Passed: 12-21-23
Effective: 12-21-23

RESOLUTION R-23-4
A RESOLUTION OF THE TOWN COUNCIL OF CHESAPEAKE BEACH TO ADOPT THE 2023 CHESAPEAKE BEACH COASTAL RESILIENCY PLAN

WHEREAS, on August 21, 2021, the Town Council of Chesapeake Beach approved the framework for the completion of a Coastal Resiliency Plan funded through a Memorandum of Understanding with the State of Maryland Department of Natural Resources; and

WHEREAS, the Technical Advisory Committee on Coastal Resiliency drafted a plan, and the Steering Committee on Coastal Resiliency coordinated public engagement sessions on details on the plan; and

WHEREAS, the Mayor and Town Council adopts the 2023 Chesapeake Beach Coastal Resiliency Plan, approved by the Coastal Resiliency Steering committee on December 11, 2023, with amendments.

NOW THEREFORE BE IT RESOLVED that the Coastal Resiliency Plan should be used to provide guidance, wherever possible, in decisions relevant to flooding and sea level rise.

Adopted: December 21, 2023

Patrick J. Mahoney, Mayor

L. Charles Fink, Council Vice President

Valerie L. Beaudin, Councilwoman

Margaret P. Hartman, Councilwoman

Lawrence P. Jaworski, Councilman

Keith L. Pardieck, Councilman

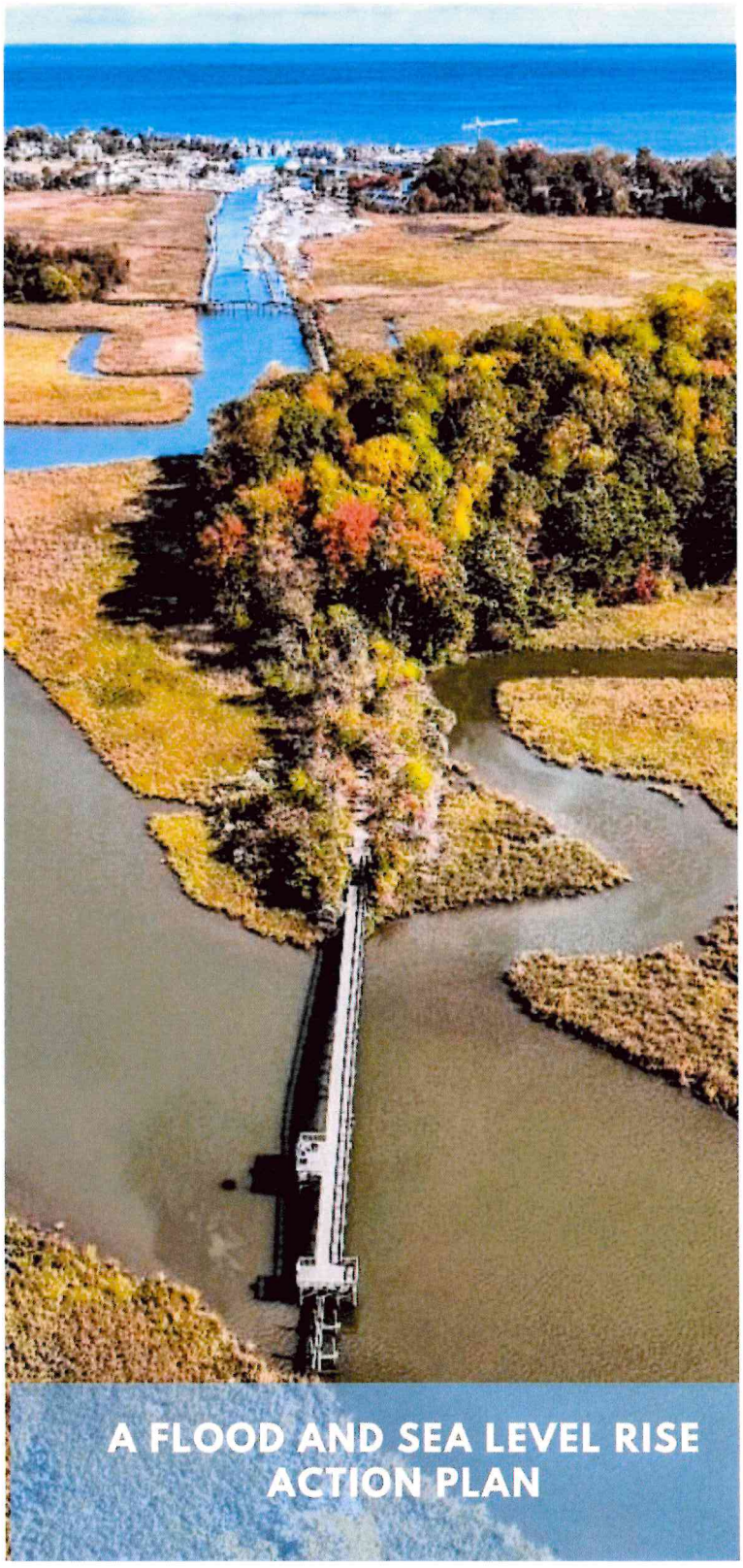
Gregory J. Morris, Councilman

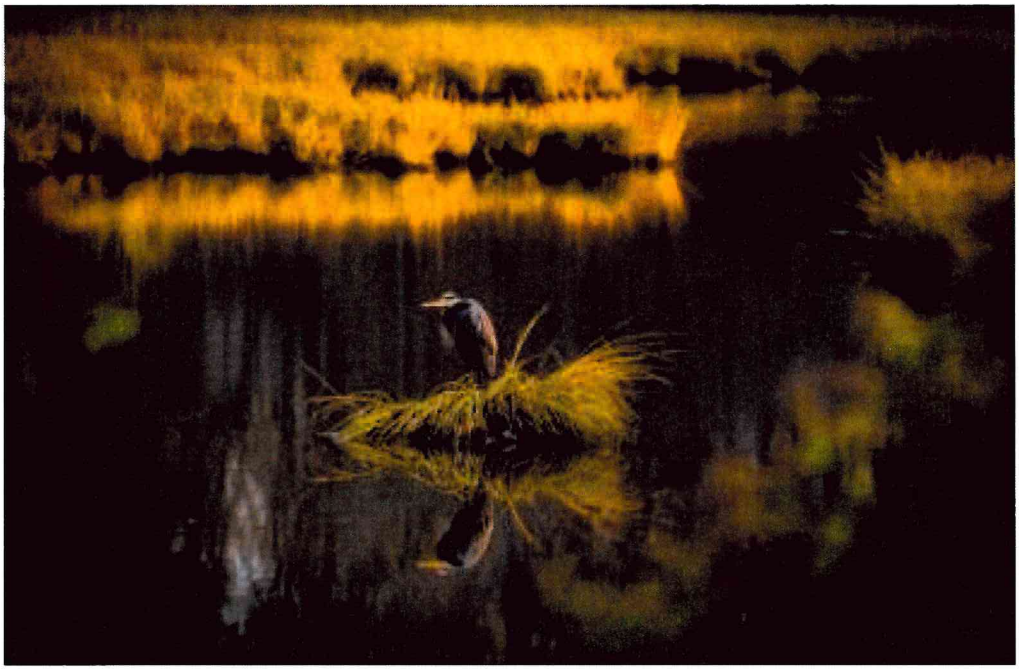
Town of Chesapeake Beach

COASTAL

Resiliency Plan

2023





Financial assistance in the preparation of this document was provided by the federal Coastal Zone Management Act of 1972 as amended as administered by the Office for Coastal Management, National Oceanic and Atmospheric, with local grant administration by the Maryland Department of Natural Resources, Chesapeake, and Coastal Service.

