is limited knowledge on the connection between climate change and earthquake probability. As research emerges on the link between climate and seismic activity, earthquake probability in the County should be re-evaluated.

K.5. Vulnerability and Risk Assessment

Although earthquakes may occur infrequently, they can have devastating impacts that affect entire communities and regions. The destructiveness of an earthquake depends on several factors, including

[116] Maryland Geological Survey. http://www.mgs.md.gov/geology/geohazards/earthquakes_and_maryland.html

the magnitude of the tremor, direction of the fault, distance from the epicenter, regional geology, and the design characteristics of buildings and infrastructure. Moderate and even very large earthquakes are inevitable; consequently, buildings in these regions are seldom designed to deal with an earthquake threat; therefore, they are extremely vulnerable.

Earthquake intensity is generally greater on soft soils than solid rock. Liquefaction can occur when loose sand and silt that is saturated with water behaves like a liquid when shaken by an earthquake to the point where it can no longer support the weight of any object that is located on it.[117] Areas that contain alluvial soils are more at risk of liquefaction occurring in the event of an earthquake. Other effects of a strong earthquake include landslides, fissuring and slumping at the ground surface, and even tsunamis. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Tsunami waves can travel across the ocean at very high speeds, depending on the location and source of the seismic event.

Figure 69 and **Figure 70** depict relative damage and probabilistic risk of earthquakes, respectively. According to the figures below, Prince George's County is located in an area of minor relative risk of earthquake damage, and low probabilistic risk. Additionally, the County's critical facilities exposure to earthquake risk is shown in **Appendix D**.

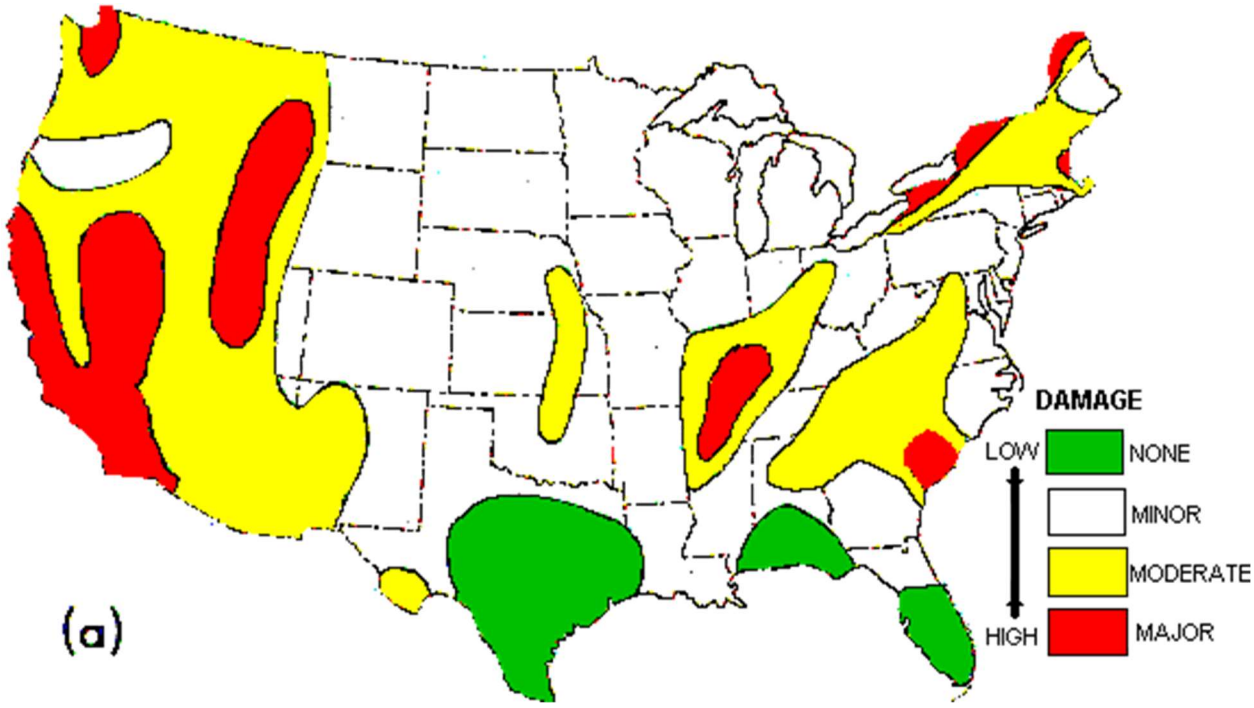


Figure 69. Relative risk of earthquake damage, based to a large extent on known earthquake history[118]

[117] United States Geological Survey. "About Liquefaction" https://geomaps.wr.usgs.gov/sfgeo/liquefaction/aboutliq.html
[118] Algermissen, S. T., 1969, Seismic risk studies in the United States: Proc., 4th World Conference on Earthquake Engineering, Santiago, Chile, v. 2, p. 14-27.

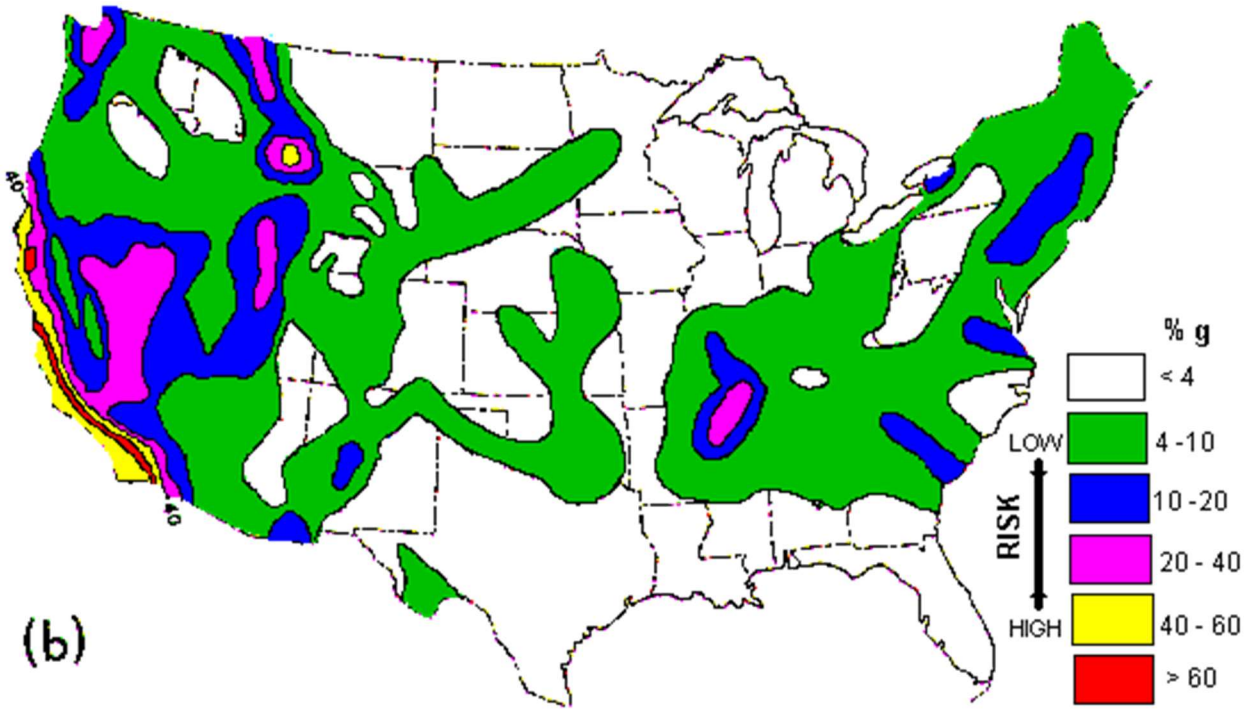


Figure 70. Probabilistic earthquake risk map showing maximum horizontal ground acceleration with a 90-percent probability of not being exceeded in 50 years [119]

K.5.a. Loss Estimate

The Hazus Earthquake Loss Estimation Methodology provides government officials with decision support software for estimating potential losses from earthquake events. This loss estimation capability enables users to anticipate the consequences of earthquakes and develop plans and strategies for reducing risk. Hazus was used to generate an estimate of the consequences of a probabilistic scenario earthquake event for Prince George's County. The resulting "loss estimate" generally describes the scale and extent of damage and disruption that may result from the modeled earthquake event.

Loss estimates created using FEMA's Hazus-MH v5.1 shows annualized losses for the region at $805,900, as shown in **Table 95**. **Table 96** shows annualized loss based on general building occupancy. The residential building stock accounts for about 68% of the total annualized loss, followed by commercial with 24% of the total loss. A comparison between the total exposure for the planning area against the estimated annualized losses indicates that, on an annual basis, less than 1% of assets exposed are vulnerable to earthquakes.

Table 95: Total Annualized Loss (from Hazus-MH v5.1)

Jurisdiction	Building	Contents	Inventory	Other	Total Loss	*Total Exposure*
City of Laurel	$11,700	$2,400	$0	$5,400	$19,600	*$5,528,165,000*

[119] Algermissen, S. T., Perkins, D. M., Thenhaus, P. C., Hanson, S. L. and Bender, B. L., 1982, Probabilistic estimates of maximum acceleration and velocity in rock in the contiguous United States: U. S. Geol. Survey Open-File Report 82-1033, 99 p.

Jurisdiction	Building	Contents	Inventory	Other	Total Loss	*Total Exposure*
Prince George's County	$503,400	$99,100	$1,500	$182,400	$786,400	*$169,405,289,000*
Total	**$515,000**	**$101,500**	**$1,500**	**$187,800**	**$805,900**	***$174,933,454,000***

Table 96: General Occupancy Related Annualized Loss (from Hazus-MH v5.1)

Jurisdiction	Residential	Commercial	Industrial	Other	Total Loss	*Total Exposure*
City of Laurel	$11,600	$7,000	$400	$600	$19,600	*$5,528,165,000*
Prince George's County	$537,600	$186,600	$23,200	$38,900	$786,400	*$169,405,289,000*
Total	**$549,100**	**$193,600**	**$23,600**	**$39,500**	**$805,900**	***$174,933,454,000***

Lastly, older buildings in the County and City of Laurel may be affected more by an earthquake than newer buildings. As mentioned in the **Severe Storm (Wind-Related)** section, **Figure 71** shows buildings constructed before 2002 (the first year that the Building Codes from 2000 were required in the County) and are broken up into three date categories and levels of possible vulnerabilities:

- 1600 to 1899 (Dark Orange): Highly Vulnerable
- 1900-1949 (Light Orange): Moderately Vulnerable
- 1950-2002 (Light Yellow): Slightly Vulnerable

Buildings that are shown in dark orange suggest that they may be more susceptible to earthquake damage than buildings in yellow. Older structures built before 1940 are often more susceptible to damage. Older critical facilities are vulnerable to damage due to the age of construction and poor condition due to age and lack of maintenance, especially in the more rural and isolated areas of the County. It is important to identify specific critical facilities and assets that are most vulnerable to severe weather. Evaluation criteria include the age of the building (and what building codes may have been in effect at the time of construction), type of construction, and condition of the structure (i.e., how well the structure has been maintained).

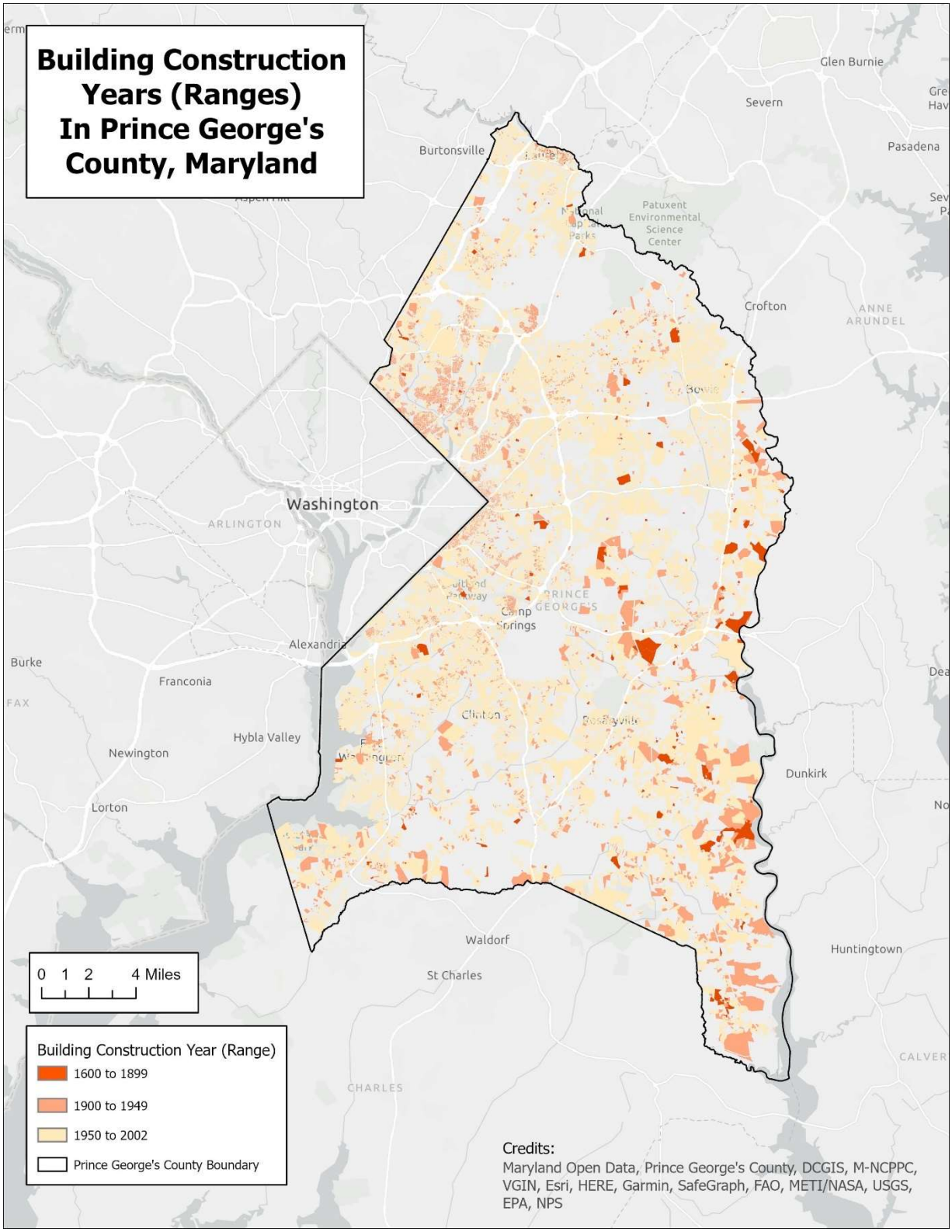


Figure 71: Building Construction Years in Prince George's County

K.6. Consequence Analysis

A consequence analysis (refer to **Table 97**) has been done to better understand the range of impacts that an earthquake event can have on several features of the planning area and the population within it.

Table 97. Earthquake Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	While a devastating earthquake in the County is unlikely, injuries are possible if earthquake shaking causes items to fall off shelves or walls. Damages to structures or infrastructure could have impacts on the life safety of the population. Evacuations are unlikely for an earthquake event, but individuals should take cover under a heavy, sturdy object in the event of an earthquake.
Public Health	Earthquakes that are strong enough to damage infrastructure may have public health impacts, such as contaminated water supply, fires from natural gas leaks, or prolonged power outages (which can especially impact public health when combined with extreme temperatures.
Critical Facilities and Infrastructure	In the event of an earthquake, there is potential for damages to critical facilities due to structural damage, fallen shelves, and loss of water or power due to ruptured pipes and power lines. Additionally, there is potential for damage to the city's infrastructure, including all pipes, roads, bridges, railroads, dams, and utility poles. During earthquakes, underground infrastructure, such as water and sewer systems and natural gas pipelines, is especially vulnerable.
Economy	The economic impact of an earthquake in the County would likely be limited to losses from damaged building contents (e.g., goods falling off shelves).
Buildings	There is potential for damages to structures during an earthquake due to structural damage, fallen shelves, and loss of water or power due to ruptured pipes and power lines. Fires caused by ruptured pipes or downed power lines have the potential to cause structure fires.

L. Extreme Cold

L.1. Description

Extreme cold is characterized by prolonged periods of unusually low temperatures, generally accompanied by high winds. The term "extreme cold" can be subjective depending on the focus-region, because regions that are relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold," while areas accustomed to winter weather may consider "extreme cold" to be temperatures freezing or below. According to the CDC, as temperatures drop below normal and as wind speed increases, heat can leave the body more rapidly, which can lead to serious health problems. Extreme cold is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat.[120]

Wind chill is defined by the National Weather Service as the rate of heat loss on the human body resulting from the combined effect of low temperature and wind. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not.[121]

While not as prevalent as extreme heat events, extreme cold events - prolonged periods of unusually low temperatures, generally accompanied by high winds – can and do occur in the Mid-Atlantic region. The "wind chill" is a measure of the combined effects of air temperature and wind speed to produce the perceived temperature. For example, a temperature of 20°F "feels like" 4°F when the wind speed is 20 mph. The National Weather Service Wind Chill chart is shown in **Figure 72**, and indicates the length of time for frostbite to develop on exposed skin.

[120] Centers for Disease Control: Extreme Cold - https://www.cdc.gov/disasters/winter/pdf/extreme-cold-guide.pdf
[121] National Weather Service: Extreme Cold - https://www.weather.gov/dlh/extremecold

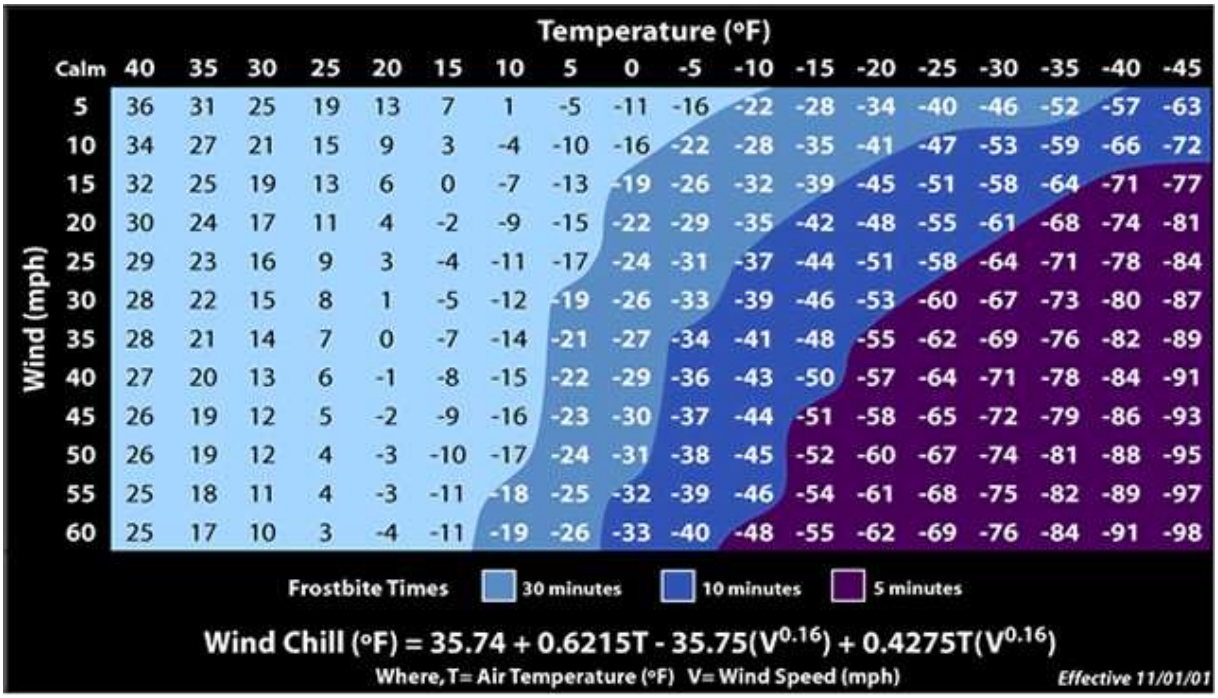


Figure 72: National Weather Service Wind Chill Chart

L.2. Location and Extent

As with extreme heat, extreme cold can occur anywhere in the county. However, the impact of extreme cold is most prevalent in urban areas, where there is usually a larger proportion of vulnerable populations, such as homeless individuals and people who rely upon public transportation. Secondary impacts of extreme cold may include the freezing and bursting of frozen pipes and severe strain on electrical and fuel systems with potential electrical or fuel service interruptions.

The lowest recorded temperature in the Prince George's County area was negative 5 degrees Fahrenheit at Reagan National Airport in nearby Washington, DC. Colder temperatures are also possible in the County.

Extreme cold combined limits the body's ability to warm itself efficiently. Overexposure may result in frostbite and hypothermia, which could lead to death. The Centers for Disease Control and Prevention state that excessive cold exposure caused 16,911 deaths in the United States between 1999 and 2011.[122] According to the Environmental Protection Agency, between 1979 and 2016, the death rate as a direct result of exposure to cold (the underlying cause of death) generally ranged from 1 to 2.5 deaths per million people, with year-to-year fluctuations. Overall, a total of more than 19,000 Americans has died from cold-related causes since 1979, according to death certificates.[123]

[122] Centers for Disease Control and Prevention. QuickStats. Number of Hypothermia-Related Deaths, by Sex – National Vital Statistics System, United States, 1999-2011. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6151a6.htm
[123] Environmental Protection Agency Climate Change Indicators: Cold-Related Deaths. https://www.epa.gov/climate-indicators/climate-change-indicators-cold-related-deaths

L.3. Previous Occurrences

There are a total of twelve cold/wind chill and extreme cold/wind chill events reported in the NCEI Storm Events Database between 1950 and 2022. Total annualized damages, deaths, injuries, and the number of events are summarized in **Table 98**. Total damage from cold/wind chill was $2,500 of crop damage from one event.

Table 98: NCEI Historic Cold/Wind Chill and Extreme Cold/Wind Chill Event Data

Event Type	Number of Events	Period of Record	Total Annualized Damage	Annualized Deaths	Annualized Injuries	Annualized Events
Cold/Wind Chill	7	1950-2022	$34.70	0	0	0.1
Extreme Cold/Wind Chill	5	1950-2022	$0	0	0	0.0
Total	**12**	**1950-2022**	**$34.70**	**0**	**0**	**0.1**

A closer review of the NCEI data does not reveal any notable periods of extreme cold or wind chill within the last ten years, and three periods of cold/wind chill within the last ten years.

L.4. Probability of Future Events

Based on the NCEI historic records of extreme temperature-related events in Prince George's County, it is estimated that the county will experience extreme cold events about once every ten years.

According to the Environmental Protection Agency, unusually cold winter temperatures have become less common across the contiguous 48 states in recent decades, particularly very cold nights. Extreme cold waves are likely to continue to decrease as winter temperatures increase in the future. This winter warming is expected to reduce the number of direct cold-related deaths, but the decrease is projected to be smaller than increases in heat-related deaths in most regions.[124]

L.5. Vulnerability and Risk Assessment

Extreme cold has social, economic, and environmental impacts. People, especially the elderly, outdoor laborers, children, and individuals that are homeless or in poor physical health, are vulnerable to cold-related illnesses (e.g., frostbite) and death (extreme hypothermia). Periods of extreme cold, especially in the early spring or fall months, can lead to agricultural and horticultural losses. Although the NCEI database does not indicate any deaths or injuries attributed to extreme cold between 2002 and 2022, the Maryland Health Department (MHD) reported that during the 2019-2020 winter season, there were 50 cold-related deaths statewide, including some in Prince George's County.[125] According to MHD, 57 cold-related deaths occurred in Maryland during the 2020-2021 reporting period. Twenty-two (22) of those

[124] EPA Climate Change Indicators: Cold-Related Deaths. https://www.epa.gov/climate-indicators/climate-change-indicators-cold-related-deaths

[125] Maryland Department of Health. Maryland Department of Health reports first cold-related illness death of the 2020-2021 winter weather season. https://health.maryland.gov/newsroom/Pages/Maryland-Department-of-Health-reports-first-cold-related-illness-death-of-the-2020-2021-winter-weather-season.aspx

deaths were suspected or presumed homeless individuals, and four (4) deaths for which it could not be determined whether the individuals were suspected or presumed homeless.[126]

Although most of the hypothermia-related deaths in Maryland occurred in Baltimore and northern areas of the state, a few of these deaths were reported in Prince George's County. The most at-risk districts which contain the largest population of elderly residents are Districts 1, 3, 4, and 6. This population group has a greater vulnerability to extreme cold; **Figure 42** in **Section G.5.a** illustrates where these populations are concentrated.

According to the Environmental Protection Agency, outdoor occupational groups that work during winter months (such as agricultural workers or utility workers) face higher risks of exposure to cold. Other groups that are vulnerable to cold include older adults, infants, people with pre-existing medical conditions, homeless people, and those with inadequate winter clothing or home heating.[127]

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for extreme temperature (heat and cold are considered together by the State). These scores and ranks are shown in **Table 99**, which shows the State's ranking for extreme temperature vulnerability in Prince George's County (including the City of Laurel) as medium-high.

Table 99. 2021 State of Maryland Extreme Temperature Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	1
Property Damage	1
Crop Damage	1
Geographic Extent	3
Events	2
Local Plan Ranking (2017)	3
Overall Weighted Risk Rating[128]	**18.5**
Overall Ranking	**Medium-High**

[126] Maryland Department of Health. 2020-2021 Cold-related Illness Surveillance Summary Report. https://health.maryland.gov/preparedness/SiteAssets/Reports_ColdArchive/NewForm/2020-2021%20Summary%20Cold%20Report_FINAL%20(1).pdf

[127] EPA Climate Change Indicators: Cold-Related Deaths: https://www.epa.gov/climate-indicators/climate-change-indicators-cold-related-deaths

[128] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

L.6. Consequence Analysis

A consequence analysis (refer to **Table 100**) has been done to better understand the range of impacts that an extreme cold event can have on several features of the planning area and the population within it.

Table 100. Extreme Cold Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Extreme cold can occur anywhere in the County. However, the impact of extreme cold is most prevalent in urban areas, where there is usually a larger proportion of vulnerable populations, such as homeless individuals and people who rely upon public transportation. Early warning of extreme cold event is helpful to allow for preparation for the event, including finding shelter and remaining indoors.
Public Health	People, especially the elderly, outdoor laborers, children, and individuals that are homeless or in poor physical health, are vulnerable to cold-related illnesses (e.g., frostbite) and death (extreme hypothermia).
Critical Facilities and Infrastructure	Critical facilities may be impacted by bursting pipes due to extreme cold. Infrastructure such as utilities and bridges may freeze due to extreme weather.
Economy	Extreme cold events may impact agricultural productivity. Indirect impacts due to loss of agricultural productivity may include higher food prices in the County.
Buildings	Extreme cold may cause pipes to crack or burst, causing water damage to buildings. Cold weather can also weaken concrete and create cracks in drywall joint compound and paint.

M. Sinkhole

M.1. Description

A sinkhole is a circular depression, typically funnel-shaped, that has no natural external surface drainage—when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface. Sinkholes are most often found in karst areas. Karst is a type of topography formed on carbonate rock, such as limestone or dolomite, and is characterized by sinkholes, caves, and open-channel groundwater flow. Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by groundwater circulating through them. As the rock dissolves, spaces and caverns develop underground.

Sinkholes are dramatic because the land usually stays intact for a time until the underground spaces get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur. These collapses can be small, or they can be huge and can occur where a house or road is located. Typically, sinkholes form so slowly that little change is noticeable, but they can form suddenly when a collapse occurs. Such a collapse can have a dramatic effect, especially in an urban setting.

Sinkholes can vary from a few feet to hundreds of acres wide and from less than 1 to more than 100 feet deep. Some are shaped like shallow bowls or saucers whereas others have vertical walls; some hold water and form natural ponds. Depressions that form on karst areas may be sinkholes, however, every depression or hole in the ground isn't necessarily a sinkhole. Depressions in the land may also be a result of rotted tree stumps, collapsed underground structures such as old septic tanks, stormwater runoff, and leaking underground pipes. The most damage from sinkholes tends to occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania.

M.2. Location and Extent

In Maryland, karst areas occur in Baltimore, Carroll, Washington, and Frederick Counties, with less extensive areas in Allegany County. True sinkholes do not form in areas underlain by hard, crystalline rock present in central and western Maryland, nor in the unconsolidated sediments of Maryland's Coastal Plain (areas approximately east of I-95). Therefore, sinkholes are not a common hazard within Prince George's County and the City of Laurel. **Figure 73** shows the geology of Maryland. Prince George's County is mainly composed of the Quaternary, Tertiary, and Cretaceous sediments of sand, silt, gravel, and clay. There are no karst areas within the County, making the probability of a sinkhole forming inside its bounds extremely low.

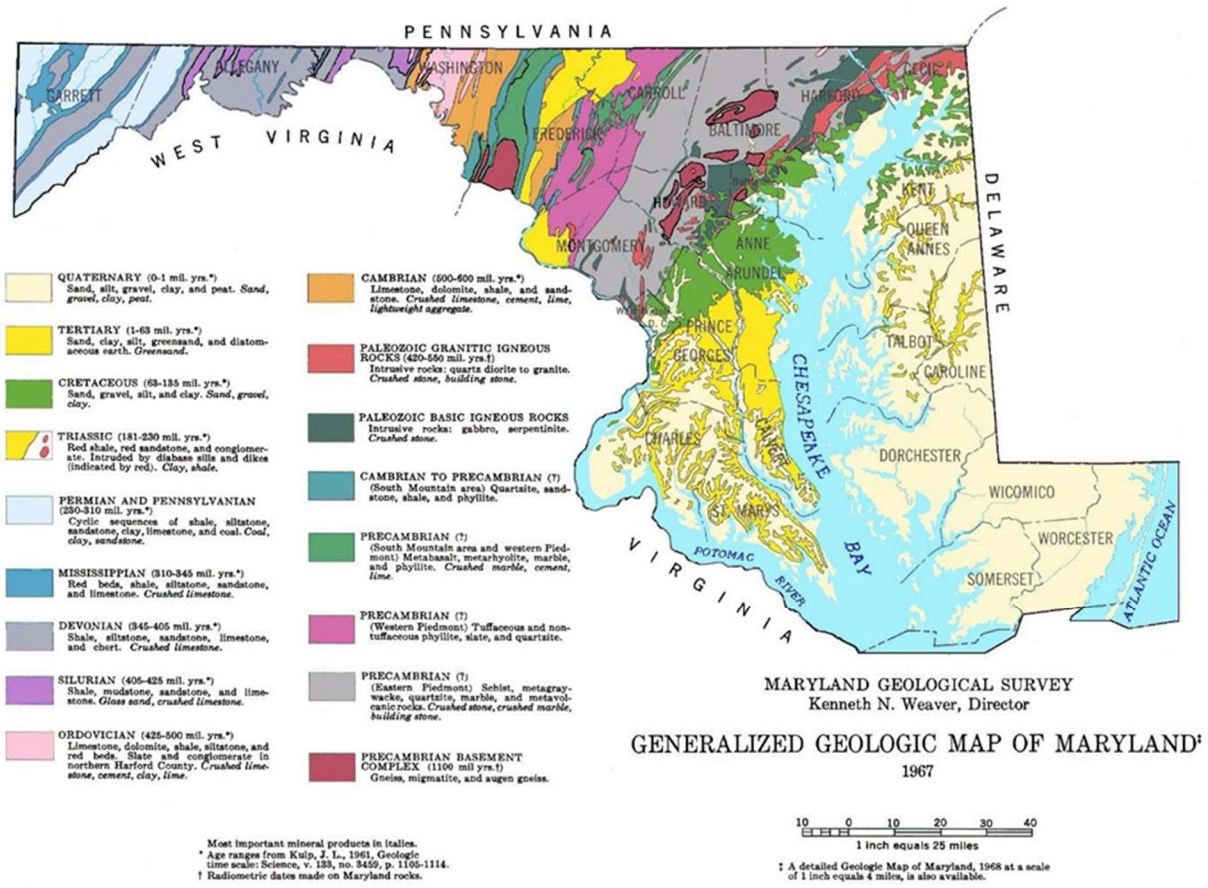


Figure 73: Generalized Geologic Map of Maryland[129]

The areas in Maryland that are most associated with collapse sinkholes are the Hagerstown Valley, the Frederick Valley, and the Wakefield Valley. To a lesser degree, sinkholes are found in Green Spring Valley, Worthington Valley, and Long Green Valley. None of these valleys are located in Prince George's County, where there are no karst areas. Overall, while not common, the entire planning area is at risk of sinkholes.

In general, sinkholes can range from a few feet across and less than a foot deep to hundreds of acres in width and a hundred feet deep. The severity of a sinkhole will depend on its size, how quickly it forms, and its proximity to existing development. A sinkhole that occurs gradually over time may be able to be addressed before damage occurs, whereas one that forms quickly may lead to property damage or service disruptions, if roads or utilities are affected. Sinkholes that occur in more developed areas will likely experience more significant damage due to the concentration of buildings, infrastructure, and people. However, even sinkholes that form gradually can incur significant damage if no interventions occur, such as the collapse of a roadway or building foundations. In a location with minimal (if any) sinkholes such as Prince George's County, they are expected to be small and not very deep when they do occur.

[129] Maryland Geologic Survey. 1967.

M.3. Previous Occurrences

A significant sinkhole incident occurred on May 11-12, 2008 (**Figure 74**) after 12 hours of continuous and relatively uniformly distributed rainfall, averaging about 0.25 inches of rain per hour. The area behind five homes on the south side of Yorkville Road was affected, resulting in the formation of a sinkhole approximately 500 feet long, 100 feet wide and 10 feet deep. In 2009, the Department of Environmental Resources received a FEMA Hazard Mitigation Assistance grant to acquire the properties, demolish the homes, stabilize the site, and retain the land as open space. The removal of the structures is expected to save $ 1,779,680 over the 100 years following the acquisitions.

Figure 74. May 2008 sinkhole event

Between August 2016 and July 2022, there were 765 drainage complaints related to sinkholes on private properties and 1,998 on public right-of-way land in Prince George's County and the City of Laurel. **Table 101** summarizes the number of sinkhole complaints that occurred by private properties and public right-of-way land in each District. The complaints considered duplicates or found to have incomplete information are not included in this summary. **Figure 75** shows the extent of sinkhole-related complaints within the County. As of July 2022, about 70% of the total complaints were closed by the Department of Public Works & Transportation and about 19% were closed by the Department of Environment.

Table 101: Number of Sinkhole Complaints from August 2016 to July 2022 in Prince George's County

Political Area	Type	Total Complaints
City of Laurel	Private Property	4
	Public Right-of-Way	8
District 1	Private Property	41
	Public Right-of-Way	135
District 2	Private Property	14
	Public Right-of-Way	64
District 3	Private Property	61
	Public Right-of-Way	181
District 4	Private Property	45
	Public Right-of-Way	146
District 5	Private Property	68

Political Area	Type	Total Complaints
	Public Right-of-Way	239
District 6	Private Property	109
	Public Right-of-Way	314
District 7	Private Property	99
	Public Right-of-Way	175
District 8	Private Property	168
	Public Right-of-Way	322
District 9	Private Property	156
	Public Right-of-Way	414
Total		**2,763**

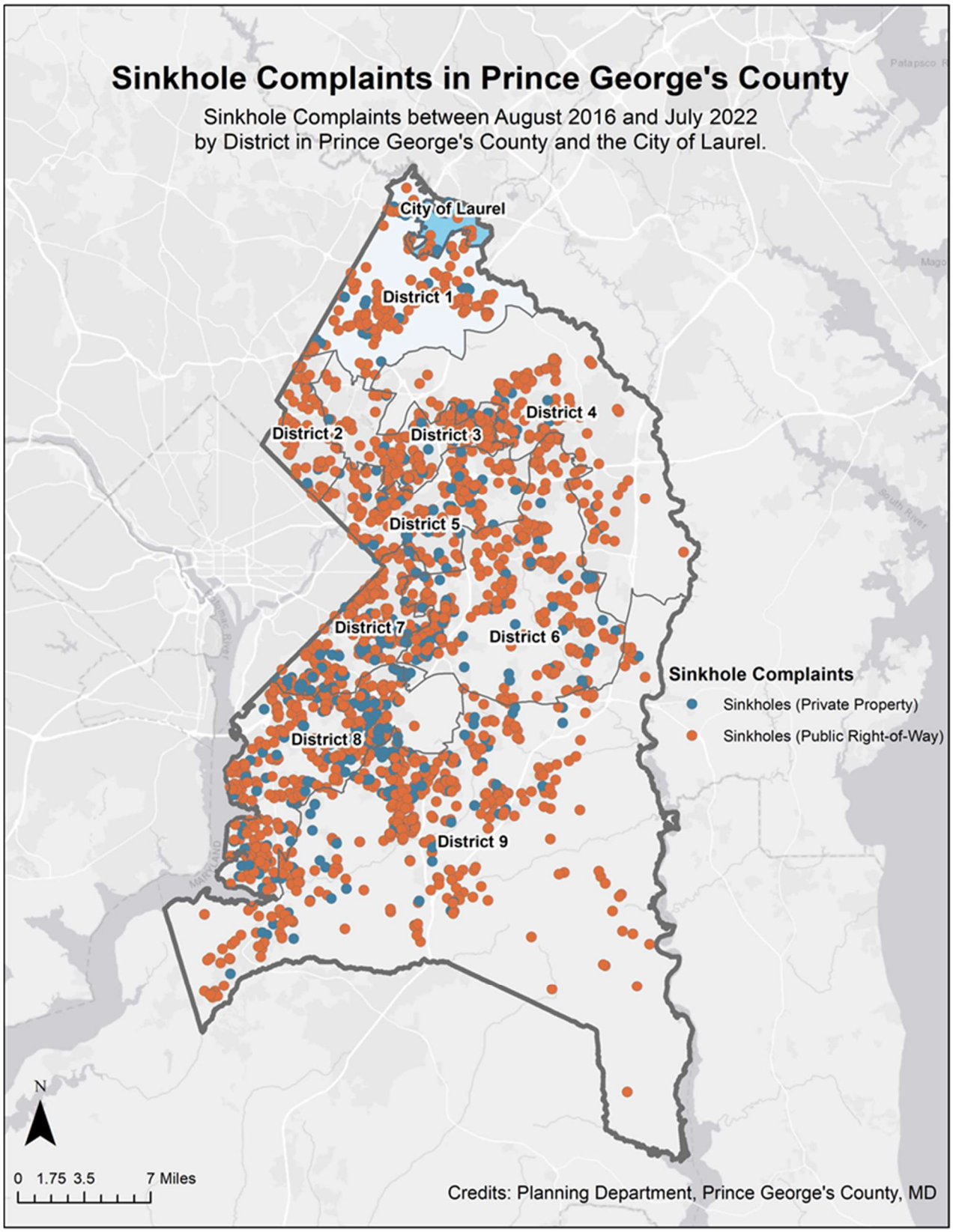


Figure 75: Sinkhole Complaints in Prince George's County (August 2016-July 2022)

M.4. Probability of Future Events

Since only one NCEI record for sinkholes occurring within Prince George's County could be found, it is posited that the vast majority of sinkholes that do occur within Prince George's County or the City of Laurel are minor events or not "true" sinkholes, such as potholes, which are caused by a failure of paving materials. There are no karst areas within the County, making the probability of a sinkhole forming inside its bounds extremely low.

Most research points to sinkhole development being heavily dependent on geology, but the role of climate change should also be considered. A case study was done in Florida that showed a correlation between climate change and an increase in sinkholes.[130] Sinkhole collapse phases were linked and followed shortly after periods of drought. As drought likelihood and intensity is expected to increase in Prince George's County, especially during the summer and fall, future occurrences may be higher than historical projections suggest.

Because sinkholes are not a significant risk in the region, a full calculation of probability was not performed for this analysis. Sinkholes are high-impact, low-probability events. With the few historic significant incidents throughout the region and limited data, the probability is low. The complaints received regarding possible sinkholes in the county are summarized in **Table 102**.

Table 102: Sinkhole Complaints in Prince George's County

Number of Complaints	Period of Record	Annualized Events
2,763	2016-2022	460.5

M.5. Vulnerability and Risk Assessment

Sinkholes can cause structures to collapse, cars to be damaged, and can cause injuries or death when occurring in a populated area. As population grows in Prince George's County and the City of Laurel, growth will continue to increase demands on groundwater supplies, elevating the risk for more land subsidence in areas already experiencing sinkholes, urban areas, as well as new subsidence in other areas. In the past, major subsidence areas have been in agricultural settings where groundwater has been pumped for irrigation.

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for soil movement (sinkhole is considered jointly with landslides and coastal erosion by the State). These scores and ranks are shown in **Table 103**, which shows the State's ranking for soil movement vulnerability in Prince George's County (including the City of Laurel) as medium-low.

