



CALVERT COUNTY *Maryland*

High Tide Flood Mitigation Plan

2025 Update

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Chapter 1: Introduction

Maryland House Bill 1427 (2019), §3-1018(b) and (c), requires any local jurisdiction to develop a plan to address nuisance flooding, update this plan every five years; publish the plan on the local jurisdiction's website; and submit the plan to the Maryland Department of Planning (MDP).¹ "Nuisance flooding" is "high tide flooding that causes a public inconvenience."²

Calvert County's 2020 nuisance flood mitigation plan "sought to create a baseline inventory of areas where tidal nuisance flooding occurs, identify flood thresholds, water levels, and conditions that lead to tidal nuisance flooding, and propose a mechanism to document tidal nuisance flooding events."³ This 2025 update evaluates changes since 2020 in nuisance, or "high tide," flooding risks and mitigation efforts.

Terminology shift: Agencies are shifting to use "high tide" flooding in place of "nuisance" flooding. This plan adopts that terminology to facilitate understanding that this type of flooding is that which is experienced along tidal coastlines.

Scope

The Calvert County High Tide Flood Mitigation Plan (HTFMP) evaluates the risk and vulnerability associated with high tide flooding in Calvert County, determines the areas of the county where high tide flooding events would be the most impactful, and offers future solutions to minimize the impact of high tide flooding. The intent of this plan is to provide analysis and outline actions to guide Calvert County's efforts to become more resilient to current and future high tide flooding along its coastline.

The HTFMP includes:

- An overview of current research and predictive modeling of sea-level rise and climate change as they relate to high tide flooding in Calvert County, Maryland.
- Identification of high tide flooding in Calvert County, including flooding history, frequency, and severity; how the County responds to high tide flooding; and tools to report high tide flooding.
- Assessment of the risk and vulnerability in Calvert County, including high-risk communities, critical infrastructure, and community resources.
- Identification of plans and policies related directly or indirectly to high tide flood mitigation.
- A review of planned actions to mitigate high tide flooding in Calvert County, including prioritization of actions, and project and partnership opportunities.

Planning Team

Development of the HTFMP was an inter-departmental effort that captured the mitigation and resilience efforts being pursued county-wide. Members of the planning team included

¹ Sea Level Rise Inundation and Coastal Flooding - Construction, Adaptation, and Mitigation, 2019, c. 442 (Maryland), <https://legiscan.com/MD/text/HB1427/id/2022044>.

² MD Natural Resource Article §3-1001.

³ Calvert County Dept. of Planning & Zoning, *Nuisance Flooding Plan for Calvert County* (1 Oct. 2020), 14, <https://www.calvertcountymd.gov/DocumentCenter/View/32539/Nuisance-Flooding-Plan-for-Calvert-County---2020>.

representatives from the Departments of Planning & Zoning, Public Safety, Public Works, and Technology Services.

Table 1-1: Calvert County HTFMP Planning Team

Name	Department	Position
Amalia Pleake-Tamm	Planning & Zoning	Environmental Planner III
Ronald Marney	Planning & Zoning	Environmental Planning Regulator
Kara Buckmaster	Public Safety	Emergency Management Specialist
Siarah Newsome	Public Safety	Public Safety GIS Analyst
Lionell Sewell	Technology Services	GIS Division Chief
Frederick “Danny” Bauer	Technology Services	GIS Analyst II
Matthew Tettimer	Public Works	Deputy Director of Public Works
Thomas Moore	Public Works	Public Works Inspector II
Jonathan Henderson	Public Works	Public Works Inspector II

Timeline

Planning development for the HTFMP began in September 2024 and continued through March 2025.

Table 1-2: Calvert County HTFMP Planning Timeline

Date	Meeting	Description
09/20/2024	Kick-off Meeting	Initial meeting with the planning team and MD DNR to discuss grant funding requirements.
09/23/2024	HTFMP Tech Deliverables	Discuss opportunities for tech deliverables to explore.
10/04/2024	HTFMP Planning Meeting	Clarify deliverables and review draft project timeline.
10/15/2024	HTFMP Planning Meeting	Coordination and planning with TS/GIS and DPW.
10/24/2024	HTFMP GIS Scoping	Identify the current flooded road reporting process and finalize scoping for the flooded roadway tool.
11/25/2024	HTFMP Planning Meeting	Review the plan outline to begin drafting.
01/02/2025	HTFMP Planning Meeting	Review the current plan and discuss mitigation plans and actions.
02/21/2025	HTFMP Inundation Modeling	Review high-risk areas and select a watershed for inundation modeling. Review timelines for plan adoption.
03/28/2025	HTFMP Final Planning Meeting	Finalize mitigation action items and review the final draft plan.

Chapter 2: Background: Coastal Flooding & Climate Modeling

As a peninsula on the Chesapeake Bay, Calvert County faces increasing coastal flood risks along its 165 miles of tidal shoreline.⁴ Apart from global sea level rise,⁵ Calvert County experiences relative sea level rise, which reflects the effects of global sea level rise along a specific coast, with land subsidence (sinking of land), tectonic plate movements, and other local factors.⁶ Sea-level rise in Maryland has been—and will continue to be—greater than the global average. Sea-level rise for Baltimore is projected to be 17% higher than the global mean sea-level rise in 2100, due to ocean dynamic processes of the North Atlantic Ocean and the Gulf Stream, as well as the weaker gravitational attraction of shrinking Antarctic ice sheets.⁷

Within the state of Maryland, variations in sea-level rise projections are attributed to land subsidence caused by glacial isostatic adjustment and groundwater withdrawals. Locations further south are generally subsiding at a faster rate than northern locations in the Bay, although land in Southern Maryland is experiencing faster subsidence than land further south toward the Rappahannock River. Sea level along Maryland's shores will likely rise between 0.3 meters and 0.5 meters above 2005 levels by 2050—that's an increase of roughly 1 to 1.5 feet.⁸ This rate is accelerating. "The sea-level rise that Maryland will experience during the first half of this century will be greater than that experienced during the whole of the last century."⁹ In the Chesapeake Bay region, "[u]p to 4.9 feet of sea level rise is possible by 2100."¹⁰ According to the National Oceanic and Atmospheric Administration's (NOAA's) data, the relative sea level at Solomons Island has risen 4.11 millimeters per year from 1937 to 2024.¹¹ This is an increased rate from that reported in 2019 (3.88 mm per year).¹²

⁴ Flood sources extend beyond Calvert's coastline. Coastal and inland areas can face flooding from weather events that cause overbank ("fluvial") flooding in Calvert's twenty-two 12-digit watersheds or overwhelm soil absorption and infrastructure capacity, causing ponding ("pluvial") flooding. Calvert County has several dams that are inherent flood sources. Mitigating these flood sources is addressed in the *Calvert County 2023 Hazard Mitigation Plan*, specifically the County's flood mitigation plan, found in Appendix K.

⁵ Since 1993, satellites have measured a global mean sea level rise of over 3.3 mm/yr. That rate is accelerating, from a rate of 2.3 mm/yr between 1993–2002 to 4.7 mm/yr between 2013–2022. Donald F. Boesch, et al., *Sea-level Rise Projections for Maryland 2023* (Univ. of Md. Ctr. for Env't Sci., 2023), 5, <https://www.umces.edu/sea-level-rise-projections>.

⁶ BayLand Consultants & Designers, Inc., *North Beach Compound Flood Action Plan* (Jun. 2023) 11, https://www.northbeachmd.org/sites/g/files/vyhlif4786/ff/uploads/2023-06-28_north_beach_compound_flood_action_plan_final.pdf.

⁷ Boesch, et al., *Sea-level Rise Projections for Maryland 2023*, 14

⁸ *Id.* at 1.

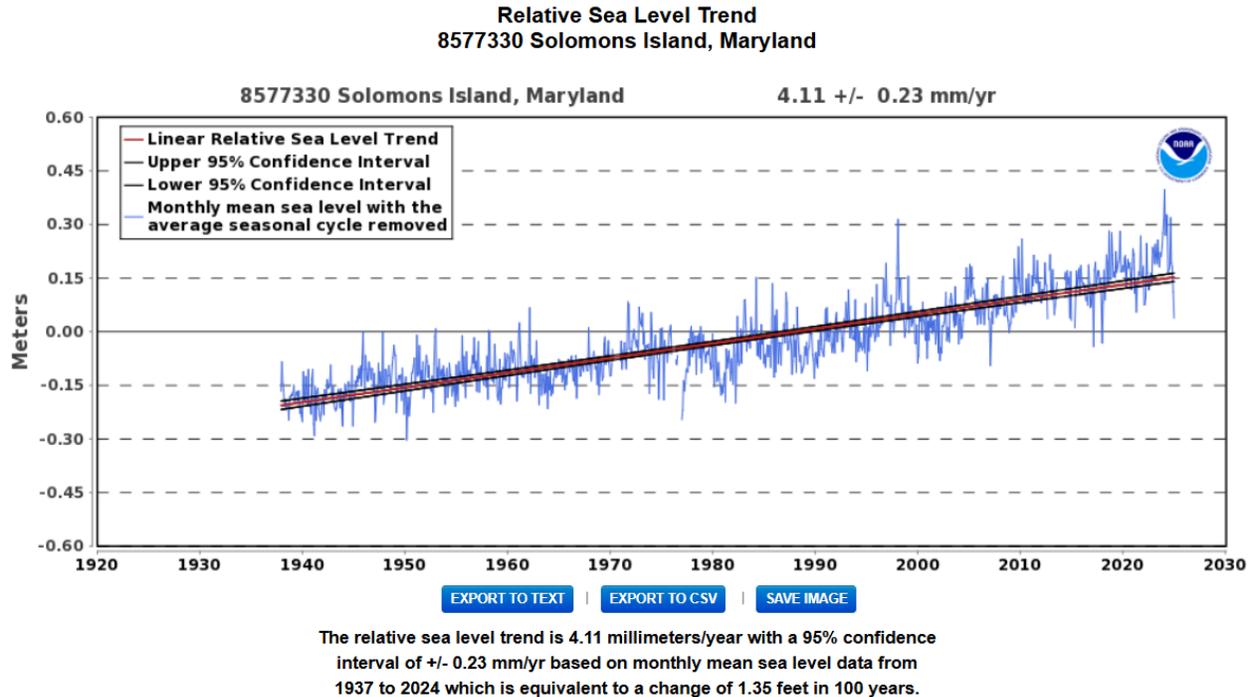
⁹ *Id.*

¹⁰ Jeremy Cox, "As land turns salty, farmers grapple with lost income" (*The Chesapeake Bay J.*, 31 Dec. 2024), <https://marylandmatters.org/2024/12/31/as-land-turns-salty-farmers-grapple-with-lost-income/?emci=84a56d64-7cc7-ef11-88ce-0022482a93af&emdi=486059a6-87c7-ef11-88ce-0022482a93af&ceid=591016>, citing Univ. of Md. Ctr. For Env't Sci.