Plan Approval:

Town of Chesapeake Beach Steering Committee Approval

Signed: _____ Date: 1-18-24
Jeffrey Foltz, Steering Committee Chair

Town Council of Town of Chesapeake Beach Approval

Signed: _____ Date: 1-18-24
Patrick J. "Irish" Mahoney, Mayor

Date Submitted to the Maryland Department of Natural Resources: 1-18-24

Acknowledgments

Chesapeake Beach Mayor and Town Council

Pat "Irish" Mahoney, Mayor
L Charles Fink, Council Vice President
Valerie Beaudin
Larry Jaworski
Greg Morris
Keith Pardieck
Margaret Peggy Hartman

Steering Committee on Coastal Resiliency

Jeff Foltz, P.E. Chairman
Larry Jaworski, P.E., CC-P, Town Councilman
Wesley Donovan
Robert Munro
Phil Pfanschmidt
Grant Soderstrom
Dave Kimelblatt

Technical Advisory Committee on Coastal Resiliency

Larry Jaworski, P.E., CC-P, Town Councilman
Jay Berry, Public Works Administrator
Christopher N. Jakubiak, AICP
Wayne Newton, P.E., Town Engineer
Josh Stinnett, Superintendent, Chesapeake Beach Water Reclamation Plant (CBWRTP)
Holly Kamm Wahl, MBA, Town Administrator

Special thanks to Sasha Land, Coastal Resilience Program Director, Maryland Department of Natural Resources, Chesapeake and Coastal Services, and Laurent McDermott, GISP and Mary Buffington, GISP with the Eastern Shore Regional GIS Cooperative, Salisbury University.

Table of Contents

Chapter 1 Introduction

Introduction

This plan addresses coastal resiliency in the Town of Chesapeake Beach. Its strategies and recommendations are intended to guide the Town as it adapts to sea level rise and an increased incidence and severity of flooding in accordance with a Memorandum of Understanding (MOU) between the Town Council of the Town of Chesapeake Beach and the State of Maryland Department of Natural Resources entered into August of 2021. As part of the MOU the Town Council approved a framework to complete the plan with two (2) task outcomes; I) flood risk mapping and analysis and, II) flood and sea level rise action plan.

The Coastal Resiliency plan was drafted by the Coastal Resiliency Technical Advisory Committee. Public input and comment were facilitated through the Coastal Resiliency Steering Committee. The Coastal Resiliency Steering Committee is made up of Town residents, Town business owners and property managers who are impacted by flooding and sea level rise. The overarching recommendations in the plan are based on a technical review of Town infrastructure impacted by flooding and sea level rise and citizen input on problem areas. The plan's goal is to make recommendations on short- and long-range plans to address Coastal Resiliency and does not bind the Town Council to future projects. This Plan is strictly conceptual and does not in any way obligate the Town to proceed with any course of action. This plan may be revised as environmental conditions or changes occur. Public hearings will be held before any formal action is taken by the Town Council.

The Coastal Resiliency plan is prepared by the Town of Chesapeake Beach using federal funds from the Office for Coastal Management at the National Oceanographic and Atmospheric Administration (NOAA). The organizational and technical approach to the project was developed jointly by the neighboring towns of Chesapeake Beach and North Beach in coordination with the Maryland Department of Natural Resources, Chesapeake and Coastal Services. The jurisdictions also coordinated in the simultaneous production of mapping used in this report which documents the projected impacts of future seal level rise. While this Plan's strategies and recommendations were developed through a planning process specific to Chesapeake Beach, they reflect an understanding of the effects of sea level rise on North Beach and compliment North Beach's own efforts to adapt to sea level rise.

General Context and Purpose

Chesapeake Beach is vulnerable to very severe flooding associated with hurricanes, tropical storms, and nor'easters; the latest such major event was Isabel in 2003[1]. It made landfall in North Carolina's Outer Banks and followed a path northwestward through western Maryland. While far removed from the Chesapeake Bay, its winds drove a 4-to-5-foot storm surge

[1] Hurricane Isabel was just one of 39 recognized flooding events between 1996 and 2016 reported by the National Climate Data Center and one of 56 tropical storm events impacting Maryland between 1980 and 2015. (Calvert County All-Hazard Mitigation Plan, 2017).

against the western shore that swamped coastal communities including the Twin Beaches (Chesapeake Beach and North Beach). Buildings were destroyed, beaches were washed away, bulkheads, piers, and revetments were damaged, and MD Route 261, including along its frontage with the North Beach Volunteer Fire Company, was inundated and impassible[2].

The Town is also vulnerable to nuisance flooding. Such flooding is not necessarily associated with named storms and sometimes results simply from the mechanisms of the tides and excessive rainfall in a short amount of time. As recently as October 2020 a high tide breached shoreline revetments and flooded residential lots close to the Bay. It entered the Fishing Creek Marina area via the Town's public boat landing. It overloaded local storm drainage systems and flooded public streets including MD Route 261. These severe events disrupt daily activities, impede travel, and add to the standing pools of water at lower elevations along roads, in parking lots, and at Kellam's Field.

Global sea level rise is related to the release of carbon dioxide emissions into the atmosphere, the resulting warming of the oceans, and melting of glaciers and polar ice sheets[3]. It is an ongoing phenomenon and is projected to continue well beyond 2100. The combination of global sea level rise and land subsidence in coastal Maryland has raised mean high tide in the Chesapeake Bay. Historic tracking at the tide gauge at Solomon's Island records an increase of about 0.15 inches per year, or 1 foot of rise, between 1937 and 2019. Sea level rise is accelerating, and current projections indicate the Town should plan for the Bay to rise another 2.4 feet by 2050[4]--that is, the Bay at Chesapeake Beach would be 2.4 feet, or 28.8 inches, higher than it was in 2000.