Table 103. 2021 State of Maryland Soil Movement Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4

[130] Global warming causes an increase in sinkhole collapse – Case study in Florida, USA. https://nhess.copernicus.org/preprints/nhess-2018-18/nhess-2018-18-SC1-supplement.pdf

Population Density	3
Injuries	1
Deaths	1
Property Damage	1
Crop Damage	1
Geographic Extent	1
Events	1
Local Plan Ranking (2017)	2
Overall Weighted Risk Rating[131]	**13**
Overall Ranking	**Medium-Low**

M.6. Consequence Analysis

A consequence analysis (refer to **Table 104**) has been done to better understand the range of impacts that a sinkhole event can have on several features of the planning area and the population within it.

Table 104. Sinkhole Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	All of the County is at risk of sinkholes. Sinkholes can cause structures to collapse, cars to be damaged, and can cause injuries or death when occurring in a populated area.
Public Health	A person can be harmed when stepping into an existing sinkhole or when the ground beneath gives way during a sinkhole's collapse. Additionally, sinkholes can cause decreased water quality by draining unfiltered water from streams, lakes, and wetlands directly into aquifers.
Critical Facilities and Infrastructure	Critical facilities located in or adjacent to a sinkhole area can be severely damaged or destroyed. There may also be damage to underground and above-ground utilities, and damage to transportation infrastructure, including roads, bridges, and railroad tracks due to sinkholes.
Economy	Sinkholes can impact local economies by decreasing agricultural productivity if they are located in agricultural areas. Additionally, they can cause damage to roadways or County owned structures, creating potentially large economic burden on local and County governments to repair.
Buildings	The amount of structural damage depends on the type of construction, the structure location and orientation with respect to the sinkhole location, and the characteristics of the sinkhole event.

[131] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

N. Wildfire

N.1. Description

A wildfire is an undesirable fire occurring in a natural area, such as forest, grassland, or prairie, which may spread to more developed areas. Wildfires can start from natural causes, such as lightning, but most are caused by humans, either accidentally or intentionally.[132]

Wildfires pose a great threat to life and property, particularly when they move from forest or brushy areas into more developed or inhabited areas. Since 1983, more than five million acres are burned annually in the U.S. as a result of wildfires, causing millions of dollars in damage. Each year, more than 70,000 wildfires occur in the U.S., almost 86% of which are started by humans; the remaining 14% are caused by lightning.[133] Weather is one of the most significant factors in determining the severity of wildfires.

The 2021 International Wildland-Urban Interface Code defined wildfires as uncontrolled fires spreading through vegetative fuels, exposing and possibly consuming structures.[134] Wildfires may create additional environmental concerns well after they are extinguished, such as increased erosion and water quality concerns via stormwater runoff. Three main factors influence wildfire behavior: topography, fuel, and weather.

Other natural hazards can contribute to the potential for wildfires or influence wildfire behavior. For example, high winds can down power lines, earthquakes can rupture gas lines, and lightning can spark fires. Lightning is a major cause of both structural fires and wildfires. Drought conditions increase wildfire potential by decreasing fuel moisture. Warm winters, hot, dry summers, severe drought, insect and disease infestations, years of fire suppression, and growth in the wildland-urban interface (WUI) continue to increase wildfire risk and the potential for catastrophic wildland fires. Forest insect epidemics and forest parasites contribute to wildfire potential by increasing fuel loading.

Wildland Urban Interface

The wildland-urban interface is the area of transition between human development and natural lands with vegetation. There is a greater risk of wildfire within the wildland-urban interface than outside of it. The **interface wildland-urban interface** describes areas where significant development (urban or suburban) runs right up to the natural vegetated areas. A clear line of demarcation can be seen between the two land uses. The **intermix wildland-urban interface** features development that is scattered throughout natural vegetated lands, which is often seen in rural or exurban areas.

Protecting the wildland-urban interface is the nation's fastest-growing firefighting expense. On average over the five years leading up to 2020, more than 80 percent of federal spending in the United States was used to suppress wildfires in the wildland-urban interface originated in the Forest Services, according to the Congressional Budget Office.[135] Protecting life and property in these areas is costly because fire managers must take an aggressive stand on the ground and from the air.

[132] Federal Emergency Management Agency. (n.d.). Wildfire | What. Protective Actions Research. Retrieved October 24, 2022, from https://community.fema.gov/ProtectiveActions/s/article/Wildfire-What
[133] National Interagency Fire Center. (n.d.). Statistics. National Interagency Fire Center. Retrieved October 24, 2022, from https://www.nifc.gov/fire-information/statistics
[134] International Code Council, Inc. (2020). Section 202 Definitions. In 2021 IWUIC: International Wildland-Urban Interface code.
[135] Congressional Budget Office. (2022, June). Wildfires. Congressional Budget Office. Retrieved October 25, 2022, from https://www.cbo.gov/publication/58212#_idTextAnchor023

N.2. Location and Extent

Forested lands and any nearby developed areas (the wildland-urban interface) are most at risk of fires. Areas in the wildland-urban interface (either interface or intermix) are illustrated in **Figure 76.**

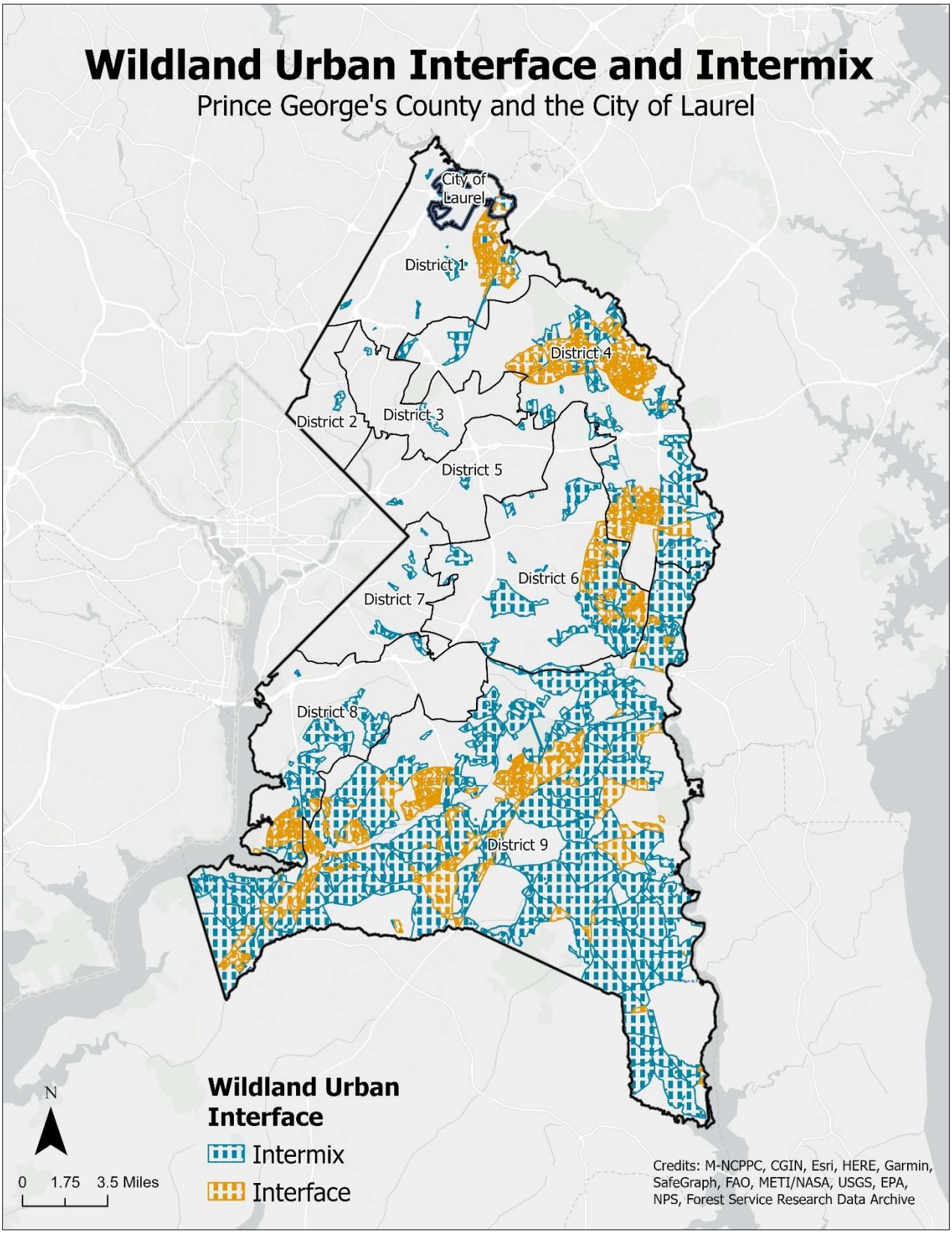


Figure 76: Wildland Urban Interface and Intermix in Prince George's County and the City of Laurel

The extent of a wildfire can be measured by its size, which is typically expressed in acres. The National Wildfire Coordinating Group has the following size classes for fires:

- Class A: one-fourth acre or less
- Class B: more than one-fourth acre, but less than 10 acres
- Class C: 10 acres or more, but less than 100 acres
- Class D: 100 acres or more, but less than 300 acres
- Class E: 300 acres or more, but less than 1,000 acres
- Class F: 1,000 acres or more, but less than 5,000 acres
- Class G: 5,000 acres or more

The wildfire's severity is often of greater significance in wildfire classification than extent, however. Wildfire severity is a function of wildfire intensity (how hot the fire was, often measured by flame height) and its spread rate (the speed the fire travels).[136] It is typically expressed as low, moderate, or high, as shown in **Table 105**, and is measured by the condition of the vegetation and land after the wildfire is extinguished.

Table 105. Wildfire Severity Classification Levels[137]

	Low	Moderate	High
Surface Litter	scorched, charred, blackened but with definable plant parts; 40 to 85 percent litter cover remains.	partially consumed; less than 40 percent litter cover remaining, much covered with black char.	no surface litter remains.
Small Woody Debris	surfaces are burned with some unburned areas.	surfaces are charred; some woody debris partially to wholly consumed.	small woody debris is fully consumed.
Large Wood Debris	surfaces blackened with unburned areas.	surfaces are all blackened; char goes into wood.	only large, deeply charred logs are left.
Stumps	stumps are intact but blackened.	stumps are burned deep enough to form charcoal.	stumps are gone; holes in ground where stumps and root systems were.
Mineral Bare Soil and Ash	exposed soils unchanged or blackened, with isolated areas that are gray to orange where downed logs burned.	black, gray, and/or orange soil dominates area, with little to no unburned areas; gray ash is present in	black, gray and orange soil dominates area; gray ash layers may be deep and extensive.

[136] Ota Lutz. NASA Jet Propulsion Laboratory, California Institute of Technology. *The Science of Wildfires*. September 14, 2020. https://www.jpl.nasa.gov/edu/news/2016/8/22/back-to-school-burn-the-science-of-wildfires/
[137] Barkley, Y., University of Idaho Extension. *How to Determine Burn Severity After a Wildfire*. August 27, 2019. https://surviving-wildfire.extension.org/how-to-determine-burn-severity-after-a-wildfire/

	Low	Moderate	High
		patches covering <20 percent of area.	
Summary	**Less than 25% tree mortality, limited effects on soils**	**25–75% tree mortality, moderate effects on soils**	**Greater than 75% tree mortality, extensive mineral soil exposure**

The National Fire Danger Rating System assesses existing and expected conditions of identified factors that contribute to how dangerous a fire may become (its potential extent and severity). The National Fire Danger Rating System rates fire potential using color-coded levels as outlined in **Table 106**.

Table 106. National Fire Danger Rating System Levels[138]

Rating	Description
Low	When the fire danger is "low" it means that fuels do not ignite easily from small embers, but a more intense heat source, such as lightning, may start fires in duff or dry rotten wood. Fires in open, dry grasslands may burn easily a few hours after a rain, but most wood fires will spread slowly, creeping or smoldering. Control of fires is generally easy.
Moderate	When the fire danger is "moderate" it means that fires can start from most accidental causes, but the number of fire starts is usually pretty low. If a fire does start in an open, dry grassland, it will burn and spread quickly on windy days. Most wood fires will spread slowly to moderately. Average fire intensity will be moderate except in heavy concentrations of fuel, which may burn hot. Fires are still not likely to become serious and are often easy to control.
High	When the fire danger is "high", fires can start easily from most causes and small fuels (such as grasses and needles) will ignite readily. Unattended campfires and brush fires are likely to escape. Fires will spread easily, with some areas of high-intensity burning on slopes or concentrated fuels. Fires can become serious and difficult to control unless they are put out while they are still small.
Very High	When the fire danger is "very high", fires will start easily from most causes. The fires will spread rapidly and have a quick increase in intensity, right after ignition. Small fires can quickly become large fires and exhibit extreme fire intensity, such as long-distance spotting and fire whirls. These fires can be difficult to control and will often become much larger and longer-lasting fires.
Extreme	When the fire danger is "extreme", fires of all types start quickly and burn intensely. All fires are potentially serious and can spread very quickly with intense burning. Small fires become big fires much faster than at the "very high" level. Spot fires are probable, with long-distance spotting likely. These fires are very difficult to fight and may become very dangerous and often last for several days.

[138] U.S. Forest Service. National Fire Danger Rating System. https://www.fs.usda.gov/detail/cibola/landmanagement/resourcemanagement/?cid=stelprdb5368839

Potential impacts from wildfires include the damage and destruction of land, property, and structures as well as injuries and loss of life. Although rare, deaths and injuries usually occur at the beginning stages of wildfires when sudden flare-ups occur from high wind conditions. In most situations, people can evacuate the area and avoid injury. Financial losses relate to wildfires include destroyed or damaged houses, barns, private facilities, vehicles, and equipment; loss of commercial timber supplies; and local- and state-costs for response and recovery.

N.3. Previous Occurrences

From 1992 to 2018, there were 88 wildfires of various sizes in Prince George's County.[139] Sizes can range from less than a quarter of an acre (Class A) to larger than 5,000 acres (Class G). **Table 107** summarizes the number of wildfires that occurred by Class in each District according to a spatial database of U.S. wildfires from the Forest Service Research Archive. District 4 and District 9 had the highest number of wildfires in the County, making up 77% of all recorded wildfires. **Figure 77** shows wildfire extent within the County, as well as specific areas of the community that participate in a Community Wildfire Protection Plan (CWPP) to fight against the wildfire danger.

Table 107: Number of Wildfires from 1992 to 2018 in Prince George's County

Political Area	Fire Size Code	Fire Description	Total Fires
City of Laurel	--	--	--
District 1	A	0.25 Acres or less	1
	B	0.26 to 9.9 Acres	3
	C	10.0 to 99.9 Acres	1
District 2	B	0.26 to 9.9 Acres	1
District 3	B	0.26 to 9.9 Acres	4
District 4	A	0.25 Acres or less	6
	B	0.26 to 9.9 Acres	15
District 5	B	0.26 to 9.9 Acres	1
District 6	A	0.25 Acres or less	1
	B	0.26 to 9.9 Acres	1
District 7	A	0.25 Acres or less	1
	B	0.26 to 9.9 Acres	1
District 8	B	0.26 to 9.9 Acres	2
	C	10.0 to 99.9 Acres	1

[139] Short, Karen C. 2021. Spatial wildfire occurrence data for the United States, 1992-2018 [FPA_FOD_20210617]. 5th Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2013-0009.5

Political Area	Fire Size Code	Fire Description	Total Fires
District 9	A	0.25 Acres or less	13
	B	0.26 to 9.9 Acres	29
	C	10.0 to 99.9 Acres	3
	E	300 to 999 Acres	2
Total			**88**

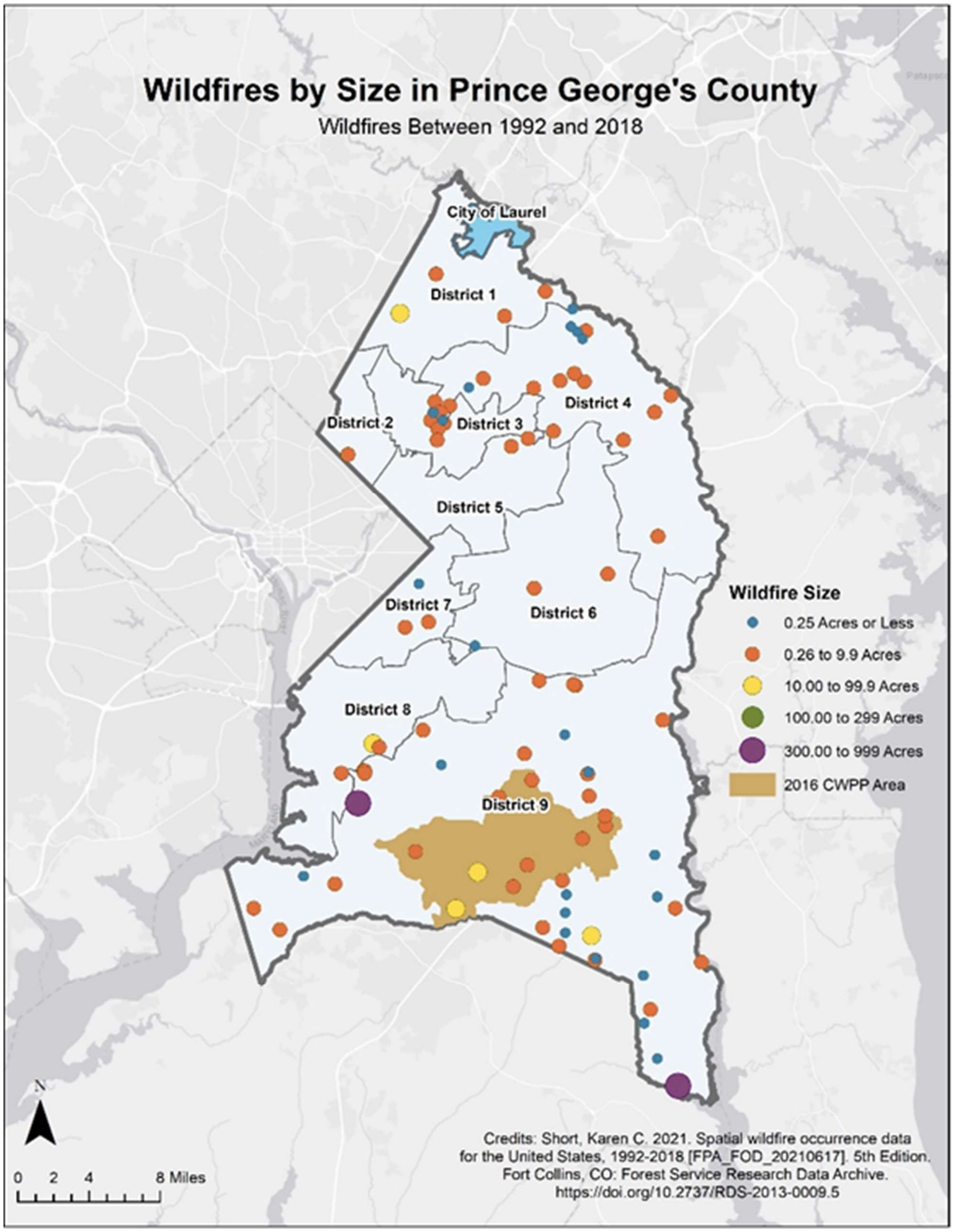


Figure 77: Wildfires (1992-2018) and CWPP in Prince George's County

N.4. Probability of Future Events

Wildfires can occur at any time of day and during any month of the year, but in Maryland, wildfire season peaks in the spring due to the combination of low humidity, high winds, and dried forest fuels. Wildfire season length and peak months may vary from year to year. The primary factors that influence how many fires occur and how many acres they burn include land use, vegetation, the amount of combustible materials present, and weather conditions, such as wind, low humidity, and lack of precipitation. Generally, fires are more likely when vegetation is dry from a winter with little precipitation and/or a spring and summer with sparse rainfall.

Based on previous occurrences of wildfires in the County, approximately three wildfires a year are expected for the County. Districts 4 and 9 will also be more likely to experience wildfires based on historical wildfire occurrences. Additionally, increased risk of extreme heat and dry conditions due to climate change may lead to an increased risk of wildfires in the County. Wildfires may become larger in extent and fire seasons may become longer and more active as climate change creates warmer, drier conditions.

N.5. Vulnerability and Risk Assessment

The most exposed property in the County is located where residential developments meet or intermingle with wildland vegetation, also known as the wildland-urban interface zone. This is where wildfire poses the biggest risk to human lives and structures.

Wildfires are a source for the fine particulate matter (PM2.5). PM2.5 are inhalable air pollutants which have an air quality standard set by the Environmental Protection Agency. According to the Environmental Protection Agency, populations exposed to PM2.5 may experience lung and heart problems such as aggravated asthma and increased respiratory symptoms.[140] The County participates in Clean Air Partners and receives daily forecasts of regional air quality and helps notify citizens and employees about air quality.[141] Buildings without fire suppression systems (e.g. sprinkler systems) or proximity to hydrants are more vulnerable to building fires.

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for wildfire. These scores and ranks are shown in **Table 108**, which shows the State's ranking for wildfire vulnerability in Prince George's County (including the City of Laurel) as medium-low.

Table 108. 2021 State of Maryland Wildfire Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	1

[140] United States Environmental Protection Agency. Health and Environmental Effects of Particulate Matter (PM). August 30, 2022. Retrieved from https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm
[141] Prince George's County, Maryland. Forecasts. Prince George's County, MD. Retrieved from https://www.princegeorgescountymd.gov/348/Forecasts

Property Damage	1
Crop Damage	1
Geographic Extent	3
Events	4
Local Plan Ranking (2017)	3
Overall Weighted Risk Rating[142]	**20.5**
Overall Ranking	**Medium-High**

N.5.a. Structures Exposed

Maryland's Firewise program aims to reduce the threat of fires in the wildland-urban interface.[143] The program helps property owners learn how to best maintain their properties so they can reduce the risk to wildfires in their area. A portion of District 9 participates in the program. To evaluate the extent of the structures in the County exposed to wildfire, the wildland urban interface and intermix spatial areas were intersected with estimated building values obtained from the Planning Department of Prince George's County. The district's estimated structure value in the wildland-urban interface is summarized in **Table 109**. Additionally, **Appendix D** contains the full, structure-by-structure critical facility hazard analysis for wildfire risk.

Table 109: Building Counts and Values within Prince George's County

Political Area	Total Buildings	Buildings in Interface	Buildings in Intermix	Total Value of Building ($)	Value of Buildings in Interface ($)	Value of Buildings in Intermix ($)
City of Laurel	7,799	177	7	2,279,302,391	78,515,998	9,136,733
District 1	29,454	4,034	1,181	7,571,367,384	1,204,917,071	354,520,398
District 2	25,488	0	160	6,287,717,200	0	171,177,800
District 3	35,330	21	444	8,653,637,886	41,380,168	71,636,470
District 4	48,895	17,049	4,894	11,026,994,203	3,318,828,479	1,148,384,272
District 5	39,990	0	324	9,137,384,403	0	38,979,231

[142] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)
[143] Maryland Department of Natural Resources. (n.d.). Firewise Maryland Services. Firewise Living in Maryland. Retrieved October 25, 2022, from https://dnr.maryland.gov/forests/pages/fire/firewise.aspx

Political Area	Total Buildings	Buildings in Interface	Buildings in Intermix	Total Value of Building ($)	Value of Buildings in Interface ($)	Value of Buildings in Intermix ($)
District 6	46,820	3,372	4,421	12,077,619,462	1,165,789,743	1,366,075,783
District 7	35,846	0	324	6,627,181,202	0	111,093,494
District 8	47,139	3,392	4,469	10,438,996,832	573,172,000	766,397,103
District 9	73,254	23,425	25,513	10,728,282,391	3,465,146,525	3,804,839,201
Total	**390,015**	**51,470**	**41,521**	**84,828,483,354**	**9,847,749,984**	**7,842,240,485**

N.5.b. Population Exposed

People that live in either the wildland-urban interface or intermix areas are more likely to be affected by wildfires compared to those who do not. As of 2020, 36.9% of 358,183 housing units (HUs) in Prince George's County and the City of Laurel, and 23.6% of 10,211 housing units in the City of Laurel are directly exposed to wildfire risk, as summarized in **Table 110**.[144] Direct exposure refers to homes directly exposed to wildfire from adjacent vegetation. Indirect exposure refers to home exposed to wildfire from indirect sources such as embers or home-to-home ignition, and not exposed refers to homes distant from direct and indirect ignition sources.

Table 110: Wildfire Risk to Housing Units (HUs) in Prince George's County

Area	Total HUs	% HUs Directly Exposed	% HUs Indirectly Exposed	% HUs Not Exposed	HUs Exposed	% Exposed HUs Directly Exposed	% Exposed HUs Indirectly Exposed
City of Laurel	10,211	23.6%	74.2%	2.2%	9,987	24.2%	75.8%
Prince George's County*	358,183	36.9%	35.1%	28.0%	257,883	51.3%	48.7%

*The calculations for Prince George's County includes the data for the City of Laurel.

Using population data from the 2020 American Community Survey, Prince George's County population by census tract was overlaid with the 2020 wildland-urban interface spatial extent.[145] **Figure 78** shows wildland-urban interface extent and total population within the County. Census tracts illustrate overall total population, but do not indicate where within census boundaries people live. This analysis considers only

[144] Scott, Joe H.; Gilbertson-Day, Julie W.; Moran, Christopher; Dillon, Gregory K.; Short, Karen C.; Vogler, Kevin C. 2020. Wildfire Risk to Communities: Spatial datasets of landscape-wide wildfire risk components for the United States. Fort Collins, CO: Forest Service Research Data Archive. Updated 25 November 2020. https://doi.org/10.2737/RDS-2020-0016

[145] Radeloff, Volker C.; Helmers, David P.; Mockrin, Miranda H.; Carlson, Amanda R.; Hawbaker, Todd J.; Martinuzzi, Sebastián. 2022. The 1990-2020 wildland-urban interface of the conterminous United States - geospatial data. 3rd Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2015-0012-3

overall tract population as an indicator of exposure. There are 141 out of 255 census tracts in Prince George's County that intersect a wildland-urban interface area, making up 391,680 acres of land. Therefore, a majority of the County's census tracts contain or are adjacent to a wildland-urban interface area. This indicates high exposure to areas more likely to experience a wildfire for many residents of Prince George's County. Only by analyzing the tracts where the population exceeded 5,109, there were a total of 9,486 acres of land (about 3% of Prince George's County) located in the wildland-urban interface. Using the same tracts, a total of 27,656 acres of land (about 7% of Prince George's County) were in the wildland-urban interface intermix.

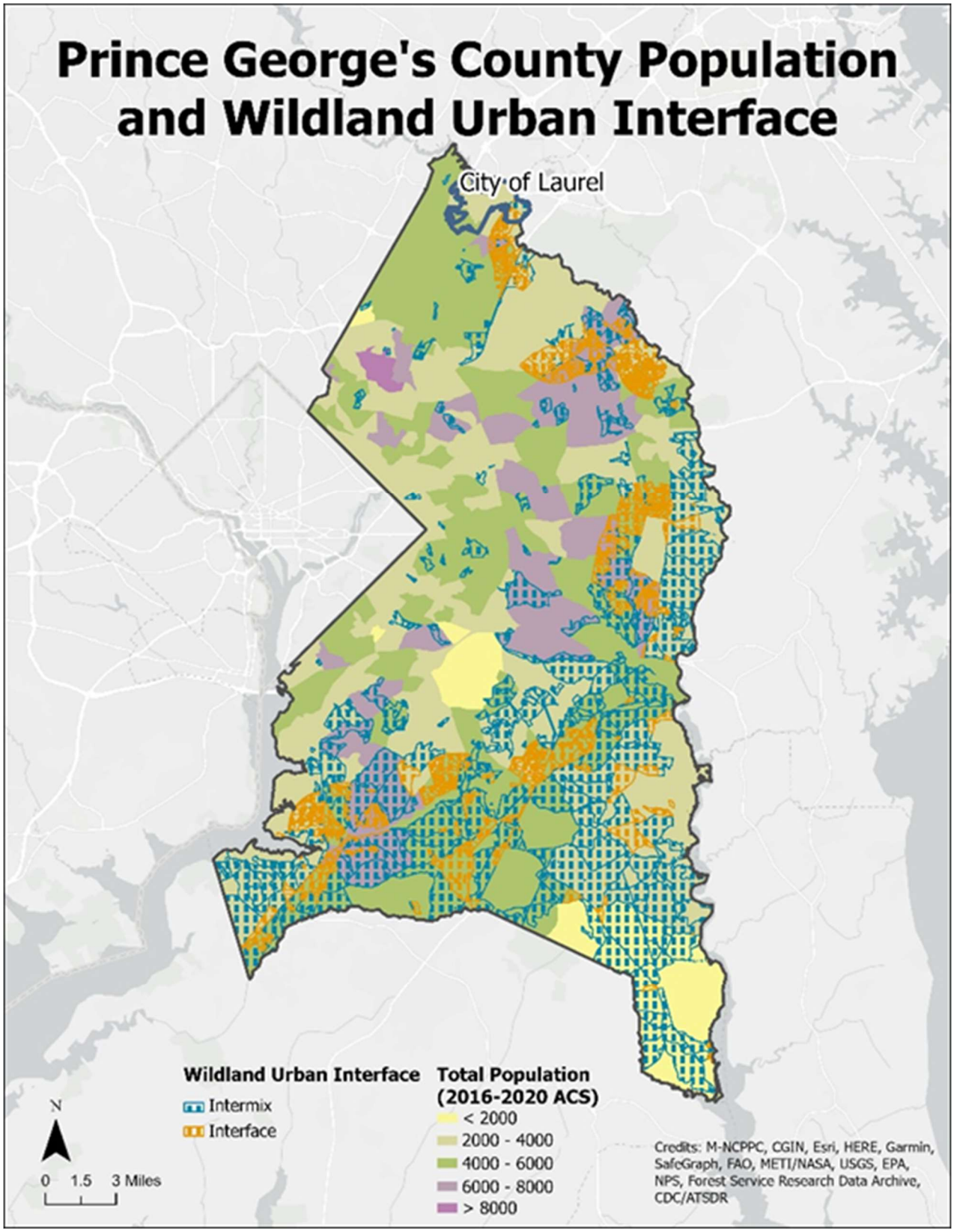


Figure 78: Total Population and Wildland-Urban Interface in Prince George's County

N.5.c. Social Vulnerability

Wildfires disproportionately affect socially vulnerable households and communities. Communities with high social vulnerability scores in wildfire-prone areas such as the Wildland Urban Interface or Intermix are less likely to have adaptive capacity for collaborative investment in fuels management and preventative activities. Lower income residents are less likely to be able to afford the expense of clearing vegetative fuels, fire-proofing their homes, or rebuilding after a fire.[146] **Figure 79** shows 2020 CDC Social Vulnerability Score by Census tract for Prince George's County overlaid with the Wildland Urban Interface and Intermix areas in the County. Twenty-four of the 74 census tracts in Prince George's County with high social vulnerability (scores greater than 0.75) intersect Wildland Urban Interface or Intermix areas. Therefore, approximately one quarter of the high vulnerability census tracts in the County are at an increased risk of wildfire.

[146] Coughlan, M., Ellison, A., Cavanaugh, A. Social Vulnerability and Wildfire in the Wildland-Urban Interface. https://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_96.pdf

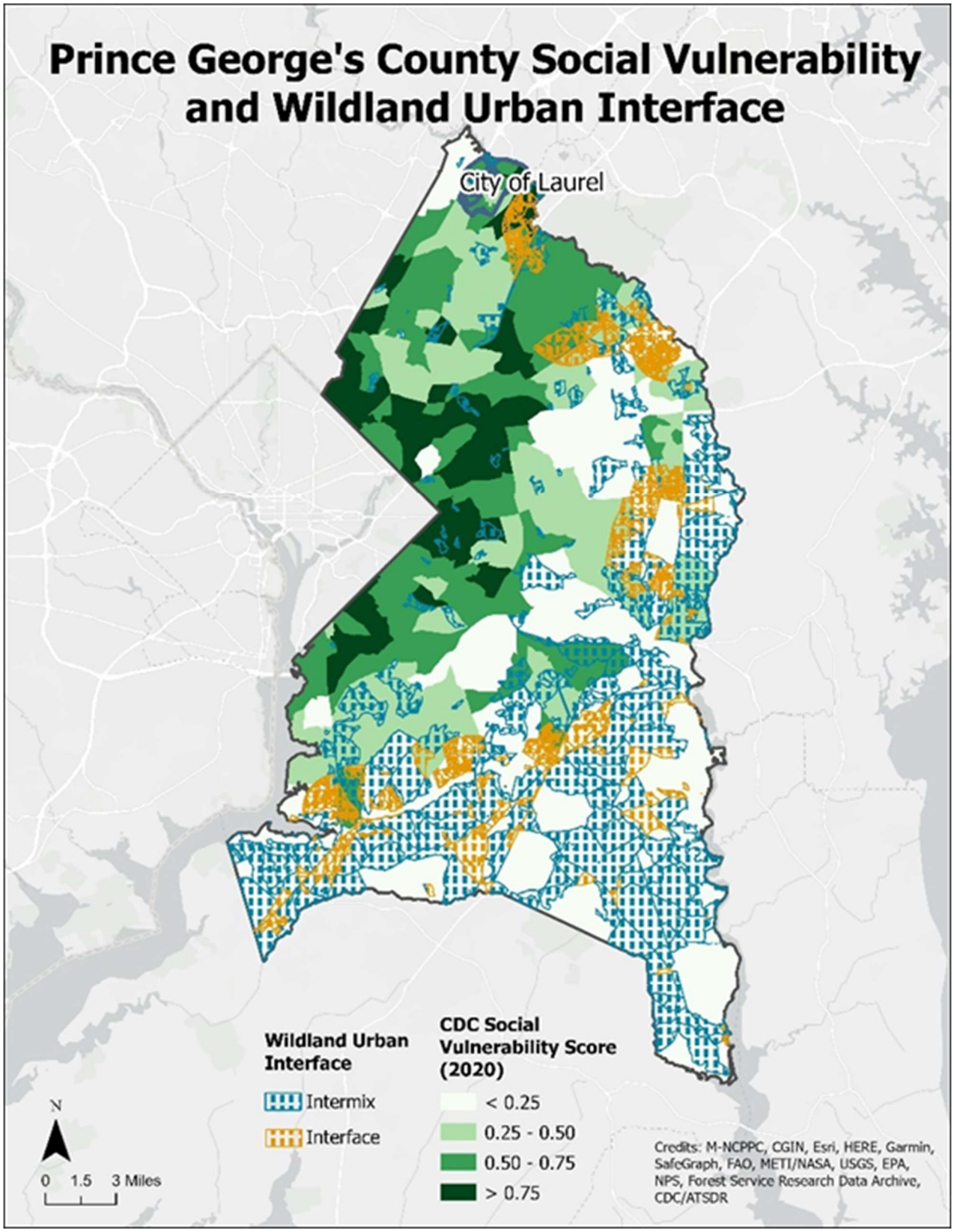


Figure 79: Social Vulnerability Score and Wildland-Urban Interface in Prince George's County

N.5.d. Future Development

There is an increased risk from wildfires in areas with increased development that are exposed to wildfire hazard areas. **Figure 80** shows the Wildland Urban Interface and Intermix overlapped with the Growth Policy Map. The Wildland Urban Interface and Intermix are zones of transition where structures and human development meet with undeveloped wildland or vegetative fuels. The Interface area is where urban sprawl presses up against natural areas, and the Intermix area is an area undergoing transition from forest and agricultural uses to urban land uses. The future growth areas in the county overlap with Wildland Urban Intermix Areas, putting those areas at higher risk of wildfire damage.

More specifically, fire departments and fire protection play critical roles in reducing the risk of wildfire and being prepared to respond in the event of a wildfire occurring, according to the United States Department of Agriculture Forest Service.[147] As of October 2021, the Planning Department of Prince George's County has listed 49 existing, 3 planned, and 34 proposed fire stations. **Figure 81** show the fire stations overlaid with the 2020 wildland-urban interface spatial extent. Of those fire stations, there are 5 existing and 7 proposed fire stations located within the wildland-urban interface intermix and there are 4 existing and 4 proposed fire stations located within the wildland-urban interface.

[147] United States Department of Agriculture Forest Service. Fire Adapted Communities. Retrieved from https://www.fs.usda.gov/managing-land/fire/fac

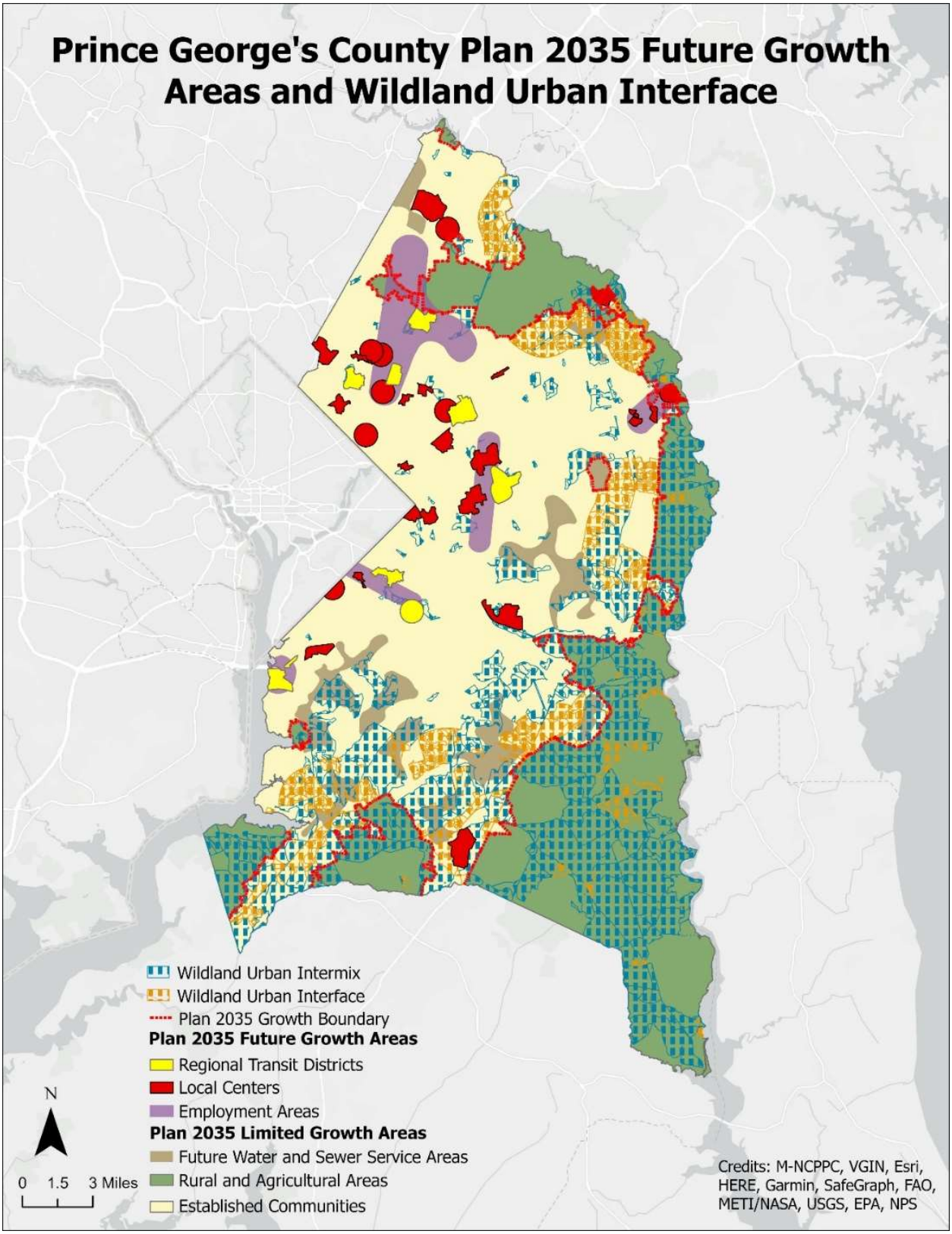


Figure 80. Prince George's County Plan 2035 Future Growth Areas and Wildland Urban Interface

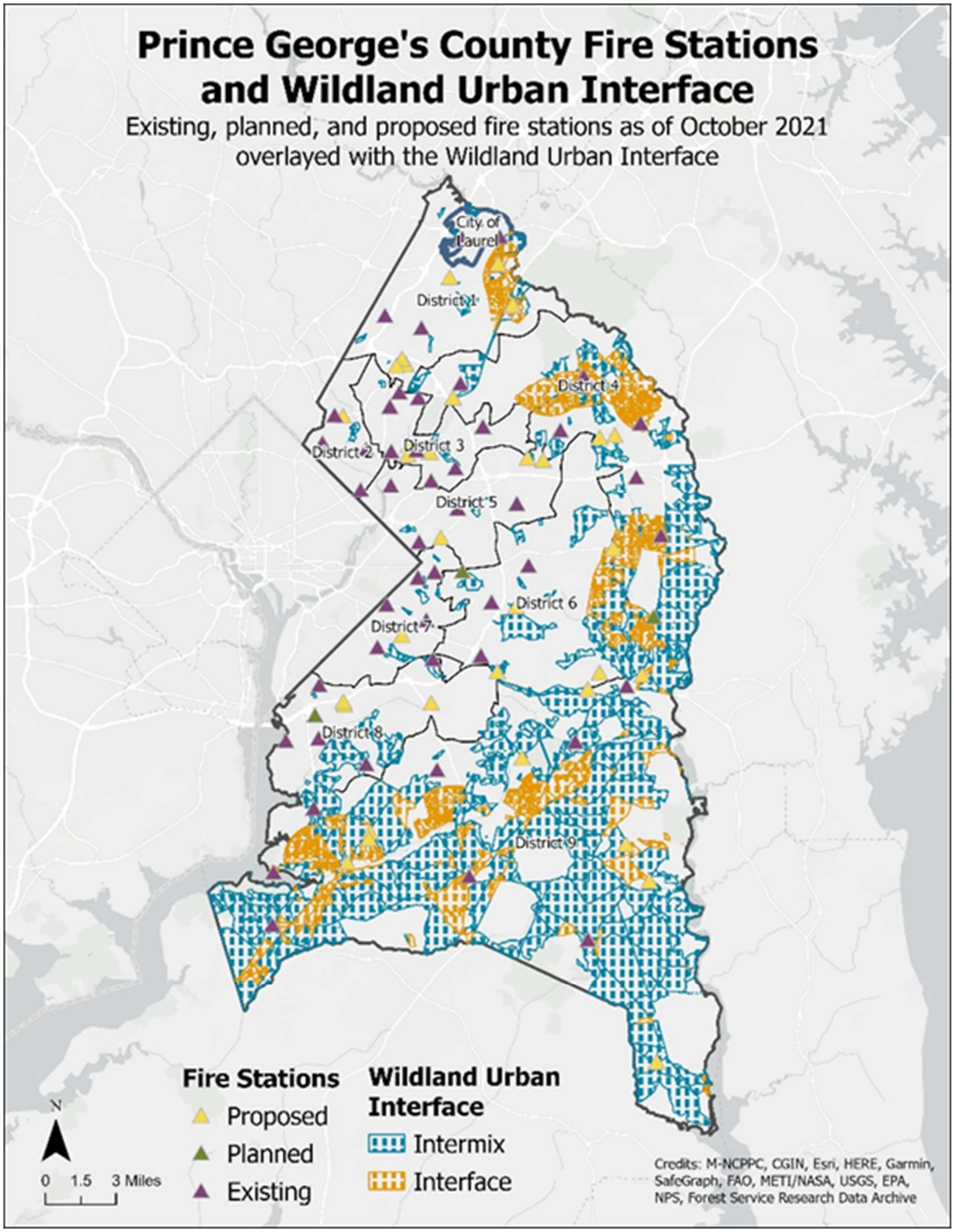


Figure 81: Fire Stations and Wildland-Urban Interface in Prince George's County

N.6. Consequence Analysis

A consequence analysis (refer to **Table 111**) has been done to better understand the range of impacts that a wildfire event can have on several features of the planning area and the population within it.