¹¹ National Oceanic and Atmospheric Admin. (NOAA), "U.S. Linear Relative Sea Level (RSL) trends and 95% Confidence Intervals (CI) in mm/year and in ft/century" (Ctr. for Operational Oceanographic Products and Services, accessed Mar. 2025), <https://tidesandcurrents.noaa.gov/sltrends/mslUSTrendsTable.html>.

¹² Calvert County Dept. of Planning & Zoning, *Nuisance Flooding Plan for Calvert County*, 1.

Figure 2-1: Relative Sea Level Trend in Solomons, MD¹³



As shown in Figures 2-2 and 2-3 below, the State of Maryland calculated sea-level rise projections in both 2023 and 2018. Notably, the projected sea-level rise in Solomons for 2050 and beyond decreased from the 2018 to 2023 projections. Using the same median risk acceptance, the 2018 analysis predicted emissions in 2050 and later will stabilize, whereas the 2023 analysis predicted they will decrease.¹⁴ According to the methodology used for the 2023 projections, this is due to the effect of the Paris Agreement and other worldwide climate change commitments.

¹³ NOAA, "Relative Sea Level Trend 8577330 Solomons Island, Maryland" (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8577330.

¹⁴ Cf. 2018 projections for a rise of 2 ft in 2050 and 2.4 ft in 2060 with 2023 projections for a rise of 1.26 ft in 2050 and 1.57 ft in 2060.

Figure 2-2: 2023 Sea Level Rise Projections for Solomons using Current Emissions Commitments Scenario (declining emissions after 2050) (SSP2-4.5)¹⁵

Quantile		2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150
SOLOMONS															
METERS	5	0.04	0.10	0.16	0.24	0.32	0.40	0.47	0.53	0.56	0.58	0.64	0.70	0.76	0.81
	17	0.07	0.14	0.21	0.30	0.38	0.47	0.55	0.62	0.67	0.71	0.78	0.85	0.93	0.99
	50	0.11	0.20	0.29	0.39	0.48	0.58	0.67	0.77	0.87	0.96	1.06	1.16	1.26	1.36
	83	0.16	0.26	0.37	0.49	0.60	0.73	0.85	0.98	1.13	1.28	1.43	1.57	1.71	1.85
	95	0.19	0.31	0.44	0.57	0.69	0.85	1.00	1.15	1.35	1.53	1.71	1.89	2.06	2.24
FEET	5	0.14	0.31	0.53	0.80	1.06	1.31	1.55	1.74	1.85	1.90	2.10	2.29	2.48	2.66
	17	0.23	0.45	0.70	0.98	1.25	1.53	1.79	2.02	2.20	2.33	2.57	2.80	3.03	3.26
	50	0.37	0.65	0.94	1.26	1.57	1.90	2.21	2.51	2.85	3.14	3.48	3.81	4.14	4.47
	83	0.51	0.87	1.22	1.59	1.96	2.38	2.79	3.20	3.70	4.20	4.68	5.15	5.62	6.08
	95	0.61	1.03	1.43	1.86	2.28	2.78	3.27	3.78	4.41	5.02	5.60	6.18	6.76	7.34

Figure 2-3: 2018 Sea Level Rise Projections for Solomons, MD, using Stabilized Emissions after 2050 Pathway (RCP-4.5)¹⁶

Tide Gauge: Solomons Island, MD			
Emissions Pathway beyond 2050: Stabilized (RCP 4.5)			
Year	High tolerance for flood risk	Medium tolerance for flood risk	Low tolerance for flood risk
2030	0.9 ft	1.1 ft	1.3 ft
2040	1.2 ft	1.5 ft	1.8 ft
2050	1.7 ft	2.0 ft	2.4 ft
2060	2.0 ft	2.4 ft	2.9 ft
2070	2.4 ft	2.9 ft	3.5 ft
2080	2.7 ft	3.3 ft	4.3 ft
2090	3.1 ft	3.8 ft	5.0 ft
2100	3.5 ft	4.4 ft	5.8 ft
2110	3.9 ft	5.0 ft	6.8 ft
2120	4.3 ft	5.5 ft	7.8 ft
2130	4.8 ft	6.1 ft	8.8 ft
2140	5.2 ft	6.7 ft	9.7 ft
2150	5.6 ft	7.3 ft	10.9 ft

¹⁵ Boesch, et al., *Sea-level Rise Projections for Maryland 2023*, 29.

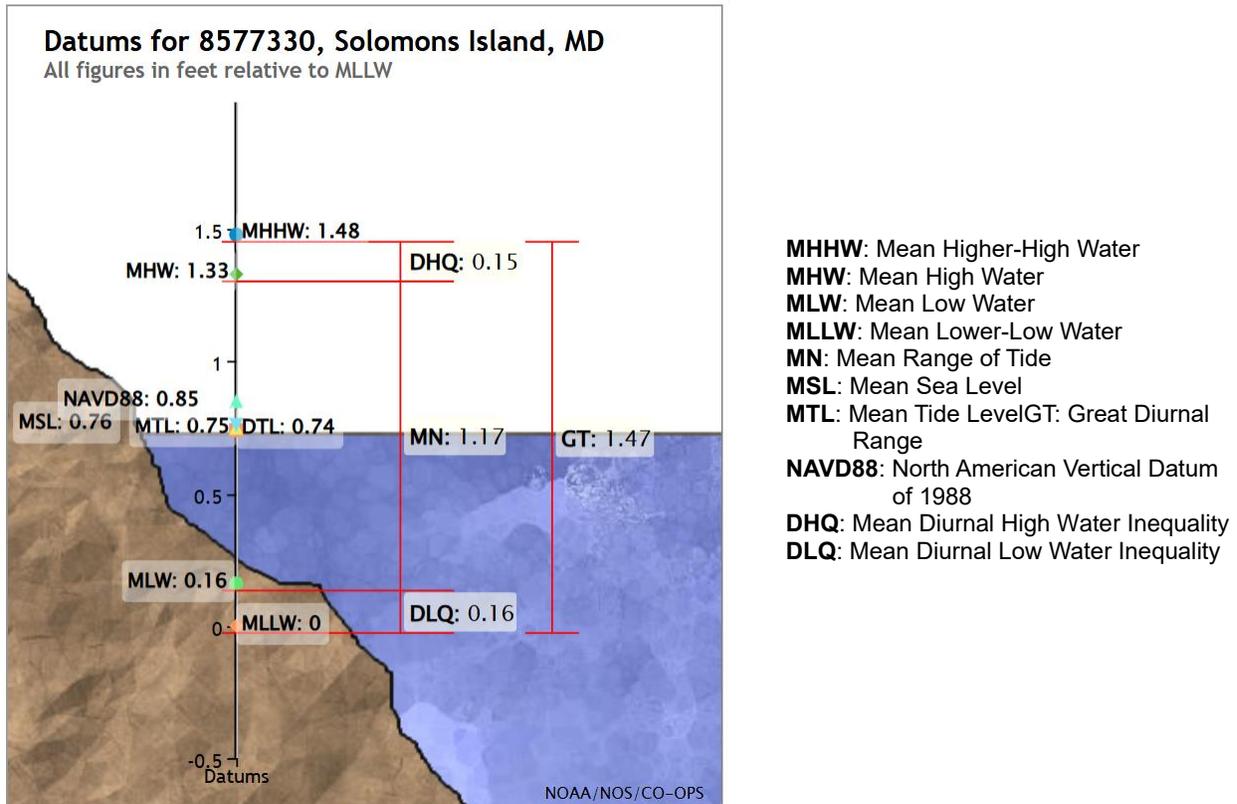
[https://www.umces.edu/sites/default/files/Maryland Sea-Level Rise Projections 2023 report 0.pdf](https://www.umces.edu/sites/default/files/Maryland%20Sea-Level%20Rise%20Projections%202023%20report%200.pdf)

¹⁶ Kate McClure, Allison Breitenother, and Sasha Land, *Guidance for Using Maryland's 2018 Sea Level Rise Projections* (Jun. 2022), 34, https://extension.umd.edu/sites/extension.umd.edu/files/2022-07/MD_SLRGuidance_June2022.pdf.

Chapter 3: High Tide Flooding

High-tide flooding is the regular flooding along tidal waterways due to tidal fluctuations. It occurs when coastal water elevations exceed the Mean Higher High Water (MHHW)¹⁷ in a given location. Figure 3-1¹⁸ displays MHHW and other tidal datums for the Solomons tide gauge.

Figure 3-1: Tidal Datums for Solomons, MD



The NOAA National Ocean Service has two sets of thresholds for high tide flooding, one maintained by the National Weather Service (NWS) and one by the National Ocean Service (NOS). Both sets of impact thresholds divide high tide flooding into three classes: minor, moderate, and major. The NWS thresholds factor in local effects such as seawalls or very localized geography; however, the NOS thresholds are more consistent across geographical areas and are preferable when examining historic water level data to determine the frequency of

¹⁷ MHHW is a tidal datum of the average of the higher high water height of each tidal day observed over the 19-year National Tidal Datum Epoch. NOAA, "Tidal Datums" (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), https://tidesandcurrents.noaa.gov/datum_options.html.