Over the very long term, the rise of the Bay is projected to largely reclaim much of Town's low lying areas built on and around tidal wetlands. In so doing the remaining marshes that so define the Town's natural setting are projected to increasingly become open water at their lower elevations, and at higher elevations, to continue to migrate into developed places. With the passage of time more and more of the Town will become vulnerable to flooding. With higher water levels in the Bay, future storm surges will arrive at the Town's shoreline feet above their predecessors and logically bring more water and hazard potential. A rising Bay will place a larger area of Chesapeake Beach at risk, including existing neighborhoods, housing complexes, cultural and recreational assets, and essential infrastructure.

The purpose of this Plan is to provide a coordinated and long-term approach to becoming more resilient to the effects of rising water levels and the flooding associated with it.

To be clear, this is not a master plan or an engineering design plan, intended to direct specific resources toward specific or known design challenges in the short term. Sea level rise is not that kind of problem, and the environmental and cultural setting of Chesapeake Beach

[2] Photos like the one on this page showing the aftermath of Hurricane Isabel in Chesapeake Beach are available at: https://forums.somd.com/media/albums/2003-hurricane-isabel-chesapeake-beach-north-beach.246/page-2

[3] In the Chesapeake Bay region sea level rise is also a function of ongoing Ice Age related land subsidence as the earth's plate, like a seesaw, falls in the east and rises in the northwest still feeling the effects of the glacier retreat.
[4] Sea Level Raise, 2018 Projections, Maryland Commission on Climate Change.

is not well suited to one design solution. There will be a time for project based plans and designs.

Rising sea level presents an ongoing community development and conservation challenge; one whose challenges and opportunities will evolve and thus cannot be fully understood here and now in 2023. The resources of current and multiple future generations will be called upon to address sea level rise and learning memory will be achieved. Therefore, this Plan is also meant to provide a forum of sorts -- an organizational and policy framework -- where solutions to what will be an evolving challenge can be refined, implemented, extended, or even corrected as needed, as residents, businesses, and property owners interact with the Town and its partners like the Town of North Beach, the Maryland Department of Natural Resources, and NOAA.

Figure 1: 2003 Photo Following Hurricane Isabel. MD Route 261 (Bayside Road) at the entrance to the Volunteer Fire Company, looking north).

Coastal Resiliency

This Plan is about building coastal resiliency. By coastal resiliency, we mean the ability of the Chesapeake Beach community to adapt to the risks posed by sea level rise. At its heart, this is a plan for the physical adaptation of the Town to the threat of sea level rise.

Resiliency, as a term used in hazard planning generally, is more comprehensive than this plan aims for. For context, the United Nations Office of Disaster Risk Reduction refers to resiliency as the ability of a community exposed to hazards to resist, absorb, accommodate to, and recover in a timely and efficient manner including by preserving and restoring essential structures and function. This and other definitions of "resiliency" embrace notions of hazard preparedness, emergency management, rescue, and rebuilding. While this Plan touches on these elements, its focus is on physical adaptation to the risk of living along the Chesapeake Bay in areas projected to become inundated. This is less about emergency response and recovery and more about long range community planning, civil engineering, and landscape and building design.

In the future as projects are implemented there will be ongoing opportunities to further incorporate the multifaceted themes of resiliency. For example: An engineering design for a sea-wall might incorporate flexibility to readily allow strengthening at such time that live loads increase; or a storm drain upgrade might be re-routed to convey water away from its previous discharge point or be designed with much larger inlets for holding water, as a means for avoiding the mechanical pumps necessary to discharge into the Bay against projected higher tides. Resiliency must permeate all plans and designs that flow from this Plan.

Related Plans and Studies

There are three local plans particularly relevant to coastal resiliency in Chesapeake Beach that have influenced this Plan. These are described below[5].

Calvert County, Maryland All-Hazard Mitigation Plan

In 2017 Calvert County adopted the All-Hazard Mitigation Plan, which includes useful information on past flood events and flood risk assessments including Chesapeake Beach and North Beach. While the County Plan does not evaluate in a detailed way sea level rise and future local vulnerabilities, its research and findings have informed this Plan.

The Plan sets goals for mitigating flood hazards with special mention of concerns that towns share with the County, namely protecting critical infrastructure and facilities that residents rely on and protecting and sustaining natural resources such as tidal wetlands that function naturally to mitigate flooding damage. With respect to flood hazard mitigation planning, the County Plan incorporates input provided by the Town of Chesapeake Beach and recommends the following specific mitigation actions for the Towns of Chesapeake Beach and North Beach:

[5] Also relevant is the Calvert County, Maryland All-Hazard Mitigation Plan, adopted by the County in 2017, which also covers the Towns of Chesapeake Beach and North Beach.

- Identify natural resources that provide mitigation such as wetlands, (riparian) buffers, etc. and make them a priority for preservation.
- Continue to ensure compliance with stormwater management regulations.
- Give high priority to undeveloped floodplain areas for preservation.
- Maintain zoning ordinance provisions for protection of all hazard areas.
- Continue a community-based stormwater management program consisting in routine inspections and debris removal.

Chesapeake Beach Nuisance Flood Plan: 2000-2025

In 2020, the Town adopted a Nuisance Flood Plan per Maryland statues which require jurisdictions that experience nuisance flooding to adopt, publish, and update a plan once every five years[6]. As defined in State law, "nuisance flooding" is high tide flooding that causes public inconvenience. Such flooding is not a product of major storm events and typically lasts only for several hours before abating.

The plan is a short-term plan intended primarily to build awareness at the local level of certain recurring flood areas, to improve the capacity of local governments to notify and warn the public about flood hazards, and to consider steps to mitigate potential hazards. The Town's Nuisance Flood Plan also provides guidance on how to document nuisance flood occurrences and sets four priorities:

- Ensure existing structures are resistant to flood-related damage, where possible.
- Create awareness of floodplain hazards and protective measures.
- Protect critical facilities.
- Prepare and update stormwater management plans.

The Town's Plan identifies three primary locations for nuisance flooding: (1) the lowest lying parts of the Kellam's recreational area and Fishing Creek Marina, (2) the northern edge of the wetland complex west of MD Route 261 and south of First Street (North Beach) (South Creek), and (3) Town-owned property along the tidal wetlands south of Harbor Road, running parallel to and west of Deforest Drive. These same areas are among the first projected to be inundated in decades due to sea level rise.