Table 111. Wildfire Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Wildfires present a serious hazard to life safety. People trapped in structures on fire may sustain injuries due to smoke inhalation or burns. Fatalities can occur during wildfire events. Evacuation is necessary for large wildfires due to their potential wide extent.
Public Health	Wildfires can result in reduced air quality due to smoke. County residents who have asthma or breathing problems may be more vulnerable to the impacts of decreased air quality.
Critical Facilities and Infrastructure	Critical facilities impacted by wildfires may become inoperable. Additionally, wildfires burning adjacent to infrastructure such as utilities and bridges may damage structural integrity.
Economy	A major wildfire event would be costly for local governments because of the potential for damages associated with property, infrastructure, and impacts to health and air quality. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event .
Buildings	Wildfires can cause significant damage to structures, ranging from smoke and fire damage to the total loss of one or multiple structures. Structures located in the wildland-urban interface, wooden buildings or densely developed areas may be at a higher risk, as fire may spread more quickly.

Wildfires can have disastrous consequences, causing damage to residences and commercial buildings as well as to timber, grasslands, and natural resources.

Timber loss and environmental damage frequently result from wildfires. Wildfire poses a significant threat to nearby buildings and populations. Forest damage from thunderstorms may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities, thereby creating heavy fire load and making suppression and response more difficult.

Economic consequences of wildfire include the cost of suppression, reduced property values, lost sales and business revenues, reduced tourism, and increased water treatment costs. Resources threatened include communities, homes, gas transmission lines, electrical facilities and lines, timber, watershed and recreation areas, and wildlife.

O. Landslide

O.1. Description

Landslides, also known as mass movements, are defined as the downward movement of soil, rock, and organic materials caused by gravity.[148] They can be a powerful, destructive force that erodes steep slopes, topples or destroys buildings, and damages roadways and other infrastructure.

Most landslides have multiple causes. They occur when the forces acting down the slope (e.g., gravity) overcome the strength of the geological materials of the slope. Therefore, they can be triggered by anything that increases the effects of down-slope forces or decrease the strength of the slope material. Landslide triggers can be natural, human-caused, or a combination of both.

Landslide events may be triggered by various natural processes such as rainfall, snowmelt, changes in water level, flood-induced erosion along the sides of slopes, excess groundwater buildup and seepage, earthquakes, and volcanic activity. Certain soil types can cause mass movements when they undergo changes in water content, such as during heavy rains or a drought. Expansive soils are soils that undergo large volume changes when moisture is added or removed, and they typically include organic soils and highly plastic clays. Pockets of potentially expansive soil formations – Marlboro Clays – are known to cause problems for building foundations and roadbeds when they are altered or cut. Marlboro Clay formations have low permeability and may have high shrink-swell (volume change) potential.

Nonetheless, many landslides are triggered by disturbance by human activities such as the removal of vegetation from slopes or hillside construction of buildings, roadways, and other infrastructure. According to the National Research Council, the primary causes of landslides are related to resource development and land use practices, including underground mining of coal or other minerals, withdrawal of petroleum or groundwater, and drainage of expansive soils. This is because these resources are partially responsible for holding the ground up. When they are removed, the rock collapses on itself. However, this is not immediately noticeable as it tends to occur over wider areas like a valley or an agricultural area as opposed to one spot like a sinkhole.

O.2. Location and Extent

Landslides can occur anywhere land on a slope becomes unstable. It is more likely on slopes that are overly steep, have loose debris such as rocks, or contain excess weight from rain or snow accumulation. Prince George's County lies primarily within the Atlantic Coastal Plain physiographic region, which ranges from nearly level to gently rolling topography. Most of the County's topography is relatively flat; less than 11 percent of the total land area has steep slopes (between 15 and 25% grade) and only 5 percent has severe slopes (greater than 25% grade). According to the Maryland Greenways Commission, a small section of the County is considered part of the Piedmont Plateau and is somewhat hillier. Landslides and slope failures are limited to small, isolated areas mostly in the western and southeastern parts of the County.

Few areas within the County have soil types that undergo large volume changes when moisture is added or removed, such as Marlboro Clays. **Figure 82** shows the location of Marlboro Clay in Prince George's

[148] United States, Department of the Interior, Geological Survey, Landslide Program and National Landslide Information Center, and Geological Survey of Canada, Landslides and Geotechnics Section, The Landslide Handbook— A Guide to Understanding Landslides, United States Geological Survey circular 1325, (Reston, VA: U.S. Geological Survey, 2001), 4, accessed February 10, 2015, http://pubs.usgs.gov/circ/1325/.

County, which may be more susceptible to land movement and landslides when intense precipitation occurs. The southwestern and central-eastern areas of Prince George's have the greatest risk of landslides within the County. However, this does not necessarily mean their risk is high. The United States Geological Survey U.S. Landslide Inventory contains historical landslide data. Based on the prevalence of data it contains for a certain area, the risk of landslides can be assumed with a reasonable assumption of uncertainty. The U.S. Landslide Inventory contains only one landslide event within the County – a small mudslide in the Fort Washington neighborhood of Piscataway Hills. Therefore, landslide risk may be relatively low throughout the County, but may be highest in the southwestern portion, which is also where Marlboro Clay is found.

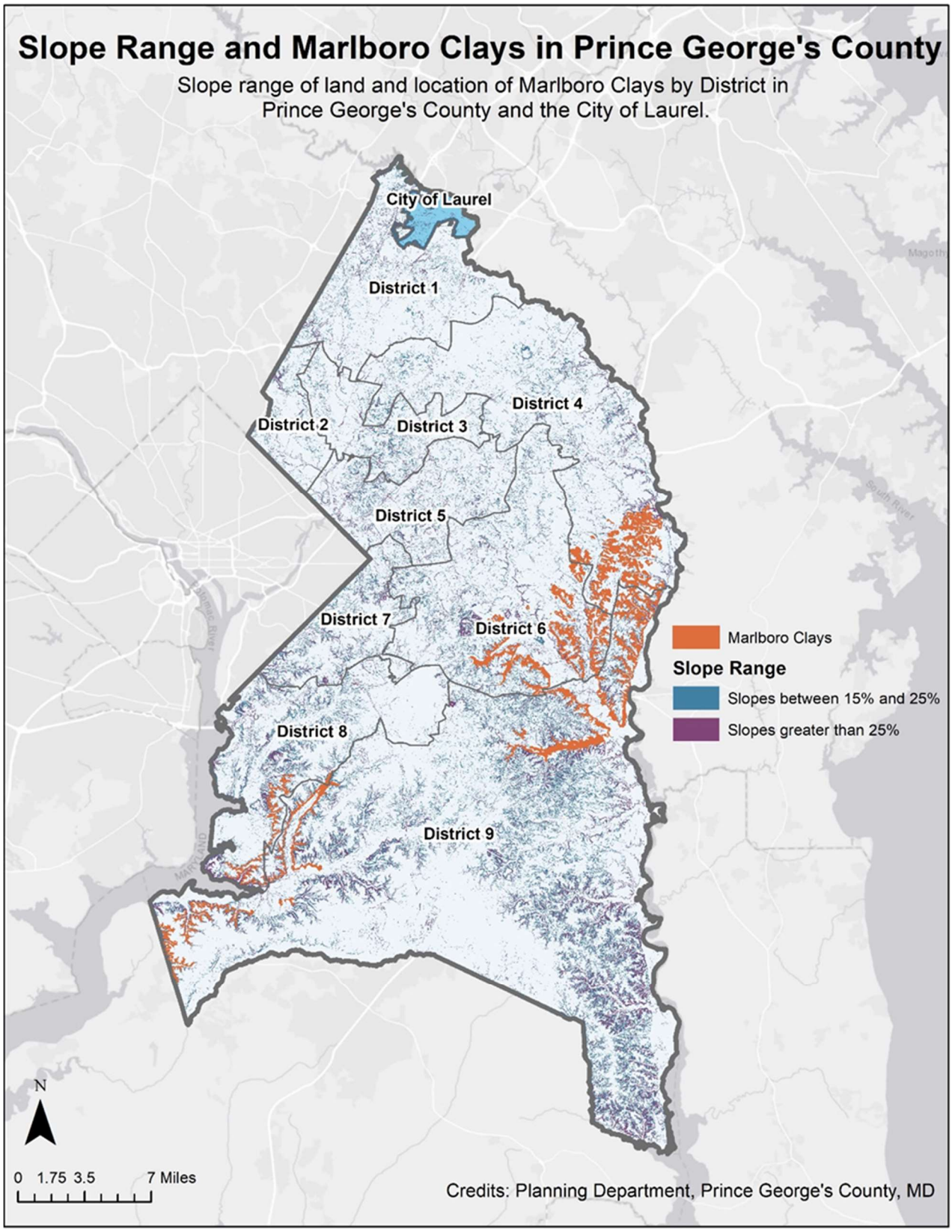


Figure 82: Marlboro Clay Areas within Prince George's County

Attributes that can contribute to a landslide's severity include movement mechanism, material type, velocity, moisture content, magnitude of range, geometry, and physical setting. Since there are many factors, classification systems have been created that focus on the three main variables: movement, material type, and velocity. The remaining attributes can be largely conveyed based on the three main variables.

Landslides may be classified into names based on the mode of slope movement (slides, flows, lateral spreads, falls, and topples) and the type of geologic material (rocks, earth, or debris/mud). **Table 112** provides a classification matrix for mass movement.

Table 112. Mass movement classification[149]

	Rock	Earth	Debris/Mud
Slides	Rock slump, rock block slide, rock slide	Earth slump, Earth block slide, Earth slide	Debris/mud slump, debris/mud block slide, debris/mud slide
Flows	Rock flow, rock avalanche	Earth flow	Debris/mud flow, debris avalanche
Lateral Spreads	Rock spread	Earth spread	Debris spread
Falls	Rockfall	Earthfall	Debris fall
Topples	Rock topple	Earth topple	Debris topple

A landslide's classification can communicate severity based on the attributes associated with specific names. For example, the velocity description can be communicated through the mode of movement as follows:

- Slides: extremely slow to extremely rapid
- Flows: extremely slow to extremely rapid
- Lateral spreads: extremely slow to extremely rapid
- Falls: very to extremely rapid
- Topples: extremely slow to extremely rapid

Table 113 details the velocity (meters/second) associated with each velocity description.

Table 113. Landslide Velocity Scale[150]

Velocity Class	Description	Velocity (m/sec)	Typical Velocity
7	Extremely rapid	5	5 m/sec
6	Very rapid	0.05	3 m/min
5	Rapid	$5x10^{-4}$	1.8 m/hr
4	Moderate	$5x10^{-6}$	13 m/month

[149] Hungr O, Evans SG, Bovis M, and Hutchinson JN (2001) Review of the classification of landslides of the flow type. Environmental and Engineering Geoscience VII, 221-238.
[150] Cruden, David M., and David J. Varnes. "Landslides: investigation and mitigation. Chapter 3-Landslide types and processes." Transportation research board special report 247 (1996).

Velocity Class	Description	Velocity (m/sec)	Typical Velocity
3	Slow	$5x10^{-8}$	1.6 m/year
2	Very slow	$5x10^{-10}$	16 mm/year
1	Extremely slow	N/A	N/A

O.3. Previous Occurrences

Currently, landslides are not known to be a significant widespread hazard in Prince George's County or the City of Laurel. The State of Maryland does not have the geologic conditions or the types of topography that are conducive to large-scale landslides, and the County does not have a history of mining or other man-made activities that contribute to landslides. However, while it is unlikely that landslides will become a significant hazard in the near future, there have been localized problems.

A review of landslide data, including the United States Geological Survey U.S. Landslide Inventory, and news articles found references to the following two landslide events related to Marlboro Clay soils:

1. A 1975 landslide damaged or destroyed 25 homes and caused approximately $500,000 worth of damage.
2. In May 2014, heavy rains triggered a small landslide in the Piscataway Hills community of Fort Washington (**Figure 83**). Despite its small geographic size, the mudslide impacted 28 homes, damaged local roads and water lines supported by Marlboro clay soils, and required approximately $15 million in hillside restoration and infrastructure repairs. This landslide remains the costliest natural disaster in Prince George's County history. A total of 7 properties were acquired through a FEMA Hazard Mitigation Assistance grant in 2014 after the event. The removal of the structures is expected to save $3,623,545.

In addition to these events, landslides have damaged or threatened other homes in Prince George's County. Seven properties were acquired through a FEMA Hazard Mitigation Assistance grant in 2005. The removal of the structures is expected to save $1,659,140 over the 100 years following the acquisitions.

Figure 83. May 2014 Landslide in the Piscataway Hills community of Fort Washington

O.4. Probability of Future Occurrences

Due to the localized variability of the hazard, probabilistic landslide data are limited and not available without a local study of specific hazard areas and conditions. Based on the two previous occurrences since 1975, there is a very low probability of future landslide events occurring in the County (a 4% annualized chance).

Landslides have greater probability of occurring after periods of severe rainfall. When considering future conditions for Prince George's County, the average annual total precipitation — based on the higher greenhouse gas emissions scenario of RCP 8.5 — is expected to slightly increase over the next 20 years from 42.2 inches to 44.6 inches according to the Climate Mapping for Resilience and Adaptation Tool. The projected increase in the number of severe storms will likely result in more frequent heavy rains and flooding that can increase the risk of landslides, so the 4% annualized chance may increase through mid-century.

O.5. Vulnerability and Risk Assessment

Landslides can cause significant damage and destruction of roadways, buildings, utility lines, and other infrastructure. Although landslide damages are usually confined to a small area, the secondary impacts of a landslide can sever key roads or utility lines and may be felt over a much wider area. Damaged pavements can cause the departments of transportation to allocate funds for repairs. Populations that are directly affected by landslides may experience injury or illness such as water-borne diseases and

electrocution due to broken power, water, gas, or sewage pipes. Individuals may also experience injury or lacerations from falling debris.[151]

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for soil movement (landslide is considered jointly with sinkholes and coastal erosion by the State). These scores and ranks are shown in **Table 114**, which shows the State's ranking for soil movement vulnerability in Prince George's County (including the City of Laurel) as medium-low.

Table 114. 2021 State of Maryland Soil Movement Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	1
Property Damage	1
Crop Damage	1
Geographic Extent	1
Events	1
Local Plan Ranking (2017)	2
Overall Weighted Risk Rating[152]	**13**
Overall Ranking	**Medium-Low**

O.6. Consequence Analysis

A consequence analysis (refer to **Table 115**) has been done to better understand the range of impacts that a landslide event can have on several features of the planning area and the population within it.

Table 115. Landslide Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Landowners across the County are at risk to impacts from a landslide event. Impacts to the public include potential for injury or loss of life, and destruction and/or loss of land and property due to emergencies from soil movement. Evacuations may be difficult due to the localized variability of the hazard.
Public Health	Populations that are directly affected by landslides may experience injury or illness such as water-borne diseases and electrocution due to broken power,

[151] World Health Organization. Landslides. World Health Organization. Retrieved November 2, 2022, from https://www.who.int/health-topics/landslides#tab=tab_2

[152] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Community Feature	Impacts
	water, gas, or sewage pipes. Individuals may also experience injury or lacerations from falling debris.
Critical Facilities and Infrastructure	Critical facilities located in the area of a landslide may be forced to close due to structural damage or loss of power. Infrastructure may experience impacts in the form of damage to roads and bridges, temporary closure of transportation routes, the potential inability of the stormwater system to handle floodwaters, and loss of power.
Economy	A landslide event would typically be more localized and costly for local governments because of the potential for damages from flooding. Some of the costs could be recouped through federal grant reimbursements, but local governments would still feel the fiscal impact of a major event.
Buildings	Home and landowners within earth movement zones may experience damage to or loss of property depending upon the severity of movement in the area.

P. Drought

P.1. Description

A drought is a deficiency of precipitation over an extended period resulting in a water shortage. Drought occurs when water systems cannot provide the minimum necessary water to sustain plant, animal, or economic systems due to shortfalls in precipitation, soil moisture, or runoff. A drought can be characterized in several different ways depending on its impact. The most common form of drought is agricultural drought. Agricultural droughts are characterized by unusually dry conditions during the growing season. A meteorological drought is an extended period of time (six or more months) with precipitation of less than 75% of the normal precipitation. Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as streamflow, snowpack, lake, reservoir, and groundwater levels. Socioeconomic drought occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought starts to affect the supply and demand of an economic product.

The severity of droughts often depends on the community's reliance on a specific water source. The probability of drought is difficult to predict because of the variables involved in determining the cause, severity, and length of a drought event

P.2. Location and Extent

All of Prince George's County, including the City of Laurel, is at risk of experiencing periods of reduced rainfall, which can lead to drought. High summer temperatures can exacerbate the severity of a drought. When soils are wet, a significant portion of the sun's energy goes toward the evaporation of the ground moisture. However, when drought conditions eliminate soil moisture, the sun's energy heats the ground surface, and temperatures can soar, which further dries the soil.[153]

Drought can cause many problems, including diminished water supply and water quality, undernourishment of livestock and wildlife, crop damage, and increased wildfire risk. Secondary impacts from droughts pose risks to farmers due to potential reduction in income, while food prices and lumber prices can increase.

The extent of drought can depend on the duration, intensity, geographic extent, and the regional water supply demands made by human activities and vegetation. The intensity of the impact from drought could be minor to major in a localized area or cause damage across a region, affecting human health and the economy. Generally, impacts of drought evolve gradually, and regions of maximum intensity change with time. The severity of a drought is determined by extent as well as intensity and duration. The frequency of a drought is determined by analyzing the intensity for a given duration, which allows determination of the probability or percent chance of a more severe event occurring in a given mean return period. **Table 116** summarizes the drought severity and its possible impacts on a community or region. The most severe drought classification, an Exceptional Drought, has occurred is possible in the planning area.

[153] The impact of extreme heat is more thoroughly addressed under the "Extreme Heat" section

Table 116: Drought Severity Classification and Possible Impacts[154]

Category	Description	Possible Impacts
D0	Abnormally dry	Going into a drought: short-term dryness slows planting, growth of crops or pastures; fire risk above average. Coming out of a drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low; some water shortages develop or are imminent; voluntary water use restrictions requested.
D2	Severe drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.
D3	Extreme drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.

P.3. Previous Occurrences

Drought events in Prince George's County since 2000 have been categorized using the U.S. Drought Monitor Changes and are shown in **Figure 84.**[155] Between 2002 and 2003, there were record dates of droughts categorized as D3 and D4. On August 27, 2002, it was recorded that 100% of the county was experiencing a drought of category D3 and 57.31% of the county was categorized as D4. Most recently, on October 15, 2019, 100% of the county was experiencing a drought of category D2.

[154] U.S. Drought Monitor. https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx
[155] National Drought Mitigation Center. Time Series. Time Series | U.S. Drought Monitor. Retrieved from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx

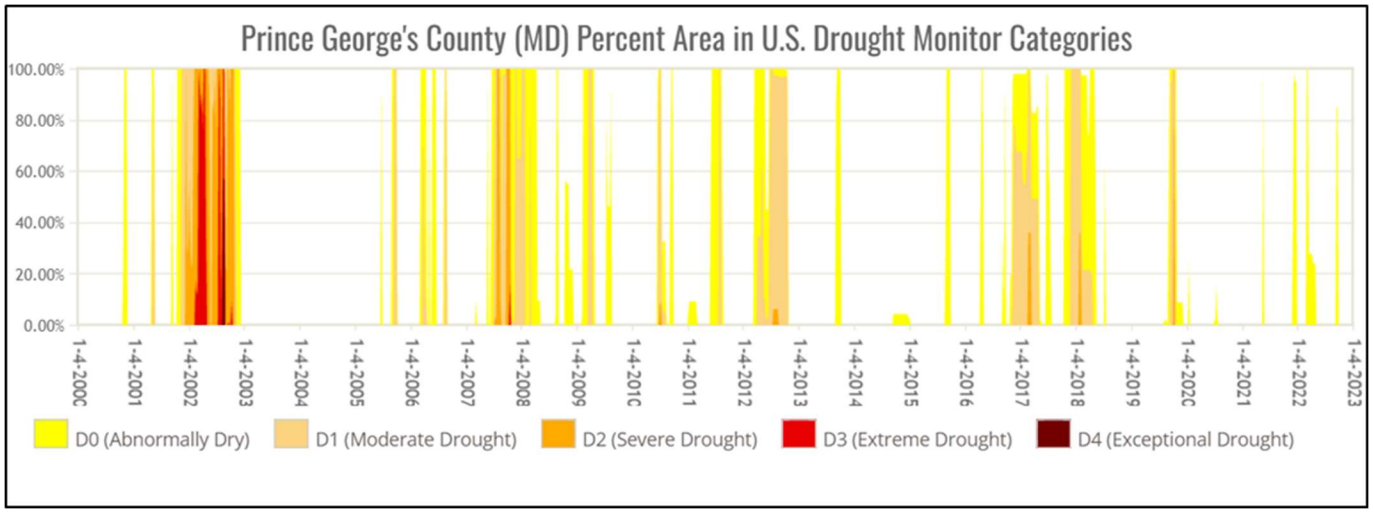


Figure 84: Prince George's County Percentage Area in U.S. Drought Monitor Changes Categories

P.4. Probability of Future Events

When considering future conditions for Prince George's County and the City of Laurel, the expected number of events and agricultural losses each year due to drought are relatively low. According to the Climate Mapping for Resilience and Adaptation tool, the average number of annual dry days for the County, based on higher greenhouse gas emissions, will slightly increase from 150.3 days to 151.9 days in approximately 20 years while the average number of annual days with maximum temperatures of more than 90°F will increase from 29.2 days to 54.1 days.[156]

P.5. Vulnerability and Risk Assessment

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for drought. These scores and ranks are shown in **Table 117**, which shows the State's ranking for drought vulnerability in Prince George's County (including the City of Laurel) as medium-high.

Table 117. 2021 State of Maryland Drought Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	1
Deaths	4
Property Damage	1
Crop Damage	3

[156] U.S. Climate Resilience Toolkit. Climate Mapping for Resilience and Adaptation. Retrieved October 26, 2022, from https://resilience.climate.gov/

Geographic Extent	1
Events	2
Local Plan Ranking (2017)	2
Overall Weighted Risk Rating[157]	**19**
Overall Ranking	**Medium-High**

P.6. Consequence Analysis

A consequence analysis (refer to **Table 118**) has been done to better understand the range of impacts that a drought event can have on several features of the planning area and the population within it.

Table 118. Drought Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	As drought is a slow developing hazard, it is unlikely to have significant impacts on life safety and is not expected to result in warnings or evacuation. Drought occurrences may result in water use restrictions. If drought is due to extreme heat the elderly, small children, the chronically ill, livestock, and pets may be at risk of impacts due to extreme heat.
Public Health	Drought has the potential to impact public health by reducing the quality and quantity of available drinking water. Low water flow due to drought can result in decreased sewage flows and subsequent increases in contaminants in the water supply.
Critical Facilities and Infrastructure	Drought is expected to have minimal impacts on critical facilities infrastructure. If water use is limited, critical facilities may lose water. Green infrastructure, such as green stormwater infrastructure, may incur minor damages during drought occurrences if plants cannot resist drought.
Economy	Drought can have economic impacts on the County, including loss of agricultural yield and death of livestock due to lack of water access. Regional drought conditions could lead to increased food prices in the County.
Buildings	Drought has minimal impacts on structures although it could have impacts on the functionality of the building if water supply is disrupted. In addition, structural issues could occur in the event that drought impacts building foundations or footings.

If a significant drought event were to occur, it could bring economic, social, and environmental impacts to the study area. Commonly, one of the most significant drought-related economic effects on a community is due to agricultural impact. Other economic effects could be felt by businesses that rely on adequate water levels for their day-to-day business, such as carwashes and laundromats. The elderly, small children, the chronically ill, livestock, and pets are most vulnerable to extreme heat.

[157] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

Droughts can also create conditions that enable the occurrence of other natural hazard events such as wildfires or wind erosion. The likelihood of flash flooding increases if a period of severe drought is followed by a period of extreme precipitation. Low-flow conditions also decrease the quantity and pressure of water available to fight fires, while dry conditions increase the likelihood that fires will occur.

Low water flow can result in decreased sewage flows and subsequent increases in contaminants in the water supply. A decrease in the availability of water also decreases the drinking water supply and the food supply as food sources become scarcer. This disruption can work its way up the food chain within a habitat. Loss of biodiversity and increases in mortality can lead to increases in disease and endangered species.

Environmental drought impacts include those on both human and animal habitats and hydrologic units. During periods of drought, the amount of available water decreases in lakes, streams, aquifers, soil, wetlands, springs, and other surface and subsurface water sources. This decrease in water availability can affect water quality such as oxygen levels, bacteria, turbidity, temperature increase, and pH changes. Changes in any of these levels can have a significant effect on the aquatic habitat of numerous plants and animals found throughout the study area. The depletion of groundwater can cause subsidence and affect infrastructure such as roads, buildings, and water pipes, and can lead to the formation of sinkholes. The impact on pavement can lead to the departments of transportation to allocate resources for repair.[158]

Identifying the first stages of drought and conserving water can aid in mitigating drought. Mitigation management for drought is a proactive process, but most of the process is initiated at the state level. The Maryland Department of the Environment uses four indicators of water sufficiency: precipitation levels, stream flows, groundwater levels, and reservoir storage. For a region to be placed in the "Watch," "Warning," or "Emergency" stage, two or more indicators must be in a "Watch" category or higher level.

Maryland is divided into six drought regions for drought monitoring and response.[159] Parts of Prince George's County are serviced by the Southern Region, except for areas served by Washington Suburban Sanitary Commission Service Area, including the City of Laurel. The regions for drought monitoring and response are shown in **Figure 85**.

[158] National Integrated Drought Information System. Navigation and Transportation. Drought.gov. Retrieved November 2, 2022, from https://www.drought.gov/sectors/navigation-and-transportation#key-issues
[159] Maryland Department of the Environment. Drought Information and Indicators. Maryland Department of the Environment. Retrieved from https://mde.maryland.gov/programs/water/droughtinformation/Pages/droughtinfoandindicators.aspx

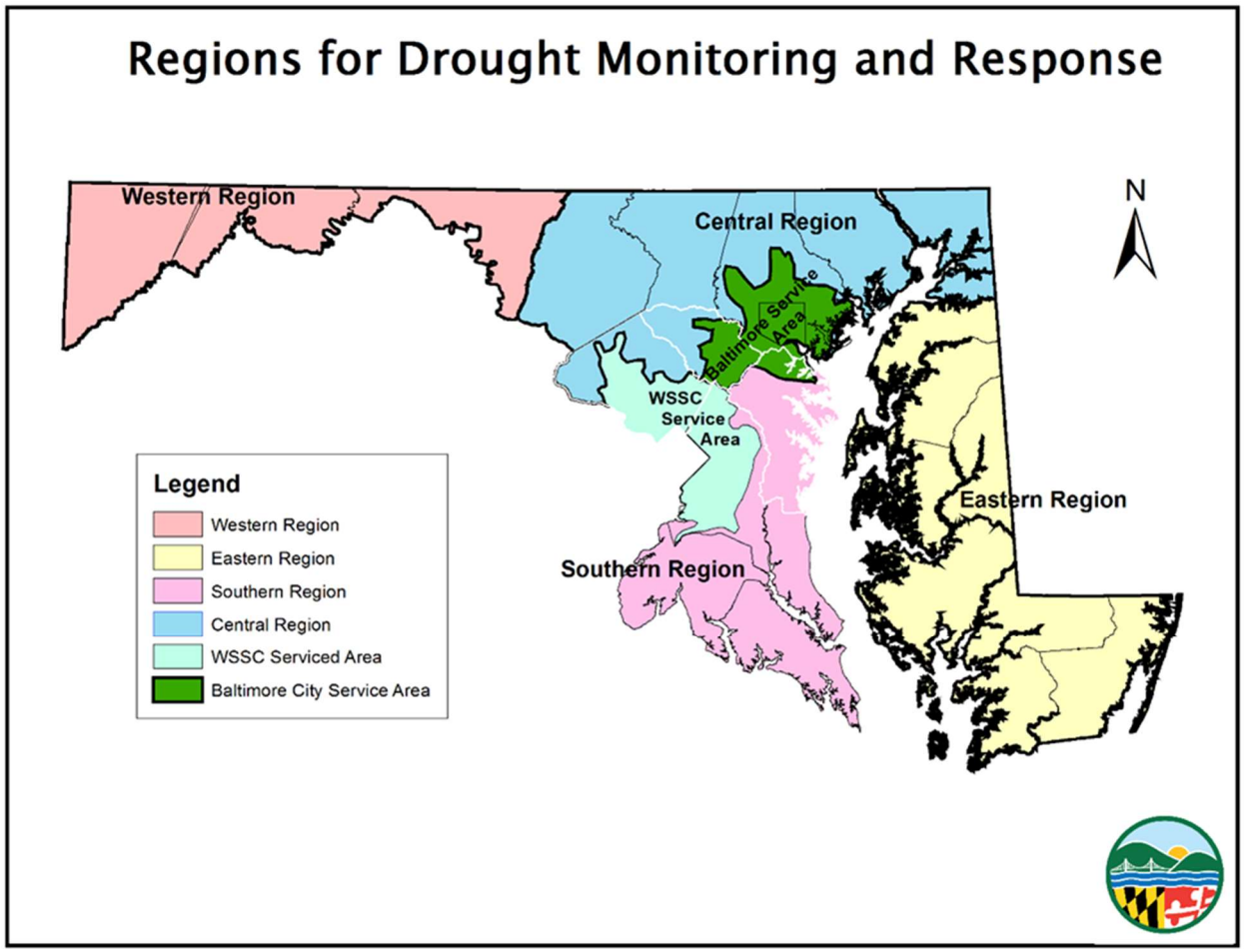


Figure 85: Maryland Regions for Drought Monitoring and Response

Q. Coastal Flood

Q.1. Description

Coastal Flooding is when water inundates or covers normally dry coastal land as a result of high or rising tides or storm surges. Coastal flooding occurs along the coasts of oceans, bays, estuaries, coastal rivers, and large lakes. Coastal flooding can be caused by storm surge, nuisance flooding, and sea level rise.

Types of Coastal Flooding

Storm surge: abnormal rise of seawater that is above the predicted astronomical tides and is generated by a storm's winds pushing water toward land. Storm surge can cause minor to major impacts to coastal infrastructure and buildings, including complete destruction.

Nuisance flooding: temporary minor inundation of low-lying coastal areas that happens during exceptional high tides. Nuisance flooding (also referred to as sunny day or tidal flooding) can cause minor impacts to coastal infrastructure and buildings. Once nuisance flooding reaches a level of moderate to major damage, it becomes classified as flooding from sea level rise.

Sea level rise: the permanent inundation of low-lying coastal areas as the increasing elevation of the oceans exceeds the land's elevation. Sea level rise can cause complete destruction of coastal communities over time as land is lost. It also worsens storm surge and nuisance flooding severity over time.

In Maryland, the major causes of coastal flooding include hurricanes and tropical storms, severe storms, and Nor'easters. Coastal flooding can cause coastal erosion; loss or submergence of wetlands and other coastal ecosystems; saltwater intrusion; high water tables; loss of coastal recreation areas, beaches, protective sand dunes, parks, and open space; and loss of coastal structures.

Q.2. Location and Extent

Storm surge extent is measured by inundation height above the ground (e.g., greater than 3 feet above ground). NOAA, the National Weather Service, and the National Hurricane Center host interactive National Storm Surge Hazard Maps that compute and display storm surge vulnerability in the United States under scenarios from a Category 1 to a Category 5 hurricane. Storm surge can cause minor to major impacts to coastal infrastructure and buildings, including complete destruction, especially if they coincide with the normal high tide to create a storm tide (the sum of storm surge and astronomical tide). Storm surges produced by storms depend on the storm's intensity, forward speed, and timing (relative to high tide and lunar cycles). Wind-generated storms can even cause flooding, coastal erosion, and structural damage upstream of typical coastal regions. Areas that are not typically susceptible to storm surge can experience damage to structures or infrastructure.

Nuisance flooding can cause minor impacts to coastal infrastructure and buildings. Once nuisance flooding reaches a level of moderate to major damage, it becomes classified as flooding from sea level rise. Sea level rise can cause complete destruction of coastal communities over time as land is lost. It also worsens storm surge and nuisance flooding severity over time. Coastal flooding extent is measured with river/stream gages to determine the water's height above normal water levels. For storm surge,

nuisance, and sea level rise flooding, topographical features (particularly elevation), ocean levels, astronomical tide levels, and the storm surge height will determine how far inland coastal flooding extends.[160]

Overall, several factors contribute to the relative severity of a coastal flood. Development, or the presence of people and property in the hazard areas, is a critical factor in determining a flood's relative severity. Additional factors that contribute to flood severity range from topography to characteristics of the structures located within the low-lying coastal area. The following is a brief discussion of some of these factors and how they may relate to the area.

- **Flood depth:** The greater the depth of flooding, the higher the potential for significant damage.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage. Floodwater may linger because of the low relief of the area, but the degree varies. Seawater can be especially harmful to buildings and contents because of the high salinity levels.
- **Velocity:** Flowing water exerts force on the structural members of a building, increasing the likelihood of significant damage. A one-foot depth of water, flowing at a velocity of five feet per second or greater, can knock an adult over and cause significant scour around structures and roadways.
- **Elevation:** The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage due to flooding.
- **Construction type:** Certain types of construction are more resistant to the effects of floodwater than others. Masonry buildings, constructed of brick or concrete blocks, are typically the most resistant to flood damage simply because masonry materials can be in contact with limited depths of water without sustaining significant damage. Wood frame structures are more susceptible to flood damage because the construction materials used are easily damaged when inundated with water.

FEMA flood maps identify the Coastal High Hazard Area as Zone V or VE. These parts of the coastal Special Flood Hazard Area show locations where waves and fast-moving water can cause extensive damage during the base food event. In V zones, wave heights are larger than 3 feet during the 1% annual chance flood. For comparison, Zone A areas are determined to have wave heights of between 1.5 and 3 feet during the 1% annual chance flood. "Zone VE" means that a detailed study has been done for the area, and Base Flood Elevations have been calculated. Structures in areas mapped as Zone V and Zone VE are subject to stricter building requirements because of the higher risk of damage from strong waves. In Prince George's County, there are only four VE zone areas, totaling 0.734 square miles (0.148% of the County's area). Depth of flooding varies across the County based on location in the flood zone. The average Base Flood Elevation of the Coastal High Hazard Area floodplain in Prince George's County is 8.3 feet. The velocity of coastal flooding can be difficult to determine. Shown in **Figure 86**, these zones are all located in District 9 along the Patuxent River. Coastal flooding does not occur in the City of Laurel.

[160] Storm Data Preparation, NOAA National Weather Service Instruction 10-1605. Operations and Services Performance, NWSPD 10-16. July 26, 2021. Available at: https://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf.

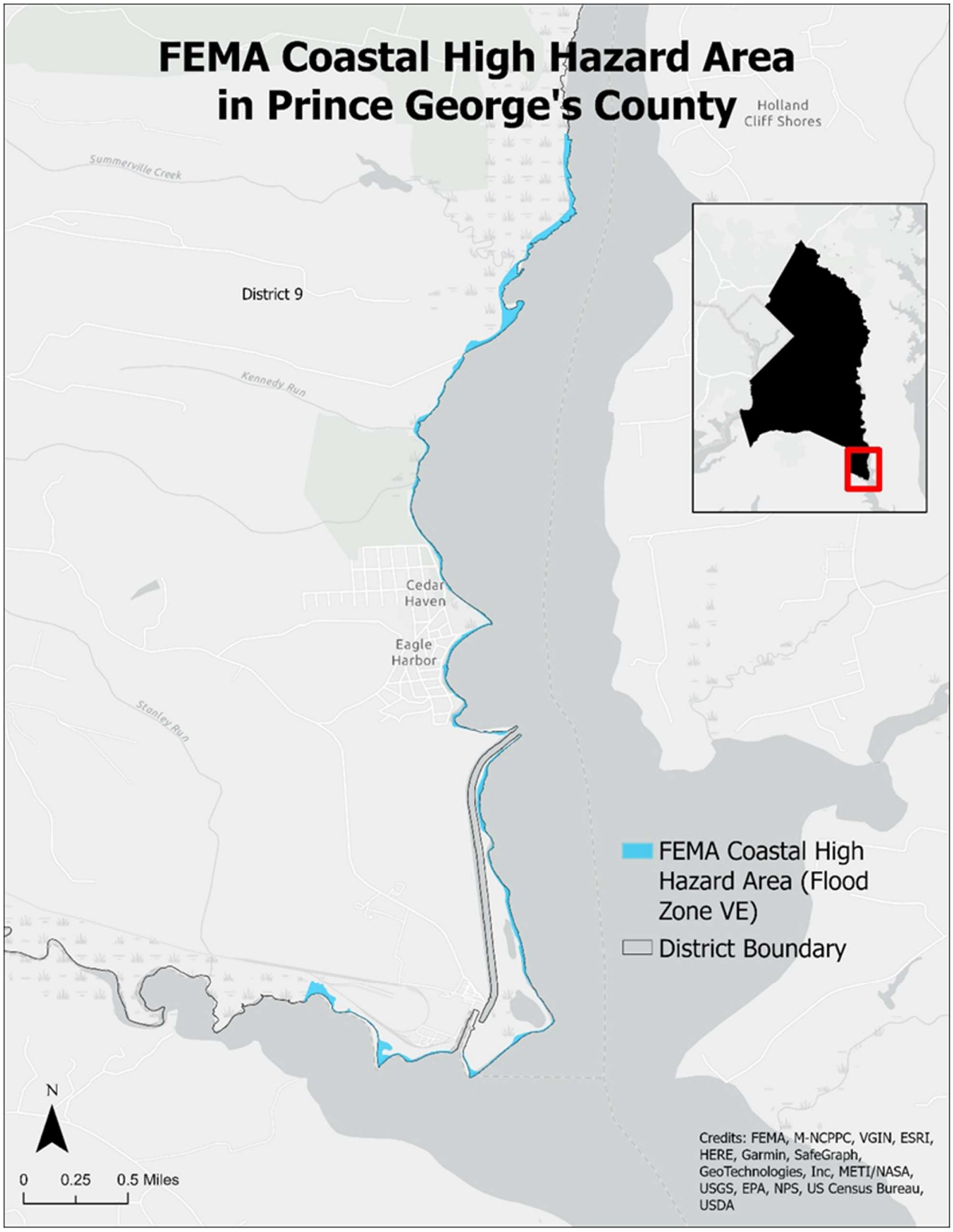


Figure 86: FEMA Coastal High Hazard Area in Prince George's County

Considering climate impacts on coastal flooding, the Maryland Department of Planning created a Coastal Climate Ready Action Boundary Inundated Zone GIS layer to reflect a three-foot rise in the base flood elevations. This layer shows the extent and depth of flood waters for coastal areas in the state above the existing ground elevation given 3-feet of sea level rise. By vertically adding 3 feet of water on top of the FEMA Special Flood Hazard Area elevations and pushing this volume of water out horizontally, the application delineates four areas of flood depths: >3 feet, 2-3 feet, 1-2 feet, and 0-1 foot.