¹⁸ NOAA, "Datums for 8577330, Solomons Island MD" (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), <https://tidesandcurrents.noaa.gov/datums.html?datum=MLLW&units=0&epoch=0&id=8577330&name=Solomons+Island&state=MD>.

past and projected flood days.¹⁹ As such, this analysis of high tide flooding in Calvert County uses the NOS impact thresholds, displayed in Table 3-1, for the NOAA tide gauge in Solomons.

Table 3-1: NOAA NOS High Tide Flooding Impact Thresholds for Solomons, MD

Threshold	Elevation (ft) Above MHHW	Impact Description ²⁰
Minor	1.699	Low threat of property damage and no direct threat to life.
Moderate	2.667	Elevated threat of property damage and some risk to life if one places themselves in unnecessary danger.
Major	3.898	Significant threat to life and property.

High Tide Flood Frequency

The *Calvert County Flood Mitigation Plan* lists past flooding occurrences, as documented by NOAA’s National Center for Environmental Information database. According to this database, there were seven documented flood events in Calvert County from 2020 to 2022.²¹ Using data from Maryland Department of Natural Resources’ MyCoast application, there were 144 reports of high tide flooding in Calvert County between September 26, 2015 and September 23, 2024. While this number does not capture all events, it reinforces that areas frequently experiencing high tide flooding include North Beach, Chesapeake Beach, Neeld Estate, Plum Point, Hallowing Point, Long Beach, Broomes Island, Cove Point, Solomons.²²

Rising sea levels increase the incidence and impact of high tide flooding. Additionally, high tide flooding is exacerbated by the increasing frequency and severity of storms and volume of rainfall. As sea levels rise along coastlines, the water depth increases and reduces frictional resistance to waves, increasing the tidal range and storm surges, particularly in combination with low-pressure weather systems.²³ This leads to greater wave overtopping (i.e., continuous waves overtopping shorelines and depositing water in normally dry areas). The combination of rising sea levels and tropical storm intensity will “greatly increase flooding frequency along the U.S. Atlantic and Gulf coasts, with a once-in-100-year flood level experienced at least once in a decade by the end of this century.”²⁴

Evolving High Tide Flooding Threat

High tide flooding is occurring more frequently every year as sea levels continue to rise and is increasingly disrupting coastal community life. NOAA tracks high tide flooding using its network

¹⁹ NOAA, “Coastal Inundation Dashboard” (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), https://tidesandcurrents.noaa.gov/inundationdb_info.html#faq.

²⁰ Impact descriptions pulled from NOAA Sea Level Calculator Glossary: https://coast.noaa.gov/data/sealevelcalculator/pdfs/Glossary_Sea_Level-Calculator_final.pdf.

²¹ MCM Consulting Group, Inc. and Calvert County staff, *Calvert County Flood Mitigation Plan* (2024), 16–17, <https://www.calvertcountymd.gov/DocumentCenter/View/47172/Appendix-K-Final-2024-Flood-Mitigation-Plan>.

²² MD Dept. of Natural Resources, “MyCoast,” <https://mycoast.org/md>. Login required, however the account is free.

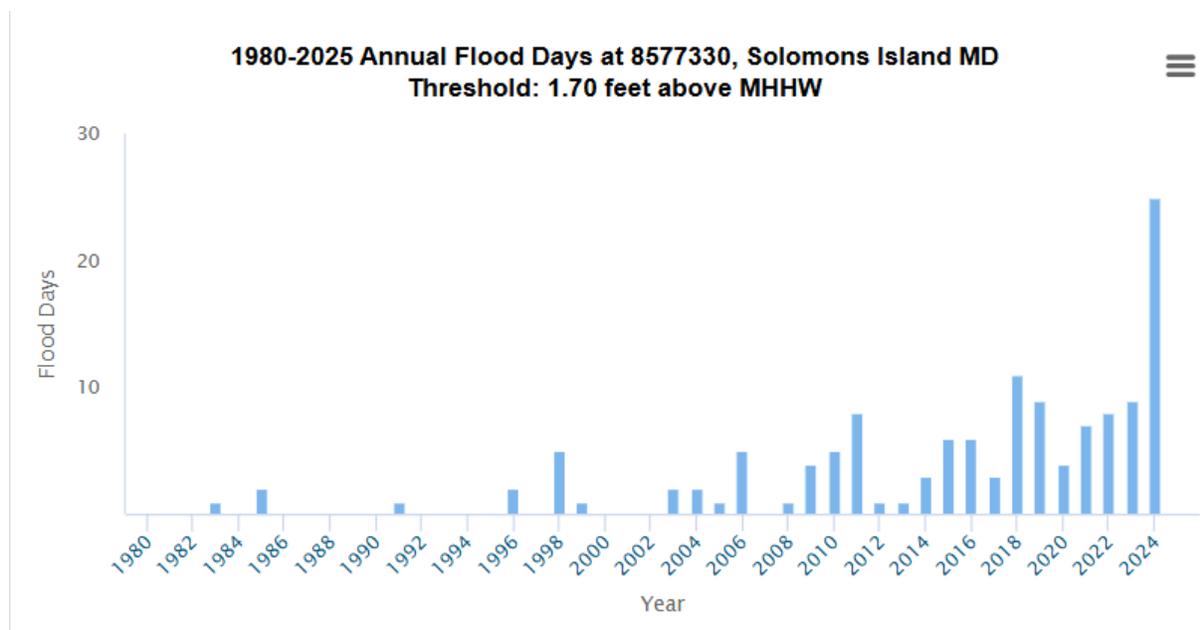
²³ Tay Harris and David Brownlee (Calvert Co. Dept. of Community Planning and Building), *Broomes Island Flood Mitigation Plan* (8 Sep. 2016), 19, https://www.calvertcountymd.gov/DocumentCenter/View/14552/BIFMP-FINAL_Ordinance-05-17?bidId=; BayLand Consultants & Designers, Inc., *North Beach Compound Flood Action Plan*, 12.

²⁴ Boesch, et al., *Sea-level Rise Projections for Maryland 2023*, 21.

of tide gauges across the United States. According to NOAA statistics,²⁵ high tide flooding days have increased between 400–1,100% in the U.S. Southeast Atlantic and Gulf Coast, and more than doubled nationwide since 2000. NOAA also predicts that high tide flooding frequency will range between 45 to 85 days per year by 2050. NOAA provides several tools, including the Coastal Inundation Dashboard and the Sea Level Calculator, to help visualize the frequency and predict future impacts of high tide flooding with consideration for sea-level rise.

Figure 3-2²⁶ shows the annual number of flood days each year according to data from the tide gauge in Solomons, MD. These are the number of days that coastal water elevations exceeded the MHHW by at least 1.669 feet and met the threshold for minor high tide flooding. As can be seen, the annual frequency of minor high tide flooding or greater has increased substantially since 1980, with a progressive increase noted over the past 5 years. Annual flood days for 2024 are more than double the frequency for any year prior.

Figure 3-2: 1980–2025 Annual Flood (Minor or Greater) Days in Solomons, MD



With this in mind, it is worth repeating that the latest high tide flood projections for Solomons predict reduced flooding in 2050 and beyond if current climate commitments are met. Compared to the 2018 sea-level rise projections for Maryland, the 2023 projections offer an improved outlook on post-2050 sea-level rise trends due to predicted worldwide reductions in greenhouse gas emissions.

Responding to High Tide Flood Events

Some areas are at risk of being stranded in waterfront communities during flood events. Multiple departments throughout the County support public messaging and awareness of hazards during

²⁵ NOAA, “High Tide Flooding” (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), <https://coast.noaa.gov/states/fast-facts/recurrent-tidal-flooding.html>.

²⁶ NOAA, “857730 Solomons Island, MD High Tide Flood Outlook Information” (Ctr. For Operational Oceanographic Products and Services, accessed Mar. 2025), <https://tidesandcurrents.noaa.gov/inundationdb/inundation.html?id=8577330#floaddays>.

a flood event. Personnel from the Department of Public Works may respond to post signage or shut down access to flooded roadways. Additionally, if the weather forecast predicts severe weather such as a prolonged rain event, tropical storm, or hurricane, the Calvert County Emergency Management Division may activate the Emergency Operations Center in accordance with the Emergency Operations Plan (EOP). Calvert County's EOP outlines emergency notification, evacuation, and response procedures to disasters.

Documenting High Tide Flood Events and Responses

Calvert County has one NOAA tide gauge, located in Solomons, Maryland. High tide flooding in Solomons begins at 1.699 ft. above MHHW. Through ongoing public outreach and education, residents are encouraged to report flooding via Maryland Department of Natural Resources' MyCoast online and mobile application. Calvert Prepare—a mobile application offered by Calvert County Department of Public Safety—also offers the ability to submit damage reports.²⁷

Figure 3-3: MyCoast Maryland



The infographic features a central blue circle with the title "What is MyCoast?" and a text block explaining the app's purpose. To the right is a blue rounded rectangle titled "How to use it?" with instructions on using the app or browser and a download icon. At the top left is a blue box with the text "Download MyCoast to document flooding in Calvert County!". The top right displays the "MyCoast Maryland" logo and a QR code. A circular inset image shows a flooded dock. At the bottom, contact information and the Maryland Department of Natural Resources logo are provided.

Download MyCoast to document flooding in Calvert County!

MyCoast Maryland



What is MyCoast?

MyCoast: Maryland allows you to communicate flooding and storm damage in your community. It is a portal to collect and analyze photos which are linked to precipitation, riverine, and tidal data to create reports that help government agencies, business owners, and residents understand impacts in your community and encourage action.

How to use it?

Take your picture via our mobile app or submit it via your browser.

Our servers retrieve weather and tide information to add context to your photo.

Local jurisdictions can use data to better meet community needs!