Chesapeake Beach Comprehensive Plan

In April 2022, the Town adopted a new Comprehensive Plan that extensively addressed sea level rise through land use and natural resource recommendations. The Plan used mapping to establish the extent of existing and projected flooding, and designated parts of the Town that are especially vulnerable. It also made specific land use and zoning recommendations to eliminate or minimize development potential in areas projected to be inundated with a 2.1 foot sea level rise as well as remaining forests and forested steep slopes. The Town Council codified these latter recommendations into law through amendments to the Zoning Ordinance and official Zoning Map in 2022. Lastly the Comprehensive Plan recommended

[6] See Maryland Senate Bill 1006 from the 2018 Session of the Maryland General Assembly which amended parts of the Transportation and Natural Resources Articles of the Annotated Code of Maryland and included revision to the Coast Smart laws related to the siting and design of infrastructure in areas vulnerable to sea level rise inundation.

that this Coastal Resiliency Plan be prepared, and it adopted overall principles to guide local planning for sea level rise over the long term, as follows:

- The low-lying land, where Fishing Creek meets the Chesapeake Bay, is the very heart of Chesapeake Beach, encompassing the recreational assets and natural resources that have shaped the Town's heritage. Continued use of this area and even redevelopment is not necessarily incompatible with projections of increased flooding.

- The Town's natural environment itself can be a guide to how to manage rising water levels in Chesapeake Beach. The Town's marshes absorb storm surges and hold back floodwaters. The Town's remaining woodlands soak up rainwater reducing the severity of flooding. The Town's topography shows that the heart of Chesapeake Beach was built on and around the natural estuary of Fishing Creek.

- A long-term response to a rising Chesapeake Bay can be positive and aligned with a vision of harmonizing land with water. In a coastal town, built as a tourist destination, rising water levels can be an asset and an opportunity to build upon the Town's heritage.

- Lands that were "made" through the filling in wetlands, are the most quickly threatened by sea level rise. Allowing space for water to reclaim parts of these areas and for wetlands to migrate within them can help recreate nature's role in holding back flood waters and buffering storm surges.

- Unplanned and uncoordinated efforts to raise the elevation of the land or build structural flood defenses including seawalls, raised bulkheads, shoreline revetments, etc. are counterproductive to ongoing efforts to coordinate an effective strategy to address sea level rise. Such measures must only be undertaken in a coordinated way consistent with an adopted plan.

- Rising water levels expand the area that is vulnerable to flooding. As the Bay rises, some areas that do not flood today are predicted to flood in the future and some areas that do in fact flood today are predicted to experience more frequent and severe flooding events.

There are other important parts of the Chesapeake Beach Comprehensive Plan that have shaped this Plan and speak to coastal resiliency including the conversion of Kellam's recreational complex into a blue-green recreational and flood management area, the introduction of small parks, the preservation of resource lands, promoting walkability and public accessibility especially to the waterfront, and eliminating new residential development potential from vulnerable areas.

Community Engagement

As part of this project the Town created the Steering Committee on Coastal Resiliency. The Steering Commission conducted four public work sessions, and three public informational

events. All the events were live-streamed and recorded. Once the analysis and findings were assembled but before recommendations were developed, the Committee held a round of neighborhood based work sessions: one at the Volunteer Fire Company and the other at the Town Hall. Notices and invitations to each event were mailed to all residents located within the localized flood hazard areas. The Town also created a webpage for the project where documents, maps, and notices were published.

Chapter 2 Existing Conditions

South Creek and Fishing Creek, Chesapeake Bay Inlets

South Creek and Fishing Creek are tributaries to the Chesapeake Bay. The watersheds they drain extend far beyond the Town's borders. Their natural estuaries are among the features of Town most vulnerable to sea level rise. South Creek drains the coastal plain north of MD Route 260 including North Beach and forested lands west of the Twin Beaches. It discharges to the Bay through a tidal estuary shown in the photo below. The Chesapeake Beach Water Reclamation Plant, North Beach Volunteer Fire Company, and the Seagate residential communities are located in this estuary. MD Route 261 crosses through it.

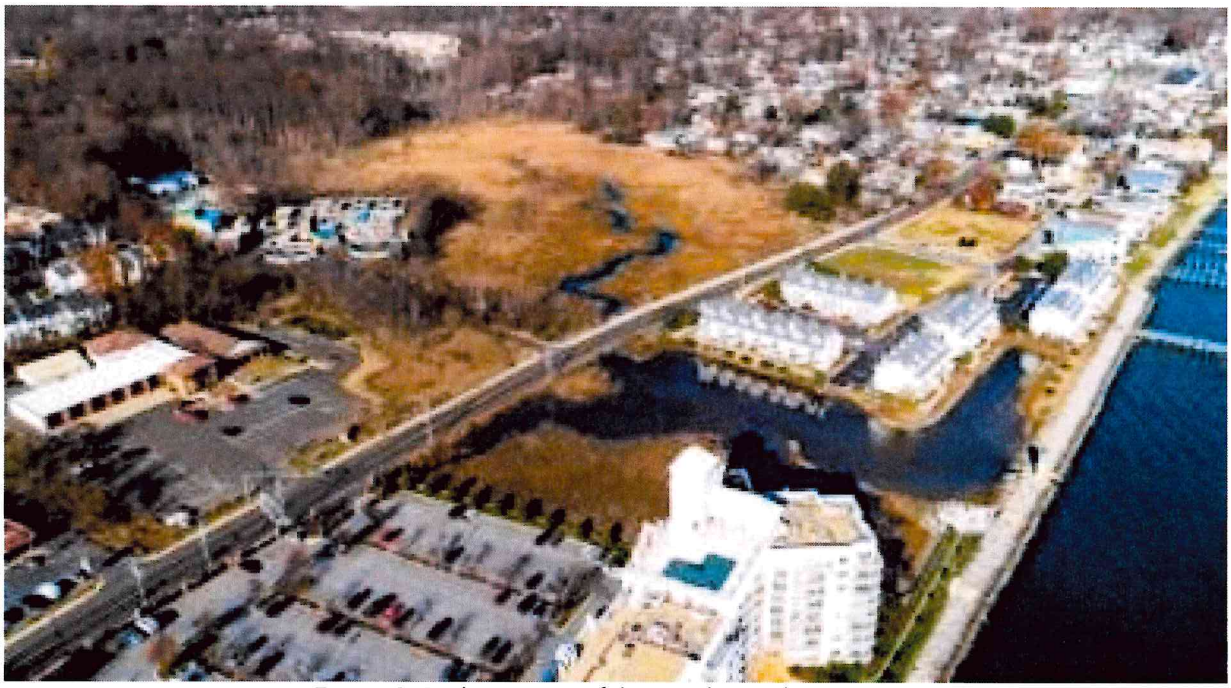


Figure 2: Birdseye view of the South Creek estuary

Fishing Creek drains a mostly forested and rural landscape and meets the Bay in the traditional maritime center of Chesapeake Beach. At one time, the Creek's natural estuary covered what is today the Courtyards at Fishing Creek Apartments and Townhouses, Chesapeake Beach Waterpark, Northeast Community Center, Fishing Creek Marina, and all of Kellam's Recreation Complex.