This layer can be used to support climate resilient planning and development in coastal areas as it can show the potential location of coastal flooding impacts as the climate changes. In Prince George's County, the Coastal Climate Ready Action Boundary is located along the eastern portion of District 9 along the Patuxent River, and the western edge of District 8 and 9 along the Potomac River. **Figure 87** shows the extent of the Climate Ready Action Boundary in Prince George's County District 9 and **Figure 88** shows the extent in Districts 8 and 9.

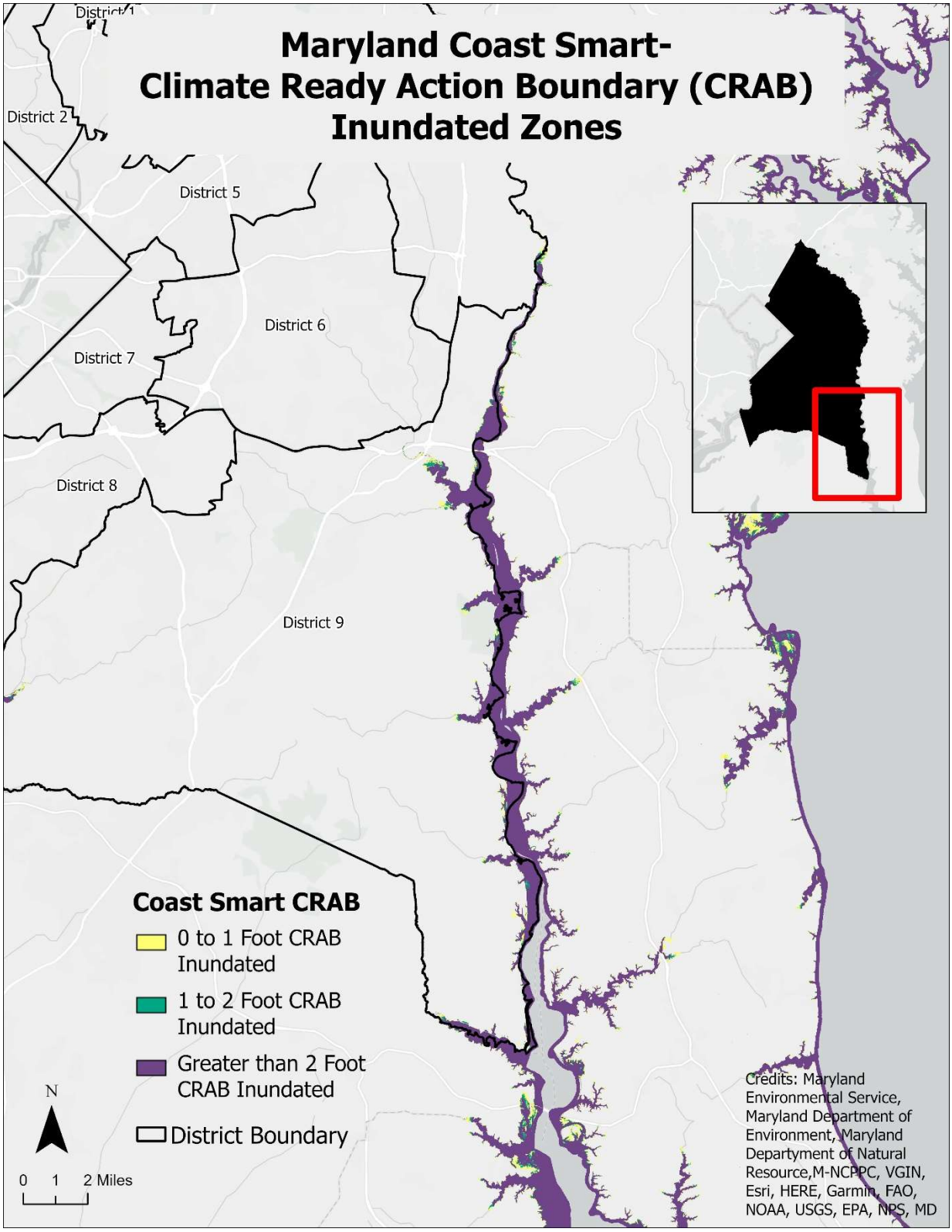


Figure 87: Climate Ready Action Boundary Areas Prince George's County District 9

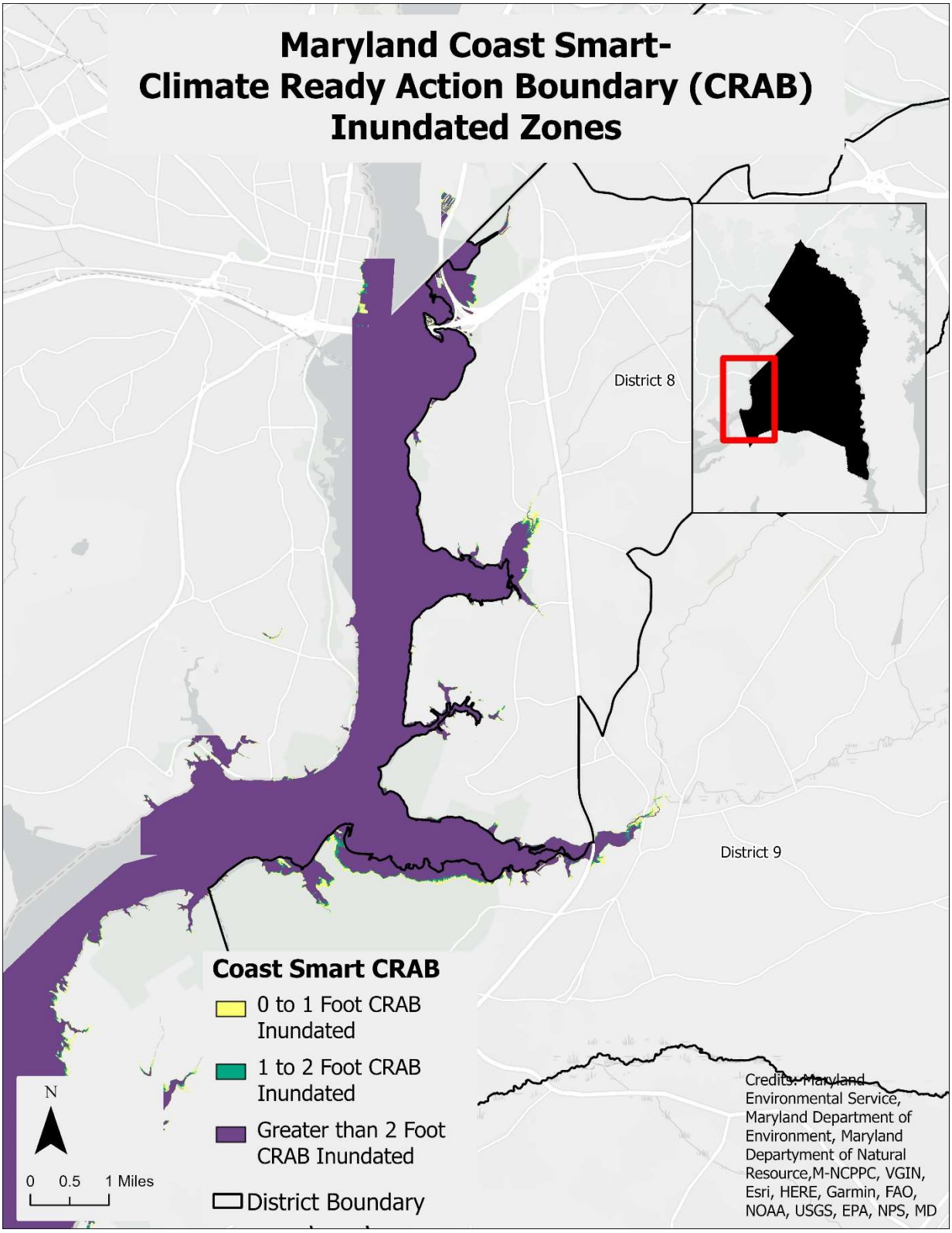


Figure 88: Climate Ready Action Boundary Areas Prince George's County Districts 8 & 9

Q.3. Previous Occurrences

According to the NCEI Storm Events Database, there have been no records of coastal flooding or storm surge flooding in Prince George's County since 1950. There have been coastal flood watches announces for Prince George's County, most recently in October 2021. During this storm event, storm surge flooding and coastal flooding of two to three feet above ground level were expected in the County.[161] Prior to this event, news records show that Hurricane Isabel in 2003 caused storm surge flooding in Maryland, impacting Prince George's County.[162]

Q.4. Probability of Future Events

Due to the lack of records on coastal flooding in Prince George's County, it is difficult to determine the probability of future events. However, as sea levels rise due to climate change, the probability of coastal flooding will increase for the County. According to the Maryland 2018 Sea Level Rise Projections, the Likely range (66% probability) of the relative rise of mean sea level expected in Maryland between 2000 and 2050 is 0.8 to 1.6 feet.[163] The rise in sea level could lead to more frequent, and more destructive coastal flooding events. Additionally, parts of the County in the FEMA VE zone are at a higher risk to coastal flooding due to the 1 percent annual chance flood event, with additional hazards associated with storm-induced velocity wave action. These parts of the County have a higher probability of experiencing coastal flooding events, and the extent of this Zone may increase with sea level rise, putting more of the County at risk of coastal flood events.

Q.5. Vulnerability and Risk Assessment

According to a 2015 Flood Risk Report for Prince George's County, seven percent of the County land area is considered coastal land.[164] This land area is located in the southern portion of Prince George's County, along the Potomac River and Patuxent Rivers. The Potomac River and the Patuxent River border Districts 8 and 9, the two most southern districts in the County. Coastal Flood extents for the Patuxent River in District 9, shown in **Figure 89**, were derived using the FEMA Hazus-MH v5.1 Flood Module for coastal hazards.

Communities located near, or within the 100-year coastal floodplain are vulnerable to coastal flooding. The impacts of coastal flooding can be short-or long-term and are most intensely experienced within local communities. To assist Maryland's coastal communities, the Coast Smart Communities program was established. Coast Smart addresses short- and long-term coastal hazards, such as coastal flooding, storm surge, and sea level rise by connecting local government staff and partners to essential information, tools, people, and trainings.[165]

The southern part of the County may be at risk for increased storm surge impacts within the Potomac and Patuxent River floodplains as sea level rises due to climate change. The Fourth National Climate Assessment projects sea level rise in the Northeast region of the United States to exceed global mean sea level rise with an average increase by 2 feet ("Intermediate-Low" sea level rise scenario) and 4.5 feet

[161] Path. Coastal Flood Warning Issues in Prince George's County: NWS. October 28, 2021. https://patch.com/maryland/bowie/coastal-flood-warning-issued-prince-georges-county-nws
[162] National Weather Service. Hurricane Isabel, September 18, 2003. https://www.weather.gov/mhx/Isabel
[163] University of Maryland Center for Environmental Science. Sea-level Rise: Projections for Maryland 2018. 2018. https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/Sea-LevelRiseProjectionsMaryland2018.pdf
[164] FEMA RiskMap. Flood Risk Report- Prince George's County, Maryland Coastal Study. 12/17/2015. https://map1.msc.fema.gov/data/FRP/FRR_24033C_Coastal_20151217.pdf?LOC=482b36a091bd403c3dc3e36ec8741232
[165] Maryland Department of Natural Resources. CoastSmart. https://dnr.maryland.gov/ccs/coastsmart/Pages/default.aspx

("Intermediate" sea level rise scenario). The most extreme sea level rise scenario estimates 11 feet of sea level rise by 2100.[166] Storm surges and coastal flooding are exacerbated by sea level rise, creating

[166] Fourth National Climate Assessment. Volume II, Impacts, Risks, and Adaptation in the United States, Chapter 18: "Northeast." U.S. Global Change Research Program. 2018; revised February 2020. https://nca2018.globalchange.gov/chapter/18/

greater impact of coastal flooding on Prince George's County.

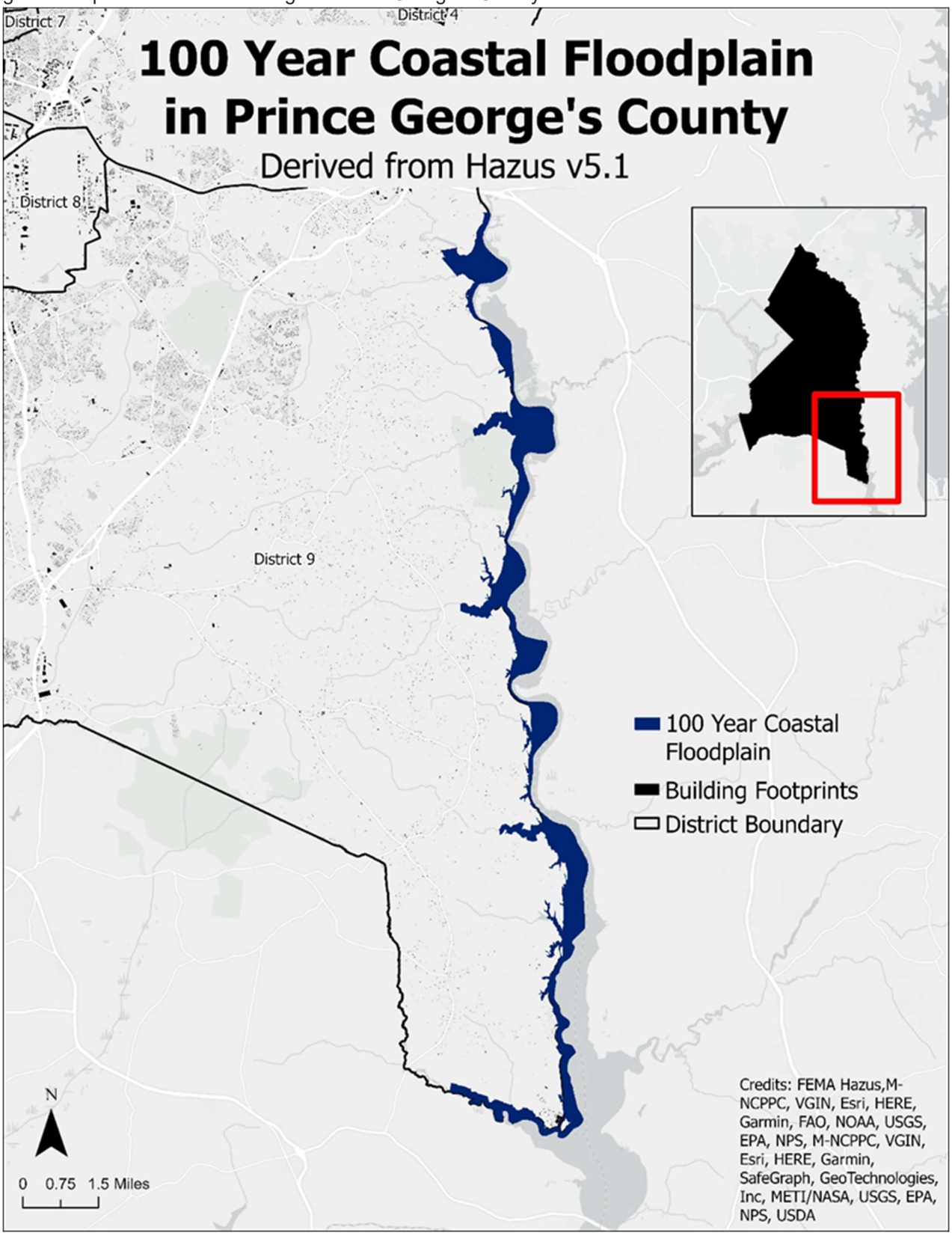


Figure 89: 100-Year Coastal Floodplain in Prince George's County

The State of Maryland 2021 Draft Hazard Mitigation Plan ranked the County on several factors for coastal hazards (coastal flood is one of several coastal hazards considered jointly by the State). These scores and ranks are shown in **Table 119**, which shows the State's ranking for coastal hazard vulnerability in Prince George's County (including the City of Laurel) as high.

Table 119. 2021 State of Maryland Coastal Hazard Ranking and Risk for Prince George's County

Risk Factors	Rank
Population Vulnerability	4
Population Density	3
Injuries	2
Deaths	4
Property Damage	3
Crop Damage	1
Geographic Extent	1
Events	2
Local Plan Ranking (2017)	4
Overall Weighted Risk Rating[167]	**23**
Overall Ranking	**High**

Q.5.a. Loss Estimation

Coastal flooding loss estimates for Prince George's County were derived using the FEMA Hazus-MH v5.1 Flood Module for coastal hazards. Flood hazard is defined by a relationship between depth of flooding and the annual chance of inundation to that depth. Annualization is the mathematical method of converting individual losses to a weighted average that may be experienced in any given year. Annualized loss is the preferred measure with which to express potential risk for hazard mitigation planning as it is useful for creating a common denominator by which different types of hazards may be compared. Annualized losses compared across a region, may indicate targeted areas for prioritization of hazard mitigation actions.

The annualized results for Prince George's County are summarized in **Table 120**. Due to population growth and increased development, all estimates of the numbers of vulnerable structures and losses may under-estimate risk at the present time. As shown in **Table 120**, approximately 80% of all exposure and 97% of all losses due to coastal flooding would be to residential structures.

Coastal flooding also has impacts to business interruption, with most losses due to relocation following a flood event. Coastal flooding can also cause damage to businesses due to loss of inventory, lack of communication with customers, and may force a business to completely shut down operations. Employers may be disrupted regardless of their location within the floodplain when customers and clients

[167] Risk = (Population Vulnerability*0.5) + (Population Density*0.5) + (Geographic Extent*1.5) + (Events*1.0) + (Property Damage*1.0) + (Crop Damage*1.0) + (Deaths*1.0) + (Injuries*1.0) + (Local Plan Risk Assessment*1.5)

cannot reach their location due to flood damage to roads. The County economy may be impacted by lack of purchases being made during a flood event. Agricultural exports may also be impacted by coastal flooding due to loss of crops.

Table 120: Prince George's County 100-Year Coastal Annualized Flood Losses (from Hazus-MH v5.1)

Prince George's County	100-Year Coastal Flood Losses (in whole dollars)				
	Residential	Commercial	Industrial	Other	Total
Total Exposure					
Prince George's County	$130,144,361,000	$26,242,415,000	$5,564,076,000	$7,454,437,000	$169,405,289,000
Direct Losses					
Building	$840,000	$4,000	$1,000	$2,000	$847,000
Contents	$505,000	$9,000	$1,000	$12,000	$527,000
Inventory	$0	$0	$0	$0	$0
Subtotal	**$1,345,000**	**$13,000**	**$2,000**	**$14,000**	**$1,374,000**
Business Interruption Losses					
Income	$20,000	$9,000	$0	$1,000	$30,000
Relocation	$136,000	$0	$0	$0	$136,000
Rental Income	$53,000	$0	$0	$0	$53,000
Wage	$47,000	$2,000	$0	$5,000	$54,000
Subtotal	**$256,000**	**$11,000**	**$0**	**$6,000**	**$273,000**
TOTAL	**$1,601,000**	**$24,000**	**$2,000**	**$20,000**	**$1,647,000**

Q.6. Consequence Analysis

A consequence analysis (refer to **Table 121**) has been done to better understand the range of impacts that a coastal flood event can have on several features of the planning area and the population within it.

Table 121. Coastal Flood Consequence Analysis

Community Feature	Impacts
Life Safety (Warning and Evacuation)	Communities located near, or within the 100-year coastal floodplain are vulnerable to coastal flooding. The impacts of coastal flooding can be short-or long-term and are most intensely experienced within local communities. Coastal flooding can cause injury or loss of life. Flood conditions necessitate warnings and evacuations may also be necessary during large-scale flood events.
Public Health	Floodwaters often contain contaminants such as bacteria and chemical hazards. Individuals traversing floodwaters or children playing in floodwaters are at risk of contracting diseases, injuries, and infections. Structures exposed to flooding may develop mold or wood rot. People with asthma, allergies, or breathing conditions may be at a higher risk to mold.
Critical Facilities and Infrastructure	Critical facilities, such as hospitals may flood and lose power during coastal flood events, forcing them to operate on backup generators. Coastal floods can also destroy critical facilities. Infrastructure may experience impacts in the form of damage from flooding, debris blockages, temporary closure of transportation routes, and the potential inability of the stormwater system to handle floodwater in a severe event.
Economy	A major coastal flood event would be costly for local governments in terms of emergency response, delivery of services, disaster cleanup, and future mitigation projects. Coastal flood events can also cause displacement of populations, impacting the local economy.
Buildings	Home and landowners within the FEMA 100-year coastal flood zone are most at risk to impacts from a coastal flood event. They may experience damage to or loss of property depending upon the severity of flooding in the area. Structures that are impacted by flooding may have structural damage, damaged electrical systems and gas tanks, or develop mold or wood rot.

R. Risk Assessment Summary

Prince George's County and the City of Laurel have opted to aggregate the findings from the risk assessment through a Hazard Risk Index. The risk factors considered were probability of occurrence, impact, geographic extent, warning time, and community concern. Each hazard's risk factors were assigned a value from 1 to 4 based on the criteria shown in **Table 122**, with a higher value indicating increased risk. A weighting factor was then applied. Finally, the risk factor's weighted index values were added together to calculate the hazard's final Hazard Risk Index score, as show in the following equation:

$$HRI\ Score = (probability\ value\ x\ 0.20) + (impact\ value\ x\ 0.35) + (geographic\ extent\ value\ x\ 0.20) + (warning\ time\ value\ x\ 0.10) + (community\ concern\ value\ x\ 0.15)$$

The Hazard Risk Index scores were then used to rank each hazard as high, moderate, or low. The Mitigation Advisory Committee reviewed and confirmed the final rankings. The Hazard Risk Index scores and overall hazard rankings are shown in **Table 123.**

Table 122. Hazard Risk Index Scoring Criteria

Hazard Risk Index Factor	Level	Criteria	Index Value	Weighting Factor
Occurrence Probability	Unlikely	Less than 1% annual probability	1	0.15
	Somewhat Likely	Between 1% and 10% annual probability	2	
	Likely	Between 10% and 90% annual probability	3	
	Highly Likely	90%+ annual probability	4	
Impact*	Minor	Minor property damages and minimal community function disruption	1	0.35
	Limited	Minor injuries are possible and more than 10% of buildings damaged	2	
	Critical	Multiple deaths/injuries possible and more than 25% of buildings damaged	3	
	Catastrophic	High number of deaths/injuries possible and more than 50% of buildings damaged	4	
Geographic Extent*	Negligible	Less than 5% of community	1	0.20
	Minor	5% to 50% of community	2	
	Moderate	25% to 50% of community	3	
	Large	More than 50% of community	4	
Warning Time	Extended	More than 24 hours	1	0.10
	Limited	12 to 24 hours	2	
	Minimal	6 to 12 hours	3	
	No Notice	Less than 6 hours	4	

Hazard Risk Index Factor	Level	Criteria	Index Value	Weighting Factor
Community Concern**	Negligible	Less than 5% reported concern	1	0.20
	Low	5% to 25% reported concern	2	
	Moderate	25 to 50% reported concern	3	
	High	More than 75% reported concern	4	

* Both impact and geographic extent include vulnerability (concerning people and infrastructure) considerations.
** Community concern comprises the opinions of the Mitigation Advisory Committee and the public's concern for each hazard as provided by the online public hazard mitigation survey.

This methodology ranks the hazards comparatively for the County based on risk. However, it does not mean that low-scoring hazard will not occur or will not have an impact on the area. It provides an overview of which hazards may pose the greatest risk to Prince George's County and the City of Laurel. A summary of the index is found in **Table 123** with the state and FEMA rankings provided for comparison.

The State of Maryland and FEMA hazard rankings are provided in the results table for comparison, and they are described as follows:

- **State Ranking**: In the 2021 State of Maryland Hazard Mitigation Plan, a score from high (5) to low (1) was awarded based on the hazard's overall ranking for each county. Some hazards have been grouped together, so they will share the same score.
- **FEMA Ranking**: The FEMA National Risk Index for Prince George's County provides risk scores for each hazard from 0 to 100. The scores are then classified from very high (5) to very low (1). The scores are calculated using an equation that combines scores for expected annual loss from hazard events, social vulnerability and community resilience (risk index = expected annual loss × social vulnerability ÷ community resilience).

Table 123. 2023 Hazard Risk Index Score Results & Overall Ranking

Hazard	Occurrence Probability	Impact	Geographic Extent	Warning Time	Community Concern	Hazard Risk Index Score & Overall Rank	State Ranking (5 = highest)	FEMA Ranking (5 = highest)
Riverine Flood	Highly Likely	Critical	Moderate	Limited	High	**3.25 (High)**	5	2
Severe Storm (Flood-Related)	Highly Likely	Critical	Moderate	Limited	High	**3.25 (High)**	5	N/A
Severe Storm (Wind-Related)	Highly Likely	Limited	Large	Limited	High	**3.1 (High)**	5	3
High Winds	Likely	Limited	Large	Limited	High	**2.95 (High)**	5	3
Tornado	Likely	Critical	Minor	No Notice	Moderate	**2.9 (Moderate)**	5	4
Extreme Heat	Highly Likely	Limited	Large	Extended	Moderate	**2.8 (Moderate)**	4	4
Winter Storm	Highly Likely	Minor	Large	Limited	Moderate	**2.55 (Moderate)**	5	4
Hurricane/ Tropical Storm	Somewhat Likely	Limited	Large	Limited	Low	**2.4 (Moderate)**	4	2
Dam and Levee Failure	Unlikely	Limited	Negligible	No Notice	Low	**1.85 (Moderate)**	4	N/A
Earthquake	Likely	Minor	Minor	No Notice	Negligible	**1.8 (Moderate)**	N/A	2
Extreme Cold	Somewhat Likely	Minor	Large	Extended	Negligible	**1.75 (Moderate)**	4	3
Sinkhole	Highly Likely	Minor	Negligible	Minimal	Negligible	**1.65 (Low)**	2	N/A
Wildfire	Highly Likely	Minor	Negligible	Limited	Negligible	**1.55 (Low)**	4	1
Landslide	Somewhat Likely	Minor	Negligible	No Notice	Negligible	**1.45 (Low)**	2	2
Drought	Somewhat Likely	Minor	Minor	Extended	Negligible	**1.35 (Low)**	4	2
Coastal Flood	Unlikely	Minor	Minor	Limited	Negligible	**1.3 (Low)**	5	2

Chapter 5. Capability Assessment

This chapter evaluates Prince George's County and the City of Laurel's capabilities and resources available to implement the actions in the Mitigation Strategy.

A. Prince George's County Capability Assessment

A.1. County Government Structure and Capabilities

Prince George's County is one of eleven charter counties in Maryland. Since 1970, it has had an elected executive and an elected council. A charter county has been granted express powers rule by the Maryland General Assembly. According to the Maryland Association of Counties (www.mdcounties.org), charter counties provide services and facilities for its citizens that are grouped by the general nature of those services and facilities:

- **General Government** – includes executive and legislative control, judicial support, election supervision, financial administration (budgeting and accounting), legal (counsel and prosecution), personnel administration, planning and zoning, general services, and alcoholic beverage control.
- **Public Safety** – includes law enforcement, fire protection, corrections, building inspection, animal control, homeland security, emergency management and traffic engineering.
- **Public Works** – includes road construction and maintenance, sewer, water, storm drains, and solid waste collection and disposal (in Prince George's County, sewer and water services are provided by the Washington Suburban Sanitary Commission).
- **Health** – includes support of the state-required and regulated county health department.
- **Education (Kindergarten through 12th grade)** – includes support of the state-required county board of education that operates under state law.
- **Community Colleges** – includes support of the county or regional board of trustees of a community college that operates under state law.
- **Libraries** – includes support of the county board of library trustees that operates under state law.
- **Recreation and Parks** – includes recreation activities and facilities, and park and open space maintenance and development (The Maryland-National Capital Park and Planning Commission has responsibility for parks and recreation in Prince George's County).
- **Development** – includes such things as urban and rural development and redevelopment, housing, economic development, and economic opportunity programs.
- **Debt Service** – includes the annual principal and interest payments on debt issued for the development of public capital facilities (i.e., roads, schools, libraries, parks, etc.).

Prince George's County administers its services and facilities through numerous departments and agencies. The primary agencies that have direct or indirect roles related to mitigation of natural hazards and which are summarized in this chapter include:

- Office of Homeland Security
- Department of Environment
- Department of Public Works & Transportation;

- Department of Housing & Community Development;
- Office of Central Services;
- Permitting, Inspections and Enforcement;
- Prince George's County Public Schools;
- Fire/Emergency Medical Services; and
- Department of Family Services.

Two other organizations that have roles related to mitigation of natural hazards are summarized in this chapter: The Maryland-National Capital Park & Planning Commission and the Washington Suburban Sanitary Commission.

A.1.a. Planning and Development Processes

Prince George's County is characterized by highly urbanized areas, high growth areas, and outlying rural areas. The comprehensive and long-term planning, zoning, and development review and approval processes are complex and involve several agencies, notably the Department of the Environment and The Maryland-National Capital Park & Planning Commission. Site-specific characteristics are considered, including the presence of mapped flood hazards, wetlands, unstable soils, and steep slopes during development review. This section presents brief overviews of key documents and highlights how natural hazards are addressed in the overall process.

The 27 municipalities in Prince George's County participate in planning and regulating development. As shown in **Table 124**, the County and The Maryland-National Capital Park & Planning Commission perform these functions for the cities, with the exception of the City of Laurel.

Table 124: Development Authorities in Municipalities

Municipality	NFIP ID#	Planning	Zoning	Building Code	Floodplain Ordinance	Schools	Fire, Emergency Medical Services, Police
Laurel	240053	Yes	Yes	Yes	Yes	✓	Yes
Bowie	✓	✓	✓	Yes (also requires County permit)	✓	✓	✓
Berwyn Heights, Bladensburg, Brentwood, Capital Heights, Cheverly, College Park, Colmar Manor, Cottage City, District Heights, Eagle Harbor, Edmondston, Fairmount Heights, Forest Heights, Glenarden, Greenbelt, Hyattsville, Landover Hills, Morningside, Mount Rainier, New Carrollton, North	✓	✓	✓	✓	✓	✓	✓

Municipality	NFIP ID#	Planning	Zoning	Building Code	Floodplain Ordinance	Schools	Fire, Emergency Medical Services, Police
Brentwood, Riverdale Park, Seat Pleasant, University Park, Upper Marlboro							

✓ Means the function is included in the County's process, the municipality thus does not have separate authority, ordinances, or services.

A.1.b. Approved General Plan

Plan 2035, Prince George's County Approved General Plan (May 6, 2014) makes comprehensive recommendations for guiding future development. The plan's vision emphasizes Accessibility, Sustainability, Prosperity and Livability. It redefines policies and objectives by re-characterizing the 2002 General Plan Policy Areas. The Developed Tier and Developing Tier were re- characterized into 2035 Policy Areas: Established Communities, Future Water and Sewer Service Areas and Employment Areas. The 2002 General Rural Tier Policy Area was converted to 2035 Agricultural/Rural Areas and the Growth Boundary Area. These new area classifications are visually communicated through the Growth Policy Map, indicating where the County will experience development or will remain undeveloped in the upcoming years. **Figure 90** shows the Plan 2035 Growth Policy Map.

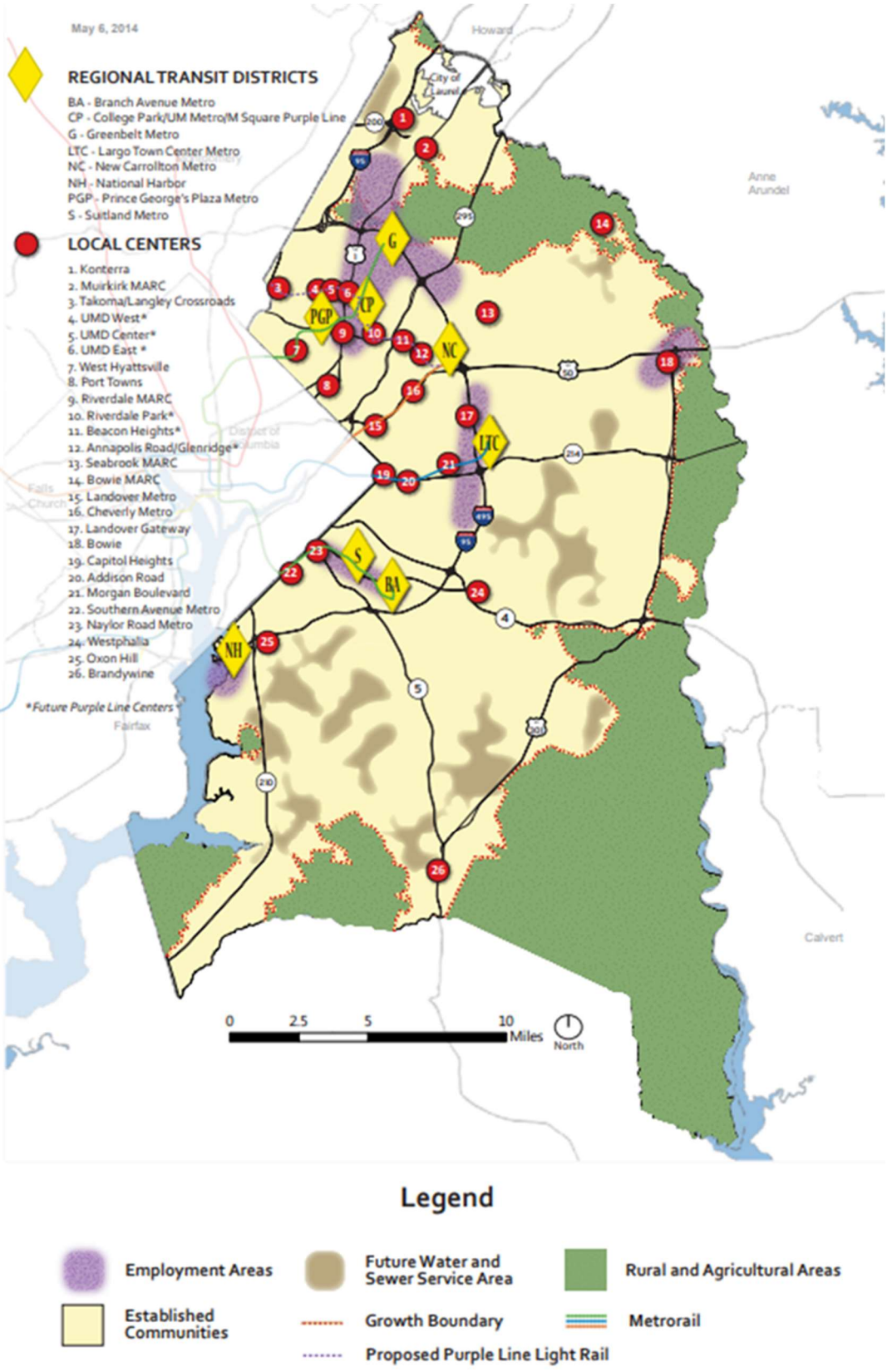


Figure 90: Prince George's County Plan 2035 Growth Policy Map

In the Plan, undeveloped flood hazard areas are included among environmentally sensitive areas. The County's goal is to preserve 80% of its remaining undeveloped land, or approximately 46,220 acres. The plan emphasizes protection of sensitive areas through methods such as property acquisitions, conservation programs, and development of enhanced or additional regulations and policies. By protecting undeveloped flood hazard areas, these spaces can provide ecosystem services such as flood control. The Plan also outlines policies related to assessing decisions for potential impacts of climate change, including flooding and sea level rise. The County aims to prioritize flood adaptation upgrades to at-risk areas and reduce development in flood-prone areas. Prince George's County is widely recognized for its progressive approach to guiding development away from flood-prone areas.

A.1.c. Zoning and Planning

The primary elements of the zoning and planning processes are highlighted below. Extensive materials, both printed matter and webpages, are issued by Department of Environment and The Maryland-National Capital Parks and Planning Commission to explain and guide citizens and developers through the processes. The County continues to coordinate the Floodplain Ordinance and Building Code whenever either is updated.

A.1.c.1. The Zoning Ordinance

The ordinance establishes several zones which permit residential, commercial, industrial or agricultural uses, or a mixture of those uses. Each zone has specific requirements and limitations. The Chesapeake Bay Critical Area Overlay Zones, required by the State, apply to tidal waters, tidal wetlands, and all land within 1,000 feet of the mean high tide line. Woodland conservation requirements are addressed through the review and approval of tree conservation plans, as detailed in the Woodland Conservation Technical Manual. Landscape provisions are also included in the Zoning Ordinance and details and requirements can be found in the Landscape Manual. Variances may be sought to obtain relief from the strict application of the Zoning Ordinance, such as to allow variances to setback or building height limitations. The ordinance was revised since the 2017 hazard mitigation plan update and the floodplain management ordinance was revised and adopted following provision of new FEMA Flood Insurance Rate Maps (September 16, 2016).

The Zoning Ordinance contains one specific provision related to floodplains:

- *Sec. 27-124.01 One hundred (100) year floodplain*. This section defines the floodplain as that which is delineated by the County's watershed management studies approved by the County Stormwater Management Task Force. At a minimum, floodplain limits are those which are delineated or revised by the Federal Emergency Management Agency. Where no studies are available or where the Department of the Environment has determined existing studies to be inapplicable, new studies shall be required and performed to the satisfaction of the Department of the Environment, taking into consideration future land use based on zoning. Watercourses having less than 50 acres of upstream watershed may be excluded.

A.1.c.2. Planning Process

Through several types of plans, the County provides guidance for future physical development. The responsibility for the General Plan and other plans rests with the Maryland-National Capital Park and Planning Commission Area master plans address the adequacy of public facilities and development proposals are analyzed for impacts on schools, police, fire, rescue, libraries, health, parks and trails. They also are used as the basis for decisions on zoning changes, special exceptions and subdivision applications.

A.1.c.3. Subdivision Review

Subdivision Regulations control subdivision of land for the purposes of sale or development. Each subdivision proposal is supported by a preliminary plan that depicts such features as lot lines, streets, drainage patterns, stormwater management facilities, topography, building restriction lines, easements and environmental features such as floodplains, wetlands, woodlands, steep slopes and unstable soils. After receiving preliminary plan approval most plans are recorded in the County land records office. This legally recorded document, known as a record plat, depicts lot lines, easements, building setbacks, public right- of-ways and any other encumbrances that restrict the physical development of the land. The Maryland-National Capital Park and Planning Commission administers the review process.

A.1.c.4. Additional Plans and Reviews

Environmental features and constraints are among many aspects that are reviewed and considered. Detailed site plans show additional detail, including location of buildings, open spaces, landscaping, grading and other physical features. Detailed plans are required for stormwater management, tree conservation, sediment and erosion control, and utilities.

A.1.c.5. Floodplain Ordinance

The Prince George's County Floodplain Ordinance (Division 4 of Subtitle 32, Water Resources Protection in the County Code, meets and exceeds the minimum requirements of the NFIP.