Contact: kate.vogel@maryland.gov
mycoast.org/md
www.dnr.maryland.gov



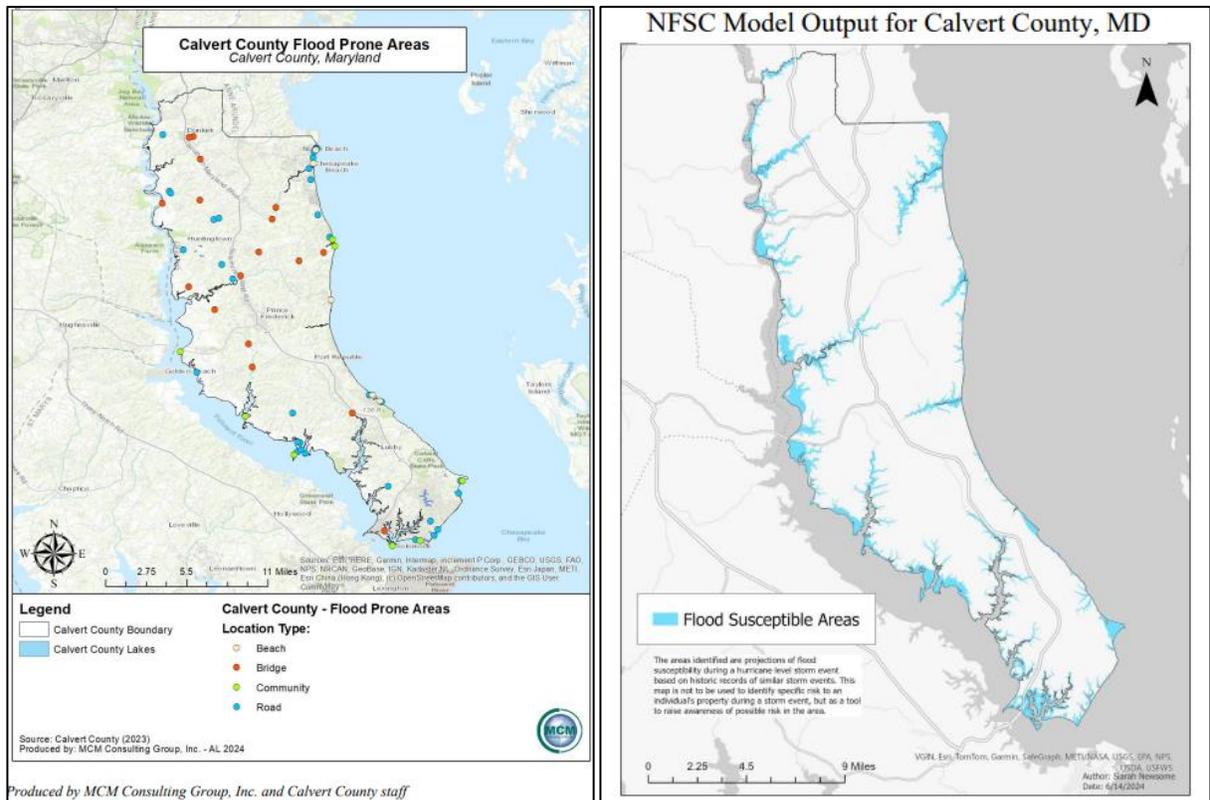
While these reporting systems capture flooding events, they don't always separate the causes of flooding (e.g., high tide versus precipitation versus combined causes). Distinguishing between flood causes can help countywide efforts to plan for and mitigate flooding.

²⁷ *Id.* at 13.

Chapter 4: Risk & Vulnerability Assessment

High tide flooding damages property, disrupts travel, and threatens cultural resources in coastal communities throughout Calvert County. The *Calvert County Comprehensive Plan* has several references to coastal flooding, an umbrella term that includes high tide flooding. The plan recognizes that natural hazards facing Calvert County include “storm surge/tide and coastal flooding.”²⁸ The *Calvert County 2023 Hazard Mitigation Plan* identifies high tide flooding as a hazard facing Calvert County, with a risk factor of 1.9 out of 4; risk factors 1.9 and below are considered low risk.²⁹ For the two incorporated towns of Chesapeake Beach and North Beach, high tide flooding received the same 1.9 risk-factor ranking.³⁰ (Note: these risk rankings are only for high tide flooding; other flooding types have higher risk rankings.) Figure 4-1 shows areas prone to flooding, both riverine and high tide.

Figure 4-1: Calvert County Flood Prone Areas³¹



²⁸ Board of County Commissioners for Calvert County, *Calvert County Comprehensive Plan* (2019, amended Feb. 2025), 4-16, <https://www.calvertcountymd.gov/DocumentCenter/View/48799/Comprehensive-Plan-Amended-2025>.

²⁹ MCM Consulting Group, Inc., *Calvert County 2023 Hazard Mitigation Plan* (2023), 250–251, <https://www.calvertcountymd.gov/DocumentCenter/View/47173/Calvert-County-2023-HMP-FINAL-APA>.

³⁰ *Id.* at 253.

³¹ MCM Consulting Group, Inc. and Calvert County staff, *Calvert County Flood Mitigation Plan*, 21.

High-Risk Communities

The *Calvert County Flood Mitigation Plan* recognizes that several waterfront communities face frequent flooding. “Most of the coastline of Calvert County...sit[s] at or near sea level, making their vulnerability to tidal flooding great.”³² Calvert County has several floodprone areas of note:

1. Chesapeake Beach and North Beach are the only incorporated towns in Calvert County. Both sit near sea level and frequently experience high tide flooding. North Beach identified twelve High Priority Areas with significant flooding issues. North Beach has a Flood Committee and 2023 compound flood action plan, which offers more details on flooding in this area.
2. Solomons Island lies at the southern tip of Calvert County, where the Patuxent River meets the Chesapeake Bay. Solomons Island has 19 flood-vulnerable structures as well as segments of roadways lying within the floodplain. This area experiences coastal erosion. Factors that contribute to flooding in Solomons are a high water table, low land elevations compared to Base Flood Elevations, challenging stormwater management conditions, littoral drift, shoreline erosion, and the construction of homes prior to 1984 flood regulations. Tidal flood water enters Solomons via the Patuxent River, Chesapeake Bay, Back Creek, Mill Creek, and The Narrows. Past storm events have seen tidal increases of 6–8 feet (Hurricane Hazel, 1954), 2–4 feet (Hurricane Floyd, 1999), and 5–9 feet (Hurricane Isabel, 2003). Breakwaters, jetties, and riprap are in use along parts of the Solomons shoreline to reduce wave action and reduce erosion.
3. Breezy Point and Neeld Estates are two communities adjacent to each other and located on the eastern shore of Calvert County along Plum Point Creek and the Chesapeake Bay. Breezy Point has 23 flood-vulnerable structures, and Neeld Estate has 45 flood-vulnerable structures. Both communities sit on a high water table, and many structures were built prior to the 1984 floodplain regulations. Additionally, many of the Base Flood Elevations within the floodplain are higher than land elevations along the shoreline, or adjacent to the shoreline, and within the floodplain. Tidal flood water enters both communities via the Chesapeake Bay and can be exacerbated by stormwater flowing from the steep slopes west of both communities. Communities can experience extensive flooding during nor’easters, tropical storms, and hurricanes. Mild to moderate flooding occurs during heavy or prolonged rains, especially during high tides. Past storm events have seen tidal increases of 6–8 feet (Hurricane Hazel, 1954), 2–4 feet (Hurricane Floyd, 1999), and 5–9 feet (Hurricane Isabel, 2003). Specific to Neeld Estate, tidal flooding comes from the Breezy Point Marina canal. During high tide, overflow from the canal floods Beach Drive.

During public meetings while developing Calvert’s comprehensive flood mitigation plan, residents were concerned not only with road and yard flooding issues, but also exposure of septic tanks and fields. Sinking ground was noted as a contributing factor; ground

³² MCM Consulting Group, Inc. and Calvert County staff, *Calvert County Flood Mitigation Plan*, 63.

around Bay Boulevard was reported to have sunk up to one foot. Specific areas affected by flooding include Bay Boulevard, Beach Drive, and Ridge Road.

4. Broomes Island is a peninsula in the Patuxent River on the western shore of Calvert County. Broomes Island is primarily less than ten feet above sea level, sits on a high water table, and many homes were built prior to 1984 flood regulations. Past storm events have seen tidal increases of 8 feet (Hurricane Hazel, 1954) and 9 feet (Hurricane Isabel, 2003); Hurricane Isabel washed away parts of Broomes Island southern tip and heavy rains flood the Broomes Island Road Causeway, stranding residents.

Broomes Island has 71 structures and road segments vulnerable to flooding. Given a 2.1-foot sea level rise, vulnerable primary structures could increase from 71 to 133; the number would increase to 196 with a 3.4-foot sea level rise. The plan identified mitigation items that included increasing the freeboard requirement, elevating or removing structures, elevating the Broomes Island Road Causeway, stormwater management improvements, septic system upgrades, culvert maintenance, tree planting in the Critical Area, and residential education on emergency preparedness procedures. Longer-term mitigation measures included considering retreat, amphibious homes and floating neighborhoods, coastal armoring, and public water and sewer.³³

5. Cove Point Community was built on a sand spit created by longshore transport of sediment from north to south along Calvert County's eastern shore. Approximately 85% of homes in this area were built prior to flood regulation implementation in 1984. The soil is sandy, sits above a high water table, and is approximately 2 to 4 feet above sea level. Tidal flooding is higher when winds are blowing from a northwesterly direction (when flood water comes from Cove Point Marsh rather than the Bay) or when winds are blowing from a north easterly direction (when flood waters come from the Bay). When combined with heavy rain events, the entrance to the community often floods. Past storm events have seen tidal increases of 8 feet (Hurricane Hazel, 1954) and 9 feet (Hurricane Isabel, 2003).

Cove Point residents ranked flooding concerns, which included seeking grants to assist in mitigation like structure elevation and elevation processes, failing septic, saltwater intrusion into wells, raising the community entrance for access and emergency services, and increasing flood insurance rates. There was also concern whether raising the Lighthouse Blvd will worsen flooding.³⁴ During public meeting while developing Calvert's comprehensive flood mitigation plan, residents' concerns also involved beach accretion and pipe blockage, particularly around Beacon Court.