To better understand the complexity of the Fishing Creek estuary, note the marshland grass symbols in Figure 4. They are indicating the historic extent of tidal wetlands on the west side

of MD 261 north and south side of Gordon Stinnett Avenue. Most of this has been replaced by parkland, parking lots, building sites, and streets.

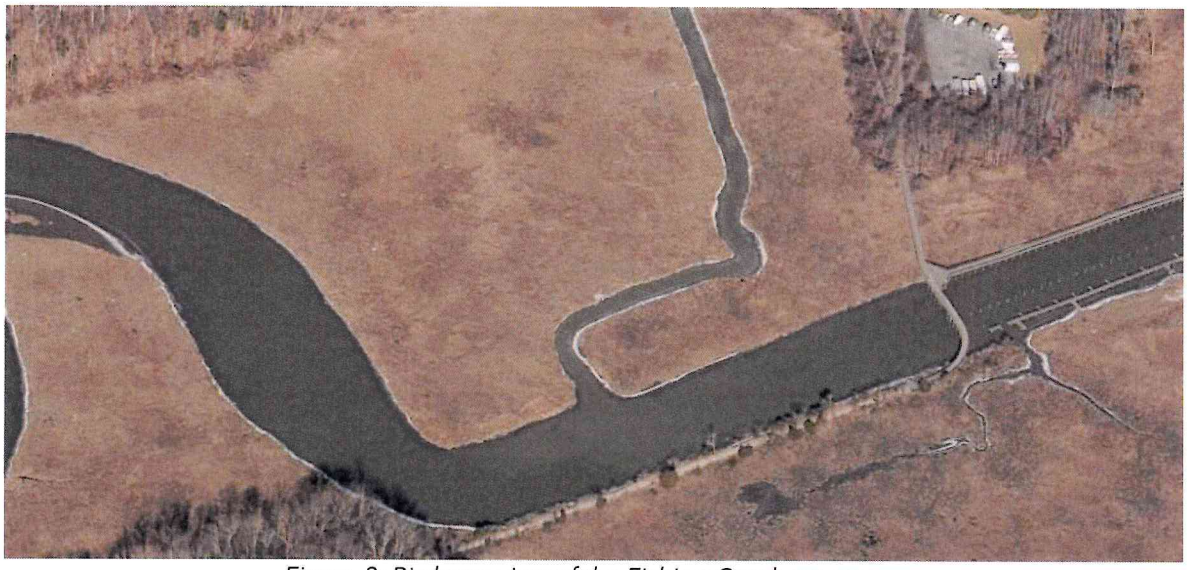


Figure 3: Birdseye view of the Fishing Creek estuary

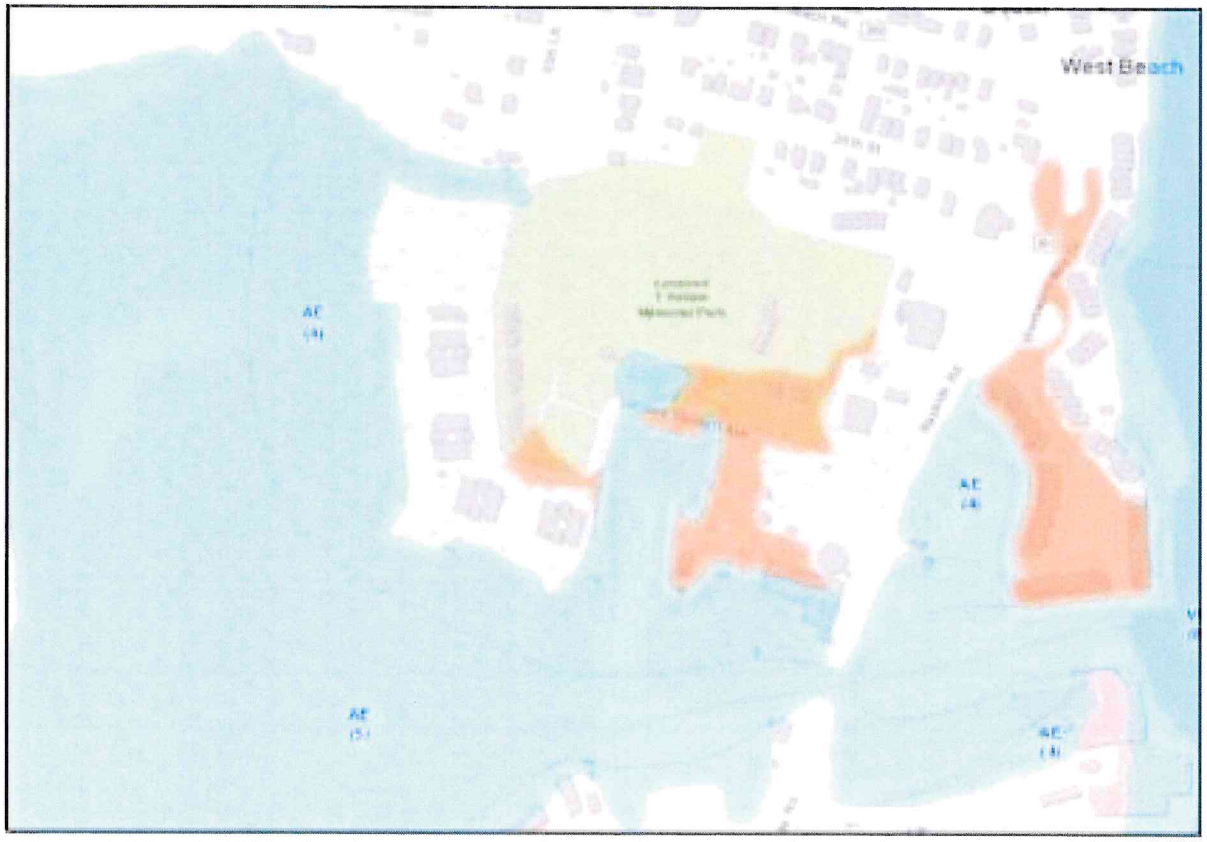


Figure 4: Historic FEMA floodplain mapping showing the extent of the marsh associated with Fishing Creek.

Floodplains

The Federal Emergency Management Agency (FEMA) regularly maps floodplains having a 1% chance of flooding in any given year (i.e., the 100-year floodplain). These are shown in Figure 5 below for most of coastal Chesapeake Beach and the North Beach area. In these floodplains, within Town boundaries, Chesapeake Beach regulates building and land development activities through its Floodplain Management Ordinance (Chapter 149 of Town Code).