A.1.c.6. Building Permit, Use and Occupancy

The Prince George's County Building Code enforces provisions supporting protection from potential impacts from natural hazards. Building permits are required for new construction and certain work on existing buildings and a robust inspection program enforces the code.

A.1.c.7. Trees and Vegetation

The Prince George's County Tree Canopy Coverage Ordinance (Division 3 of Subtitle 25, Trees and Vegetation) establishes procedures, standards, and requirements to preserve, maintain, enhance, and restore tree canopy coverage on developed and developing sites for the benefit of County residents and future generations. Tree canopy requirements shall be met unless a waiver has been granted.

A.2. The Capital Improvement Plan

The Capital Improvement Program is the County's six-year financial plan for constructing and renovating permanent facilities such as schools, libraries, fire stations and roads. Capital projects often take two to three years to complete. The Capital Improvement Program provides a detailed, year-by-year schedule of all planned expenditures and financing requirements for each construction project. Eligible capital improvement projects address frequent home flooding (water entering the habitable structure area), and alleviate severe road flooding that does not fall under jurisdiction of the county Department of Public Works and Transportation. Also included are flood control system certification, municipal participation, storm drain acceptance and flood warning systems projects. When possible, water quality enhancement features are incorporated in capital improvement projects. Property owners directly benefiting from capital improvement projects must pay for and provide the county with a right of way.

Projects that specifically address flood hazards, whether as a primary purpose or adjunct component, include:

- **COE County Restoration**. This program is a partnership with the U.S. Army Corps of Engineers and will involve the design and construction of environmental enhancement and flood control projects in the Anacostia and Patuxent River watersheds. Numerous projects are in the planning and design phase, including levee improvements, water quality measures, wetland creation, and reforestation and fish blockage removal. In Fiscal Year 2023, construction and certification support will continue on the Allison Street Levee.
- **County Revitalization and Restoration**. This project provides funding for infrastructure improvements and reconstruction in areas targeted for revitalization. Improvements will include the installation of traffic signals, intersection modifications, drainage structures, street lighting, landscaping, water quality and quantity measures, bicycle lanes, sidewalks and other amenities necessary to improve or expand existing roadway infrastructure while enhancing the appearance of the community.
- **Green Street Improvements**. This project provides funding for improvements along major roadways and at key intersections to improve appearance, safety and functionality while addressing environmental issues. This will improve water quality and related environmental conditions in the immediate vicinity of the projects undertaken.
- **Stormwater Management Restoration**. The County's stormwater management infrastructure is aging and in need of extensive and expensive repairs. The project determines the condition of the storm drain system, which will provide a basis for a large-scale repair of storm drain infrastructure throughout the County. Ponds identified as deficient will be corrected, constructed and landscaped. Several countywide initiatives are also funded here, including tree plantings for water quality and a comprehensive street tree inventory.
- **Endangered Structure Acquisition Program**. This project provides for the acquisition of residential properties within the 100-year floodplain and properties vulnerable to unforeseen natural conditions such as a slope failure or stream erosion. This project will mitigate severe economic impacts associated with flooding events to commercial, industrial and residential properties. Acquisition of the most severely flood-prone properties will have a positive impact. Properties which are acquired are then evaluated for opportunities to implement wetland banking, stream restoration, flood mitigation, reforestation and/or green space opportunities.
- **Flood Protection and Drainage Improvement**. This program consists of flood protection and drainage relief projects that will address surface run-off causing home flooding, alleviate road flooding and correct residential yard drainage deficiencies. It will also provide flood mitigation and drainage improvement to residential structures which cannot be corrected through the County's Department of Public Works and Transportation maintenance program.

A.3. Ordinances and Regulations

A.3.a. Subdivision Regulations

The Prince George's County regulations pertaining to the subdivision of land are found in Subtitle 24. The broad purposes are to provide for the public health, safety, and general welfare, including wise use and management of natural resources and provision of open space. A stated objective is that "Significant natural features which are impossible or difficult to reproduce, such as waterways, streams, hills, wooded lands, and specimen trees, should be preserved to the degree practicable." Some highlights pertaining to natural hazards:

- Stormwater management must be addressed in all subdivision proposals (minor subdivisions are four or fewer single-family residential lots; major subdivisions are all others).
- Preliminary plans for subdivision must show flood hazard areas, forest stands, perennial streams, non-tidal wetlands, and soil types (including highly erodible soils).
- Minimum lot areas are specified, generally exclusive of any land within the 100-year floodplain.
- For residential subdivisions, a 25-foot setback from the floodplain shall be established as a building restriction line.
- Proposals for most residential subdivisions are required to plat and convey to the County or a municipality suitable and adequate land for active or passive recreation; land shown for preservation as part of a stream valley park on an official master plan may be substituted under certain conditions.
- Developers are encouraged to dedicate floodplain areas for public purpose, otherwise such areas are subject to a floodplain easement.
- The area in the floodplain easement may be used for utility lines and /or storm drainage facilities, open-type fencing, or passive recreation, provided that no structures are built that would interfere with the flood conveyance capacity.
- A 50-foot perennial stream buffer is required.
- The minimum 50-foot perennial stream buffer may be extended to include the floodplain, adjacent slopes of 25% or greater, and highly erodible soils on slopes of 15% or greater and additional area deemed necessary to protect the stream or floodplain.
- The subdivision of land found to be unsafe for development, which may be due to natural conditions such as, but not confined to, flooding, erosive stream action, high water table, unstable soils or severe slopes, or to man-made conditions such as unstable fills or slopes may be restricted or prohibited.

A.3.b. Stormwater & Wetlands Regulations

The Prince George's County regulations pertaining to stormwater management are found in Subtitle 32, Water Resources Protection and Grading Code Division 3, Stormwater Management. The purpose of the requirements is to protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse results of increased stormwater runoff associated with land development. Proper management of stormwater runoff minimizes damage to public and private property, reduces the effects of development on land and stream channel erosion, assists attainment and maintenance of water quality standards, reduces local flooding, and maintains, as nearly as possible, predevelopment runoff characteristics of the area.

The County's Stormwater Management ordinance sets the standards for stormwater management design plans, as well as establishes requirements for inspection, maintenance, and enforcement of stormwater management plans.

The County emphasizes the use of non-structural stormwater best management practices when a development is proposed. Stormwater best practices used and promoted in the County emphasize "No Adverse Impact" structures such as bio-retention facilities, underground infiltration, on-site ponds, and off-site regional facilities. Protection of existing wetlands and replacement of impacted wetlands are controlled through permitting related to grading and construction activities. County stormwater management regulations include several provisions for the safe conveyance of excess stormwater and floodwaters and to increase groundwater recharge. Stormwater management plans are also required for all redevelopment plans in the County.

The County includes a Nontidal Wetlands Protection Ordinance in Subtitle 32, Division 5 of its code of ordinances. This ordinance outlines Prince George's County's comprehensive program for the protection, conservation and regulation of nontidal wetlands. The goal of this program is to ensure no net loss of nontidal wetland acreage and function and to strive for a net resource gain in the County.

Development proposals that include wetland impacts are subject to the requirements of the Maryland Department of the Environment and the U.S. Army Corps of Engineers.

A.3.c. Floodplain Ordinance

The revised Floodplain Ordinance (Division 4 of Subtitle 32 Water Resources Protection and Grading Code) was adopted September 16, 2016 to protect life and health and to minimize public and private property damage by controlling development within the floodplain.

Due to the County's restrictive approach to floodplain development, proposals for new development in the regulated floodplain are not common. Substantial improvements and additions to existing buildings are subject to ordinance provisions. The following highlights the areas in which the ordinance exceeds minimum requirements:

- New development of substantial improvement is required to be 2 feet above the Base Flood Elevation.
- The 1%-annual chance floodplain is based upon ultimate conditions hydrology or full build out of the watershed based upon current zoning or land use proposed in an approved Master Plan.
- The lowest floor of any new building or substantial improvement/additions to existing buildings are to be elevated one or more feet above the elevation of the 1%-annual chance floodplain.
- Activities proposed for the mapped floodplain must be evaluated using engineering methodologies to determine the impact on flood elevations; compensatory storage that offsets any impacts is required.
- For any new buildings or substantially improved buildings or additions, enclosures below the lowest floor are not allowed.

A.3.d. County Building Code

Prince George's County stays current with the Maryland Building Performance Standards (which are based on the current Editions of the *International Building Code*, the *International Mechanical Code*, the *International Energy Code*, the *International Existing Building Code,* and the *International Residential Code*). By amendment, the County embodies in the building code, certain additional regulations for grading, drainage, surface structures, erosion control, and stormwater management. The codes apply to new construction and work on existing structures.

According to FEMA's National Building Code Adoption Tracking Portal, Prince George's County uses up to date hazard building codes that protect against five hazards; flood, seismic, tornado, hurricane wind, and damaging wind. The County uses 2018 International Building Codes (IBC). The County is also anticipated to adopt the 2021 IBC in 2024.[168] Additionally, the County's building codes have been rated as "Resistant," with 100-percent of the county being required to adhere to a hazard-resistant building code, according to FEMA's Climate Mapping for Resilience and Adaptation's statement of hazard resistance code adoption status.[169]

168 FEMA. National Building Code Adoption Tracking Portal. https://stantec.maps.arcgis.com/apps/MapSeries/index.html?appid=a053ac48343c4217ab4184bc8759c350
169 FEMA. Climate Mapping for Resilience and Adaptation v 1.0.4. https://livingatlas.arcgis.com/assessment-tool/explore/details

Prince George's County has adopted amendments to the Building Code that are specific to wind damage, damage due to heavy winter storms fires, and drainage, outlined in the following codes:

- *Subtitle 4, Building, Division 1 Building Code*:
    - *Sec. 4-144. Fire and Smoke Protection Features, Section 704, Fire-Resistance Rating of Structural Members; Sec. 4-145. Exterior Walls, Section 705, Combustible Materials on the Exterior Side of Exterior Walls; Sec.4-149. Fire and Smoke Protection Features, Section 705, Exterior Walls; Sec. 4-151. - Fire and Smoke Protection Features, Section 708, Fire Partitions.* Each of these sections contains fire resistance guidelines to protect structures from fires.
    - *Sec. 4-187. Structural Design; Snow Loads; Section 1608.1, General.* References American Society of Civil Engineers 7 for design snow loads; but design roof load shall not be less than that determined by Sec. 1607 of the Code, and in no case less than thirty (30) pounds per square foot snow load, plus the drift.
    - *Sec. 4-188. Dampproofing and Waterproofing*. *Section 1805.4.3.8, Site Grading* The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in twelve (12) units horizontal (1:12) for a minimum distance of 5 feet (914 mm) measured perpendicular to the face of the wall or an approved alternate method of diverting water away from the foundation shall be used. Consideration shall be given to the possible additional settlement of the backfill when establishing the final ground level adjacent to the foundation.

The residential building code applicable to one and two-family dwellings identifies the wind speed, flood loads, and snow load for prescriptive designs. It also addresses unstable soils, giving the building code office the authority to require additional measures. The County adopted modifications to the residential code that are comparable to the adopted modifications to the building code.

- In addition to the Building Code, *Subtitle 32. Water Resources Protection and Grading Code. Division 2* contains guidance on protecting structures from geologic hazards and drainage:
    - *Sec. 32-133. Denial of Permit (c) Geological Hazard*. "If, in the opinion of the Director or Permitting, Inspections and Enforcement, the land area for which grading is proposed is subject to geological hazard to the extent that no reasonable amount of corrective work can eliminate or sufficiently reduce settlement, slope instability, or any other hazard to persons or property, the grading permit shall be denied."
    - *Sec. 32-162. On-site Drainage (a) (6).* "In order for drainage to discharge into natural watercourses such natural ground shall be protected from erosion by an adequate amount of riprap or by other measures. Flows exceeding three (3) cubic feet per second will not be permitted in open facilities such as swales and ditches, but shall be conveyed in enclosed storm drain systems."
    - *Sec. 32-162. On-Site Drainage (a)(7).* "Overflows [of drainage] from the one hundred (100) year storm shall be traced through the site and intervening area to their locations of discharge into a natural stream and, at critical locations, their hydraulic gradient determined to ascertain that the proposed construction does not flood or damage existing and proposed buildings or structures along the trace."

A.4. Department of the Environment

The mission of the Department of Environment is to protect and enhance the natural and built environments of Prince George's County by enforcing Federal, State and County laws to create a healthy, safe and aesthetically pleasing environment for all residents and businesses of the County. Its programs, which are some of the most progressive in the Nation, work hand in hand with the County Executive's Livable Communities Initiative to provide healthy, safe, and clean communities for the citizens and residents of Prince George's County. Descriptions of the department's functional groups and initiatives that address natural hazards are briefly described below.

Environmental Services. Prince George's Environmental Services group is responsible for environmental stewardship of the County and administers programs for stormwater management, floodplain management and damage assessment, allocation of water and sewer service, reforestation of designated areas, capital projects construction, and the restoration of degraded streams and ponds. Prince George's County is recognized as a national model for ecosystem management and restoration. Special programs focus on the quality of streams, others on industrial and residential pollution prevention, the revitalization of older communities, the restoration of the Anacostia River and its tributaries, the preservation and replacement of trees, and the protection of the Chesapeake Bay.

The Group is involved with a number of programs associated with land development and revitalization, working closely with the Office of Engineering in the Department of Public Works and Transportation to ensure development projects will meet environmental concerns and the required codes, but at the same time, making sure this process is fairly and practically applied.

The Environmental Services Group is charged with monitoring the County's activities that are related to its continued compliance with and participation in the NFIP and the NFIP's CRS. For summary information on the NFIP and CRS, please refer to Chapter 4.B.3.b and Chapter 4.B.3.c, respectively.

Permits and Review Group. The Permits and Review Group provides technical support to review and approve plans for construction, including fire and life safety. The County code requires that an owner or authorized agent obtain a permit to erect, construct, enlarge, alter, move, improve, connect, demolish, use and/or occupy, or raze any building. Other types of projects which require permits include grading, stormwater, installation or construction of chimneys, billboards, carports, chairlifts, escalators, swimming pools, wood burning stoves, certain fences, antennas, and installation or renovation of certain electrical devices and wiring.

Licenses and Inspection Group. The Licenses and Inspections Group (LIG) provides regulation of construction, development, and grading activity in the County and incorporated municipalities (except the City of Laurel), through inspection and enforcement. Codes enforced include building, electrical, fire, mechanical, energy, accessibility, grading, stormwater management, zoning, and other applicable State and County codes for construction and development projects. Except for work of a minor nature, commercial projects are required to be certified by third party inspection agents under the Third-Party Inspection Program. The Group's Commercial Construction/Life Safety Team oversees the Third-Party Inspection Program.

Permit and Inspection Activity and Staff Qualifications. The Office of Engineering and the Licenses and Inspection Group are staffed by professionals who meet or exceed State requirements for certification in their trade/specialty, either through the model code organization or the Maryland Department of Housing & Community Development. Most staff members maintain multiple certifications. To maintain qualifications, staff members attend training offered by the International Code Council, the Maryland Department of Housing & Community Development, and commercial providers.

Countywide Flood Reduction Program. Prince George's County has a strong record of dealing with flooding since 1972's Tropical Storm Agnes brought the potential for significant impacts to the attention of elected officials and policymakers. The County joined the National Flood Insurance Program (NFIP) that year, and soon thereafter established a task force to analyze the risks and data on flood control projects, to review flood emergency procedures, and to recommend actions to address flooding. A comprehensive watershed-based stormwater management plan approach has evolved during the past 45 years which is nationally recognized as an innovative and practical way to meet regulatory requirements, enhance clean water and protect riverine and wetland systems in a highly urban and suburban environment.

Sustainability Division. The Sustainability Division (SD) is responsible for the planning, development and implementation of environmental programs that protect communities and enhance the quality of life in Prince George's county.

The Sustainability Division leads floodplain studies, including 100-year floodplain studies for county stream reaches. **Chapter 4** of the 2023 HMP summarizes the results of the risk assessment for flood hazards, which indicates that 9.7% of the total properties in Prince George's County and the City of Laurel are exposed to flooding in the 1% or 0.2% chance floodplain, with a grand total of approximately $8 billion value exposed to flooding. Most buildings have not experienced flooding in at least the last 35 years (period for which the County has records). Many of the areas where flood-prone development exists are targeted for urban revitalization, especially inside the Beltway along the Anacostia River, Oxon Run, and Beaverdam Creek.

Comprehensive Watershed Management Plans. The Department of Environment has the responsibility to conduct watershed studies and develop management plans. The purposes of the plans include determination of potential flooding based on planned future development, consideration of mitigation alternatives to control flooding and minimize damage, and identification of stormwater management strategies to alleviate water quality impacts and stream channel erosion associated with development.

Flood hazard mitigation alternatives considered for identified problem areas range from nonstructural (buyout, site modification, elevation) to structural (levees/floodwalls, channel improvements, bridge/culvert improvements, retention/detention structures). Pre-determined criteria are used to evaluate and rank alternatives. Selected projects have been implemented using a mix of County and State funds.

Climate Action Commission. The Climate Action Commission was created in the Spring of 2020 to develop a Climate Action Plan for Prince George's County. The Climate Action Plan (CAP) aims to help the County reach its carbon emissions goal of a 50% reduction by 2030 (compared with 2005 levels). The goal aligns with the State's projection for 50% emission reduction by 2030 through the implementation of the Maryland 2030 Greenhouse Gas Reduction Plan and the Metropolitan Washington Council of Government's goals for the region. In January 2022, Prince George's County DoE submitted the official Climate Action Plan to the County Council and in July 2022, the Plan was adopted by the County.

A.5. Floodplain Management

A.5.a. Continued Compliance with the NFIP

Although the County's Floodplain Ordinance is the foundation for its participation in the NFIP, all of its programs and initiatives related to reducing flood hazards are evidence of the commitment to comply with and exceed the requirements of the federal program. **Table 125** shows community participation in the NFIP as of December 12, 2022.

Prince George's Floodplain Administrator and the County's Planning and Zoning Division of the Community Development and Code Compliance Department administer the County's floodplain

management ordinance, and therefore are responsible for enforcing the substantial damage provisions in the ordinance after a hazard event. This includes ensuring that repair or improvement to substantially damaged structures in any flood hazard area does not happen without a permit obtained from the County.

Substantial Damage

Damage of any origin sustained by a building or structure whereby the cost of restoring the building or structure to its condition before damage would equal or exceeds fifty percent (50%) of the market value of the building or structure before the damage occurred.

Table 125: Community Participation in the NFIP as of December 12, 2022

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date
245208A	Prince George's County	N/A	08/04/72	09/16/16	08/04/72
240053A	City of Laurel	08/09/74	11/01/78	09/16/16	11/01/78

Source: FEMA Community Status Book Report, Maryland, December 12, 2022

The Maryland Department of the Environment's Community Assistance Program conducts periodic Community Assistance Visits to review community performance. The report of the February 22, 2017 visit indicated that the program was in good standing and complimented the County on its commitment to strong floodplain management, which is also evidenced in its CRS rating of 5. The Community Assistance Visit report also praises the County's floodplain management ordinance, which contains numerous higher regulatory standards including prohibiting new buildings in the regulatory floodplain, the FEMA or County floodplain, whichever is more restrictive.

Program administration highlights include:

- Maintain Elevation Certificates on all new and substantially improved buildings, in computer format, and make copies available;
- Provide Flood Insurance Rate Map information and information on the purchase of flood insurance to inquirers; inform lenders, insurance agents, and real estate offices about the service;
- Maintain current Flood Insurance Rate Maps and copies of past effective maps;
- Conduct an annual outreach to floodplain residents;
- Require hazard disclosure as part of real estate transactions;
- Maintain materials on drainage problems and flood protection in the public libraries and provide assistance to inquirers and property owners;
- Develop new flood hazard data as part of the development review process and maintain and update changes to the flood hazard maps;
- Preserve open space in the floodplain (over 13,400 acres in stream valley parks) and maintain lots where buildings were acquired as open space;
- Encourage property owners to retrofit flood-prone buildings; and
- Review stormwater management proposals; maintain stormwater management and drainage systems and implement capital projects for drainage and flood control.

A.5.b. NFIP Community Rating System

The NFIP's CRS is designed to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. NFIP flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote awareness of flood insurance.

Prince George's County is rated as a Class 5 community, which translates to a 25% reduction in flood insurance rates for local residents and businesses located in mapped special flood hazard areas (and a 10% discount outside of mapped Special Flood Hazard Area s). The Class 5 rating places Prince George's County in the top 3% of over 1,000 communities nationwide that participate in the CRS.

In April 2022, The City of Laurel joined the CRS program. The City is classified as a Class 7 community, receiving a 15% premium discount for properties within the Special Flood Hazard Area and 5% discount outside the Special Flood Hazard Area.

A.5.c. Community Assistance Visits

The NFIP offers a Community Assistance Program that offers a Community Assistance Visit to a community by a FEMA staff member or staff of a state agency on behalf of FEMA. This visit provides technical assistance to the community and assures that the community is adequately enforcing its floodplain management regulations.

Community Assistance Visits typically consist of a tour of the floodplain, an inspection of community permit files, and meetings with local appointed and elected officials. If any administrative problems or potential violations are identified during a Community Assistance Visit the community will be notified and given the opportunity to correct those administrative procedures and remedy the violations to the maximum extent possible within established deadlines. FEMA or the state will work with the community to help them bring their program into compliance with NFIP requirements.

Communities that have participated in a Community Assistance Visit and the date of their most recent visits are shown in **Table 126**.

Table 126. Community Assistance Visits

Community Name	Community Assistance Visit Date
Prince George's County	February 22, 2017
City of Laurel	June 3, 2021

A.5.d. Public Information and Outreach

Prince George's County has a robust initiative to inform its citizens about flood hazards and related matters, including:

- Every June is declared "Flood Awareness Month" by the County Executive.
- The Department sponsors a booth with flood information at various fairs.
- The webpage has numerous pages with flood hazard information, including links to related sites.
- A telephone number is dedicated for citizens to use for questions about flooding and stormwater concerns.

- A direct mailing about flood hazards and mitigation measures is sent each June to about 3,700 owners of properties that are impacted by mapped flood hazard areas.
- A direct mailing consisting of s a letter and brochures about the NFIP goes to the 300 insurance agents, mortgage lenders, and real estate agents that do business in the County.
- GIS-based flood maps are used to respond to inquiries from homeowners, insurance companies, and lending institutions, about the location of properties and buildings with respect to the mapped floodplain.

A.5.e. Flood Warning Activities

Prince George's County recognizes that with approximately 3,800 buildings located in mapped Special Flood Hazard Areas scattered throughout the County, many are not subject to frequent or deep flooding and many will remain subject to some degree of flooding. In addition to the weather monitoring and notification activities of the Office of Homeland Security and Washington Suburban Sanitary Commission, DER has identified and implemented automated flood warning systems in three areas. Automated flood warning systems rely on a network of rain and stream gauges, and computer models, to monitor and predict conditions conducive to flooding.

A.5.f. Flood-Prone Structures and Elevation Certificates

Elevation certificates are prepared by surveyors and document the ground elevation, floor elevation, and other building characteristics. The County has approximately 760 certificates on file electronically and available to the public. Property owners may use certificates for flood insurance rating purposes and the County uses the detailed information to evaluate mitigation options. As funding permits, the County may collect additional elevation certificates.

A.5.g. Residential Mitigation Activities

The County's damage reduction program places considerable emphasis on mitigation of flood damage to residential properties. This emphasis is reflected in the criteria used to prioritize use of mitigation funds for acquisition and site modifications (floodwalls and grading). Interest in this program is typically generated after floods that cause damage. Since the mid-1980s, the County has accomplished numerous residential mitigation projects, such as the acquisition of flood-prone homes. Using combinations of County, State and federal funds, 75 homes have been acquired and the land dedicated to open space. During 2004, a FEMA grant was awarded to support acquisition of two homes. Since the 2010 hazard mitigation plan update, FEMA Hazard Mitigation Assistance program funds were used to acquire and demolish seven residential structures at high hazard due to the Piscataway Slope Failure which has been exacerbated during periods of heavy rain. The project cost was

$2,689,500 and since the property lots are in perpetual greenspace easement there will be no further development on this high-risk site. Residential Floodproofing. Using County funds, measures to protect 62 homes have been constructed, primarily using site grading and flood walls around entrances.

A.6. The Maryland-National Capital Park & Planning Commission (Planning)

The Maryland-National Capital Park and Planning Commission is a bi-county agency, created by the General Assembly of Maryland in 1927. The Commission's geographic authority extends to the great majority of Montgomery and Prince George's Counties. It has three major functions:

- The preparation, adoption, and, from time to time, amendment or extension of the General Plan for the physical development of The Maryland-Washington Regional District;
- The acquisition, development, operation, and maintenance of a public park system; and
- In Prince George's County only, the operation of the entire County public recreation program.

The Maryland-National Capital Park and Planning Commission's Planning Department is managed to help preserve and protect the County's resources by providing planning services and growth management guidance, and by facilitating effective intergovernmental and citizen involvement through education and technical assistance.

To fulfill its responsibilities, the Planning Department undertakes a wide range of planning activities and is responsible for certain reviews of development proposals. Because those activities are so extensive, **Section A.6.a** summarizes only the responsibilities of the two key offices involved in development review, and the role of the environmental planning and special project's sections in long-range planning. **Section A.7.b** highlights how natural hazards are recognized and addressed. **Section C** summarizes elements of the General Plan and the Green Infrastructure Plan that touch on natural hazards.

A.6.a. Development Review

The Maryland-National Capital Park and Planning Commission's Planning Department has a significant role in the review of development proposals for compliance with certain requirements contained in the Zoning Ordinance and the Subdivision Ordinance). The divisions within the department that are mainly responsible for these reviews are the Development Review Division and the Countywide Planning Division.

The Development Review Division is responsible for assisting customers to comply with the Zoning Ordinance and Subdivision Regulations through a managed review process. While development is viewed as the economic engine of the County, protecting the integrity of neighborhoods is equally important. The Development Review Division encourages growth in a way that is sensitive to the needs and values of neighborhoods. The Development Review Division consists of five sections:

- Zoning: Processes zoning map amendments, special exceptions, variances, special permits, certification of nonconforming uses, departures from parking and loading schedules, parking lot and loading area design, landscaping, and sign standards. The Subdivision Section processes preliminary plans and final plats of subdivision; reservation and vacation plats; and premise addressing.
- Urban Design Review: Processes comprehensive and specific design plans, conceptual and detailed site plans, and applications for alternative compliance from the Landscape Manual.
- Permit Review: Reviews site plans submitted with grading, building, signs, and use permits for conformance with the requirements of the Zoning Ordinance. Review comments are provided to the applicant and the County Department of Environmental Resources, which is the agency responsible for the acceptance, processing, and issuance of permit applications.
- Planning Information Services: Provides assistance with planning and zoning information research for specific properties, within Prince George's County. Also provides Zoning Certification and general information requests.
- Applications: Provides assistance to citizens seeking information on pending development applications and to those filing zoning, subdivision, and urban design applications. This work unit assigns application numbers, reviews applications for completeness, advises applicants on

advanced notification and sign posting requirements, and maintains and facilitates access to the official application files.

The Countywide Planning Division consists of four sections that work together on countywide issues providing planning services and technical support to the Planning Department and other County, State and regional agencies: Environmental Planning, Historic Preservation, Special Projects and Research, and Transportation Planning. The sections that have a role in addressing hazards are:

- The Environmental Planning Section prepares an overall review of environmental conditions affecting the site, using information as submitted in the natural resource inventory (NRI), the tree conservation plans, and in-house GIS databases and aerial photographs.
- The Special Projects Section of the Countywide Planning Division provides environmental support for the long-range plans of the Community Planning Divisions.

A.7. The Maryland-National Capital Park & Planning Commission (Parks)

The Maryland-National Capital Park and Planning Commission, Department of Parks & Recreation is charged with managing the public park and recreation system within Prince George's County. With more than 27,000 acres of parkland, the Commission strives to provide a balance between natural, undeveloped open space and land that is developed with recreational facilities and trails. The Maryland-National Capital Park and Planning Commission's improved properties include athletic fields and tennis courts, playgrounds, fitness trails, golf courses, outdoor pools, a trap and skeet range, an equestrian center, several lakes, ice rinks, an airport and miles of paved surface trails. Buildings include community center facilities, nature centers, many historic structures, house museums and sites, cultural arts facilities, Recreations Centers, multi-generation centers, a baseball stadium and the aviation museum in College Park.

A.7.a. Land Acquisition, Park Planning and Development

The M-NCPCC Park Planning & Development Division (PP&D) within the Department of Parks and Recreation provides the planning, engineering, design, landscape plan development, and construction management functions involved in bringing new parks and recreation facilities to the public. Each year, the Division acquires about 100 to 300 acres of land through the Maryland-National Capital Park and Planning Commission capital improvement funding, grants, mandatory dedication (subdivisions), and surplus property programs. Design, engineering, and management of park construction oversight is the responsibility of the professional in-house staff comprised of planners, landscape architects, engineers, surveyors, architects and construction inspectors.

A.7.b. Existing Facilities and Weather-Related Hazards

The Maryland-National Capital Park and Planning Commission monitors weather conditions and receives severe weather alerts from the Office of Homeland Security and the National Weather Service and the decisions of County Government regarding closures and delays are followed, except that programs for school children follow the notifications issued by the Prince George's County Public School System. Employees and constituents are advised to listen to local broadcasts for closures.

The Department of Parks and Recreation has a diverse force of maintenance personnel and equipment that allows it to deal with the effects of natural hazard events:

- For previous events, existing resources have been adequate to handle disaster recovery work. Maryland-National Capital Park and Planning Commission facilities have not experienced severe damage since Hurricane Agnes in 1972.
- Snow removal on Maryland-National Capital Park and Planning Commission's properties is a seasonal function. Additionally, the Maryland-National Capital Park and Planning Commission is part of the County's snow emergency plan and crews are designated to support snow removal on public streets. Priority is given to office buildings, community centers, and all operating and programmed facilities. Athletic fields, playgrounds, community and neighborhood parks are plowed after the programmed facilities are deemed accessible. Removal of tree debris from high winds or heavy snows is managed by in-house forces, either by chipping and spreading or disposal at the landfill. Sites are prioritized based on impacts. Area Operations staff are equipped with chain saws and tree removal gear and generally handle smaller, less complex tree and debris removals. Priority is given to blocked building entrances, sidewalks, access roads, and parking lots, followed by trails and woodland areas.
- Maintenance personnel are mobilized when major events are predicted. They are responsible for checking roof drains, securing buildings, and, if flooding is predicted, pulling docks at the Waterfront Park and Patuxent River sites.
- Mobilization of forces for preemptive maintenance is based on the predicted severity of an event, using up-to-date weather information.

A.8. Department of Public Works & Transportation

The Prince George's County Department of Public Works and Transportation administers a comprehensive transportation system that includes local public transit services. The Department has the following duties:

- Designs, constructs and maintains county's transportation infrastructure inclusive of roads, bridges, sidewalks, curbs, gutters, and roadside drainage.
- Plans, installs and maintains streetlights, roadway regulatory signs, pavement markings and traffic management devices.
- Landscapes and maintains grassy areas and trees in public rights-of-way including litter collection, debris removal, mowing, tree trimming and emergency tree removal.
- Reviews and issues permits for site development projects that include site grading, construction of roadway infrastructure, stormwater management facilities, street lighting and landscaping, as well as inspects and approves all construction before release of permit to ensure compliance to the County Code.
- Maintains flood control facilities, including pumping stations and the storm drainage network.
- Administers the county's Capital Improvement Project Program regarding transportation infrastructure.
- Coordinates with the Maryland State Highway Administration (SHA) on the planning, design, construction and operation of state highways within the county.
- Oversees the county's public transportation system (TheBus, Call-A-Bus and Call-A-Cab) and coordinates regional public transit services (rail and bus) with the Washington Metropolitan Area Transit Authority.

- Administers and enforces the county's Critical Area, Sediment and Erosion Control and Stormwater Management programs.
- Coordinates with Maryland National Capital Park and Planning Commission on the planning and design of site development projects in the county.
- Evaluates and test construction materials used on Capital Improvement Projects and permitted construction sites.
- Coordinates with local Soil Conservation District on site grading when applicable.

A.8.a. Requirements for Roads and Drainage

The Office of Engineering issues permits for site grading, stormwater management, roadway construction, utility construction within the rights-of-way or for construction within the Critical Area to those planning to develop a property or to perform work within the public right-of-way or on private property that will impact on the public road rights-of-way and/or the Chesapeake Bay area or its tributaries.

Requirements imposed through the permit process are intended to ensure that adequate and safe transportation infrastructure is constructed, effective sediment and erosion control is maintained, and requisite stormwater management design requirements are met. The Office of Engineering inspects all permitted construction projects throughout the construction period to ensure county code compliance.

The following detail additional hazard-related road and drainage requirements:

- **Flood-Resistance Requirements for Roads and Bridges**: In addition to meeting County requirements, road and bridge construction that impacts flood hazard areas or non-tidal wetlands must also be approved by the Maryland Department of the Environment. Bridges and culverts are expected to be stable during passage of the discharge equal to the 100-year flood. Design standards also include provisions for evaluating the potential for scour and providing appropriate protection against scour of abutments, piers, wing walls, and culvert inlets and outlets.
- **Unstable Soil Requirements**: Due to pothole and road damage from freezing and thawing cycles in areas with poor drainage (including Marlboro and Christiana clays), the Department determined it appropriate to mitigate damage by requiring deeper excavation, increased base thickness and additional underdrainage. Design requirements are found in the American Association of State Highway and Transportation Officials and State Highway Administration manuals and apply to roads improved by the county and those built by private developers.
- **Snow Load Requirements**: The American Association of State Highway and Transportation Officials bridge design criteria include accounting for anticipated snow load.

A.8.b. Road and Drainage Maintenance

Prince George's County maintains more than 1,820 miles of roadways ranging from low-volume rural and secondary roads to high-volume primary collector and arterial roadways. The Office of Project Management is responsible for inspection and improvement of bridges and drainage channels. The inspection reports help identify required maintenance work and are used to prioritize projects.

The Office of Highway Maintenance provides roadway infrastructure, litter control, and stormwater management to all users in the County in order to ensure a safe and aesthetically pleasing transportation system. The work is undertaken by several specialized crews with a total of more than 140 crew members. Office of Highway Management is charged with roadway patching and surfacing; bridge maintenance; pipe repair and replacement; ditch and channel maintenance and inlet and drainage pipe cleaning; driveway aprons; sidewalk, curb and gutter maintenance; and stormwater management facility

maintenance. Additional responsibilities include snow and ice removal, maintaining street trees, and maintenance of various flood control facilities.

The inspection program is an important aspect of maintenance of the system. More than 2,400 service requests are received from County residents annually. Inspectors respond within three working days, unless an emergency is reported, in which case the response is immediate. After high water events, an inspection is performed to determine if maintenance and repairs are warranted. A 24-hour emergency on-call program covers emergency service requests, and flood control and pumping station responses.

A.8.c. Flood Control Facility Maintenance

In the 1940s, the U.S. Army Corps of Engineers constructed the Anacostia Flood Control Project which includes more than three miles of levees (combined length along both sides of the Anacostia River). To manage drainage on the landward side of the levees, the Corps installed four pumping stations (Bladensburg, Colmar Manor, North Brentwood, and Edmonston). The Department operates and maintains pumping stations. Signals are transmitted when the pumps turn on automatically based on water levels. The Corps and the Department conduct an annual inspection of the levees, floodway channel and pumping stations. The Department is responsible for maintenance, including mowing, vegetation control, debris removal, and stabilization of erosion. The pumping stations receive quarterly and annual maintenance and testing of the electrical and mechanical equipment.

The U.S. Army Corps of Engineers constructed two other Flood Control Projects. The Upper Marlboro Flood Control project completed in 1964, which included approximately 1,950 linear feet of levee, 3,000 linear feet of channel improvements, 1,413 linear feet of new channels, and 4,430 linear feet of floodway clearing. The Forest Heights Flood Control project completed in 1964 included 4,160 linear feet of channel improvements, 2,250 linear feet of levee, and two drop structures. As with the Anacostia Project, the Corps and the Department conduct an annual inspection of the levee systems.

In addition to maintaining the Anacostia Flood Control Project, the County manages, and maintains several non-federal flood control projects:

- Sligo Creek Flood Control levee: built by the Washington Suburban Sanitary Commission in 1973.
- Northeast Branch Flood and Erosion Control Channelization (above East-West Highway): built by the Washington Suburban Sanitary Commission in 1976.
- Henson Creek Flood Control Levee and Channelization near Morningside: built by the Washington Suburban Sanitary Commission in 1972.
- Oxon Run Flood Control Levee near Green Valley Drive: built by the Washington Suburban Sanitary Commission in 1982.
- Oxon Run Tributary Floodwall: built by the County to protect homes and a school (completed 2004).
- Northeast Branch Flood Control Levee near Allison Street: built by the Washington Suburban Sanitary Commission.

A.8.d. Department of Public Works and Transportation Public Information

The Department's webpage provides topical information to the public, which includes, but is not limited to: snow and ice conditions, traffic management, planned and ongoing Capital Improvement Program road improvements, street repairs, traffic signals, signs and markings, street light repair and installation, storm drainage and other services such as litter and debris removal. The site includes contact numbers for customer service requests, as well as a state-of- the-art traffic center information, and press releases

concerning emergency conditions, road closings, and outreach activities are posted. A section of the website is devoted to Frequently Asked Questions which features a specific section about storm drainage.

A.8.e. Department of Public Works and Transportation and Natural Hazards

Weather is an important influence on the County's road system and stormwater management facilities in terms of the physical infrastructure and how the County prepares for and responds to events. Weather is monitored through the local news media and the National Weather Service. Four weather-related conditions are influential to hazards: snow/ice; heavy rain/flooding; extreme heat; and coastal erosion.

A.9. Washington Suburban Sanitary Commission

The Washington Suburban Sanitary Commission, a bi-county water and sewer agency, was established on May 1, 1918 to serve Montgomery County and Prince George's County. It is the eighth largest water and wastewater utilities in the country.

A.9.a. Dam and Reservoir Operations

Washington Suburban Sanitary Commission maintains its three dam reservoirs to comply with all federal and/or State requirements concerning the safety of the dam structures. The dams are periodically inspected and maintenance is performed regularly to assure safe functioning.

The T. Howard Duckett Dam located on the Patuxent River is rated as a "high hazard" dam because of the possible adverse incremental consequences that could result from the release of water due to failure of the dam or rainfall-runoff that exceeds design events in the watershed above the dam. Dams rated as "high hazard" are required by the Maryland Department of Natural Resources Dam Safety Division to be capable of safely passing the Probable Maximum Flood. At the time it was constructed in 1954 the Duckett Dam could pass the Probable Maximum Flood. Since that time the Probable Maximum Flood has been increased to 32 inches of rain in a 72-hour period. The statistical probability of such a storm is once every 10,000 years. The average annual rainfall in Central Maryland is 42 inches. The change to a more stringent requirement has resulted in Duckett Dam being deemed inadequate to safely pass this theoretical storm, mainly due to potential erosion of earth slopes and foundations. Due only to the dam's inability to safely pass such a storm, Maryland Department of Natural Resources characterized the dam as "unsafe" (such designation does not imply any imminent threat). Washington Suburban Sanitary Commission responded with a downstream slab scour protection project to allow the dam to safely pass the Probable Maximum Flood, which will remove the "unsafe" label from the dam. Construction was completed during 2012. An Emergency Response Plan, approved by the Maryland Department of the Environment, is coordinated with downstream jurisdictions.

The reservoirs are managed to optimize water supplies, not as a flood control system. Washington Suburban Sanitary Commission's operating protocols specifically address monitoring of weather conditions and management of water levels to minimize flood impacts when feasible. Water level is typically maintained with 3 feet of freeboard (corresponds to runoff from about 1 inch of rainfall in watershed). Water may be released from the reservoir if major runoff events are forecast. Under some release scenarios flooding occurs in the City of Laurel and other downstream areas in the County. Washington Suburban Sanitary Commission notifies city and county officials in advance of any releases that could cause flooding.

A.9.b. Construction of Water Supply & Sewer Lines

Washington Suburban Sanitary Commission constructs about eighty miles of new (or replacement) water supply lines and eighty miles of new (or replacement) sewer lines annually. Developers install water and sewer lines to Washington Suburban Sanitary Commission specifications; Washington Suburban Sanitary Commission takes ownership if inspections during construction indicate compliance with Washington Suburban Sanitary Commission requirements. Construction in the waters of the State, including installation of utility lines under streams and floodplains, as well as activities that impact non- tidal wetlands, is required to satisfy State regulatory requirements administered by the Maryland Department of the Environment. Washington Suburban Sanitary Commission administers the delegated State sediment control program for all utility construction in Montgomery and Prince George's Counties.