³³ Harris and Brownlee, *Broomes Island Flood Mitigation Plan*.

³⁴ Calvert County Dept. of Community Planning and Building, *Cove Point Community Flood Mitigation Plan* (Sep. 23, 2014), 6, <https://www.calvertcountymd.gov/DocumentCenter/View/9505/Final---Cove-Point-FMP-2014-09-23?bidId=>.

Other waterfront communities in Calvert County also face frequent high tide flooding, such as Dares Beach, Randle Cliff Beach, Summer City, Scientists Cliffs, Calvert Beach and Long Beach. Recognizing this, future development within these areas, and other areas is limited.³⁵

Underserved and Overburdened Communities

Underserved and overburdened communities contain households that are resource-stressed yet face increased environmental risks.³⁶ Underserved and overburdened communities in Calvert County were identified using the Federal Emergency Management Agency’s (FEMA) Resilience Analysis and Planning Tool (RAPT). This free, publicly available geographic information systems (GIS) tool can help emergency managers and community partners “visualize and assess potential challenges to community resilience.”³⁷ The tool includes over 100 data layers related to infrastructure, hazards, and community demographics. Data layers are pulled from authoritative sources, including the U.S. Census American Community Survey (ACS) 2018–2022 five-year estimates for demographic indicators.

One of the features of the community demographics layers is the Community Resilience Challenges Index (CRCI). The CRCI uses the 22 most common community indicators of vulnerability or challenges to resilience—including population characteristics, household characteristics, housing, healthcare, economic, and connection to community—to calculate scores for resilience. Values for the CRCI are calculated at the county, census tract, and tribal boundary levels. CRCI scores are interpreted as percentiles (1-100), in which higher percentiles indicate higher vulnerability or greater challenges to resilience.

The CRCI indicator results for Calvert County are displayed in Table 4-1. The indicators that were the top 3 drivers of the CRCI value for Calvert County are Medical Professional Capacity, No Affiliation with a Religion, and Number of Hospitals. This means these are the three indicators that deviate the most from the national average of the 22 indicators in the CRCI.

Calvert County has an overall CRCI percentile of 1, indicating it is one of the most resilient communities in the nation, faces fewer challenges to resilience, and is less vulnerable to disasters. Overall, Calvert County has high resilience and low risk. However, within the County, certain populations are more vulnerable to hazards like high tide flooding. Examples of these populations include low-income individuals and households, populations over 65 years of age, and households without internet access. The CRCI scores for census tracts in Calvert County, displayed in Figure 4-2, show populations within the county that face different challenges to resilience. More information on the census tracts with the highest CRCI percentiles (i.e., higher vulnerability and more challenges) is detailed in Table 4-2.

³⁵ Board of County Commissioners for Calvert County, *Calvert County Comprehensive Plan*, 3-16

³⁶ For this plan, “underserved and overburdened communities” are defined as minority, low-income, tribal, and indigenous populations or communities in the United States that potentially experience disproportionate environmental harms and risks due to exposures or cumulative impacts or greater vulnerability to environmental hazards. Kate Vogel et al., *State of Maryland Nuisance Flood Plan Guidance Update*, Publication No: DNR 14-070824-1 (Jul. 2024), 4, https://dnr.maryland.gov/ccs/Documents/Final_Nuisance_Flood_Plan_Guidance_2024.pdf.

³⁷ FEMA, *Resilience Analysis and Planning Tool User Guide* (May 2023), 1, https://www.fema.gov/sites/default/files/documents/fema_rapt-user-guide-2023.pdf.

Table 4-1: Calvert County CRCI Indicators

Indicator	Calvert
Percent without HS Diploma	5.53%
Percent Age 65 and Older	15.50%
Percent with a Disability	9.55%
Percent Households without a Vehicle	3.08%
Percent Households with Limited English	0.19%
Percent Single-Parent Households	15.55%
Percent of Households without a Smartphone	10.29%
Percent of Mobile Homes Relative to Housing	0.93%
Percent Owner-Occupied Housing	80.20%
Number of Hospitals per 10,000 People	0.00
Number of Medical Practitioners per 1,000 People	12.89
Percent without Health Insurance	3.17%
Percent Below Poverty Level	4.27%
Median Household Income	\$128,078
Percent Unemployed Labor Force	3.18%
Percent Unemployed Women in Labor Force	4.13%
Percent Workforce Employed in Predominant Sector	21.43%
Income Inequality (Gini Index)	0.38
Social/Civic Organizations per 10,000 People	1.07
Percent without Religious Affiliation	58.81%
Percent Inactive Voters	5.05%
Population Change	0.57

Figure 4-2: CRCI Percentiles by Census Tract in Calvert County

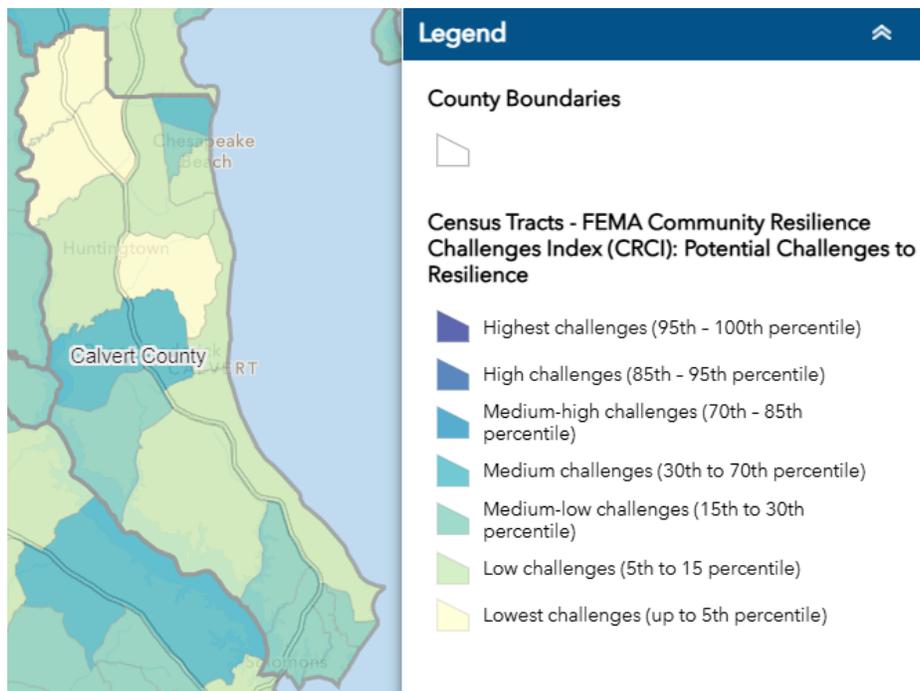


Table 4-2: Calvert County Census Tracts with the Highest CRCI Percentiles

Census Tract	Location Description	CRCI Percentile
8607.02	Prince Frederick, east of Rt. 2/4 until Double Oak Rd, north of Parkers Creek, south of Hunting Creek	40
8604.04	North Beach, east of Paris Estates Ct., north of Rt. 260	36
8607.01	Prince Frederick, west of Rt. 2/4, north of Rt. 231, south of Hunting Creek	34

It is important to note that CRCI scores do not reflect individual or community-level preparedness actions. It also has a limited ability to reflect individual indicators that can increase or decrease vulnerability. Lastly, Calvert County’s score should not be interpreted to mean the County has no vulnerability. Every individual and every community is vulnerable to disasters, regardless of their resilience.

Risk to Critical Infrastructure

High tide flooding poses significant threats to the functionality and longevity of critical infrastructure, particularly in coastal areas. Negative impacts are experienced due to both direct damage to infrastructure and disruption of services.

Transportation Infrastructure

Transportation infrastructure includes roadways, bridges, sidewalks, and their associated stormwater management features. This infrastructure is critical to the normal daily functioning of Calvert County residents, commuters, schools, and businesses. High tide flooding can submerge transportation infrastructure, making it impassable or unsafe. It also increases the maintenance costs to ensure their structural integrity. Flooded roadways can delay emergency-service response. Such delays result in worsened patient outcomes, increased property damage from fire or other hazards, and delayed police response for public safety. Finally, rising water levels decrease the clearance under bridges, threatening the passage of maritime traffic.

Several communities throughout Calvert County—including Broomes Island, Chesapeake Beach, Cove Point, and North Beach—experience regularly occurring high tide flooding that impacts transportation infrastructure. Examples of road segments and bridges in Calvert County that are frequently affected by high tide flooding include:

1. Charles St, Solomons (adjacent to Back Creek)
2. Chaneyville Rd (intersection with Graham Creek)
3. Broomes Island Causeway
4. Beach Drive in Neeld Estates
5. MD 261 in North Beach
6. Bay Avenue in North Beach
7. Entrance to Cove Point Community

Wastewater Treatment

Severe high tide flooding has the potential to overwhelm wastewater treatment facilities. The Town of Chesapeake Beach operates an Enhanced Nutrient Removal treatment plant that

provides sewer services to the Towns of Chesapeake Beach and North Beach, a portion of Anne Arundel County, and a portion of Calvert County. Operations at the Chesapeake Beach Water Reclamation Treatment Plant have been compromised in the past due to flooding during severe storms such as Tropical Storm Isaias in 2020, although high tide flooding by itself is unlikely to result in this level of disruption.

Electricity and Communications

Communication networks, especially those dependent on ground-based infrastructure like fiber optics, can be disrupted by floodwaters that damage cables, cell towers, or data centers.

Communication infrastructure is critical to the delivery of public services, including emergency services. County residents and first responders alike require reliable means to communicate in the event of an emergency. Power infrastructure can also be vulnerable and limit access to critical services. Power-dependent individuals, such as those with powered medical devices, are especially vulnerable.

Buildings and Housing

High tide flooding can infiltrate basements, ground floors, and low-lying areas of buildings, damaging property, furniture, and equipment. This is particularly harmful to structures that aren't built to withstand regular flooding. Repeated exposure to high tide flooding can accelerate coastal erosion, weakening the foundations of key infrastructure and making these structures more vulnerable to future flooding or storms. Saltwater intrusion from high tide flooding can affect groundwater quality, corrode metal infrastructure, damage concrete foundations, and even cause hazardous material spills if industrial facilities are submerged.