Figure 5: Mapped FEMA Floodplain, 1% Annual Chance Flood Area

Figure 6 below maps the existing 1% Annual Chance floodplain from MD Route 260 north to North Beach. It provides a more detailed view of the northern part of Town and the floodplain associated with South Creek.

Figure 6: FEMA 1% Annual Chance Floodplain

The figures below highlight separate flood zones within this above geographic area and show the base flood elevation (BFE). BFE is FEMA's estimate of the elevation of surface water resulting from the "base flood". The base flood is the flood with a 1% chance of being equaled or exceed in any given year. BFE can be thought as the minimum elevation above which a homebuilder must set the first floor to prevent water entering the home during a flood with a 1% annual chance of occurring. Figure 7 shows that the flood zone associated with South Creek has a BFE of 4 feet. Figure 8 shows floodplain that is mapped without a BFE. Figure 9 shows the flood zones along the shoreline from First Street in North Beach to 27th Street is subject to high velocity wave action and has a BFE of 8 feet.

Figure 7: FEMA Flood Zone AO base flood elevation Is 4 feet.

Figure 8: FEMA Flood Zone AO base flood elevation is not mapped by FEMA.

Figure 9: FEMA Flood Zone VE, Special Flood Hazard Area. This area Is subject to high velocity wave action. Base flood elevation Is 8 feet.

Wetlands

Most of the Town's floodplain is tidal estuarine wetlands (marsh). These wetlands attenuate flooding, prevent shoreline erosion, improve the water quality of the Bay, and provide habitat for native plants, fish, and wildlife. They protect the existing settlement pattern in the historic center of Chesapeake Beach. Figure shows the wetlands in Chesapeake Beach.

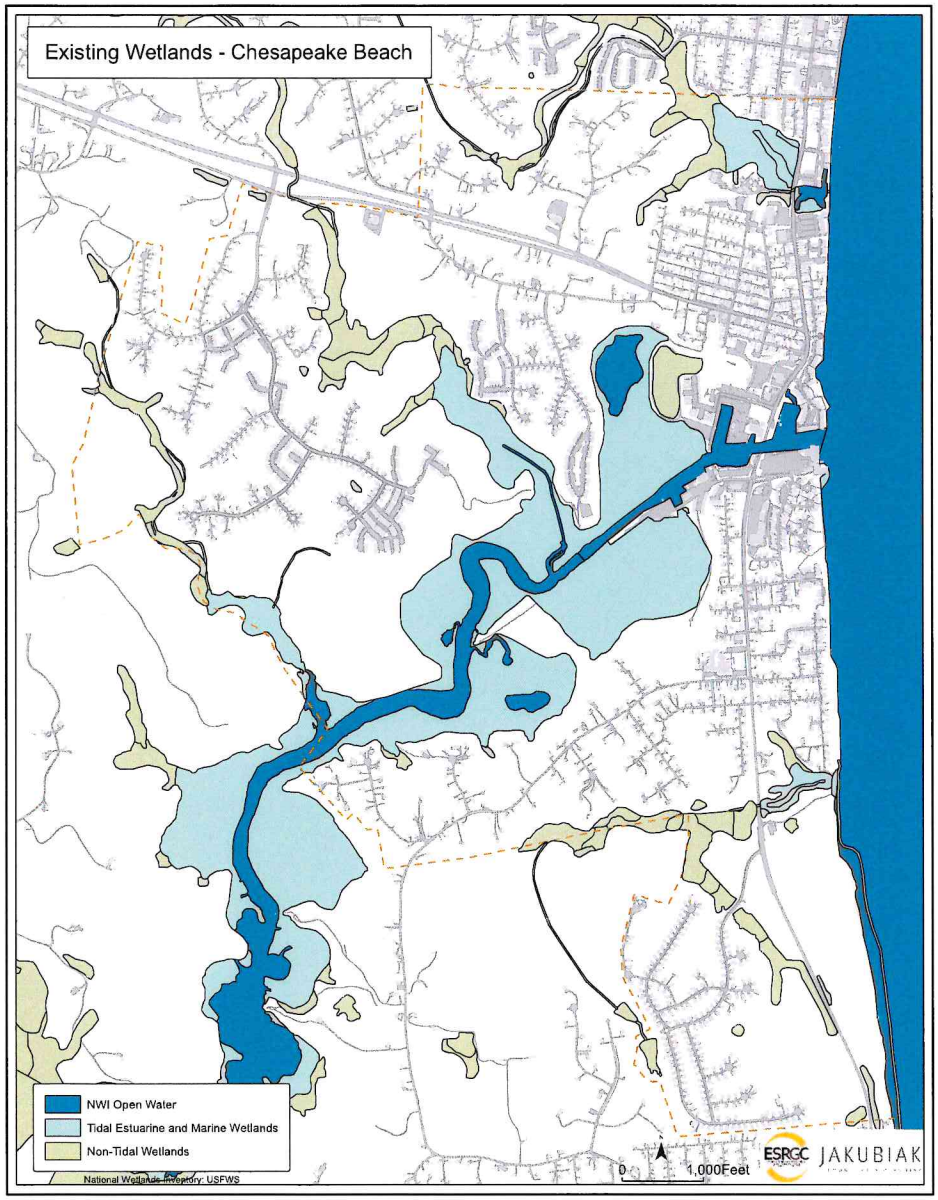


Figure 1: Mapped Wetlands in Chesapeake Beach.

The dominant wetland in and around Chesapeake Beach is the 92-acre Estuarine and Marine Wetland associated with Fishing Creek. Shown on Figure 10, it's the central green area on either side of Fishing Creek. This defining landscape feature consists of deep-water tidal habitats and marshes in which the bottom is both flooded and exposed by tidal action. It is also among the most scenic type of all natural resources in coastal Maryland. These marshes adjoin forested parcels, including a 200+ acre covenant protected by Forest Interior Dwelling Species (FIDS) habitat north of the Fishing Creek marshlands. Strict enforcement of this covenant and preservation of the forested areas surrounding the Fishing Creek marshlands is an essential element of local flood management.

The similar but smaller (12.5-acre) wetland complex of the same type on the north end of Town extends into North Beach and is associated with South Creek (See Figure 2.) Though it is mainly on the western side of MD Route 261, it is associated with the tidal action which is restricted to some extent by the seawall and a flood gate located between the Seagate and Horizons on the Bay housing communities.

Figure 10 also shows that non-tidal wetlands are located near both major tidal marshes. These are generally forested and extend into slightly higher elevations at greater distance from tidal action. The Town's non-tidal wetlands, whether populated by trees or just herbaceous plants, provide vital basins for retaining and filtering rainwater that flows from upland locations. The largest non-tidal wetland in Town is seven acres in size and is actually the Town's dredge disposal site. It separates Kellam's Field and the Courtyards at Fishing Creek from the Town's central tidal marsh. Even more extensive however, are the non-tidal wetland associated with South Creek (which extends northwesterly into North Beach) and along various tributary streams within the Town. These wetlands are mostly forested, and their preservation is an essential element of local flood management.