A.9.c. Water Supply Adequacy and Drought Plans

Washington Suburban Sanitary Commission has determined that water supplies on the Potomac River are "more than adequate" to meet current and future water needs (until 2030) of its service area (includes portions of Prince George's County and Montgomery County). Washington Suburban Sanitary Commission works with the Interstate Commission on the Potomac River Basin (ICPRB) Co-Op, a regional cooperative with the U.S. Army Corps of Engineers and Fairfax Water, monitoring all municipal and utility requests to withdraw additional waters from the Potomac River. The Interstate Commission on the Potomac River Basin prepares demand forecasts every five years to monitor the Washington metropolitan area's water needs with available flows.

In 2018, Washington Suburban Sanitary Commission participated in a drought exercise hosted by the Interstate Commission on the Potomac River Basin to test the mechanisms in the Potomac River Low Flow Allocation Agreement for allocating water during an extreme drought, and to explore the interactions between multiple drought management plans that encompass the Potomac River and the Washington Metropolitan Area. This exercise helped to address education and coordination needs, created momentum toward further improvement and preparation, and identified areas for improvement in drought response in the region.[170]

A.9.d. Washington Suburban Sanitary Commission and Natural Hazards

The two filtration plants on high ground to distribute water are not subject to flooding, although large flooding events could damage water intake structures (Hurricane Agnes runoff raised the Patuxent River level downstream of the T. Howard Duckett Dam almost to the top of the Rocky Gorge raw water pumping station). Although the wastewater treatment plants are located in low areas to facilitate gravity flow, only small portions of the properties of the three plants located in Prince George's County are located within mapped flood hazard areas. The majority of critical plant infrastructure is above the 100- year flood elevation.

More than fifty sewage pumping stations are located throughout the bi-county region; several may be located within the mapped 100-year flood hazard area, but critical operating equipment is set on floors above the flood elevation in accordance with state design guidelines. None has been damaged by flooding. Nearly all pumping stations have dual feed power supply or emergency generators as back up during power failures, which can occur during storm events.

Urban streams experience erosion and course changes, which occasionally expose water and sewer lines and manholes; infrastructure protection measures for stream crossings are undertaken in compliance with State permit requirements. Some projects to stabilize erosion and restore streams have

[170] Policy Works LLC. 2018 Washington Metropolitan Area Drought Exercise. https://www.potomacriver.org/wp-content/uploads/2019/03/DREX-Report_v4-for-distribution.pdf

been undertaken, typically in association with major sewer construction projects that are aligned along watercourses.

A.10. Department of Housing & Community Development

The Department of Housing and Community Development and the Housing Authority expands access to a broad range of quality housing by creating safe, well planned, attractive residential communities and enabling families to become self-sufficient and communities to become stable. Individuals and families with housing or community improvement needs are served. Special emphasis is given to low- and moderate-income people who live or work in the County. Department of Housing and Community Development carries out its mission through aggressive grant leveraging, creative financing, innovative planning, and productive partnerships with public, private and community-based organizations.

The Department's work is accomplished by two divisions and through two quasi-independent authorities:

- **Community Planning and Development Division**: Oversees and manages the Department of Housing and Urban Development planning and reporting documents and is responsible for coordinating and preparing the County's 5-year Consolidated Plans and Annual Action Plans for Housing and Community Development, and the Consolidated Annual Performance and Evaluation Reports. The Division is also responsible for oversight and management of the Federal programs: Community Development Block Grant (CDBG), Home Investment Partnerships Program (HOME), and Emergency Solutions Grants (ESG) funds, including the American Dream Down Payment Initiative (ADDI), CDBG Recovery (CDBG-R) and Homelessness Prevention and Rapid Re-housing Program (HPRP).
- **Rental Assistance Division**: Enables low-income families to rent from any landlord with Section 8 rental assistance.

A.11. Homeland Security

The Prince George's County Office of Homeland Security develops and maintains comprehensive emergency management programs through planning with federal, State, local officials, and the private sector, to develop a coordinated safety and preparedness strategy. The objective of this office is to protect life, property, and the environment from the effects of natural and man-made disasters, including terrorist acts.

The Office of Homeland Security responds to natural hazard events by providing shelter for displaced persons and facilitates rapid restoration of normal conditions. The Office of Homeland Security also coordinates volunteer programs to assist staff with its responsibilities during emergency incidents and disasters. The Office of Homeland Security provides the following services:

- Provides effective and orderly governmental control and coordination of the County's emergency response to reduce the impact such events may have on Prince George's County residents.
- Prepares and maintains the County's comprehensive Emergency Response Plan providing emergency management planning for the entire County.
- Provides Prince George's County residents, businesses, and non-profit organizations with emergency preparedness education and training necessary to reduce loss of life, minimize property damage, and protect the environment from emergencies and disasters regardless of cause.

- Serves as the liaison and coordinator of State/Federal financial assistance for municipalities and County residents following County declared disasters.
- Staffs and operates the Emergency Operations Center, which is the County's command post during serious incidents and severe weather occurrences.
- Serves as the liaison to the Maryland Department of Emergency Management and other local emergency management agencies and organizations.
- Coordinates the activities of volunteer, public and private agencies in all phases of emergency management (Preparedness, Response, Recovery, and Mitigation).
- Develops plans and exercises, and coordinates emergency management training for Prince George's County.
- Assures timely and adequate public warning of potential or imminent disaster events and provides disaster-related safety information to the public and media.
- Assists Municipalities, County, State, and Federal officials and their respective constituents with disaster preparedness, response, mitigation, and recovery programs.
- Provides the public and media organizations with accurate and timely information regarding emergency management programs and issues in Prince George's County.

The Office of Homeland Security routinely monitors weather conditions and forecasts reported by the National Weather Service and commercial television. When conditions warrant, the National Weather Service directly contacts the County and conference calls are conducted with neighboring counties and the State.

The Office of Homeland Security features a Preparedness Center on their website. This site has general preparedness resources, emergency preparedness guides, and information about natural hazards that impact the County. One of the preparedness resources is a Family Preparedness Guide, which has been published in both English and Spanish.

The County's Emergency Operations Center has cooling centers located throughout the County. These centers offer a cooling area with seating any time temperatures reach 90 degrees or higher. Residents can locate these centers on the map, shown in **Figure 91** or learn more information about cooling centers by calling 3-1-1.

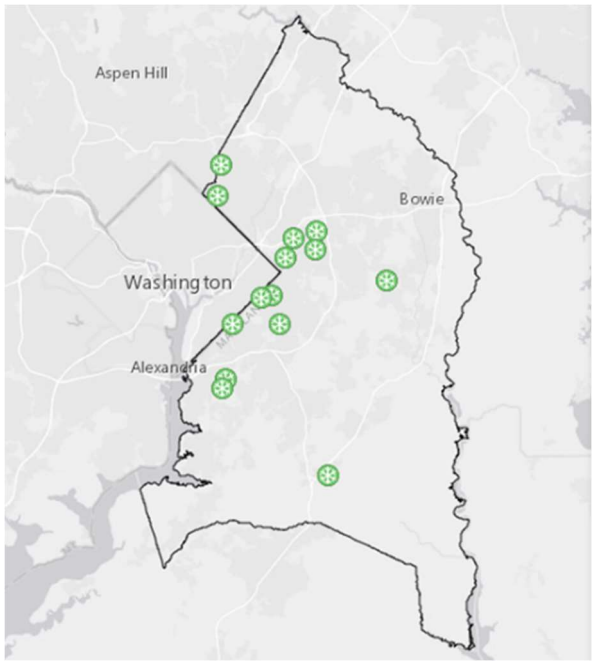


Figure 91: Cooling Centers in Prince George's County

A.12. Office of Central Services

The Office of Central Services administers centralized support services for the County, including facilities operation and management, contract administration and procurement, fleet management, real estate, construction, and administrative services.

The Facilities Operation & Management Division is responsible for the maintenance of county-owned and leased facilities. The Division oversees the operation of more than 100 County occupied buildings, including fire and police stations, County and State Court Houses, a child day care center, and the County's Correctional Facility. Facilities Operation & Management is also responsible for the overall management direction of the County's vertical construction program.

All work on County buildings, including construction of new buildings, work inside existing buildings, and additions to existing buildings, must comply with the Prince George's County Building Code and all other County requirements. Building permits are obtained and DER conducts inspections during construction.

The County is self-insured. During the past five years, county-owned buildings have not sustained significant damage due to lightning, wind, rain, snow/ice, or hail. County-owned buildings did sustain damage after Tropical Depression Lee in 2011 which resulted in construction of a floodwall to protect the County Administration Building in Upper Marlboro.

A.12.a. Prince George's County Public Schools

As outlined in the Quality Schools Program Strategic Plan, the School System faces opportunities and challenges as it pursues its mission to serve the education needs of the

County's citizens. The Prince George's County Public Schools functions as an agency of the State Department of Education. The operating budget is funded by the Prince George's County Government; the capital budget is funded by both State and County funds.

The Prince George's County Public Schools owns its inventory of buildings. The Department of Planning and Architectural Services is responsible for the capital improvement program, including acquisition of land for new facilities, planning renovations and additions to existing facilities, and disposal of surplus property. The Prince George's County Public Schools is self-insured for property damage.

A.12.b. Fire/Emergency Medical Services

The Fire/Emergency Medical Services Department is responsible for fire suppression, emergency medical services, fire prevention, fire and rescue communications, research, training and the coordination of the volunteer fire companies. In addition to responding to structural fires, the Department is responsible for coordinating the County's response to hazardous materials incidents and wildfires, as follows:

- **Hazardous Materials**: The Fire/EMA Department maintains the County's hazardous materials response plan and coordinates the Local Emergency Preparedness Committee, a federally mandated organization that operates under "community right to know" rules established by the federal government, primarily focusing on public awareness and hazardous materials. A database of the physical locations of certain hazards materials as reported in the Tier II reports required by the U.S. Environmental Protection Agency is maintained. Hazardous materials incidents are largely associated with transportation of materials.
- **Forest & Brush Fire**: At the state level, response to forest and brush fires is coordinated by the Maryland Forest Service, which also operates the Statewide Fire Monitoring System to collect fire weather data and determine fire danger ratings. Some department personnel are trained in wildland fire suppression.

A.13. Department of Family Services

The Department of Family Services ensures the development and provision of a comprehensive, responsible and effective community-based human service delivery system that enhances the quality of life for individuals and families of Prince George's County.

The Department's has seven Family Services Committees that are directly involved with citizens, many with special needs and vulnerabilities. Each of the committees has an affiliated agency which ensures that goals and objectives that are set by committees are met to support the County's vulnerable citizens. The seven committees are:

- Aging Advisory Committee
- Commission for Children, Youth and Families
- Commission for Individuals with Disabilities
- Commission for Veterans
- Commission for Women
- Social Services Board
- Commission on Fathers Men and Boys

The Department of Family Services activates outreach to its constituencies when extreme heat or prolonged cold spells may threaten health and safety.

B. City of Laurel Capability Assessment

The City of Laurel uses Maryland city management programs, policies and procedures outlined in a series of City Council Ordinances.

B.1. City Government Overview

The City of Laurel, Maryland is governed by a Mayor and City Council form of government in accordance with its Charter, adopted on April 4, 1870. The elected officials consist of the Mayor, serving a four-year term, and five Council members who serve two-year terms. The Mayor and City Council provide community leadership, develop policies to guide the City in delivering services and achieving community goals, and encourage citizen awareness and involvement:

- **Office of the Mayor**: The Mayor is the Chief Executive of the City with all the powers necessary to secure the enforcement of all ordinances and resolutions passed by the City Council. As the leading elected official of the City, the Mayor is empowered to approve or veto legislation, prepare the annual budget, and directly supervise the administration of the City. The Mayor has authority to declare emergencies and has broad emergency powers during a declared emergency.
- **City Council**: The City Council, as the legislative body of the City of Laurel, appropriates funds, considers and enacts resolutions, and adopts regulations and ordinances for the protection of rights and privileges, peace and good government, and safety and health of all citizens.

The key elements of the City's organization engaged in planning for, responding to and mitigating natural hazard events as well as regulating land development are:

- **City Administrator**: The City Administrator carries out the charges of the Mayor and City Council through day-to-day management, support, and oversight of all City departments and functions.
- Police Department. The Laurel Police Department is a full-service law enforcement agency. In addition to its law enforcement responsibilities, the department works with the Emergency Manager to alert citizens to pending flooding. Police officers have the authority to provide control during situations that may create threats to life and property.
- **Economic and Community Development**: The Department of Economic and Community Development maintains and oversees the built environment within the City of Laurel. The department is responsible for zoning compliance, subdivisions, development and historic preservation review, economic development, affordable housing and implementation of the City's Master Plan. These activities are intended to improve the quality of life in the City. The City's zoning authority is independent of Prince George's County. Article IV, Division 1 of the City's Unified Land Development Code outlines the Floodplain Management Regulations.
- **Public Works**: Public Works provides engineering planning, design, and construction administration for street rehabilitation and construction projects on City property. Technical support is provided to other City departments. It conducts engineering review of plats and plans for subdivisions and site plans for single lot developments. To assure compliance with City requirements, subdivision improvements are inspected during construction. The department maintains record drawings of construction improvements and topographic maps, develops and implements the Capital Improvement Program (CIP).

- **Budget and Personnel Services**: The Department administers all of the financial activities of the City government, administration of all employee benefits and advises and assesses the City management staff in all other personnel matters.
- **Parks and Recreation**: Parks and Recreation maintains the City's 21 park and recreation facilities and approximately 288 acres of parkland and associated equipment. It is responsible for developing and implementing recreational programs. During times of emergency the department is responsible for opening shelters and procuring food. The City's two shelters have been certified by the American Red Cross (and both are outside the mapped floodplain).
- **Emergency Management**: The Emergency Manager (EM) is the City's designated official responsible for managing the Emergency Operations Center (EOC) during activations to support the Incident Commander responding to and mitigating all hazard emergency incidents. The EM is responsible to identify, develop, and implement rules, regulations, and policies regarding the preparedness, mitigation, response, and recovery from disasters within the City boundaries. During normal operations the EM works for the Emergency Services Director and coordinates closely with the City Administrator. However, during emergency activations the EM works directly for the Mayor and coordinates with the Emergency Services Director and the City Administrator to ensure the management of resources during these incidents. Additionally, the EM is the City's designated Floodplain Manager who works closely with and coordinates with the Department of Economic & Community Development on all floodplain issues within the City of Laurel.
- **Emergency Services Department**: The Department of Emergency Services (ES) reports to the City Administrator's Office and the Deputy City Administrator is the Director of Emergency Services. The department coordinates activities associated with the Laurel Police Department and the two fire service departments within the City (Laurel Volunteer Fire Department & Laurel Volunteer Rescue Squad) regarding providing emergency services to the citizens of Laurel. The Emergency Services Department provides guidance and leadership to the Emergency Operations Center's Policy Room during emergency activations and major incidents within the City. Additionally, the Emergency Services Department coordinates the activities of the Emergency Manager and all associated programs within the emergency management field.

B.2. City of Laurel Master Plan

The City of Laurel strives to maintain a high quality of life for its citizens through the regulation of land uses and the protection of natural resources. The City approved a Comprehensive Master Plan in 1961 and subsequent Master Plans in 1974, 1989, 1997, and 2008, amended September 28, 2009 by City Ordinance Number 1647. The most recent City Master Plan was adopted by City Council through Ordinance Number 1873 on September 26, 2016. The Master Plan is kept on file and available for inspection at the office of the clerk to the city council and is available online.

B.3. Development Controls

The Unified Land Development Code was adopted on September 26, 2016 with the Master Plan through Ordinance Number 1877. Various governmental functions related to land use, development and re-development are administered through this code and amendments, as outlined in the sections below.

B.3.a. Sectional Map Amendment

The City has adopted the Sectional Map Amendment which coordinated the City Zoning Map with the proposed Land Use Categories approved in the Master Plan Comprehensive Land Use Plan Map. The Sectional Map Amendment was enacted to bring zoning in compliance with the Master Plan. Approval of any future Zoning Map amendments will be predicated upon findings as stipulated in Land Use, Division I. Single- Jurisdiction Planning and Zoning, Maryland Land Use Code Annotated (2014) as may be amended.

B.3.b. Comprehensive Land Use Map

As in the previous master plans, a study area outside the City's corporate limits is considered. General land use proposals are made for those areas surrounding the City which are integral to the functioning of the City. Development on the boundaries of the City has and will continue to have an impact on the City in terms of the quality of life and the ability to deliver services to City residents. Land use recommendations are made in anticipation of future development.

B.3.c. Zoning Regulations

The City Zoning Regulations, contained within the Unified Land Development Code, chapter 20 of the Laurel City Code, is a major tool which implements the goals and objectives of the Master Plan. Within the Code are the specific regulations that detail permitted uses and the location of buildings in relation to the land. The City of Laurel pursuant to the authority vested in it by Title I – V inclusive, of Article 66(B), as amended, of the annotated Code of Maryland (1957 Edition) adopted City Ordinance Number 427 on January 9, 1961 creating and establishing regulations dividing the City into districts or zones for zoning purposes.

The City of Laurel Land Development Code provides for twenty-three individual zoning districts organized into five general zoning classifications: residential, commercial, office, industrial and planned development. The Code also provides for revitalization, neo-traditional, mixed use, transit-oriented and arts & entertainment overlay areas to supplement the "by right" development options available within the five zoning classifications.

B.3.d. Subdivision Regulations

Subdivision regulations provide for orderly growth and well- planned development by setting standards for the uniform control of development which involves the subdivision of land into more than one parcel. Subdivision regulations should encourage a desirable relationship of subdivision design to the general physical characteristics of an area and also encourage preservation of natural attributes to foster compatibility of development with the natural character of the land. Subdivision regulations should also provide standards for density, open space, suitable building space, and vehicular and pedestrian traffic. Requirements for the provision of potable water, sanitary sewer, stormwater drainage, and other utility systems are established within these regulations. Other factors, such as the limitations on development created by steep slopes, soils type(s), and flood plains are also contained in the Subdivision Regulations.

The City of Laurel pursuant to the authority and provisions of Titles I – IV, inclusive, of Article 66(B) of the Annotated Code of Maryland (1968 Edition, as amended) and pursuant to the authority and provisions of the Charter of the Mayor and City Council of Laurel adopted City Ordinance Number 476 on April 14, 1969 establishing subdivision regulations governing procedures for approving preliminary plans and final plats, design standards for streets, alleys, easements, blocks, lots, public sites and open spaces, required improvements of paving, stormwater drainage, potable water supply, and sanitary sewers. These regulations have been updated frequently; most recently through the On December 23, 1974 the Mayor

and City Council adopted City Ordinance Number 525, a comprehensive amendment to the City Subdivision Regulations. The Regulations have been amended, as necessary, to comply with State regulations and subsequently adopted Master Plans.

B.3.e. Historic Districts

On November 10, 1975 the Mayor and City Council adopted City Ordinance Number 535 creating the City of Laurel Historic District Commission. In May 1978 Historic Districts Number 1, 2 and 3 officially recognized in order to safeguard the heritage and atmosphere of the older sections of the City. Historic District Number 4 was established in May 1979, District 5 in May 1980, District 6 in July 1981and District 7 in September 1983. In accordance with the powers afforded under Article 66(B) of the Annotated Code of Maryland, the Historic District Commission, through the Building Permits process, oversees all construction, improvements, and requested demolitions within the seven (7) Historic Districts. Decisions made by the Commission are based on a Historic District Design Guidelines meant to ensure the retention of Laurel's historic structures. As a part of this program the City also offers a tax credit program to encourage public participation.

B.3.f. Housing-Property Maintenance Code

A property maintenance code governs the maintenance of existing residential structures and all existing premises and constitute minimum requirements and standards for premises, structures, equipment and facilities for light, ventilation, space, heating, sanitation, protection form the elements, life safety, safety from fire and other hazards, and for safe and sanitary maintenance.

In September 1977, the Mayor and City Council adopted a Housing-Property Maintenance Code for single-family and multi-family dwellings within the City that established minimum standards governing the condition and maintenance of dwellings, multi-family dwellings and dwelling units. The City of Laurel adopted the Prince George's County Housing Code in August 1983 and made a concentrated effort of enforcement through a residential rental licensing process.

The rental licensing program is a program that sets minimum property maintenance standards that must be met by all rental property owners. This includes multi-family, single-family detached, townhouse, duplex, condominium, apartment units above or below businesses and individual rooms rented out. All rental units are re-inspected every three (3) years. This program is effective in maintaining a higher level of quality and safety among rental dwellings.

The Mayor and City Council subsequently adopted the Building Officials and Code Administrators International, Inc. 1990 Edition of the National Property Maintenance Code in November 1993, the 1998 Edition in February 1999, the 2006 Edition in April 2009. The International Code Council (ICC) 2012 Edition of the International Property Maintenance Code was adopted in July 2012, the 2015 Edition in April 2015, and the 2018 Edition in 2021.

B.3.g. Building Code

A Building Code regulates the construction of buildings and structures. The purpose of the Code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards.

The Mayor and City Council of Laurel adopted a Building Code in July 1954 to regulate the design, construction, alteration, repair, equipment use, location, occupancy, maintenance, demolition and removal of buildings and structures. The City has over time amended and reorganized the provisions of the Building Code to keep-up-to-date with the latest edition of the International Building Code. The Mayor

and City Council adopted the International Code Council International Building Code, 2018 Edition in July 2021. The building codes include provisions to ensure that buildings are designed and constructed to resist certain environmental loads. The minimum design must account for loads associated with a basic wind speed (3-second gust) of 115 miles per hour. The minimum snow load for roof design is 30 pounds per square foot.

B.3.h. Floodplain Management

Tropical Storm Agnes in June 1972 generated the flood of record in Laurel where Washington Suburban Sanitary Commission measured high water marks that indicated the recurrence interval of the event was slightly greater than the 1 percent-annual-chance flood (100 years). This event continues to influence the City's approach to floodplain management and public safety 45 years later.

The most significant natural hazard that impacts Laurel is flooding, particularly flooding of the Patuxent River, which is shown in the 100-year floodplain in **Figure 92**. A large water supply dam that is owned and operated by the Washington Suburban Sanitary Commission is located immediately upstream of I-95 above the City. Three Patuxent tributaries flow through the City: Walker, Crow and Bear Branches.

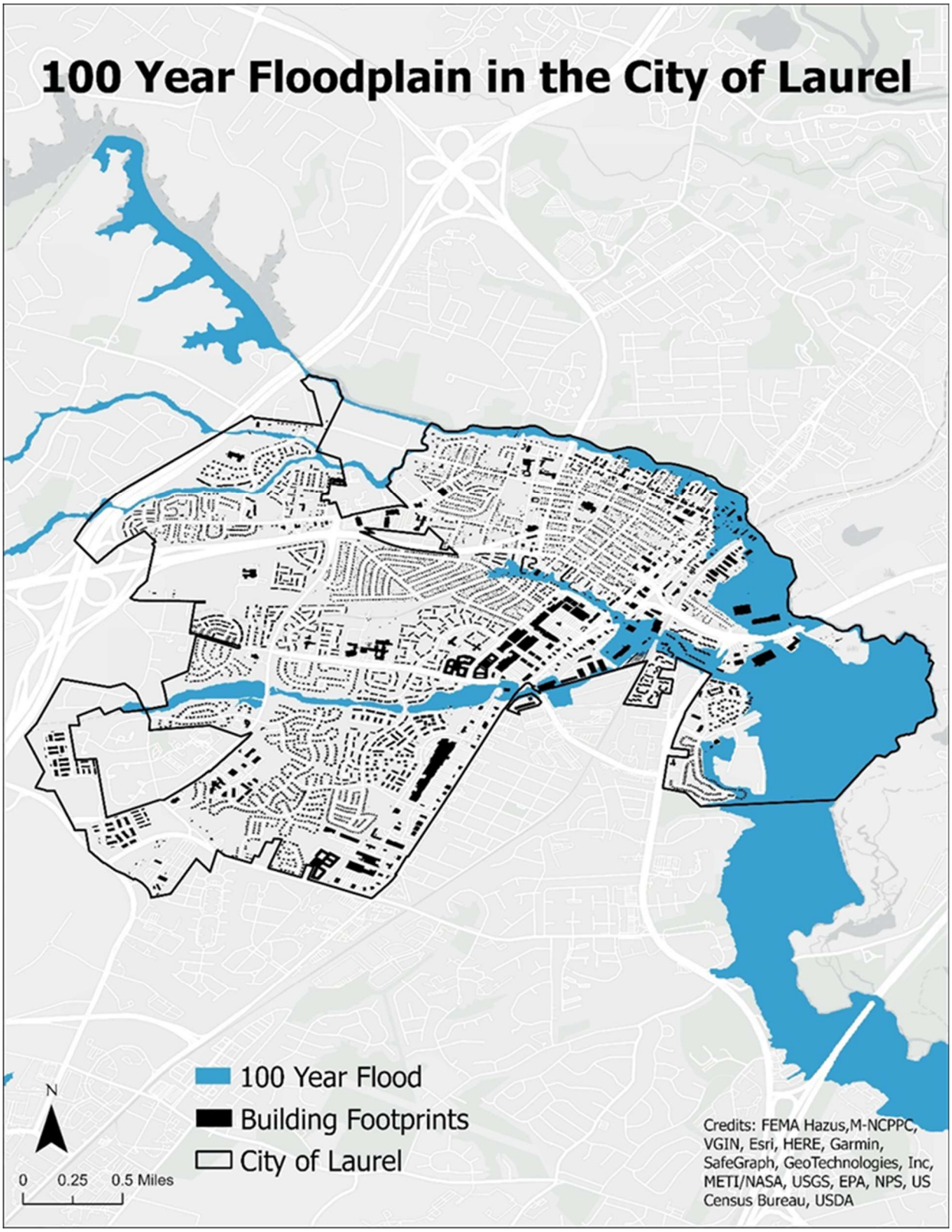


Figure 92. City of Laurel 100-Year Floodplain

Laurel has two distinct types of flood risk. The more probable risk is riverine flooding due to prolonged rainfall that causes waterways to overflow their banks and which may prompt Washington Suburban Sanitary Commission to open floodgates. Although failure of the dam is extremely unlikely, the consequences associated with dam breach have been examined. Due to the City's proximity to the dam, City officials are in regular communications with Washington Suburban Sanitary Commission and participate in periodic exercises of the emergency plan and notification procedures.

B.3.h.1. National Flood Insurance Program

The City of Laurel does not have any properties that are designated by FEMA as "repetitive loss properties" (insured by the NFIP and have received two or more flood insurance claims of at least $1,000) or "severe repetitive loss properties" but continues to monitor property status annually. The City adopted new flood insurance rate maps, the Special Flood Hazard Area and a new, updated floodplain management ordinance, which is Article IV of the Unified Land Development Guide on September 16, 2016 through City Ordinance 1868. As with all city ordinances, the Floodplain Management Ordinance is accessible online.

The City of Laurel entered the CRS on April 1, 2022, and the current effective date for the program is April 1, 2022. The NFIP CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risks. The City's class is ranked as 7, which gives a 15% premium discount to properties in the Special Flood Hazard Area, or regulated floodplain, and 5% premium discount for non-Special Flood Hazard Area properties.[171]

B.3.h.2. Ordinances and Regulations

The City of Laurel administers regulations and ordinances to regulate flood hazard areas to minimize exposure of people and property. Administration of the floodplain management ordinance is the joint responsibility of the City's Floodplain Manager (Director of Economic and Community Development) with assistance from the Emergency Manager. They are, therefore, also responsible for enforcing the substantial damage provisions in the ordinance after a hazard event. This includes ensuring that repair or improvement to substantially damaged structures in any flood hazard area does not happen without a permit obtained from the City.

Substantial Damage

Damage of any origin sustained by a building or structure whereby the cost of restoring the building or structure to its before damaged condition would equal or exceed fifty (50) percent of the market value of the building or structure before the damage occurred. Also used as "substantially damaged" structures.

The current Flood Insurance Rate Map (Panel #240053 0001E, revised 9/16/16) is used as the minimum flood hazard area within which development must conform to floodplain management regulations in the City of Laurel. If a floodplain has not been delineated, the City can require applicants to provide a survey that evaluates and defines the flood hazard area. All proposals for work in flood hazard areas are subject to the requirements of the Maryland Department of the Environment. The City requires applicants to obtain all State permits prior to issuing the local permit.

[171] FEMA. n.d. "Community Status Book Report- Maryland"

The City's standard procedure for determining the extent of the mapped flood hazard area through ground-truthing is to measure off of the centerline of the waterway shown on the flood hazard map and apply that distance to the applicant's site plan. In areas where Base Flood Elevations are shown, there is no cross check with the topography and the flood zone is superimposed on the site plan. For individual building permits issued for single lot development, the City requires owners to submit an Elevation Certificate to document compliance before the Use and Occupancy Permits are issued.

The Subdivision Regulations of the City of Laurel outline the requirements for the design, review and approval of subdivisions. The City expressly restricts the subdivision for development of any real property which lies within the fifty-year floodplain of any streams or drainage courses. Preliminary plans (plat plans) are required to show waterways, drainage structures, and flood elevations and boundaries of flood-prone areas (including floodways). Where a proposed subdivision includes a floodplain area and the area is to be left in open space, the area is placed in a floodplain easement or made available for public park or recreation uses. Areas under a floodplain easement may be used for utility lines or storm drainage facilities.

In approved subdivisions that include floodplain areas, development permits are not issued for any type of new construction within the area delineated as floodplain. Platted lots may include flood hazard areas (or other areas deemed to be "unsafe land") provided proposed building sites meet zoning setbacks, 100-foot setback from the edge of a watercourse shown on the flood insurance rate map plus an additional 25-foot setback from the floodplain. If the proposal includes fills or other structure elevating techniques, levees, channel modifications, or other methods to overcome flood or erosion-related hazards, they must be designed in compliance with the City's flood hazard prevention requirements.

Applicants for work on existing buildings are required to submit the value of work proposed. For work on floodplain buildings, that value is compared to the assessed value as a screening for whether the proposed work constitutes a substantial improvement (50 percent or more of market value). Every application for renovation, improvement, or repair of existing buildings is checked to determine if the building is located in the mapped flood hazard areas. The City's Floodplain Manager or an authorized designee must review and sign-off on any permits for work on existing flood-prone buildings.

For the rehabilitation of structures within the floodplain, the City requires mitigation efforts where possible. Most structures already in the floodplain are slab-on-grade. Elevation Certificates are required before any permits are issued to insure that, in as much as possible, that floor elevation changes are such that the grade of the finished first floor is above the floodplain elevation and that all electrical outlets are at least 1.5 feet above the flood elevation.

The Maryland Department of the Environment periodically conducts a compliance audit of the City's floodplain permitting and review activities. The City has consistently been found in compliance since 1978 (confirmed by the most recent visit was December 21, 2010), when the City began participation in the NFIP. The most recent Community Assistance Visits for the City of Laurel in November 2020 and June 2021 found Laurel's administration of their floodplain management program to be in good standing.

B.4. Fiscal Programming

The Capital Improvement Program is a fiscal plan, or a schedule, for financing public improvements over a period of time. The schedule balances the City's need for public improvement with its ability to finance improvements. It spreads the improvements over a six (6) year period in order to stabilize expenditures and to avoid sharp fluctuations in ad valorem tax rates. With capital programming it is possible to reconcile major improvements with financial resources.

The Capital Improvement Program is developed using the general guidelines outlined in the Master Plan. These guidelines for growth and development help City officials to anticipate the need for public improvements by approximating the period by which facilities must be in place and by determining the type of facility needed. The plan, in delineating future development and population levels which are based on phasing considerations, presents the factors which influence the demand or need for future public facilities and other capital expenditures and the general framework required for capital expenditure.

The City Capital Improvement Program is updated annually to provide a continuous plan for the scheduling of major capital expenditures and for formulating the annual City budget.

Annual revisions include the addition of a capital budget to fund projects in the next fiscal year. As the Capital Improvement Program is updated, proposed improvements are reviewed against Master Plan goals and objectives to insure consistency. The budget proposed for Fiscal Year 2023 is $11,942,563 in new project funding; and $14,183,286 requested for reauthorization. The Capital Improvements Program budget for Fiscal Year 2023 includes $2,052,741 for hazard mitigation.

B.5. Code Adoption

On July 26, 2021, The City approved Ordinance 18-46, which officially adopted the following Codes:

- The International Building Code, 2018 Edition. (Ref: COMAR 05.02.07)
- State of Maryland Fire Prevention Code, 2018 Edition.
- The International Residential Code for One and Two-Family Dwellings, 2018 Edition. (Ref. COMAR 05.02.07)
- The International Mechanical Code, 2018 Edition. (Ref: COMAR 05.02.07)
- The International Existing Building Code, 2018 Edition. (Ref: COMAR 05.16)
- The Maryland Accessibility Code.(Ref: COMAR 05.02.02)
- The International Energy Conservation Code, 2018 Edition (hereinafter referred to as the "Energy Code"). (Ref. COMAR 05.02.07)
- International Swimming Pool and Spa Code, 2018 Edition.
- The National Electrical Code, 2017 Edition. (Ref: COMAR 05.02.07)
- National Fire Protection Association, NFPA Codes, 2018 Edition.
- The International Property Maintenance Code (IPMC), 2018 Edition. (Ref: COMAR 05.02.01)
- The National Electrical Code, 2017 Edition. (Ref: COMAR 05.02.07)

B.6. Communicating with Citizens

The City of Laurel actively communicates with its residents using a variety of media, each of which can be used to convey information about preparing for and responding to natural hazards:

- The monthly newsletter, MayorGram, is posted on the City's web page, emailed to all residents and businesses that sign up for it, and is available in hardcopy at all City facilities. The newsletter reports on City activities and progress on various initiatives, and informs readers about upcoming activities and events. It is available to convey information important to the residents relating to hazard and how to mitigate the effects. Content related to flooding and flood safety has been addressed.

- Several documents related to preparing for disasters and emergencies can be downloaded from City's web page, including brochures specific to tornadoes, winter storms, heat waves, and hurricanes (also in Spanish).
- The City's regulations are accessible through the web page and public access to GIS maps is provided through the Prince George's County's and the Maryland-National Capital Parks and Planning Commission's online applications and web viewers.
- The Streets & Drainage page on the County's web site includes answers to typical questions posed by citizens.
- The local government public access video channel is accessible to residents who subscribe to cable and internet providers and through the City's streaming video link (www.laurel.md.us/streaming). Mayor and City Council meetings, other public meetings and critical watches, warnings and mitigation efforts are shown on this channel.
- After major flooding, the City posts information on the public access video channel, including information about the City's post-disaster permitting requirements.
- Local AM/FM radio station broadcasts emergency information on an as-needed basis (AM 600, 630, 980, 1090, 1500 and FM 88.1, 95.5, 103.5.
- Door hangers, email, telephonic messages and targeted direct mailings have been used after floods to inform people of their post-flood responsibilities; the contact/mailing list is considered to be comprehensive, including addresses in the floodplain and other homes that have flooded.
- City Emergency Response staff offer briefings to residential associations and business groups to improve awareness of natural and man-made hazards.

B.7. Natural Resources

The City of Laurel values its open space and encourages protection of trees and wetlands in its development processes. Activities proposed within wetland areas must be approved by the Maryland Department of the Environment under state statute and by the U.S. Army Corps of Engineers under the authority of Section 404 of the Clean Water Act.

The following describe the City's ordinances related to open space and forest conservation:

- **Open Space** – Open Space is addressed in the City's Subdivision Ordinance (Sections 15-7 and 15-8). The City may require up to 10 percent of gross area or water frontage for park, school or recreational purposes. The location of set-aside areas are to be approved by the Parks and Recreation Director using a ratio of one acre of park for every 100 dwelling units. Areas must be appropriate in area, shape and terrain for intended park uses. City may elect to accept a fee as alternate to dedication, in whole or in part, to maximize accessible locations.
- **Forest Conservation (Ordinance No. 1079)** – In 1992, the Mayor and City Council adopted the Forest Conservation ordinance to comply with State requirements. Applications for subdivisions and plan approvals, site plan approvals, development plan approvals, grading permits or sediment control permits for an area of land of forty thousand (40,000) square feet or greater shall submit a forest stand delineation and a forest conservation plan. Methods to protect delineated forest stands and trees during construction shall be accomplished using methods approved by the department, as provided in the Forest Conservation Technical Manual. The City submits Forest Stand Delineations and Forest Conservation Plans to the Maryland Department of Natural Resources for review of all development proposals.

B.8. Ongoing & Previous Mitigation Initiatives

This section highlights Laurel's activities and programs that reduce the impact of natural hazards. **Section C** summarizes measures described in other sections for reference.

- **Revised Flood Insurance Rate Maps**. Engineering studies to revise the floodplain maps resulted in revised Flood Insurance Rate Maps which were reviewed during a lengthy public review process during 2015 and 2016. The maps were formally adopted by the City Council on September 16, 2016. The revised maps show somewhat higher flood elevations than shown on the previous Flood Insurance Rate Map.
- **Property Mitigation**. Flood prone properties are identified during the hazard mitigation planning cycle. Three properties were identified last time: one has been acquired and demolished and mitigation solutions are being sought for the others. As mentioned previously, priority mitigation projects have been identified by the City's consultant and a pathway for funding is being explored.
- **Stormwater Management**. Working with The Maryland Department of Environmental Resources and Prince George's County Department of Environment the City will attempt to alleviate several concerns relating to stormwater runoff that affects several residential areas that are outside of the floodplain as shown on the FEMA map. Stormwater management for the City is administered through the Prince George's County Department of Environment.
- **Drainage Maintenance**. Prince George's County is responsible for public drainage infrastructure in the City. However, due to its proximity to the Patuxent River, the City recognizes the critical importance of adequate drainage and biannual inspections of storm drains and cleans inlets to reduce blockage.
- **Insurance for Public Buildings**. The City maintains property insurance coverage on its buildings to cover damage due to structural fire, wind and lightning and flood. Three NFIP flood insurance policies are in effect for buildings that form the Laurel Municipal Swimming Pool which is in the floodplain of the Patuxent River.

C. Summary of Existing Mitigation Activities

Table 127 highlights measures and programs in Prince George's County and the City of Laurel governments that reduce the impact of natural hazards.