The *Calvert County Comprehensive Plan* recognizes that many communities throughout the County were developed before current health, safety, and environmental regulations. Particularly with waterfront communities in the County, their location “leads to increased risks of flooding or cliff erosion, and their small lot sizes served by wells and septic systems may contribute to public health and environmental threats.”³⁸

Long-term Impacts on Critical Infrastructure

As sea levels rise, the frequency of high tide flooding will continue to increase, making it harder to protect critical infrastructure without substantial investments in climate adaptation. Impacts may be mitigated by retrofitting or rebuilding infrastructure to be more resilient to flooding. Examples of such mitigation techniques include raising roads, installing flood barriers, wet- or dry-floodproofing, and relocating critical facilities. As sea levels rise and flooding events become more frequent, proactive planning and investment will be essential to protect both public and private infrastructure.

Risk to Community Resources

Beyond critical infrastructure, high tide flooding threatens community resources. In this plan, community resources are grouped into four categories: historic; recreational; aquaculture, agriculture, and water-adjacent businesses; and natural resources.

Historic

The Calvert Peninsula was home to Native Americans for over 10,000 years, with English settlers arriving by the 1650s. Given the importance of waterways for transport, commerce, and

³⁸ Board of County Commissioners for Calvert County, *Calvert County Comprehensive Plan*, 3-16.

livelihoods, many of Calvert County’s historical sites are located along shorelines. Since the late 17th century, many Calvert County shorelines have receded more than one hundred feet, taking archaeological sites and standing structures with them. Historic assets at risk include:

1. J.C. Lore Oyster House (Solomons Island): This National Historic Landmark consists of a 1934 canning factory, one of only five nationally significant properties associated with the oyster-processing industry, supplying much of the Midwest with “Patuxent” brand oysters, as well as crab and fish. This structure flooded so frequently that it had to close daily. A drainage upgrade was performed in 2024, and flooding has been temporarily abated.
2. Cove Point Lighthouse (Cove Point): This 1820s lighthouse was the first structure in the Cove Point community and served ship traffic in the Chesapeake Bay. This National Register of Historic Places-listed lighthouse is now owned by the County and managed by the Calvert County Marine Museum, operating as a rental property and special events venue.³⁹ Cove Point Light is the oldest continuously operating lighthouse on the Chesapeake. Currently, water sheets across the property and adjacent to the lighthouse structure during rain events. Although hardened, the shoreline immediately before the lighthouse remains susceptible to coastal erosion.
3. Calverton Archaeological site (Battle Creek): Located along the Patuxent River, Native Americans occupied the Calverton Site for hundreds of years before the area served as the colonial county seat from 1668 until 1722. Several grant-funded archaeological investigations have been conducted at the site, as intact cultural features are currently in active erosion. No erosion controls have been installed.
4. Coastal flooding threatens numerous historical architectural resources. Encroachment provides the most visible threat. However, inundation results in deterioration of masonry piers and foundations and the rot of organic materials, impacting mid- and long-term structural integrity. Saltwater not only corrodes metal building materials but can seep into the pores of concrete foundations, cracking and scaling the concrete, a process known as “spalling.”
5. The Southern Maryland National Heritage Area also identifies heritage areas of national significance in areas that experience tidal flooding.

The effects of climate change—specifically increasing sea-level rise, coastal erosion, coastal inundation, and increased storm frequency and intensity—represent a major, ongoing, and accelerating threat to Calvert County’s archaeological resources. Sea level rise accelerated after the Younger Dryas geologic cooling period (approximately 12,000 years ago). Sea level rise and coastal erosion have claimed an unknown number of archaeological sites. The earliest sites are particularly vulnerable due to retreating shorelines. High tide flooding threatens the archaeological record of Calvert County.

³⁹ Calvert County Dept. of Community Planning and Building, *Cove Point Community Flood Mitigation Plan* at 6.

Table 4-3: Effects of High Tide Flooding on Archaeological Sites in Calvert County

Number of vulnerable resources in event of higher water levels			
Rise in Water Level	2 feet	5 feet	10 feet
Archaeological Sites	44	69	105
Buildings	3	24	105

Source: Calvert County Historic District Commission, 2017

Figure 4-3: Undercutting of a Native American and Colonial shell midden along the Patuxent River



Figure 4-4: Coastal erosion of an Early Colonial Period site along Chesapeake Bay



Recreational

Calvert County offers many parks, beaches, and boat ramps for residents and visitors, as well as hosting camps for youth groups. Given their coastal nature, several sites are affected by high tide flooding.

1. Breezy Point Beach and Campground includes approximately two thousand feet of bayfront beach as well as a fishing pier, trailer sites, playground, volleyball courts, concession stand, and a shaded picnic area. The area experiences significant coastal erosion. A living shoreline and beach revitalization project were completed in 2024.
2. Jefferson Patterson Park is part of the Maryland Historical Trust and has 560 acres along the Patuxent River with more than 65 identified archaeological sites, and 9,000 years of documented human occupation.⁴⁰ The park hosts 6th grade CHESPAX and 8th grade social studies field trips, as well as other programs educating participants on the environmental and historical resources in Calvert County. A living shoreline with a segmented stone breakwater and marsh plantings helps reduce wave energy.
3. Flag Ponds is a state-designated Natural Heritage Area with beaches, nature trails, and views of the Calvert Cliffs. The trails, boardwalk, and roadway leading to the beach are frequently inundated with tidal flooding. This includes the north end adjacent to Long Beach as well as low-lying areas by the Fishing Shanty and the Beach Bathrooms. Wooden walkways and bridges along the Lower North Ridge Trail have been expanded to allow access for hikers during high tide flooding. The Flag Ponds shoreline is eroding at rates exceeding six feet per year, and this process is aggravated by tidal flooding.⁴¹ Calvert County partnered with the Maryland Department of Natural Resources, which recommended a living shoreline to control the shoreline erosion at Flag Ponds Nature Park.⁴²
4. Hallowing Point Waterfront Park has approximately 15 acres of park property and includes two boat launches, parking, and a shoreline fishing area. These boat ramps frequently flood due to high tide flooding. The Department of Natural Resources is working with Calvert County Parks and Recreation to develop a master plan for future improvements to this area.⁴³

Flooding can also transport debris and contaminants that encourage harmful algal blooms and high levels of bacteria. This causes danger to swimmers, puts fisheries at risk, and threatens water-based recreation.

Aquaculture, Agriculture, and Water-Adjacent Businesses

Calvert County's aquaculture faces changes from increased high tide flooding. Storm surges can impact fixed aquaculture infrastructure, and rising salinity levels impact species viability. Flooding can also spread pathogens and other contaminants to cultured species.

⁴⁰ MD Dept. of Planning, *Jefferson Patterson Park & Museum* (accessed Mar. 2025), <https://jefpat.maryland.gov/Pages/default.aspx>.

⁴¹ Calvert County Dept. of Planning & Zoning, *Nuisance Flooding Plan for Calvert County*, 6–7; See also Calvert County Government, "Living Shoreline Project" (accessed Mar. 2025), <https://www.calvertcountymd.gov/2167/Living-Shoreline-Project>.

⁴² Calvert County Government, "Living Shoreline Project."

⁴³ MD Dept. of Natural Resources, MD Park Service, "Hallowing Point Waterfront Park" (accessed Mar. 2025), <https://dnr.maryland.gov/publiclands/Pages/southern/Hallowing-Point-Waterfront-Park.aspx>.

Saltwater intrusion is affecting farmland in Calvert County, with farmers experiencing damaging salt patches. Tracking trends in soil salinity and understanding root causes can help develop mitigation solutions, such as transitioning to more salt-tolerant crops like sorghum or pursuing financial assistance programs.

The University of Delaware offers a GIS application for tracking saltwater intrusion for the Delmarva Peninsula using satellite and drone imagery, displaying affected land by land type.⁴⁴ On the Peninsula, visible salt patches almost doubled between 2011 and 2017, with elevated salinity values extending hundreds of meters from those areas.⁴⁵ Economic losses were estimated between US \$39.4 million and US \$107.5 million annually.⁴⁶ While this tool doesn't capture Calvert County, it is instructive in showing the impact of increased soil salinity from flooding.

Finally, high tide flooding can force water-adjacent businesses to elevate and floodproof their properties. This can include businesses, parking lots, docks, and piers. Beyond the significant cost of these alterations, business owners often face regulatory challenges as permitting approval at the federal, state, and local levels can take years. The required cost and time can be limiting factors in pursuing mitigation actions.

Natural Resources

High tide flooding can physically overwhelm natural drainage areas that shed water from inland areas, exacerbating flooding during precipitation events. It can also change the chemistry of marshes located near the coast that mitigate flooding. Marshes absorb flood waters and their vegetation anchors soil, preventing erosion.

Aquifers are a critical water supply for Calvert County, which draws upon the Aquia, Piney Point, Nanjemoy, Magothy, and Low Patapsco aquifers. Properties are served by either public water and sewer or are served by well water and septic fields. Rising sea levels and saltwater intrusion can endanger drinking-water wells, particularly in lower elevation communities. Rising tidal inundation can also threaten septic drainage fields, causing them to fail and resulting in the need for installing holding tanks or other sewage treatment systems.

Given Calvert County's geography as a peninsula, there are many marshes and wetlands throughout the County. Three wetlands of note follow:

1. Battle Creek Cypress Swamp features the northernmost limits in the United States for the natural range of bald cypress trees. The Nature Conservancy acquired property in the area in 1957, and the Battle Creek Cypress Swamp Sanctuary was designated a National Natural Landmark in 1965. The Sanctuary is a part of the Chesapeake Bay Gateways Network. Bald cypress trees are highly adaptable to flood conditions, stabilizing soil and absorbing excess water.