As sea levels rise, the Town's marshlands are expected to gradually transform into open water and simultaneously grow in response to both higher surface and ground water levels. Which is to say, the wetlands and marshes are dynamic; as they fill with water, they will also migrate and establish themselves where conditions are right for their growth.

Chesapeake Bay Shoreline

Two-thirds of the Town's 2.4-mile Bay shoreline, from North Beach south to 17th Street, is safeguarded by revetments. A revetment is a permeable wall of stones set at an angle away from the water to absorb the energy of waves and protect against erosion. Only a small section of the Bay's shoreline, at the Rod 'N' Reel Resort, is protected by bulkheading. Except for this small run of bulkhead and developed shoreline, the shoreline is gently sloping and mostly planted in lawn. There are three small private beach areas, one at Windward Key, one at Chesapeake Station and another at the Rod 'N' Reel Resort. There are no naturalized or vegetated (living) shorelines or buffer zones in Town except at Brownies Beach and the Randle Cliff Natural Heritage Area.

From 17th Street southward, the shoreline becomes very steep with slopes exceeding 50%. Cliffs are a special type of steep slope, where the face of the slope rises at least 10 feet at a grade of 50% or more[7]. The cliffs extend to Brownies Beach, where the shoreline flattens out again allowing Brownies Creek to flow into the Bay. After leveling out at the Brownies Creek inlet, the shoreline rises steeply again, this time in a naturalized condition and unprotected by revetment. Here the shoreline becomes the Randle Cliffs, which is a dynamic natural landform, continually eroding by force of waves, ground and surface water, and wind.

The Maryland Department of Natural Resources has designated the Randle Cliffs and its associated upland forest a Natural Heritage Area. Its combined geological, hydrological, and biological features are considered among the best in Maryland. Habitats for three threatened / endangered species are found there[8]. The Town has protected the area with its Resource Conservation zoning.

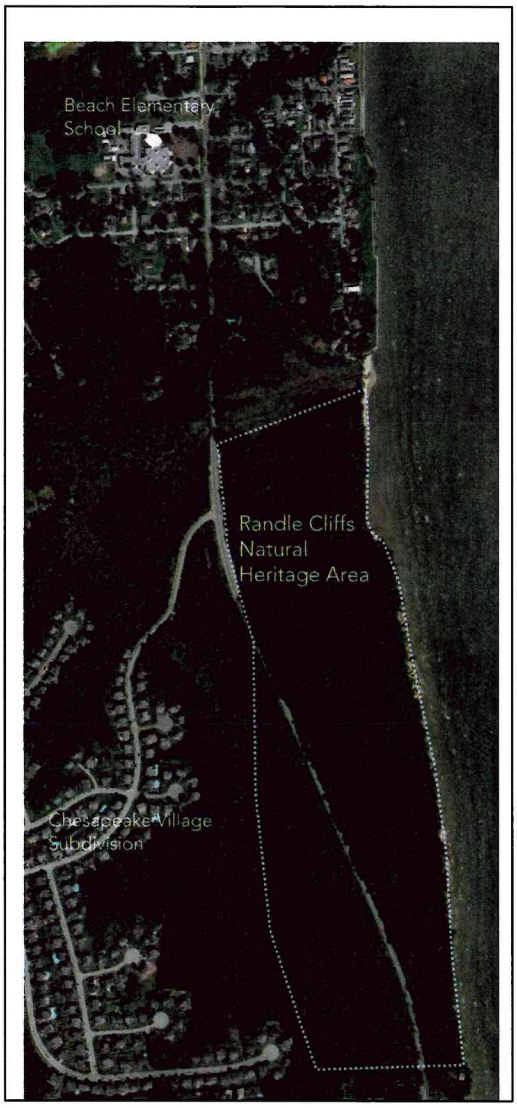


Figure 2: Bay Shoreline in southern Chesapeake Beach.

[7] The tops of these shoreline slopes were subdivided and sold as building lots long before the advent of zoning. Houses and other structures now stand above the Bay, most notably along B Street. Heavy rains in recent years have caused noticeable sloughing and evoked concerns about the natural processes at work shaping the shoreline. Considering this, the Town adopted a Steep Slope Ordinance in 2018 requiring independently reviewed geo-technical studies and special stormwater management planning as conditions for future building activities.
[8] Puritan Tiger Beetle found in the intertidal zone, beach, cliff face and upland forest along Bay shoreline. Red Turtlehead (plant) found in the floodplain and non-tidal wetland areas to the west of MD Route 261. Glade Fern found in the northeast facing ravines and contiguous uplands between and above the ravines in the southwestern part of the area.

Drainage

Drainage in low lying areas has increasingly become a challenge and the Chesapeake Beach Nuisance Flood Plan: 2000-2025 documented locations throughout the Town where residual standing water follows coastal flooding and/or precipitation events. Figures 12 and 13 show two of those locations.

Figure 3: Standing Water at the Tot Lot at Kellam's.

Figure 4: Standing water on Gordon Stinnett Ave.

There are two areas of Town, however, where major drainage systems are not operating effectively as described below and the effects are more extensive. Both would require updated engineering and significant investment. The solutions to both are integrally tied to this Plan's approach to coastal resiliency.

Floodgate

The South Creek estuary is partially controlled by a flood gate located between Seagate (on the north) and Horizon's on the Bay (on the south). Between these communities is the eastern section of the estuary's tidal wetland which is separated from the Chesapeake Bay by a floodgate with a revetment and causeway. These features are visible in the photo below, which was taken from the northbound lane of MD Route 261. The open floodgate is in the distant center of the photo. Over time, this wetland has been converting to open water.

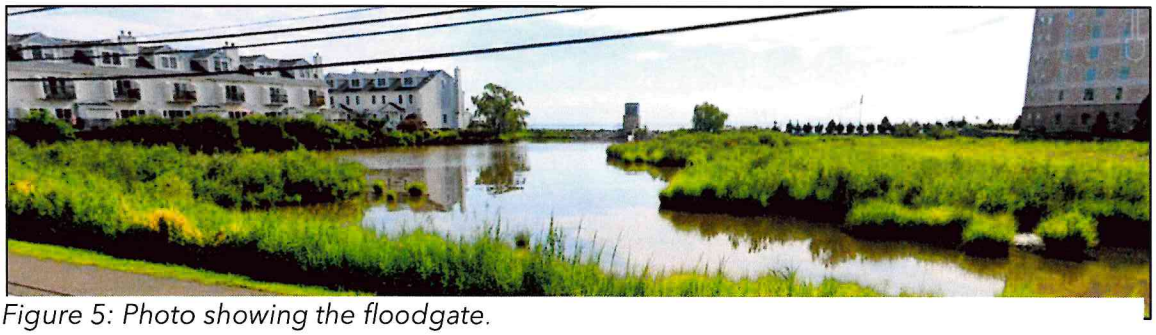


Figure 5: Photo showing the floodgate.