Table 127. Summary of County and City activities that reduce hazard impacts

Hazard	Activities
Prince George's County	
Flood	• Department of Environment provides online/handout information to inquirers; site-specific flood hazard information, advice on flood insurance and measures to minimize damage • Department booth at festivals includes flood mitigation and safety materials • June is Flood Hazard Awareness Month • Master Plan sets forth policies to preserve environmental features (Maryland-National Capital Park and Planning Commission; Department of Environment) • Zoning Ordinance includes Chesapeake Bay Critical Area Overlay Zone (Maryland-National Capital Park and Planning Commission; Department of Environment) • Green Infrastructure Plan calls for conservation of natural areas, including flood hazard areas (Maryland-National Capital Park and Planning Commission; Department of Environment) • Developers required to delineate flood hazard areas and wetlands as part of subdivision review layouts and building permits (Maryland-National Capital Park and Planning Commission; Department of Environment) • Flood hazard area protection and damage-resistant measures imposed through subdivision regulations and floodplain management code requirements (Maryland-National Capital Park and Planning Commission; Department of Environment) • County participates in the NFIP's CRS (Department of Environment) • Management of increased stormwater runoff required as part of new development (Department of Environment; Department of Public Works and Transportation) • Department of Environment identifies, designs and implements structural and nonstructural projects to reduce flood damage • Department of Environment and Office of Homeland Security operate flood-threat recognition and warning capabilities • Department of Public Works and Transportation and State standards minimize flood risks and damage for roads, bridges and culverts • Department of Public Works and Transportation operates flood control pump stations • Department of Public Works and Transportation inspects drainage ways, maintains channels and levees • County and U.S. Army Corps of Engineers in discussions regarding maintenance and upgrades of the Anacostia River levees • Washington Suburban Sanitary Commission monitors weather and predicted storm activity to manage reservoirs • The Maryland-National Capital Park and Planning Commission acquires and maintains open space, including active recreational areas and passive open space

Hazard	Activities
	• Prince George's County Public Schools avoids selecting new school sites that are affected by mapped flood hazard areas • Flood warning system notification lists updated with flood-prone properties based on revised flood maps. General flood warnings delivered to the public through traditional and social media platforms such as the Office of Homeland Security website, Twitter, and Facebook.
Winter Storm	• Department of Environment enforces the State building code with criteria for design snow load for buildings and structures • Department of Public Works and Transportation requires bridge designs to account for snow load • Department of Public Works and Transportation has snow removal plans and capacity • Department of Public Works and Transportation has brochures and online content related to snow emergencies and snow removal (in English and Spanish) • Several agencies monitor weather and developing conditions (Office of Homeland Security Department; Department of Public Works and Transportation; Department of Environment, Schools) • Family Services does outreach to elderly
High Winds/ Tornado	• The State building code is enforced with criteria for design wind load for buildings and structures • Several agencies monitor weather and developing conditions (Office of Homeland Security; Department of Public Works and Transportation; Department of Environment, Schools) • Office of Homeland Security coordinates with other agencies to operate Alert Prince George's system for citizen notification; • Housing Authority retrofit public housing facility with code-compliant window assemblies
Severe Storm	• The State building code is enforced with criteria for wind design load and lightning protection for buildings and structures • Several agencies monitor weather and developing conditions (Office of Homeland Security; Department of Public Works and Transportation; Department of Environment; Schools) • Office of Homeland Security coordinates with other agencies to operate Alert Prince George's system for citizen notification; recovery presentations online/cable
Drought	• Washington Suburban Sanitary Commission manages reservoirs for water supply • Metropolitan Washington Council of Governments Water Supply and Drought Awareness Response Plan • County and City participate in regional planning initiatives (Washington Suburban Sanitary Commission, Washington COG) • The Maryland-National Capital Park and Planning Commission complies with water restrictions, focusing limited water supplies on unique horticultural resources, including champion and historic trees and irreplaceable resources
Wildfire	• Fire/ Emergency Medical Services coordinates with Department of Natural Resources for wildland fire response • Fire/ Emergency Medical Services has some personnel trained in wildland fire suppression

Hazard	Activities
Dam Failure	• Washington Suburban Sanitary Commission periodically inspects dams and performs regular maintenance to assure safe functioning • Washington Suburban Sanitary Commission's Emergency Response Plan for Rocky Gorge Dam (Duckett) is approved by the Maryland Department of the Environment and is coordinated with downstream jurisdictions • Washington Suburban Sanitary Commission notifies the City of Laurel in advance of releases that may cause flooding
Extreme Heat	• Family Services does outreach to elderly residents • Department of Public Works and Transportation's road and bridge standards for expansion joint and improvements in joint materials minimize damage due to extreme heat
Landslide	• Department of Public Works and Transportation requires roads to have deeper excavation, increased base thickness and additional underdrainage in areas with poor drainage (Marlboro and Christiana Clays) • Preliminary plans for subdivisions must depict steep slopes and unstable soils (Maryland-National Capital Park and Planning Commission) • Subdivision of land may be restricted or prohibited if found to be unsafe for development, which may be due to natural conditions such as, but not confined to unstable soils or severe slopes (Maryland-National Capital Park and Planning Commission) • Department of Environment enforces the State building code with addresses unstable soils, giving the code office authority to require special measures • Grading permits may be denied no reasonable corrective work will eliminate or reduce settlement, slope instability or geological hazards to persons or property (Maryland-National Capital Park and Planning Commission; Department of Environment)
City of Laurel	
Flood	• Enforcement of floodplain management requirements. • The Department of Public Works is authorized to close roads when flooding is imminent. • City newsletter, webpage, direct mailing, door hangers, email, telephonic message, public access video and radio used for public information and alerts. • Laurel identifies drainage problems and implements improvements. • Laurel has acquired flood hazard areas along Bear Branch Creek, Crow Branch Creek and the Patuxent River (Riverfront Park) and maintains as open space and passive recreation areas. • Economic and Community Development along with the Emergency Manager use the revised FIRMs to promote flood awareness and to pursue funds to mitigate impacts to residential and commercial properties.
Streambank Erosion	• Laurel addresses riverbank erosion through the purchase of flood hazard areas along Patuxent River (Riverfront Park) and subdivision regulations that require setback.
Winter Storm	• Economic and Community Development enforces the building codes criteria for design snow loads for buildings and structures.

Hazard	Activities
	• City newsletter, webpage, direct mailing, door hangers, email, telephonic message, public access video and radio used for public information and alerts • Office of Homeland Security develops and disseminates outreach materials for residents, businesses, and visitors. • Office of Homeland Security monitors weather and developing conditions.
High Wind/ Tornado	• Economic and Community Development enforces the building codes, with criteria for design wind loads for buildings and structures. • Office of Homeland Security monitors weather and developing conditions. • Office of Homeland Security coordinates with other agencies and the County to operate • Alert Prince George's for citizen notifications.
Severe Storm	• Economic and Community Development enforces building codes with criteria for design wind loads for buildings and structures • Economic and Community Development enforces the building code with lightning protection requirements for nonresidential buildings. • Office of Homeland Security monitors weather and developing conditions. • City newsletter, webpage, direct mailing, door hangers, email, telephonic message, public access television and radio used for public information and alerts. • Office of Homeland Security coordinates with other agencies to operate Alert Prince George's for citizen notifications.
Drought	• Washington Suburban Sanitary Commission manages reservoirs for potable water supply. • Laurel participates in regional drought planning initiatives (Washington Suburban Sanitary Commission, Washington COG).
Dam Failure	• City has regular communication with Washington Suburban Sanitary Commission regarding the upstream dam and receives advance notices of releases that may cause flooding
Extreme Heat	• City newsletter, webpage, direct mailing, door hangers, email, telephonic message, public access video and radio used for public information and alerts • Office of Homeland Security develops and disseminates outreach materials for residents, businesses, and visitors.

C.1. Potential Areas of Improvement

C.2. Prince George's County and the City of Laurel could improve existing mitigation capabilities by applying for grants to fund mitigation projects. The City of Laurel would benefit from dedicated staff to collaborate with the County on grant applications and mitigation action implementation. Additionally, building capacity to complete benefit-cost analyses and apply for technical assistance or project scoping assistance would allow the

County and the City to expand their capabilities to achieve mitigation. National Risk Index Community Resilience Indicator Score

The County's overall resilience to natural hazards can also be expressed through a FEMA National Risk Index Community Resilience indicator score. Prince George's County has a relatively moderate ability to prepare for natural anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. according to the National Risk Index.[172] Community resilience score is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI). The BRIC index uses 49 variables arrayed in the six broad capitals (or categories) of community resilience. The six capitals include: human well-being/cultural/social; economic/financial; infrastructure/built environment/housing; institutional/governance; community capacity; environmental/natural.[173] According to the BRIC scoring, Prince George's County has a medium low community resilience score when compared to other counties in the state, but a medium community resilience score when compared to the counties in the nation. BRIC community resilience scores for the state of Maryland, including Prince George's County is shown in **Figure 93**. Continuing to build resilience capabilities within the County will improve the community resilience score moving forward.

[172] FEMA National Risk Index. Community Resilience. Map | National Risk Index (fema.gov)
[173] University of South Carolina. BRIC- Baseline Resilience Indicators for Communities. https://www.sc.edu/study/colleges_schools/artsandsciences/centers_and_institutes/hvri/data_and_resources/bric/

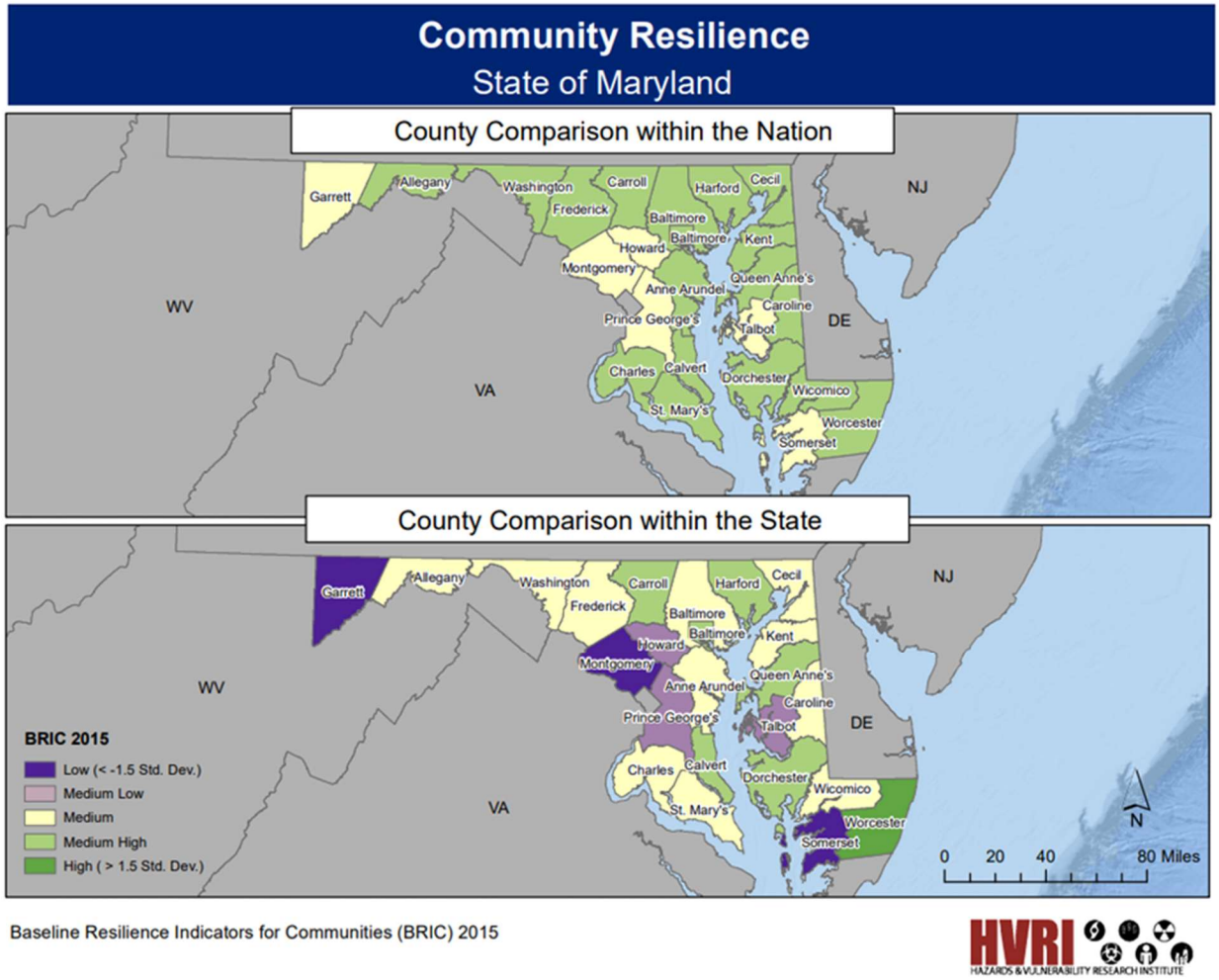


Figure 93: BRIC Community Resilience, State of Maryland

D. Plan Assessment

A review of County (**Table 128**) and City (**Table 129**) enabling statutes, ordinances, planning documents, and building codes revealed that some aspects of existing efforts strongly support mitigation capabilities.

Table 128. Prince George's County Plan Assessment

Plan Name	Description	Mitigation Integration Options
Plan Prince George's 2035 Approved General Plan (2014)	Plan Prince George's 2035 includes comprehensive recommendations for guiding future development within Prince George's County. The Plan updates a 2002 Prince George's County Approved General Plan by establishing new land use patterns and development centers.	The Plan briefly mentions mitigation on page 141 in Climate Change Policy 4. The Plan suggests including more detailed hazard information related to climate adaptation and mitigation strategies when updating the County's Hazard Mitigation Plan. Consider adding a description of hazards and their priority in upcoming County plans.
Climate Action Plan (2022)	The plan summarizes the climate threats in the County as we understand them, as well as progress to date in advancing climate action, particularly in reducing greenhouse gas emissions. Building on this information, it presents strategies to achieve a carbon-free, resilient Prince George's County.	The plan discusses climate hazards and trends in Prince George's County, as well as mitigation actions for climate-driven hazards.
Priority Preservation Area Functional Master Plan (2012)	The plan contains recommendations for agricultural land preservation; seeking funds for agricultural preservation; minimization of development and barriers to farming in the priority preservation area; valuation of farm and forest land for environmental and economic value; and reclaiming land for agricultural enterprises and agricultural support services. This plan recommends an approach to sustaining farm and forest operations that clarifies the county's intent to prioritize agricultural land preservation and provides a framework in the implementation table for accomplishing the policies and strategies outlined, partnering with the appropriate federal, state, local, and nonprofit agencies.	The Plan contains action steps to preserve farmland and forestland, which when protected can mitigate the impacts of flooding. In future preservation plans, consider adding a section outlining hazard impacts on preserved lands.

Formula 2040 (2013)	This Plan establishes a framework that will assure the department can meet future parks and recreation programmatic and facility needs. Through the Plan, the County establishes a framework that will assure that we can meet future parks and recreation programmatic and facility needs.	The Plan provides goals and action strategies to preserve open spaces. As part of the development of the next Plan, meet with the Plan developers to discuss the impacts of hazards on the parks system.
Green Infrastructure Master Plan (2005)	The plan identifies a contiguous network of environmentally sensitive areas throughout the county and sets forth a goal, objectives, policies, and strategies to preserve, protect, and enhance these elements by the year 2025. The plan supports the desired development pattern in the General Plan. This is the first comprehensive functional master plan ever developed for environmental ecosystems in Prince George's County.	The plan includes maps of regulated areas within the 100-year floodplain and identifies gaps in protected areas throughout the County. Future updates to the plan should incorporate coastal flooding risks as well as riverine flooding risks to the sensitive and important environmental features throughout the county.
Land Preservation Parks and Recreation Plan (2022- Draft)	The Land Preservation Parks and Recreation Plan (LPPRP) provides goals, objectives, and policy guidelines for the delivery of parkland, open space, and recreation opportunities in Prince George's County. The LPPRP specifies standards to help identify the need for parkland and recreation facilities in an ongoing effort to provide equitable opportunity and benefit to county patrons.	The Plan includes references to the County floodplain ordinance as well as the HMP as a guide for future growth.
Prince George's County, Maryland-Phase II Watershed Implementation Plan (2012)	The goal for this Plan is to develop reduction strategies to meet nutrient and sediment allocations at the County scale.	In the next Plan, include strategies for mitigating the risk of flooding on the septic and stormwater system, particularly drainage improvements intended to handle heavy downpours during storms.
Approved Historic Sites and Districts Plan (2010)	This Plan sets countywide preservation policy and provides citizens, nonprofit organizations, the private sector, and government agencies with guidance on historic preservation.	In the next Plan, include a goal to mitigate the impact of hazards on historic sites and resources. Also consider adding a section that discusses historical sites in hazard prone areas, the potential impacts of different hazards, and potential mitigation options.

Prince George's County Master Plan of Transportation 2035 (2022)	Master Plan of Transportation 2035 (MPOT 2035) supports Plan Prince George's 2035, the County's approved general plan, by setting a guiding vision, supporting goals, and measurable actions to achieve a more equitable transportation system for all people who travel in the County, regardless of which travel mode they choose	The Plan mentions preparing a hazard mitigation plan with a focus on improving roads to withstand flooding. In future plans, consider including a section on roads/transportation infrastructure in the County that are currently vulnerable to flooding and other hazards.

Table 129. City of Laurel Plan Assessment

Plan Name	Description	Mitigation Integration Options
City of Laurel Master Plan (2016)	This document amends the 2007 Master Plan and the 2009 Update. While recent growth and development have brought a large degree of amenities and benefits to the City, they have also brought some associated problems, which must be addressed. This plan identifies a number of these issues and opportunities and recommends a structure for providing for orderly and balanced growth.	The Plan creates policies for limiting riverine flooding in the Patuxent River Watershed, as well as limiting dam-related flooding through the management of the Duckett Dam in coordination with the Washington Suburban Sanitary Commission. In future plans, consider including a description of all hazards that may impact the City, and their priority in upcoming plans.
Berwin Heights-Sustainable Community Action Plan (2017)	This Plan discusses strengths and weaknesses in the Town relating to environment, economy, transportation, housing, quality of life, and local planning and land use in the community sectors. It also outlines desired outcomes, strategies and action items, and implementation partners for each of the sectors going forward.	Consider incorporating mitigation strategies in the "Strategies and Action Items" section of future plans.
City of Bowie 2022-2025 Climate Action Plan Implementation Plan	This plan outlines the action areas and implementation steps the City will take to reduce greenhouse gas emissions.	The Plan discusses expanding urban tree canopy, which is a mitigation strategy for extreme heat. Consider adding a section to discuss mitigation actions for other climate-related hazards.

City of Bowie Sustainability Plan	The Sustainability Plan builds upon the Climate Action Plan and all the other sustainability work that has come before it. The plan has three themes inspired by the City's motto: Growth, Unity, and Progress. Under each theme are topics, under each topic are goals, and for each goal strategies and actions have been identified.	The Plan includes strategies focused on emergency response to hazards, including flooding and storms.
City of Bowie Emergency Operations Plan (2016)	The City of Bowie Emergency Operations Plan (EOP) is a multi-discipline, all hazards plan that establishes a single, comprehensive framework for the management of major emergencies and disasters within the City.	This Plan describes hazard mitigation and the process for receiving Hazard Mitigation Assistance. Consider describing the potential hazards that may require assistance to mitigate in future plans.
Green Infrastructure Stormwater Management Climate Adaptation Plan: Dueling Creek Watershed- City of Mount Rainier, Maryland (2021)	The purpose of this Plan was to increase awareness on climate change issues and identify how green infrastructure can be used in the City to help mitigate the effects of increasing frequency, intensity, and duration of rainfall on localized flooding and other changes to local climate such as changing weather patterns and increasing temperatures.	The Plan discusses and maps areas in the City that may be at higher risk of pluvial flooding, as well as coastal flooding due to sea level rise. The Plan also describes the impacts of climate change on flooding and recommends mitigation actions to reduce vulnerability to flooding in the City.

Chapter 6. Mitigation Strategy

This chapter outlines the methodology of mitigation project selection and prioritization and provides an overview of the hazard mitigation goals, actions, and projects selected for the 2023-2028 planning horizon.

A. Introduction

Both Prince George's County and the City of Laurel have plans which outline a vision for the future of their communities and are consistent with hazard mitigation planning. In May 2014, Prince George's County approved the Plan 2035, Prince George's County General Plan, which includes county goals and strategies to guide future land use, growth and development, and environmental protection and preservation of important lands. The City of Laurel's General Plan was approved in September 2016 but did not include growth and development projections. The vision statements of the general plans promote community well-being and sustainability, which enables cross-cutting interfaces with the Hazard Mitigation Plan. The hazard mitigation strategy contained within this HMP sets the stage for long-term disaster resistance by identifying actions that will, over time, reduce the risk of people and property to hazards. In addition, the HMP enables continued eligibility for certain mitigation grant funds.

The mitigation strategy is a culmination of several elements that ultimately result in a path to resilience via an action plan. It includes:

- Revising the 2017 Hazard Mitigation Plan's goal;
- Evaluating a wide array of potential actions based on the results of the risk assessment and capabilities assessment;
- Selecting and prioritizing mitigation actions; and
- Developing mitigation action plans for Prince George's County and the City of Laurel.

A.1. Existing Authorities, Policies, Programs, and Resources for Mitigation

Relevant authorities, policies, programs, and resources available to support Prince George's County's and the City of Laurel's hazard mitigation activities are outlined in the **Capability Assessment** chapter. Both jurisdictions have experienced program administrators and staff who can work with the Mitigation Advisory Committee to advance the mitigation strategy and further facilitate a holistic, integrated program to reduce hazard risk and increase the resilience of the County and City's growing and diverse communities.

B. Mitigation Goals

When a community decides that certain risks are unacceptable and mitigation actions may be achievable, the development of goals and actions takes place. Goals are long-term, general statements.

The Mitigation Advisory Committee reviewed and revised the mitigation goal in the 2017 HMP on two different occasions: during the Mitigation Advisory Committee kick-off on September 19, 2022, and during the risk assessment results meeting on November 16, 2022. The committee discussed the County's and City's desire to expand from one goal to four to highlight specific needs while maintaining a broad enough

scope to represent the varied needs and wants of diverse communities. The final goals for the updated HMP were shared during a meeting to review and revise the mitigation strategy on December 14, 2022. The revised goals apply to both Prince George's County and the City of Laurel:

Increase public education and awareness of natural hazard risks to people and private property, and promote current and new opportunities to participate in mitigation planning.

Prevent future climate-related damages and losses to communities, critical facilities, and natural resources through ordinances, policies, and plans aligned with regional and state resilience and equity goals.

Implement structural projects that mitigate the risks of natural hazards to people, infrastructure, and environmental assets while equitably distributing project benefits.

Integrate hazard mitigation into regular staff training and responsibilities to improve capabilities and ensure climate adaptation is adequately considered and addressed in county/city actions.

C. Mitigation Action Selection

The 2017 mitigation actions were reviewed during the December 14, 2022, Mitigation Advisory Committee meeting. The conversation centered on the Committee's suggestion to move away from including actions that are considered a capability of the County or City and towards including more innovative actions and projects. Staff from designated lead agencies updated the status of each action and determined which should be continued and if modifications were required. The status of each action from the previous plan is outlined in **Appendix E**.

Once the determinations were made for the 2017 actions, a wide range of new actions was identified and discussed by the Mitigation Advisory Committee during the December 14th meeting, as well as through a mitigation strategy survey distributed shortly after the meeting. An overview of the actions considered and how the final selected actions were prioritized is described in the sections below.

C.1. Actions Considered

The Mitigation Advisory Committee systematically reviewed different activities that could prevent or reduce the impacts of the hazards discussed in **Chapter 4**. This was done to ensure that all possible measures were explored, not just traditional approaches. **Table 130** lists the categories of mitigation and emergency management activities along with some activities that could be considered under each.

Table 130. Mitigation Action Categories and Types

Action Category	Action Types
Prevention	Planning and zoning; Building codes; Open space preservation; Floodplain regulations; Stormwater management regulations; Drainage system maintenance; Capital improvements programming; Shoreline/riverine setbacks
Property Protection	Acquisition/Demolition/Relocation; Building elevation; Critical facilities protection; Retrofitting (i.e., wind-proofing, floodproofing, seismic design); Safe rooms, shutters, shatter-resistant glass; Insurance
Natural Resource Protection	Land acquisition; Floodplain protection; Watershed management; Riparian buffers; Forest and vegetation management; Erosion and sediment control; Wetland preservation and restoration; Habitat preservation; Slope stabilization; Historic property
Structural Projects	Reservoirs; Dams/levees/dikes/floodwalls/seawalls;Diversions/detention/retention; Channel modification; Beach nourishment; Storm sewers
Emergency Services	Warning systems; Evacuation planning and management; Emergency response training and exercises; Sandbagging for flood protection; Installing temporary shutters for wind protection
Education and Awareness	Outreach projects; Speak series/demonstration events; Hazard mapping Real estate disclosure; Library materials; School children educational programs; Hazard expositions

The above categories served as a framework for the types of mitigation actions considered by the Mitigation Advisory Committee. New potential actions were created based on the vulnerabilities identified in the risk assessment, the results of the capability assessment, and the relevant strategies found in other planning documents, such as Plan Prince George's 2035, the Prince George's County Climate Action Plan, and the Maryland Climate Adaptation and Resilience Framework Recommendations.

Actions that were considered and reviewed by the Mitigation Advisory Committee are shown in **Table 131**, along with the pros and cons of each action in the context of the County and City and their hazard conditions. For additional context, a discussion of current regulatory and preventative standards and programs can be found in **Chapter 5**.

Table 131. Review of Possible Mitigation Activities

Potential Action	Pros	Cons
Prevention		
Perform regular tree trimming	County & City: • Can prevent power outages during storms and	County & City: • Jurisdiction/ responsibility would need to be clarified

Potential Action	Pros	Cons
	keep people connected for emergency services • Can prevent damage to property and injuries to people during severe weather • Can improve long-term health and stability of tree	and coordinated with PEPCO/utility providers
Conduct a watershed study	County: • Provide detailed information to identify flood risk areas for mitigation measures and long-term management plans • Can be used to identify mitigation measures that reduce flood risk	County: • A countywide study can be time consuming and costly • Securing funding may be challenging or strain workforce capacity • Other measures like improved land use planning, structural flood protection, and emergency preparedness plans are still needed
Develop a Comprehensive Reforestation Plan to find and address gaps in the existing tree canopy.	County: • Help identify and prioritize gaps in tree canopy or areas key for preservation for heat mitigation and air quality • Help research species that are native and improve chances of survival	County: • Some stakeholders may resist provisions that require protection of trees on private property • Limited monitoring and enforcement
Property Protection		
Prohibit all waivers to allow development in floodplains.	County & City: • Reduce risk of damage to structures and loss of life during flood events • Preserve natural floodplains with important ecological benefits • May reduce future financial burden on taxpayers	City & County: • Limits availability of land for future growth • Some stakeholders may resist the potential loss of value from affected properties

Potential Action	Pros	Cons
Create metrics to track routine stormwater maintenance and monitor how the work is increasing capacity and where additional capacity may be needed through retrofits.	County: • Ensure maintenance is consistent and effective • Identify gaps that may need retrofits • Reduces risk of flooding • Can identify potential cost savings	County: • Challenges in enforcing compliance • Implementation of new technology costs
Use conservation subdivisions in areas adjacent to Rural and Agricultural Areas to transition density and to encourage preservation of green infrastructure corridors as defined by the County's Green Infrastructure Plan.	County: • Can preserve character	County: • May be more expensive and difficult to attract development
Perform energy grid modernization in socially vulnerable areas by adding a solar microgrid to reduce system outages from natural hazards. Additionally, evaluate new and existing government buildings, critical facilities, and infrastructure for solar potential.	County & City: • Reduces risk of system outages • Reduces reliance on fossil fuels • Solar can be less expensive in the long-term	County & City: • Actual energy grid modernization can be costly to install new technologies
Office of the County Executive must introduce and support a County Council resolution requiring the County to integrate extreme weather and energy-efficiency criteria into building codes.	County: • Can help future property protection of buildings • Can reduce greenhouse gas emissions • May reduce need for costly repairs	County: • Challenges with compliance • Stakeholder resistance to perceived potential additional burdens • Potential increase in construction cost and challenges incentivizing development
Adopt and Enforce Policies to Require Green Infrastructure Practices for New and Existing Properties, especially native plantings, rain gardens, green corridors, runoff retention, and other nature-based ways to reduce and naturally filter runoff on private and public properties. Insert specific enforceable language in guiding	County: • Improve water quality and risk of flooding • Aesthetic benefits • Ecological benefits to wildlife habitats	County: • Enforcing compliance • Potential stakeholder resistance

Potential Action	Pros	Cons
County documents related to proposed and existing development.		
Natural Resource Protection		
To preserve environmentally sensitive land and to encourage development in the Regional Transit Districts, evaluate a transfer of development rights program, density exchanges, or purchase of development rights program for the Rural and Agricultural Areas. Explore opportunities to transfer development rights within areas and to coordinate with the Watershed Implementation Plan and Maryland Accounting for Growth Policy	County: • Can preserve environmentally important areas and encourage development in optimized areas • Balance demand with natural resource protection for environmental and public health benefits • Reduce need for infrastructure in rural and agricultural areas	County: • Evaluating the cost of this program might be challenging
Structural Projects		
Conduct a study to determine the feasibility of creating a stormwater park/greenway (or another watershed- or landscape-scale flood risk reduction project) that will improve natural floodplain functions in areas of high risk.	County: • Reduce risk of flooding in high risk areas • Ecological and aesthetic benefits • Identify potential costs and viability	County: • Land acquisition • Cost
Develop structural and action plans with inundation mapping for all High Hazard Potential Dams with poor conditions and no Emergency Action Plans. Develop structural and action plans for high-risk pump stations, levees, and other flood control infrastructure.	County: • Identify potential impacts of dam failure • Improve safety and reliability • Can identify emergency actions in hazard events	County: • May require acquisition of new technology or data • Cost of study and subsequent cost of repairs to infrastructure
Implement stormwater management projects, such as drainage retrofits, to address pluvial/stormwater flooding in community-identified areas.	County & City: • Improve public safety and water quality • Reduce property damage and pollution	County & City • May involve installation of new infrastructure • Cost of compliance

Potential Action	Pros	Cons
Emergency Services		
Develop a plan with the Department of Social Services, Department of Health, and Office of Sustainability to create Resilience Hubs in vulnerable communities to increases community capacity to prepare for, withstand, and respond to natural hazard impacts and emergency situations. These should also function as heating/cooling centers.	County: • Ensure a central location to prepare, withstand, and respond to events • Increases community capacity and public safety • Improve quality of life and support vulnerable populations	County: • May require costly acquisition of new facilities or retrofitting • Operating may be challenging
Continue to Support Regional Drought Response and Planning. Continue the County's commitment and participation with the Metropolitan Washington Council of Governments and Washington Suburban Sanitary Commission when drought awareness responses are activated.	County & City: • Mitigate negative impacts of drought • Protect natural resources	County & City: • Navigating potential coordination between jurisdictions and stakeholders with potential conflicting priorities
Education and Awareness		
Conduct outreach to homeowners on mitigation projects for flooding from streams near homes	County: • Engage residents • Identify and prioritize needs of homeowners	County: • Specialized materials can be difficult to coordinate • Homeowners may resist additional burden
Develop a County Hazard Mitigation Hub website	County: • Provide a center for digital information • Fast and accessible for preparation and response to disasters • Could serve as a platform for engagement and feedback	County: • Technical expertise
"Demonstrate County commitment to climate action through publicly transparent tracking, monitoring, evaluation, and reporting. Require Maryland-	County: • Increasing accountability and trust with stakeholders	County: • Technical expertise

Potential Action	Pros	Cons
National Capital Park and Planning Commission to create and establish a public Smart Growth Dashboard that tracks approved preliminary plans of subdivisions, approved site plans and development proposals."	• Identify areas of need for resources • Improve efficiency of permitting processes	

C.2. Action Prioritization

The STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria (**Table 132**) were used to prioritize the mitigation actions as high, medium, or low for the County and City[174]. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions for the area's jurisdictions to undertake. The Economic criterion includes a benefit-cost review. This process was used to help ensure that the most equitable and feasible actions would be implemented based on the jurisdictions' risks and capabilities.

Table 132. STAPLEE Project Evaluation Criteria

Category	Example Questions
Social	• Is the proposed action socially acceptable to the community(s)? • Are there equity issues involved that would mean that one segment of a community is treated unfairly? • Will the action cause social disruption?
Technical	• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other community(s) goals?
Administrative	• Can the community(s) implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political	• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal	• Is the community(s) authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? • Are there legal side effects? Could the activity be construed as a taking? • Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action? • Will the community(s) be liable for action or lack of action? • Will the activity be challenged?

[174] This same prioritization criteria was applied for HHPD actions. Specific HHPDs will be matched to projects being implemented based on their assigned condition severity and the risk they pose to the community based on inundation data.

Category	Example Questions
Economic	• What are the costs and benefits of this action (i.e., cost-benefit review)? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the community(s)? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other community goals, such as capital improvements or economic development? • What benefits will the action provide?
Environmental	• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

The above STAPLEE categories and relevant questions were discussed when selecting and prioritizing actions, although a detailed written analysis was not conducted. For measures such as education and outreach that do not result in a quantifiable reduction of damages, the relationship between the probable future benefits and the cost of each measure was factored in. Generally, each jurisdiction's representatives evaluated the actions for inclusion in the plan with the following framework:

- **Time** – Can the strategy be implemented quickly?
- **Ease to implement** – How easy is the strategy to implement? Will it require many financial or staff resources? Are there programs to secure the additional resources needed to implement?
- **Effectiveness** – Will the strategy be highly effective in reducing risk? Are other strategies more effective?
- **Lifespan** – How long will the effects of the strategy be in place?
- **Hazard(s) Mitigated** – Does the strategy address a high-priority hazard, or does it address multiple hazards?
- **Equity** – Does the strategy have disproportionate negative impacts on vulnerable communities?

High priority was placed on the actions that are considered consistent with current County and City plans, technically feasible, likely to have high political and social acceptance, and can be achieved using existing resources or are eligible for grants. Projects for which federal mitigation grant funds are sought must be eligible activities according to the most recent policy and guidance and illustrate a cost-to-benefit ratio greater than or equal to one.

While considering STAPLEE Project Evaluation Criteria, there may be cases where Prince George's County has prioritized a mitigation action but does not feel it can move it forward due to insufficient staff capacity or technical skills. In this case, it may be appropriate to consider technical assistance options. As detailed in **Chapter 7.B.1**, technical assistance is direct support to a community that builds resilience community capacity and capabilities in ways that meet their unique needs. This is typically done by federal, regional, or state agency staff or their contract support working with local communities directly.

D. 2023-2028 Mitigation Actions

All 2023-2028 mitigation actions are outlined in this section. The descriptions and/or definitions for the elements that accompany each action are described in **Table 133**. **Table 134** contains Prince George's County's actions and **Table 135** contains the City of Laurel's actions. The key details included are meant to add relevant context and encourage implementation and accountability. For detailed actions plans of the "high priority" actions, refer to **Appendix F**.

Table 133. Action Input Descriptions

Action Detail	Input Description
Category of mitigation action	Prevention, property protection, natural resource protection, structural projects, emergency services, or education and awareness
Action number	Jurisdiction abbreviation - # (e.g., PG-1)
Applicable goal(s)	• Goal 1: Implement structural projects that mitigate the risks of natural hazards to people, infrastructure, and environmental assets while equitably distributing project benefits. • Goal 2: Integrate hazard mitigation into regular staff training and responsibilities to improve capabilities and ensure climate adaptation is adequately considered and addressed in county/city actions. • Goal 3: Increase public education and awareness of natural hazard risks to people and private property, and promote current and new opportunities to participate in mitigation planning. • Goal 4: Prevent future climate-related damages and losses to communities, critical facilities, and natural resources through ordinances, policies, and plans aligned with regional and state resilience and equity goals.
Action lead	The department or office responsible for ensuring the action is implemented
Timeframe for implementation	• Short-term: less than three years • Long-term: more than three years • Ongoing: continuous with no designated end date • Funding contingent: timeline is dependent on funding from a source outside of the jurisdiction
Priority level for implementation	High, medium, or low

D.1. Prince George's County Mitigation Actions

Some of the County's actions have been integrated and adapted from other County plans. They are signified by the color of the "Action Number" column accordingly:

- Plan 2035 Prince George's Elements integrated policies are shown in **orange**.
- Climate Action Plan Priority Recommendations are shown in **green**.

Table 134. Prince George's County 2023-2028 Mitigation Actions

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Prevention							
PG-1	Partner with federal agencies, the state, and Non-governmental Organizations to utilize available technical assistance to translate identified risks into mitigation projects, especially for benefit cost analyses for the County and municipalities.	X			X	Office of Homeland Security	Ongoing	Medium
PG-2	Using the best available data, check the locations of HazMat sites, National Pollutant Discharge Elimination System sites, and other land uses; if found to be in flood hazard areas, communicate with the owner/handler of hazardous materials and known pollutants regarding risk and appropriate response and protection measures.			X	X	Department of Environment	Short-term	Medium
PG-3	Integrate mitigation plan requirements and actions into other appropriate planning mechanisms, such as comprehensive plans and capital improvement plans.				X	Maryland-National Capital Park and Planning Commission	Ongoing	High
PG-4	Collect flood depth information to support a grant to provide elevation certificates in areas newly included in the Special Flood Hazard Area or to those experiencing				X	Office of Homeland Security	Funding contingent	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	flooding issues to support Letter of Map Amendments (LOMA) or NFIP premium reductions.							
PG-5	Expand codes and standards enforcement, such as for existing land use regulations and policies.		X		X	Department of Permitting, Inspections and Enforcement	Ongoing	Medium
PG-6	Prohibit all waivers to allow development in floodplains.				X	Department of Permitting, Inspections and Enforcement	Ongoing	High
PG-7	Revise Prince George's County Code of Ordinances to incorporate and require climate-resilient design, nature-based infrastructure, and climate-resilient practices. Adopt and enforce policies to require green infrastructure practices for new and existing properties, especially native plantings, rain gardens, green corridors, runoff retention, and other nature-based ways to reduce and naturally filter runoff on private and public properties.	X			X	Maryland-National Capital Park and Planning Commission, Planning Department	Short-term	High
PG-8	Office of the County Executive must introduce and support a County Council resolution requiring the County to integrate extreme weather and energy-efficiency criteria into building codes.				X	Department of Permitting, Inspections, and Enforcement	Short-term	High
PG-9	Require County Stormwater Management (SWM) Standards to Incorporate Projected Climate Change Impacts by using approved downscaled and up-to-date climate impact information to reevaluate peak rainfall estimates and future design storm profiles. Evaluate SWM standards using this criterion at least every three (3) years.	X			X	Department of Public Works and Transportation, Stormwater Management Division	Long-term	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Require all upgrades of County storm drain systems and Capital Improvement Project roadway, bridge, culvert and stormwater management repair or renovation projects to meet these updated climate-resilient design criteria.							
PG-10	Avoid Future Development in Flood Inundation Areas Below Existing High-hazard Potential Dams. Require that plan sets for subdivision proposals and permit applications to show the danger reach and inundation area and prohibit new construction in these areas.				X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	High
PG-11	Conduct Countywide Thermal Mapping of Tree Canopy Cover with Shade Study, and Aerial Utility Mapping exercises. Then conduct a neighborhood-level Heat Vulnerability Assessment. Address the identified gaps in the tree canopy through appropriate heat mitigation actions and projects.				X	Department of the Environment	Short-term	High
PG-12	Conduct a study on the feasibility of using climate-smart building materials in mitigation projects and normal County/City construction projects to mitigate impacts from extreme temperatures and rainfall. Examples include those listed on the Maryland Department of the Environment's "Alternative/Innovative Technology List of Approved Practices." Once complete, develop a process that promotes the use of these materials wherever feasible.				X	Department of the Environment	Long-term	Medium
PG-13	Adopt the most recent published edition of the I-Codes (e.g., International Building Code, International Residential Code).				X	Department of Permitting, Inspections and Enforcement	Short-term	High
	Property Protection							

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-14	Support mitigation projects that will result in the protection of public or private property from natural hazards. Eligible projects include but are not limited to: 1. acquisition of hazard-prone property or structures 2. Elevation of flood-prone structures 3. Minor structural flood control projects 4. Relocation of structures from hazard-prone areas 5. Retrofitting of existing buildings, facilities, and infrastructure 6. Retrofitting of existing buildings and facilities for shelters 7. Critical infrastructure protection measures 8. Stormwater management improvements 9. Advanced warning systems and hazard gauging systems (weather radios, reverse-911, stream gauges, I-flows) 10. Targeted hazard education 11. wastewater and water supply system hardening and mitigation	X		X	X	Office of Homeland Security	Ongoing	Medium
PG-15	Implement appropriate mitigation measures for hazard-vulnerable priority critical facilities	X			X	Department of Public Works and Transportation	Long-term	High
	Natural Resource Protection							
PG-16	Use the Watershed Implementation Plan to prioritize stabilization projects, especially if funding from outside resources is available for the mitigation of environmental impacts.	X			X	Department of the Environment	Ongoing	Medium
PG-17	Coordinate with Pepco, Baltimore Gas and Electric, and any other utility companies (as appropriate) to schedule and perform regular tree trimming to mitigate the risk of power outages during windstorms. Maintenance should be conducted to retain a healthy tree canopy, ensure trees' longevity, and decrease the risk of power outages. Prioritize socially vulnerable neighborhoods/ populations	X			X	Department of Public Works and Transportation	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	first and maintain old-growth trees with large canopies to encourage tree retention for extreme heat mitigation. Develop mutual aid with the City of Laurel to provide limited resources and personnel to assist in trimming ang tree control as needed.							
PG-18	Implement proposed flood mitigation projects from the upcoming watershed study for the Collington Branch Stream. Develop a Memorandum of Agreement with the City of Laurel to inspect and clean the portion of the stream that runs through their jurisdiction.				X	Department of the Environment	Long-term	High
PG-19	Conduct a study to determine the feasibility of creating a stormwater park/greenway (or another watershed- or landscape-scale flood risk reduction project) that will improve natural floodplain functions in areas of high risk.				X	Maryland-National Capital Park and Planning Commission	Short-term	Medium
PG- 20	Develop a program to utilize vacant land (both publicly and privately owned) for stormwater management. Acquire land to serve the dual purpose of green infrastructure/ stormwater infiltration and recreational/open space.				X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	Medium
PG-21	Use conservation subdivisions (or other site planning and landscape conservation tools) when developing in Established Communities near Rural and Agricultural Areas to cluster development, transition density, and encourage the preservation of green infrastructure corridors, as defined by the County's Green Infrastructure Plan.	X			X	Maryland-National Capital Park and Planning Commission, Planning Department	Ongoing	Medium
PG-22	To preserve environmentally sensitive land and to encourage development in the Regional Transit Districts, evaluate a transfer of development rights program, density exchanges, or purchase of development rights program for the Rural and Agricultural Areas. Explore opportunities to				X	Department of the Environment	Ongoing	Low