⁴⁴ Univ. of Delaware, "Salt Patch Mapper" (accessed Mar. 2025), <https://experience.arcgis.com/experience/830352c8f8d84266b9131196388479c3/page/About/?draft=true&org=udel&views=Pic5>.

⁴⁵ Pinki Mondal et al., "The spread and cost of saltwater intrusion in the US Mid-Atlantic" (*Nature Sustainability* 20 Jul. 2023), <https://www.nature.com/articles/s41893-023-01186-6>.

⁴⁶ *Id.* Estimates assumed 100% profit loss in at-risk farmlands within a 200 m buffer around salt patches in 2016–2017.

2. Flag Ponds Nature Park is adjacent to the Long Beach Community. The north end is experiencing shoreline erosion at rates exceeding 6 feet a year.⁴⁷ The park has two freshwater ponds— Duncan’s Pond and Richardson’s Pond—where visitors can observe the freshwater pond ecology and learn watershed science. These ponds are separated from the Chesapeake Bay by a narrow beach dune system. Shoreline erosion threatens these ponds as a breach would allow saltwater intrusion, damaging the freshwater wetland ecosystems.
3. Cove Point Marsh is a freshwater marsh designated by the federal government as a Coastal Barrier Resources System and by the Maryland Department of Natural Resources as a Natural Heritage Area.⁴⁸ Flooding with Bay water increases salinity levels, affecting rare, threatened, or endangered species in the marsh. Beginning in 2009, Dominion began restoration efforts to repair a berm separating the freshwater marsh from the Chesapeake Bay, as saltwater inundation was damaging the freshwater marsh. The shore erosion control structure includes a 2,500-foot-long revetment to the north fitted with four one-way flood control valves as a redundancy check should heavy precipitation overwhelm the marsh’s ability to absorb runoff. A segmented breakwater to the south provides habitat for the endangered nor’easter beach tiger beetle.⁴⁹ Dredged material was placed behind the revetment to create an upland habitat, planted with native dune vegetation.⁵⁰ This restoration work is currently being monitored by the University of Maryland’s Chesapeake Biological Laboratory.

⁴⁷ Calvert County Government, “Flag Ponds Nature Park - Shoreline Remediation Microdocumentary - Calvert County, MD” (14 Dec. 2021), <https://www.calvertcountymd.gov/2167/Living-Shoreline-Project>.

⁴⁸ Calvert County Dept. of Community Planning and Building, *Cove Point Community Flood Mitigation Plan*, 7.

⁴⁹ *Id.*, at 8.

⁵⁰ *Id.*

Chapter 5: High Tide Flood Mitigation Policies & Plans

High tide flooding is addressed in myriad Calvert County plans, either specifically or as an all-flood hazard. The *Calvert County Comprehensive Plan* addresses floodplain management in Chapter 4, encouraging the protection of natural resources for flood control⁵¹ and identifying coastal flooding as a hazard facing Calvert County.⁵² Flooding and coastal storm winds are ranked as the top two risks for Calvert County,⁵³ and five objectives directly address flooding.⁵⁴ The Plan includes enforcing local, state, and federal floodplain regulations and building standards for development in flood hazard areas,⁵⁵ which are integrated into the Calvert County Zoning Ordinance through floodplain and Open Space regulations. Calvert County's Zoning Map shows Wetland Districts, designating areas of tidal wetlands. Finally, Calvert County follows the International Building Code (IBC) and the International Residential Code (IRC); however, "flooding" in those requirements typically combines all sources of flooding.

Calvert County is a National Flood Insurance Program community and participates in the additional Community Rating System (CRS), earning reduced flood insurance premiums for stronger, future-forward protections from flood hazards like higher freeboards and new software for citizens to better assess flood risks to properties.⁵⁶ Annual reports on CRS efforts are published online.⁵⁷ The *Calvert County 2023 Hazard Mitigation Plan* identified planning and regulations, structure and infrastructure, natural systems protection, and education and awareness as mitigation techniques for flooding (note, these measures were to address all forms of flooding, not solely nuisance flooding).⁵⁸

The *Calvert County Flood Mitigation Plan* specifically addresses high tide flooding, recognizing that high tide flood vulnerability is expected to increase. "Tidal flooding is already a common occurrence, and with climate change factors, that frequency will likely increase. Increased coastal erosion along the Chesapeake Bay will result in less coastal areas able to accept water in high tide events.... Sea level rise could also contribute to greater tidal flooding events."⁵⁹

Two coastal community-level flood mitigation plans were adopted. The *Cove Point Community Flood Mitigation Plan* recommended exploring funding for public water and sewer and pursuing FEMA funding to elevate or acquire properties.⁶⁰ The *Broomes Island Flood Mitigation Plan*

⁵¹ Board of County Commissioners for Calvert County, *Calvert County Comprehensive Plan*, 4-2.

⁵² *Id.*, at 4-16.

⁵³ *Id.* Note, this ranking was based on analysis within the County's 2017 hazard mitigation plan; 2023 risk analysis placed high-tide flooding as 24th out of 28 risks facing Calvert County. Risk analysis is calculated by: (Probability x .30) + (Impact x .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10). See MCM Consulting Group, Inc., *Calvert County 2023 Hazard Mitigation Plan* at 248–251.

⁵⁴ Objective 4.1.2 seeks to preserve and restore floodplains; Objective 4.4.3 emphasizes pre-disaster retrofitting and post-disaster planning; Objective 4.4.4 seeks to retrofit, relocate, or acquire repetitive-loss properties and enforce floodplain regulations; Objective 4.4.5 seeks to protect natural flood-mitigation resources; and Objective 4.4.6 seeks to reinforce critical facilities and infrastructure during and after hazard events.

⁵⁵ Board of County Commissioners for Calvert County, *Calvert County Comprehensive Plan*, Action Item 4.4.4.4.

⁵⁶ See FEMA, "Flooding Happens Everywhere" (accessed Mar. 2025), <https://www.floodsmart.gov/> and FEMA, "Community Ranking System" (accessed Mar. 2025), <https://www.fema.gov/floodplain-management/community-rating-system>.

⁵⁷ See Calvert County Government, "Community Ranking System (CRS)" (accessed Mar. 2025), <https://www.calvertcountymd.gov/1926/Community-Rating-System>.

⁵⁸ MCM Consulting Group, Inc., *Calvert County 2023 Hazard Mitigation Plan*, 289.

⁵⁹ MCM Consulting Group, Inc. and Calvert County staff, *Calvert County Flood Mitigation Plan*, 62–63.

⁶⁰ Calvert County Dept. of Community Planning and Building, *Cove Point Community Flood Mitigation Plan*.

noted flooding impacts on businesses and floodwater on roads. It recommended consideration of elevation projects, stormwater management, and septic system improvements at the Ballard Rogers-Penkert Lane-River View Road intersection; resident education on hurricane and flood readiness; and continued nontidal water quality sampling.⁶¹

North Beach, an independent municipality, adopted the *North Beach Compound Flood Action Plan* to address compound flooding (i.e., coastal and stormwater flooding) and prioritized floodprone areas, displayed in Table 5-1.⁶²

Table 5-1: Prioritization of Floodprone Areas in North Beach

Priority	Assessment Area Description
1	7th Street between Bay, Annapolis and Atlantic Avenue
2	5th Street between Chesapeake Avenue and Bay Avenue
3	Atlantic Avenue
4	9th Street between Chesapeake Avenue and Atlantic Avenue
5	Bay Avenue between 5 th and 7 th
6	Annapolis Avenue between 7th Street and 9th Street
7	Chesapeake Avenue between 4th Street and 6th Street
8	Dayton Avenue between 3rd Street and 6th Street
9	1st Street between Chesapeake Avenue and Bay Avenue
10	Frederick Avenue between 3rd Street and 4th Street
11	Greenwood Avenue and 8th Street
12	Burnt Oaks North Apartments
13	Other Areas Identified by Community Input

The North Beach plan proposes several mitigation actions, divided by the timeframe for implementation. Mitigation options include seawalls; revetments; earthen berms; stop logs; storm-drain, pump, and tide-gate valve improvements; elevated roadways; underground storage; and green infrastructure. Additional non-structural mitigation techniques include updating policies and design standards to anticipate increasing flood hazards.

Calvert-St. Mary's Metropolitan Planning Organization's 2050 plan acknowledges that climate change is increasing flooding due to increased sea levels. This affects transportation infrastructure by shortening its lifetime, increasing maintenance costs, and making some infrastructure "completely unusable due to sea-level rise, coastal flooding, and more intense rain."⁶³ The plan predicts that high tide flooding will increase and intensify, and notes that storm surge is a risk for the MPO region as it blocks evacuation routes. Storm surge and flooding, "is a concern in the MPO region because evacuation in Calvert County is entirely dependent on MD 2-4. Solomons Island is a high concern for flooding."⁶⁴

Finally, the *2040 Calvert County Transportation Plan* notes that increased tidal and storm activity are causing an increase in roadway flooding. "[T]hirty roads have experienced recent or

⁶¹ Harris and Brownlee, *Broomes Island Flood Mitigation Plan*

⁶² BayLand Consultants & Designers, Inc., *North Beach Compound Flood Action Plan* at ii.

⁶³ St. Mary's County Dept. of Land Use and Growth Management, *Moving Forward 2050: Calvert-St. Mary's Metropolitan Planning Organization* (22 Apr. 2024), 77, <https://calvert-stmarysmpo.com/DocumentCenter/View/527/Moving-Forward-2050>.

⁶⁴*Id.*

recurring flooding since 2018.”⁶⁵ The plan looks to Calvert’s hazard mitigation plan to help inventory roadway conditions.⁶⁶

⁶⁵ Note, this flooding includes both tidal and precipitation sources. Sabra & Associates, Inc., *2040 Calvert County Transportation Plan* (May 2020), 11, A10, <https://www.calvertcountymd.gov/DocumentCenter/View/31794/Ordinance-13-20>.