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	transfer development rights within areas and to coordinate with the Watershed Implementation Plan and Maryland Accounting for Growth Policy							
PG-23	Align Economic Development Plans with the Climate Action Plan, preserving existing agricultural land and natural areas and promoting development in already-developed areas near high-capacity transit. Perform an economic development and climate adaptation analysis of existing agricultural land and natural areas that are crucial to climate resilience on a subwatershed basis. Identify areas of open space for preservation and optimum use for climate resilience.				X	Department of the Environment	Short-term	High
	Structural Projects							
PG-24	Create metrics to track routine stormwater maintenance and monitor how the work is increasing capacity and where additional capacity may be needed through retrofits.				X	Department of Public Works and Transportation	Ongoing	Medium
PG-25	Conduct a Countywide Flood Assessment (including pluvial mapping) to understand the impact of updated rainfall intensity estimates per the latest version of NOAA Atlas 14, recent elevation data, and stormwater controls. Identify priority areas for mitigation projects and update the stormwater ordinance as needed.				X	Department of the Environment	Ongoing	High
PG-26	Develop structural and action plans with inundation mapping for all High Hazard Potential Dams with poor conditions and no Emergency Action Plans. Develop structural and action plans for high-risk pump stations, levees, and other flood control infrastructure. Ensure a			X	X	Department of Public Works and Transportation	Long-term	High

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	process for supporting affected "downflow" communities that a dam failure hazard would inundate.							
PG-27	Implement stormwater management projects, such as drainage retrofits, to address pluvial/stormwater flooding in community-identified areas. Prioritize restoration projects from the Watershed Implementation Plan (WIP) that will support the Plan 2035 future land use pattern. Downtowns should be given priority for stormwater retrofits, especially environmental site design practices. Land acquisition or ecological restoration activities should be targeted to stronghold watersheds.	X			X	Department of Public Works and Transportation	Ongoing	High
PG-28	To reduce system outages from natural hazards, perform energy grid modernization in socially vulnerable areas by adding a solar microgrid. Prioritize areas that are known to suffer multiple outages during the year.	X			X	Department of Public Works and Transportation	Ongoing	Low
PG-29	Evaluate new and existing government buildings, critical facilities, and infrastructure for solar energy generation potential and install solar panels and batteries if feasible.				X	Department of Public Works and Transportation	Ongoing	Low
	Emergency Services							
PG-30	Update Upper Marlboro Emergency Response Plan to address flooding, including evacuation, emergency response, mitigation, etc.			X	X	Office of Homeland Security	Short-term	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-31	Update the County's disaster recovery plan to include a post-disaster strategic rebuilding decision framework that comprehensively integrates equity.				X	Office of Homeland Security	Short-term	Medium
PG-32	The Department of Family Services Agency on Aging will continue its outreach to seniors and other vulnerable populations about health and safety during periods of extreme heat and extreme cold. Information will be added to the Family Service's web page and frozen meal distribution with supplement provision of hot meals during severe weather periods from January through March.			X	X	Department of Family Services	Ongoing	Medium
PG-33	Develop a plan with the Department of Social Services, Department of Health, and Office of Sustainability to create Resilience Hubs in vulnerable communities to increases community capacity to prepare for, withstand, and respond to natural hazard impacts and emergency situations. These should also function as heating/cooling centers.	X			X	Department of Social Services; Department of Health; Office of Sustainability	Long-term	Low
PG-34	Assess Climate Projections and Consequences of Dam and Levee Failure. Analyze baseline conditions against local/regional climate projections to highlight future vulnerabilities and risk. Model hydrological loads to the consequences of failure under present and future conditions and jointly evaluate dams, levees, and interdependent components. Incorporate Findings in Emergency Action Plans.				X	Office of Homeland Security	Ongoing	High
	Educations & Awareness							

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-35	Continue annual flood risk awareness and mitigation mailing to all owners of high-risk properties in the Special Flood Hazard Area, including Repetitive Loss/Severe Repetitive Loss structures. Provide additional outreach in response to new/upcoming grant opportunities and funding.			X	X	Office of Homeland Security	Ongoing	High
PG-36	Work with County municipalities and/or develop public-private partnerships to provide hazard awareness messaging and information on hazard preparedness and mitigation in secondary languages for promotion using local newspapers, municipal websites, social media, etc.		X	X	X	Department of Community Relations	Ongoing	High
PG-37	Integrate hazard mitigation considerations in future updates of the Citizens' Preparedness Guide and Business Preparedness Guide, including mitigation projects they can implement and how they can get their project included in an upcoming grant application.			X	X	Office of Homeland Security	Ongoing	Medium
PG-38	Conduct outreach to homeowners located on Founders Terrace (and other high-priority streets/neighborhoods) on opportunities to get funding for potential flood mitigation projects for the streams that run behind their homes.			X	X	Department of Community Relations	Short-term	Medium
PG-39	Develop a County Hazard Mitigation Hub website similar to the public outreach website for Vision Zero. This should be combined with the future Climate Resilience Website as described in Plan 2035 if possible. Coordinate with various county agencies, such as the Department of Environment (DoE), Office of Homeland Security, and Office of Information Technology (OIT).			X	X	Office of Homeland Security	Short-term	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
PG-40	Demonstrate County commitment to climate action through publicly transparent tracking, monitoring, evaluation, and reporting. Require the Maryland-National Capital Park and Planning Commission to create and establish a public Smart Growth Dashboard that tracks approved preliminary plans of subdivisions, approved site plans and development proposals. Integrate this into the hazard mitigation/climate action hub website (refer to Action PG-41).			X	X	Maryland-National Capital Park and Planning Commission	Ongoing	Medium
PG-41	Develop an action guide for socially vulnerable communities that provides step-by-step guidance on how they can get their home considered for inclusion in a mitigation project/grant application.			X	X	Office of Homeland Security	Short-term	Medium
PG-42	Send a digital copy of the 2023 HMP to all County and City staff, as well as all homeowner associations within the planning area.		X	X	X	Office of Homeland Security	Short-term	High
PG-43	Integrate conducting an annual/semi-annual comprehensive grant availability search and information dissemination into a County staff member's job description. This staff member should coordinate an annual workshop with the County and its municipalities to discuss county-wide priorities and projects that should be submitted in grant applications.		X			Office of Homeland Security	Ongoing	Medium

D.2. City of Laurel Mitigation Actions

Table 135. City of Laurel 2023-2028 Mitigation Actions

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	Prevention							
L-1	Partner with federal agencies, the state, and non-governmental organizations to utilize available technical assistance to translate identified risks into mitigation projects, especially for benefit-cost analyses.		X		X	Office of Emergency Management	Ongoing	Medium
L-2	Integrate mitigation plan requirements and actions into other appropriate planning mechanisms, such as comprehensive plans and capital improvement plans.				X	Office of Emergency Management	Ongoing	High
L-3	Adopt the most recent published edition of the I-Codes (e.g., International Building Code, International Residential Code).				X	Department of the Fire Marshal and Permit Services	Short-term	High
	Property Protection							
L-4	Support mitigation projects that will result in the protection of public or private property from natural hazards. Eligible projects include but are not limited to: 1. acquisition of hazard-prone property or structures 2. Elevation of flood-prone structures 3. Minor structural flood control projects 4. Relocation of structures from hazard-prone areas 5. Retrofitting of existing buildings, facilities, and infrastructure 6. Retrofitting of existing buildings and facilities for shelters 7. Critical infrastructure protection measures 8. Stormwater management improvements 9. Advanced warning systems and hazard gauging systems (weather radios, reverse-911,	X			X	Department of Economic & Community Development	Ongoing	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
	stream gauges, I-flows) 10. Targeted hazard education 11. wastewater and water supply system hardening and mitigation							
L-5	Promote the use of climate-smart building materials in mitigation projects and normal City construction projects to mitigate impacts from extreme temperatures and rainfall, such as those listed on the Maryland Department of the Environment's "Alternative/Innovative Technology List of Approved Practices."	X			X	Department of Economic & Community Development	Ongoing	Medium
	Structural Projects							
L-6	After flood events, the City will evaluate whether to pursue funding to implement flood mitigation projects.	X			X	Office of Emergency Management	Ongoing	High
L-7	Assess Climate Projections and Consequences of Dam and Levee Failure. Analyze baseline conditions against local/regional climate projections to highlight future vulnerabilities and risk. Model hydrological loads to the consequences of failure under present and future conditions and jointly evaluate dams, levees, and interdependent components. Incorporate Findings in Emergency Action Plans.		X		X	Department of Public Works; Department of the Environment	Short-term	Medium
L-8	To reduce system outages from natural hazards, perform energy grid modernization in socially vulnerable areas by adding a solar microgrid. Prioritize areas that are known to suffer multiple outages during the year.	X			X	Department of Public Works	Funding contingent	Medium

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
L-9	Evaluate new and existing government buildings, critical facilities, and infrastructure for solar energy generation potential and install solar panels and batteries if feasible.	X			X	Department of Public Works	Short-term	Low
L-10	Implement stormwater management projects, such as drainage retrofits, to address pluvial/stormwater flooding in community-identified areas.	X			X	Department of Public Works	Ongoing	High
	Emergency Services							
L-11	At the intersection of Van Dusen Road and Contee Road (Anderson's Corner), add a comprehensive recreational building, comprised of indoor recreational space, gymnasium(s), and meeting rooms. Unlike a typical community center, the City envisions more of a steel building structure with a hybrid use between drop-in programs for local residents and a larger multiuse footprint to host a wider range of recreational sports and activities. The City will conduct a feasibility study that includes considering stormwater runoff effects and the potential to use the facility as a hazard shelter and/or extreme temperature refuge.	X		X	X	Department of Economic & Community Development	Long-term	Medium
	Educations & Awareness							
L-12	Work with City closed circuit television network to produce seasonal hazard awareness and topical mitigation programming.		X	X		Office of Emergency Management	Short-term	Low

Action Number	Action	Goal 1	Goal 2	Goal 3	Goal 4	Action Lead	Timeframe	Priority
L-13	Develop an action guide for socially vulnerable communities that provides step-by-step guidance on how to get their home considered for inclusion in a mitigation project/grant application.		X	X	X	Office of Emergency Management	Short-term	Medium
L-14	Send a digital copy of the 2023 HMP to all County and City staff.		X	X		Office of Emergency Management	Short-term	Medium

D.3. Hazard Mitigation Grant Program Mitigation Projects

In addition to the mitigation actions, Prince George's County and the City of Laurel have submitted projects under FEMA Hazard Mitigation Grant Program (HMGP) funding. These projects align with the mitigation goals outlined in **Chapter 6.B** of this Plan. The projects and their descriptions are shown below:

- HMGP-4491-DR-MD-0009: Prince George's County Preparation of Flood Warning System SOP. 5% initiative project. The purpose of the proposed activity is to develop a standard operating procedure (SOP) for Prince George's County's two flood warning systems which enable the County to monitor real-time flood conditions and provide information to relevant authorities and impacted communities.

- HMGP-4491-DR-MD-0012: City of Laurel, Prince George's County Emergency Back-Up Generators for Critical Facilities 6. Regular project. Upsizing of 5 and obtaining 1 generator at 6 critical facilities. Buildings include: City/Municipal Hall, Laurel Police Department, Park and Recreation Maintenance Facility, Laurel Armory Facility, City Services Building, and Public Works Facility.

- HMGP-4491-DR-MD-0017: Prince George's County Town of Eagle Harbor Shoreline Restoration - Phased. Regular project. The living shoreline component of this Project will prevent shoreline erosion, increase resilience against storms, improve water quality, and protect properties and infrastructure along the shoreline.

- HMGP-4491-DR-MD-0016: Prince George's Residential Flood Mitigation 75th Ave (phased project).

- HMGP-4491-DR-MD-0018: Fort Washington Neighborhood Flood Risk Mitigation Project (Phased project).

E. Mitigation Actions Summary

After all the final decisions were made, the mitigation strategy included 57 total actions —43 for Prince George's County and 14 for the City of Laurel. However, the City of Laurel may choose to participate in the County's actions as feasible when true County-wide mitigation is needed. **Table 136** and **Table 137** below provide further summary information on the mitigation strategy.

Table 136: Summary of final determinations for the 2017-2023 mitigation actions

Determination	Number of Actions	Actions Included
In Progress - Carried Over	9	PG-1; PG-3; PG-14; PG-15; PG-30; PG-35 L-4; L-6; L-12
Not Started – Carried Over	8	PG-2; PG-4; PG-31; PG-32; PG-36; PG-37 L-1; L-2
Not Started - Removed	4	n/a
Completed - Removed	11	n/a

Table 137 lists the hazards covered in the 2023 HMP and the mitigation actions applicable to each. The objective was to have at least one action for each hazard.

Table 137: Action Applicability by Hazard

Hazard	# PG Actions	# Laurel Actions	Applicable Actions
Riverine Flood	31	8	PG-1; PG-2; PG-3; PG-4; PG-5; PG-6; PG-8; PG-9; PG-13; PG-14; PG-15; PG-16; PG-18; PG-19; PG-20; PG-22; PG-23; PG-25; PG-27; PG-30; PG-31; PG-33; PG-35; PG-36; PG-37; PG-38; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-6; L-12; L-13; L-14
Severe Storm (Flood-Related)	26	11	PG-1; PG-3; PG-5; PG-6; PG-8; PG-9; PG-12; PG-13; PG-14; PG-15; PG-20; PG-21; PG-22; PG-23; PG-24; PG-25; PG-27; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-5; L-6; L-10; L-11; L-12; L-13; L-14
Tornado	20	9	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-28; PG-29; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-8; L-9; L-12; L-13; L-14

Hazard	# PG Actions	# Laurel Actions	Applicable Actions
Severe Storm (Wind-Related)	21	9	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-17; PG-22; PG-23; PG-28; PG-29; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-8; L-9; L-12; L-13; L-14
Hurricane/Tropical Storm	20	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-28; PG-29; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14
Winter Storm	20	9	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-28; PG-29; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-8; L-9; L-12; L-13; L-14
High Wind	21	9	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-17; PG-22; PG-23; PG-28; PG-29; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-8; L-9; L-12; L-13; L-14
Extreme Heat	22	9	PG-1; PG-3; PG-5; PG-8; PG-11; PG-12; PG-13; PG-14; PG-15; PG-17; PG-22; PG-23; PG-31; PG-32; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-5; L-11; L-12; L-13; L-14
Dam and Levee Failure	21	8	PG-1; PG-3; PG-5; PG-8; PG-10; PG-13; PG-14; PG-15; PG-22; PG-23; PG-26; PG-31; PG-33; PG-34; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-7; L-12; L-13; L-14
Earthquake	18	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14
Extreme Cold	20	9	PG-1; PG-3; PG-5; PG-8; PG-12; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-32; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-5; L-11; L-12; L-13; L-14
Drought	18	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14

Hazard	# PG Actions	# Laurel Actions	Applicable Actions
Coastal Flood	20	8	PG-1; PG-2; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-35; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-6; L-12; L-13; L-14
Landslide	18	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14
Wildfire	18	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14
Sinkhole	18	7	PG-1; PG-3; PG-5; PG-8; PG-13; PG-14; PG-15; PG-22; PG-23; PG-31; PG-33; PG-36; PG-37; PG-39; PG-40; PG-41; PG-42; PG-43 L-1; L-2; L-3; L-4; L-12; L-13; L-14

Chapter 7. Plan Implementation

This chapter describes the implementation plan, identifies available programs and resources to support implementation, and outlines procedures for maintaining the plan as a living document.

A. Distribution

After the update's adoption, the 2023 HMP will be posted on the Prince George's County Department of the Environment's website, the Office of Homeland Security's website, and the City of Laurel's website. Notices of its availability will be distributed to the following groups:

- Federal and state agencies that were notified and invited to participate in plan development;
- Mitigation Advisory Committee;
- Adjacent counties and the District of Columbia;
- Citizens who attended public meetings or participated in surveys and provided contact information; and
- Organizations, agencies, and elected officials who received notices of public meetings.

B. Implementation and Maintenance

Both Prince George's County and the City of Laurel have programs and activities that reduce the impacts of hazards and emergencies. **Chapter 5** describes the general County and City capabilities and ongoing activities that reduce the impacts of hazards, in part, through the implementation of the actions in the HMP.

Implementing the actions outlined in **Chapter 5** will involve adequate planning, finding projects, and integrating actions throughout the County's and City's various other efforts. These can be aided by finding technical assistance, securing funding, and integrating hazard mitigation into other planning mechanisms. The sections below explore these topics in more detail.

B.1. Technical Assistance

In cases where Prince George's County or the City of Laurel has prioritized a mitigation action, but does not feel it can move it forward due to insufficient staff capacity or technical skills, technical assistance provided by FEMA or other state or federal agencies may help.

Technical assistance is direct support to a community that builds the community's resilience capacity and capabilities in ways that meets their unique needs. This is typically done by federal, regional, or state agency staff or their contract support working with local communities directly. While the types of support vary by program, themes often include increasing understanding of risk and mitigation, inspiring communities to action, and helping prepare for project funding or implementation.

Factors of a Successful Technical Assistance Project

- Existing community support and ownership.

- Helps position the community to action, including applying for funding or passing a policy or ordinance.
- Integration with other resilience efforts.
- Community is disadvantaged or lower capacity.
- Project helps overcome challenges and addresses risk.

Better understanding community interests and needs, followed by tailored support to fill those gaps, is key to supporting low-capacity communities and equity. Technical assistance programs acknowledge there is no one-size-fits-all solution to supporting communities and that risk information alone is often not enough to support implementation of mitigation actions.

Table 138 outlines sources of potential technical assistance funding or non-financial technical support available to the County.

Table 138. Sources of Technical Assistance

Name	Overview	Contact
FEMA Mitigation Planning Technical Assistance	FEMA's Risk Mitigation Action Planning (MAP) Program identifies flood risk to promote informed planning and development practices. Risk information is primarily conducted on a county or tribal basis and includes both regulatory flood risk maps and nonregulatory risk information. Under FEMA Risk MAP program, agency staff or their contractors can provide technical assistance tailored to a community's need, such as increasing understanding of risk and mitigation or helping prepare for project funding or implementation. This may include a project alternatives analysis or exploring project costs and benefits. For more information refer to the Incorporating Mitigation Planning Technical Assistance into Risk MAP Projects Guidance and the FEMA Region 3 Hazard Mitigation Planning webpage.	Primary point of contact at Maryland Department of Emergency Management or FEMA Region 3
FEMA Building Resilient Infrastructure and Communities (BRIC) Direct Technical Assistance	Building Resilient Infrastructure and Communities (BRIC) Direct Technical Assistance (DTA) gives full support to communities that may not have the resources to begin climate resilience planning and project solution design on their own. Through process-oriented, hands-on support, BRIC DTA will work to enhance a community's capacity to design holistic, equitable climate adaptation solutions that advance numerous community-driven objectives. For more information, refer to the BRIC Direct Technical Assistance webpage.	Communities can send a request through an online submission form found here.

FEMA Dam Safety Collaborative Technical Assistance	FEMA offers a Collaborative Technical Assistance (CTA) series to help communities at risk of dam-related flooding to better understand their risk landscape and the potential consequences of dam-related emergencies. The CTA will include planning for emergencies related to operational discharges or dam-related infrastructure failure. Participants will engage in a facilitated planning process with community stakeholders to build relationships, develop plans, and collaborate with whole community partners to achieve the goal of increased preparedness to dam-related hazards. For more information, refer to the Dam Safety Collaborative Technical Assistance webpage.	Preston Wilson at Preston.Wilson@fema.dhs.gov or Alesia Za Gara at alesia.zagara@associates.fema.dhs.gov.
U.S. Army Corps of Engineers Floodplain Management Services Program (FPMS)	FPMS activities cover the full range of information, technical services, and planning guidance and assistance on floods and floodplain issues within the broad umbrella of floodplain management. Technical services and planning guidance under the FPMS Program are provided to State, regional, and local governments without charge, within program funding limits. For more information regarding FPMS, refer to the Serving Local Communities Through Technical Service Programs webpage.	Stacey Underwood at 410-962-4977 or Stacey.M.Underwood@usace.army.mil
U.S. Army Corps of Engineers Continuing Authorities Program	The Continuing Authorities Program solves water-resource, flood-risk mitigation and environmental restoration problems in partnership with local sponsors without the need to obtain specific Congressional authorization. This program decreases the amount of time required to budget, develop and approve a potential project for construction. Continuous Authorities Program allows the Corps to plan and implement projects that are smaller, less complex and less costly. For more information, refer to the Continuing Authorities Program webpage. Requests for assistance from a state or local government agency should be in the form of a letter describing the location and nature of the problem and requesting assistance under the program.	Anastasiya Kononova, Continuous Authorities Program Manager, at 410-962-2558.
U.S. Army Corps of Engineers National Hurricane Program	The U.S. Army Corps of Engineers and FEMA work with the National Oceanic and Atmospheric Administration (NOAA) to conduct hurricane evacuation studies with the goal of helping local communities understand their evacuation timeline. For more information, refer to the appropriate fiscal year's National Hurricane Program Fact Sheet.	Tom Laczo at 410-962-6773, or Thomas.D.Laczo@usace.army.mil

Environmental Protection Agency Technical Assistance Services for Communities (TASC) Program	Provides independent assistance to help communities better understand the science, regulations and policies of environmental issues and Environmental Protection Agency actions. The TASC program benefits communities by explaining technical findings and answering community questions, helping them understand complex environmental issues, and supporting their active roles in protecting healthy communities and advancing environmental protection. The services are determined on a project-specific basis and provided at no cost to communities. For more information, refer to the Technical Assistance Services for Communities Program webpage.	Contact the appropriate Environmental Protection Agency Regional TASC Coordinator

Visit the following link to download a list of service providers for technical assistance created for the Chesapeake Bay Stewardship Fund through the National Fish and Wildlife Foundation: https://www.nfwf.org/sites/default/files/2022-02/2022-Chesapeake-Bay-Watershed-Technical-Assistance-Providers-List-updated.xlsx.

B.1.a. Technical Assistance Case Studies

Training: Data Modernization and Resilience Meeting

- Assistance need: Allegan County, Michigan and its multiple townships were going through the FEMA map update process which resulted in new mapping for most of the county as it was previously unmapped. There were local concerns about what this would mean as far as duties at the local level (many townships felt understaffed and thought this additional duty would overwhelm them) and were concerned that mapping flood risk would dampen the local real estate market.

- About the assistance: Due to the number of newly mapped communities, it was decided to develop an NFIP 101 session as part of the technical assistance and outreach to help the communities understand what was involved in the program. FEMA delivered a presentation on the NFIP which was followed by the State of Michigan speaking on the technical assistance they provide in joining the program and then their regionally based officials that can assist with more difficult issues as they arise. In addition, two local officials representing communities already participating in the NFIP spoke about their experience. One assured the others that the job duties were not overwhelming and where to go for help on the more challenging issues. Another representative talked about how the flood maps help inform sensible local development decisions. Later in the follow-up meetings, state mitigation staff were there to talk about potential projects and planning grants.

- Results: The initial meeting helped ease the minds of many of the community officials in the unmapped areas. The tone of the process changed from skepticism to many of the officials embracing it and participating throughout the length of the process including the three meetings.

One community applied to join the NFIP by the 3rd meeting and a local tribe, Gun Lake, applied for a planning grant.

Risk and Priority Assessment & Funding Opportunities and Best Practices

- Assistance need: In 2016, Hurricane Matthew - a major flooding in eastern North Carolina - dumped a large amount of rainfall shortly on top of a large rainfall event that occurred the week before. The most severe flooding experienced took place in Fayetteville (Cumberland County) and Lumberton (Robeson County). The State (North Carolina) and the affected communities sought assistance to organize post-Matthew resilient redevelopment planning and grant identification in the area.
- About the assistance: Assistance included multiple engagements with key officials and the general public as well as identification and basic scoping of mitigation project ideas that could be funded with post-disaster funding. In each county, the planning team led a series of six meetings (three with local officials and three with the public) to determine major impacts from the storm, identify any unmet needs that still existed several months after the event, and develop a set of mitigation projects. During these meetings, planners used an online ArcGIS portal to identify specific locations where impacts had occurred and to discuss details of what occurred during the storm. These high impact areas became the basis to propose potential projects.
- Results: The resulting plans mobilized the communities to prioritize their greatest mitigation needs and provided the needed elements to begin preparation of mitigation grant applications, several of which were submitted to FEMA and later Department of Housing and Urban Development.

B.2. Funding Opportunities

In the same manner of outlining lead agencies of parallel efforts for future mitigation projects, **Table 139** outlines notable sources of potential funding. Additional funding opportunities in the state of Maryland may be found on the Maryland Department of Natural Resources webpage, and the Georgetown Climate Center Adaptation Clearing House may list more opportunities in Maryland and nationwide.

Common federal sources of grants and loans include FEMA, the U.S. Department of Housing and Urban Development, the National Parks Service (NPS), the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, the U.S. Economic Development Administration (EDA), and the U.S. Fish and Wildlife Service (FWS).

Table 139. Sources of Potential Funding

Name	Source	Funding Type	Maximum Funding	Local Cost Share	URL
Hazard Mitigation Grant Program (HMGP)	FEMA	Grant	---	25%	Webpage
Building Resilient Infrastructure and Communities (BRIC)	FEMA	Grant	$2 million (state set-aside) or $50 million (national competition)	25%	Webpage
Flood Mitigation Assistance (FMA) Program	FEMA	Grant	$25,000 (planning); $50,000 technical assistance; $900,000 project scoping; $300,000 capability and capacity building; $50 million localized projects; N/A individual projects	25%	Webpage
Pre-Disaster Mitigation (PDM) Grant Program	FEMA	Grant (via congressional appropriation)	---	25%	Webpage
Public Assistance - Mitigation	FEMA	Grant	---	25%	Webpage
Safeguarding Tomorrow Revolving Loan Fund (RLF) Program	FEMA (provided to states)	Loan	---	Eligible as local cost share match for other Hazard Mitigation	Webpage

Name	Source	Funding Type	Maximum Funding	Local Cost Share	URL
				Assistance grant	
Community Development Block Grants (CDBG) - Disaster Recovery	Department of Housing and Urban Development	Grant	---	None	Webpage
Community Development Block Grants (CDBG) - Mitigation	Department of Housing and Urban Development	Grant	---	None	Webpage
Regional Conservation Partnership Program (RCPP)	United States Department of Agriculture	Grant	$10 million	None, but encouraged	Webpage
Emergency Watershed Protection Program	United States Department of Agriculture	Grant	< $5 million	Varies	Webpage
National Coastal Resilience Fund	National Fish and Wildlife Foundation & NOAA	Grant	None	None, but encouraged	Webpage
Interagency Nonstructural Flood Risk Management Projects	U.S. Army Corps of Engineers	Technical Assistance	---	Yes	Webpage
Environmental Quality Incentives Program (EQIP) - Wildfire and Hurricane Mitigation	United States Department of Agriculture	Incentive	$3 million	25%	Webpage
Building Blocks for Sustainable Communities	Environmental Protection Agency	Technical Assistance	---	None	Webpage
Greening America's Communities Program	Environmental Protection Agency	Technical Assistance	---	None	Webpage

Name	Source	Funding Type	Maximum Funding	Local Cost Share	URL
Superfund Redevelopment Initiative (SRI)	Environmental Protection Agency	Technical Assistance	---	None, but encouraged	Webpage
Urban Waters Small Grants Program (UWSG)	Environmental Protection Agency	Grant	$60,000	None	Webpage
Urban and Community Forestry (UCF) Program	United States Department of Agriculture	Grant	Varies	Yes	Webpage
Resilient Maryland Program	Maryland Energy Administration	Grant	Varies	---	Webpage
Chesapeake and Coastal Grants Gateway	Maryland Department of Natural Resources	Grant	Varies	---	Webpage

B.3. Utilizing Social Vulnerability Scores

CDC Social Vulnerability Index scores can be used by Prince George's County and the City of Laurel to identify potential mitigation project locations. Social Vulnerability scores by census tract are based on percentiles. Percentile ranking values range from 0 to 1, with higher percentile scores indicate greater social vulnerability.

Socially vulnerable populations often face disproportionate adverse effects of natural disasters without equitable opportunities to prepare for them; therefore, they would benefit greatly from mitigation projects. Knowledge of social vulnerability scores throughout the County and City is essential when applying for grant programs that provide funding for mitigation projects located in areas with high social vulnerability.

For the most recent census-tract level SVI scores, refer to the CDC's Social Vulnerability Index Interactive Map. The official 2020 CDC Social Vulnerability Index map is provided in **Figure 94**.

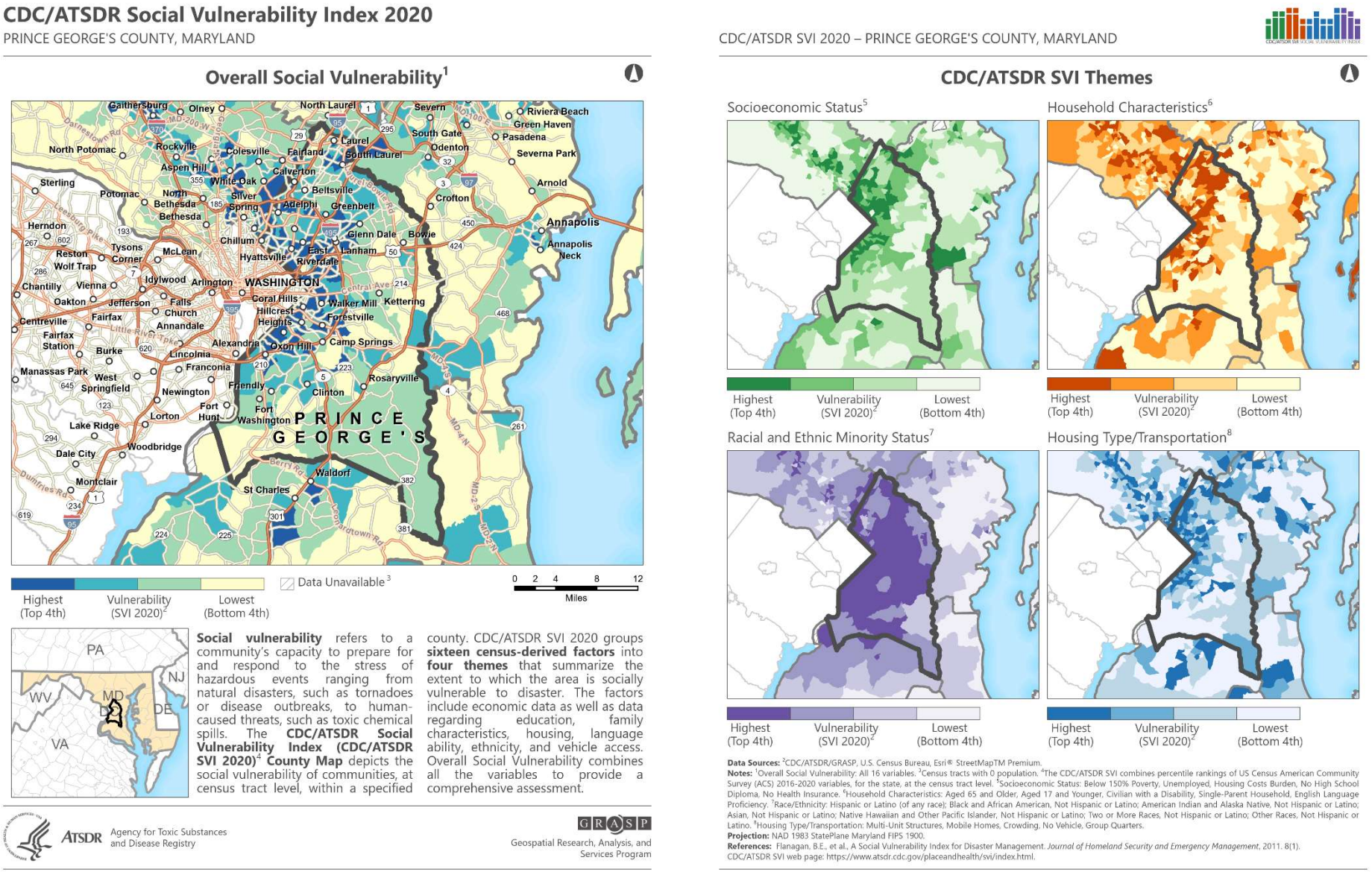


Figure 94. 2020 CDC Social Vulnerability Index Map for Prince George's County

B.4. Incorporating Mitigation Plan Requirements into Other Local Planning Mechanisms

Chapter 5 describes how Prince George's County and the City of Laurel address hazards as part of their current planning mechanisms and processes, including land development, infrastructure design, and public outreach. The development of the 2023 HMP did not reveal any significant gaps in how hazards are addressed in existing planning mechanisms or processes, however, there are opportunities to explore integrating this process within the community, with other parallel programs and initiatives in the County or City, or in tandem with efforts in cities or at the regional, State, and National level as they become available.

The following list identifies lead agencies that are likely to undertake complementary and parallel efforts to future mitigation projects:

- Prince George's County Department of the Environment: This department is responsible for protecting and improving the environment in Prince George's County. It works on a variety of issues related to environmental, hazard, and climate change planning, including air quality, water quality, hazardous waste, and sustainability.
- Maryland Department of the Environment: The Maryland Department of the Environment is the state agency responsible for protecting and improving the environment in Maryland. It works on a variety of issues related to environmental, hazard, and climate change planning, including air quality, water quality, hazardous waste, and sustainability.
- Maryland Department of Emergency Management: The Maryland Department of Emergency Management is responsible for coordinating the state's response to disasters and emergencies. It works on a variety of issues related to hazard and emergency management, including emergency preparedness, response, and recovery.
- Prince George's County Office of Homeland Security: The Prince George's County Office of Homeland Security is responsible for coordinating the county's response to disasters and emergencies. It works on a variety of issues related to hazard and emergency management, including emergency preparedness, response, and recovery.
- Maryland-National Capital Park and Planning Commission: A bi-county agency that is responsible for planning and developing parks, recreation, and open space in Montgomery and Prince George's Counties in Maryland. Efforts to protect and preserve the natural and cultural resources in the region include the Maryland-National Capital Park and Planning Commission 's Department of Parks and Recreation has a Division of Natural and Historical Resources that is responsible for managing and protecting the natural and cultural resources within the park system. This division works on a variety of environmental planning and resource management activities, including land acquisition, restoration, and preservation of natural areas, as well as the management of historic sites and resources.

Broadly speaking, this recommendation simply aims for the Mitigation Action Committee to explore new ways to continue building relationships and operational capacity between organizations with similar goals to improve our communities' relationships with the natural environment.

C. Monitoring and Reporting Progress

The Prince George's County Department of Environment and the Office of Homeland Security will coordinate an annual meeting of the Mitigation Advisory Committee and assemble an annual report to the Maryland Department of Emergency Management and FEMA Region 3 detailing annual progress on mitigation actions (refer to **Appendix I** for an annual progress report template) as well as outreach activities. The Prince George's County Office of Homeland Security Regional Planner will lead in compiling the annual report and the City of Laurel's Department of Emergency Services Emergency Manager with work with County officials to support its development. In each jurisdiction, the lead agencies will be contacted and asked to report on the status of implementation, including obstacles to progress and recommended solutions. All 27 incorporated municipalities within Prince George's County will be invited and encouraged to attend the annual meeting. To monitor progress, the Department of Environment may convene a meeting of the appropriate agencies to discuss and determine progress, and to identify obstacles to progress, if any.

The Plan will be evaluated for effectiveness by the Mitigation Advisory Committee during each annual meeting. To evaluate effectiveness of the Plan, the Committee members will determine mitigation actions that have been successfully implemented and identify additional support if needed to advance near-term actions. Additionally, the Committee will update the public on action status and document hazard occurrences and impacts. Finally, the Committee will identify new or additional vulnerabilities that may impact the County and City, to be addressed in the future update of the Plan.

In addition to the scheduled reports, the Office of Homeland Security, the Department of Environment, and the City of Laurel Emergency Manager will convene meetings after damage-causing natural hazard events to review the effects of such events. Based on those effects, adjustments to the mitigation actions and priorities may be made or additional event-specific actions may be identified. Such revisions shall be documented as outlined in **Section D**, below.

D. Evaluations, Revisions, and Updates

Revisions that warrant changing the text of the HMP or incorporating new information may be prompted by a number of circumstances, including the identification of new mitigation actions, the completion of several mitigation actions, a significant change in hazard risk, or to satisfy requirements to qualify for specific funding. Minor revisions may be handled by addenda.

A major comprehensive review and revision of the HMP will be considered over a five-year cycle. The HMP was first adopted in 2005 and the first updated plan was in 2010. The County and City adopted the 2023 update on October 12, 2023 following Maryland Department of Emergency Management and FEMA conditional approval. The Mitigation Advisory Committee will be re-convened by the Prince George's County Office of Homeland Security Regional Planner and City of Laurel Department of Emergency Services Emergency Manager to conduct the comprehensive evaluation and update during the next cycle. At that time, natural hazard events that have occurred will be incorporated and the risk assessment will be updated if such events indicate new or altered exposures. Particular attention will be given to progress made on the mitigation actions. Actions that have not been completed and new actions that have been identified will be re-prioritized and examined in terms of feasibility, staff resources, County and City goals, and budget limitations.

The Mitigation Advisory Committee will involve the public in the plan maintenance process and during the major comprehensive review of the HMP utilizing at least the same level of effort as described in this

update. The public will be notified when the revision process is started and provided the opportunity to review and comment on changes to the HMP and the proposed mitigation actions. It is expected that a combination of virtually-distributed information, draft documents posted on the website, and/or public County and City Council meetings may be used.

E. Future Improvements

The Hazard Mitigation Process is designed to be steps to continuous improvement and refinement. In order to support this effort, recommendations made during this review that were not able to be implemented due to time and budget constraints were compiled, and a review of other recently published and comparable hazard mitigation plans was conducted. The resulting recommendations for the next comprehensive update of the 2023 HMP are described below.

- Integrating the Risk Assessment's mapping into the Hazard Risk Index: The Hazard Risk Index used in the summary section of the Risk Assessment provides a way to compare and rank hazards by their overall impact on the planning area. This could be taken a step further by integrating GIS analyses into the index scores of spatial hazards so they can be automatically computed not only for the planning area as a whole, but smaller communities. This can allow for more targeted mitigation actions to be linked to specific areas, since hazard impacts can vary greatly across the planning area.
- Priority Project Sheets: A priority project sheet can be developed for the top 5 or so actions as identified by the Mitigation Advisory Committee and/or the public. These sheets would be based on the funding application requirements for the action's most likely funding opportunity. This would allow for a head start on the future application which may increase project implementation.
- Neighborhood Focus Groups: Hazard risk, vulnerability, and priorities can vary greatly between neighborhoods and communities throughout the planning area. To help integrate these differences into the overall Mitigation Strategy, focus groups can be used to gather valuable feedback from priority neighborhoods or populations. This would also help develop a more detailed, intersectional social vulnerability analysis to assess the County's current abilities to ensure that projects have distributional equity.
- State Integration: Further integrating with the State of Maryland's identified priorities and related frameworks.
- Risk Hot-Spot Mapping: Combine all spatial assessments to identify and more granularly map "hot spots" of overlapping hazard risk, social vulnerability, and future development.
- Standalone Executive Summary: Public feedback highlighted the desire for a standalone executive summary that provides the most important information for the average County or City resident in a more manageable package. While the current executive summary gives a high-level overview, a more thorough versions could be developed, or perhaps tailored versions for the City of Laurel and Prince George's County.

F. Public and Stakeholder Involvement

Feedback from residents, businesses, and other stakeholders is a critical part of hazard mitigation planning. The input from the Prince George's County and the City of Laurel public was a highly valuable part of the 2023 HMP update, and it will continue to be sought as the planning process continues and

evolves. Public and stakeholder involvement helps guide mitigation actions and projects through prioritizing what the public values and needs.

Public notice of the annual review will be given, and public participation will be actively invited. At a minimum, notification will be through web postings and press releases to local media outlets, primarily newspapers. In addition, an annual event will be held to publicize progress on implementing the mitigation plan. This event could be timed to coincide with the anniversary of a significant event or annual awareness event. The County will also post a link to the mitigation plan on the Office of Homeland Security's website. It is recommended that the County's website serve as a means of communication by providing information about mitigation initiatives and updates to the projects and the HMP itself.

As resources become available, social media should be utilized to publicize public hazard mitigation planning meetings and news. Specifically, community Facebook groups and the Prince George's County Subreddit can be utilized as they are already-existing community networks that allow for greater exposure to those who do not typically see notices about hazard mitigation planning. Feedback can and should be solicited from these groups as a way to bolster knowledge of hazard issues using local knowledge.

Additionally, as described in the future improvements section, outreach can be conducted to further involve community groups (e.g., church groups, schools, volunteer organizations) in the planning process. Emergency management professionals can also be contacted to determine areas for collaborations and identify specific mitigation projects that can be collaboratively implemented to address hazards that effect both jurisdictions.