⁶⁶ *Id.*

Chapter 6: Mitigation Actions, Timeline, and Prioritization

The *Calvert County Flood Mitigation Plan* assesses Calvert County's flood vulnerability based on historic information, areas of previous concern, and future trends for flooding in the county. The plan collates flood mitigation actions from other county plans⁶⁷ and concludes with five preventative measures and eight recommendations that include actions like reviewing evacuation procedures for coastal and high tide flooding; working with Calvert County Environmental Health regarding holding tanks for septic near sea walls; and reporting high tide flooding to MyCoast and reviewing those reports.⁶⁸ Additionally, the *Calvert County 2023 Hazard Mitigation Plan* identifies approximately thirty mitigation actions for flood prevention and recovery. These span measures from making critical and community lifeline facilities more resilient, testing emergency communications and early warning systems, public education, vulnerability assessments of assets and populations, upgrades of infrastructure like bridges and stormwater projects and preserving undeveloped floodplain areas.

2020–2025: High Tide Flood Mitigation Progress

Calvert County's *2020 Nuisance Flooding Mitigation Plan* sought to create a baseline inventory of tidal nuisance flooding areas and propose a mechanism to document tidal nuisance flooding events.⁶⁹ In response, staff began developing a new data-collection tool in 2024. The departments of Public Safety, Technology Services, and Public Works began piloting a new Flooded Roadway Tool to track which roadway segments are flooding, their flooding frequency, and the cause of the flooding. Additionally, in 2024, an interdepartmental Calvert County team began promoting the Maryland Department of Natural Resources' tool, MyCoast, as mentioned above in Chapter Three. Staff continue to pilot interactive data tools and improved data collection for Calvert County property owners.

Calvert County staff has taken other actions to enhance the county's resiliency and mitigate high tide flooding impacts. Calvert County's floodplain regulations were updated in early 2025. Additionally, the County improved from a Community Ranking Score of 8 to 7 in early 2025. The Department of Planning & Zoning partnered with the Department of Communications & Media Relations to produce a series of engaging videos on the role floodplain regulations play in safeguarding communities.⁷⁰

Calvert County Parks and Recreation is working with the Maryland Department of Natural Resources on a master plan of future improvements to the Hallowing Point Waterfront Park. Among the goals is environmental restoration to improve water quality and habitat. In 2021, the Maryland Department of Natural Resources hired a consultant to begin two conceptual Master Plans based on these needs and public feedback from the first public outreach survey conducted in 2021.⁷¹ Additionally, the Breezy Point Beach & Campground shoreline restoration project began in July 2023, involving erosion control measures, beach revitalization, and stone breakwaters.

⁶⁷ MCM Consulting Group, Inc. and Calvert County staff, *Calvert County Flood Mitigation Plan*, at 67–68, 76.

⁶⁸ *Id.* at 79–80.

⁶⁹ Calvert County Dept. of Planning & Zoning, *Nuisance Flooding Plan for Calvert County* at 14.

⁷⁰ See Calvert County Dept. of Planning & Zoning, "Floodplain Management" (accessed Mar. 2025), <https://www.calvertcountymd.gov/554/Floodplain-Management>.

⁷¹ MD Dept. of Natural Resources, MD Park Service, "Hallowing Point Waterfront Park."

The Department of Public Safety’s Emergency Management offers engaging emergency preparedness sessions to schoolchildren, community associations, and civic groups, strengthening our resilience to handle flooding impacts. Finally, in 2024, a drainage upgrade was performed for J.C. Lore Oyster House, and flooding has been temporarily abated.

2025 New or Continuing High Tide Flood Mitigation Action Items

Prioritization of these actions is subject to change depending on funding opportunities, environmental factors, and other considerations:

1. Expand inundation modeling to additional watersheds. As part of this high tide planning update, Calvert County staff piloted a detailed analysis of high tide and storm surge flooding impacts on one of our floodprone communities. Staff can use this new tool to examine how other floodprone communities will be impacted by increasing high tide flooding.
2. Explore using sensors to track water levels and tidal flooding for more informed planning and emergency-response decision making.
3. Encourage community engagement in reporting blocked culverts and stormwater management infrastructure along the shoreline.
4. Continue to deploy the Flooded Roadway Tool to track road closures and flooding causes.
5. Explore the geographic realities and funding opportunities for elevating or otherwise mitigating flood impacts on roadways.
6. Explore data collection and tracking of saltwater intrusion’s impact on Calvert County agriculture. Identify and communicate mitigation strategies and funding opportunities among Calvert County farmers.
7. Seek funding and partnership support for nature-based solutions. Nature-based solutions for flood mitigation include restoring coastal wetlands, planting oyster reefs, deploying protective breakwaters, improving drainage, and installing living shorelines that can use segmented stone breakwaters, beach nourishment, and wetland plantings. These mitigation efforts often require significant funding, years of planning, implementation, and approvals, as well as cooperation with adjacent property and business owners. However, Calvert County is fortunate to have several active citizen science groups and two estuarine science laboratories that offer promising collaborations. Staff across the departments of Planning & Zoning, Public Safety, Public Works, and Parks & Recreation continue to consider funding and regional partnerships in pursuit of flood-mitigation efforts.
8. Strengthen resiliency through public education on risk awareness through high tide flood outreach and interactive maps, tools, and technology. Support public outreach to communicate increasing risks and preparedness strategies for high tide flooding. Educate communities that may experience flooding in the future.
9. Encourage future development to consider going beyond current regulatory requirements and consider recent precipitation data when designing stormwater management infrastructure. Accounting for heavier rainfall patterns can preserve stormwater infrastructure’s ability to process both precipitation- and tidal-based flooding.
10. Continue to research and develop methods for mitigating high tide flooding impacts on Calvert County’s heritage sites. These preservation actions are regularly pursued by the historic planning team within the Department of Planning & Zoning.

Prioritized Areas for Action or Further Study

The high-risk communities identified in Chapter Four inform the prioritization of geographic areas for action or further study. This prioritization is also informed by the identification of

vulnerable critical facilities, the presence of environmental or historic resources requiring preservation, and communities with disproportionate repetitive loss properties. Additionally, further analysis of specific geographic locations and development of new mitigation items may occur in response to information learned from the inundation modeling opportunities discussed in Action Item 1. Finally, prioritization is subject to change based on other factors not currently present, such as environmental changes or new funding opportunities.

Funding & Partnership Opportunities

Collaboration at regional scales provides solutions unachievable at local levels and provides symbiotic benefits. A partnership between the Maryland Department of Emergency Management and the Federal Emergency Management Agency acts as a conduit to federal assistance for acquiring or demolishing properties, elevating structures, floodproofing, and flood-risk reduction projects. This assistance is provided through the Hazard Mitigation Grant Program, the Flood Mitigation Assistance program, and the Building Resilient Infrastructure and Communities program. These programs are available either annually or after a Presidential Disaster Declaration, typically require a 25% cost share, and the latter two programs are nationally competitive.

The Maryland Department of the Environment leads the Comprehensive Flood Management Grant Program, which may supply the 25% cost-share for these programs. There is also disaster funding available from the U.S. Department of Housing & Urban Development (although funding is not permanently authorized); disaster assistance from the Natural Resources Conservation Service; and the National Oceanic and Atmospheric Administration.

Additional funding opportunities include:

1. The National Wildlife Federation (NWF) offers assistance for Coastal Resilience for the Mid-Atlantic Region.⁷² NWF staff can assist in developing resilience concepts and grant proposals, provide technical assistance, and assist with project management.⁷³
2. The Maryland Smart Energy Communities FY25 Grant Programs offer assistance for local governments' sustainable energy projects, which can increase community resiliency in case of emergency.⁷⁴
3. The Maryland Water Infrastructure Financing Administration offers several grants and revolving loans for wastewater treatment plant upgrades, flood mitigation, and resiliency.⁷⁵
4. The U.S. Department of Agriculture's Community Forest and Open Space Conservation Program might be used to acquire forestland to preserve natural flood mitigation control.⁷⁶

⁷² Kate Vogel (Sr. Manager, Coastal Resilience), "Coastal Resilience: Mid-Atlantic" (National Wildlife Federation, accessed Mar. 2025), [Coastal Resilience for our Mid-Atlantic Region](#).

⁷³ Kate Vogel (Sr. Manager of Coastal Resilience for MD Dept. of Natural Resources), email to Amalia Pleake-Tamm (Environmental Planner, Calvert County Government), 13 Dec. 2024.

⁷⁴ MD Energy Admin., "Maryland Smart Energy Communities FY25 Grant Programs" (accessed Mar. 2025), <https://energy.maryland.gov/govt/Pages/smartenergycommunities.aspx>.

⁷⁵ MD Dept. of the Environment, "Maryland Water Infrastructure Financing Administration" (accessed Mar. 2025), <https://mde.maryland.gov/programs/wqfa/pages/index.aspx>.

⁷⁶ Government.gov, "View Grant Opportunity USDA-FS-2025-CFP" (accessed Mar. 2025), <https://grants.gov/search-results-detail/356124>.

5. A multi-agency team supports the Five Star and Urban Waters Restoration Grant, which aims to improve wetland and coastal habitat restoration.⁷⁷

Conclusion

High tide flooding is rising at nearly all NOAA tide gauge locations. The national trend in high tide flooding frequency is accelerating and is more than twice as likely now as it was in 2000.⁷⁸ As noted in Figure 3-2, the annual frequency of minor high tide flooding or greater at Solomons Island has increased since 1980, with a noted increase over the past five years. Annual flood days for 2024 are more than double the frequency for any year prior.

However, there are encouraging developments. The latest high tide flood projections for Solomons predict reduced flooding in 2050 and beyond if current climate commitments are met. Furthermore, Calvert County Government continues to take mitigative measures to safeguard communities and infrastructure against high tide flooding.

Calvert County can increase resiliency by remaining aware of local flood risks. Examining and understanding high tide flood trends can better prepare Calvert County residents and business owners for future impacts.

⁷⁷ National Fish and Wildlife Foundation, “Five Star and Urban Waters Restoration Grant Program” (accessed Mar. 2025), <https://www.nfwf.org/programs/five-star-and-urban-waters-restoration-grant-program/five-star-and-urban-waters>.

⁷⁸ NOAA, “High Tide Flooding.”