The floodgate, with its revetment and causeway, were intended to prevent storm surge from entering the wetland and flooding the northern part of Town, including Seagate and MD Route 261[9]. However, the floodgate is in a permanently open position, so it does not operate to prevent tidal flooding. Figure 15 shows that MD Route 261 was inundated by the October 2022 unnamed tidal event that occurred without precipitation.

During times of precipitation and upland flooding, the open floodgate is intended to allow water to flow out to the Bay thus preventing the back up of water. When there is a major coastal flooding event (like October 2022) or coastal event in combination with a rain storm– a common occurrence--the floodgate system also cannot work which among other things overwhelms the drainage system near the Seagate townhouse community.

Figure 6: View from Sea Gate community along MD 261 frontage looking west toward the sidewalk railing on MD Route 261 which is underwater following the un-named high tide event on October 12, 2022.

Seagate, which lies on the north bank of the wetland, contains a pumped stormwater system near the intersection of C and 31st Streets. This pump drains a sump area and discharges its water through a storm drain which outfalls about 460 feet to the south into the wetland. Presumably, the water is meant to be held in the wetland where its sediments are allowed to drop out. But, in times of coastal flooding, the water in the wetland is pushed westward over MD Route 261 (or through a culvert) whereupon it eventually moves eastward returning to the sump area to be pumped again into the wetland. This creates a continuous circular pumping scenario.

[9] That is, in the rare occurrence where there is coastal high flooding event without significant precipitation.

To avoid this, the drainage infrastructure would need to be re-constructed to pump directly to the Bay. The ultimate design solution for MD Route 261, however depends in large part of how this drainage system is reconfigured.

29th Street & Veterans Park

The Bayfront properties between 29th Street and Veterans Memorial Park have traditionally drained into the Bay through a series of storm drainpipes or wall openings in a bulkhead. The storm drain design for this area, which was implemented, is shown below. It is no longer effective. Note that it extends well west of MD Route 261 into the Middle Subdivision. Some years ago, the Army Corps of Engineers (USACOE) built the current stone revetment structure to protect those properties from eroding effects of wave action. In doing so, the USACOE raised the level of the structure relative to the homes and yards behind the revetment and did not modify drainage infrastructure.

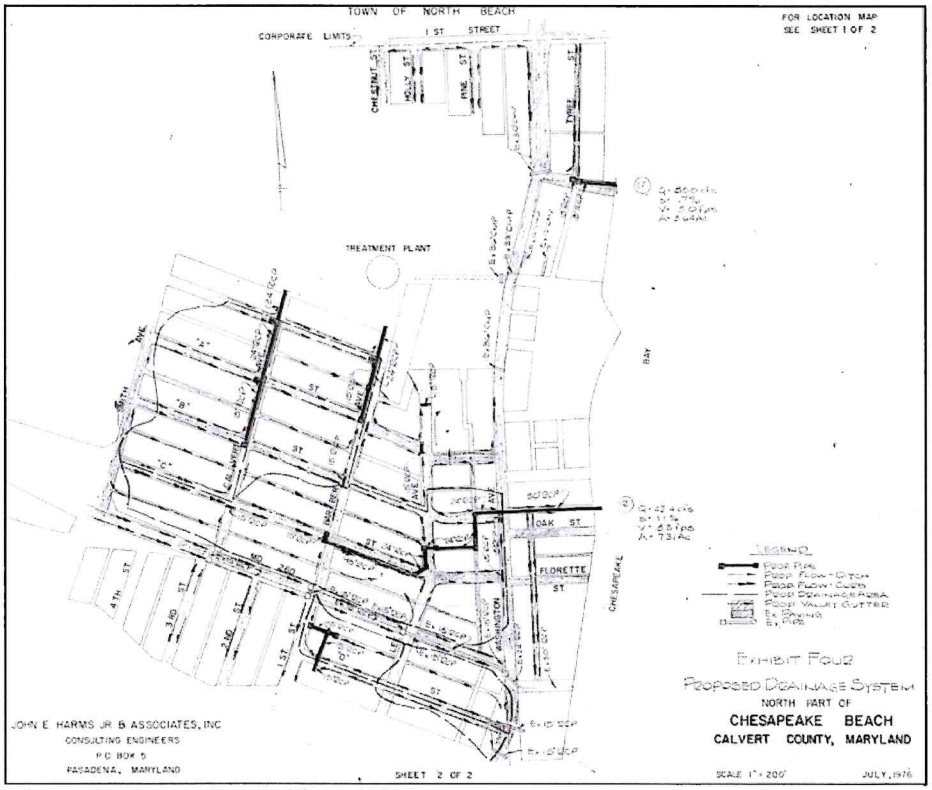


Figure 7: Storm Drain Plan, 1976.

Over time due to sea level rise and the raised revetment wall, both of which have prevented the discharge of water to the Bay, private property owners and the Town have found it necessary to implement incremental drainage solutions. Storm drains have been re-routed to find low areas to convey water and pipes have been elevated where possible. Also, the storm drain outlet at 28th Street and the Bay was completely plugged to prevent ponding on private property during high tide events. A comprehensive and areawide drainage assessment needs to be undertaken including videotaping the existing drainage system.

Detailed mapping is required to determine an optimal method of modernizing the drainage system in light of the sea level rise projected in this Plan.

Chapter 3 Vulnerable Areas and Assets

Background

Local sea level is measured at tide gauges in the Chesapeake Bay. The baseline for the sea level projections used in this report is the level recorded in 2000 at the Solomon's Island, Maryland tide gauge. When this report refers to sea level rise, it is referring to the change above the levels recorded at the Solomon's Island tide gauge in 2000. The projections of sea level rise are from the Maryland Commission on Climate Change, Sea-Level Rise Expert Group via the University of Maryland Center for Environmental Science (UMCES). The Commission's publication titled Sea-Level Rise: Projections for Maryland 2018, is the source for the projections[10]. Pursuant to State law, these projections are to be updated every five years.

Tolerance for Flood Risk

The UMCES projects sea levels at various "tolerances for risk" and advises how these projections should be used when planning or and designing improvements. Figure 17 shows the projections for three levels of risk tolerance by decade through the year 2150.

This Plan uses maps for projected sea levels in the years 2030, 2050, and 2100 at a "low tolerance for flood risk". Figure 17 shows, for example, that in 2050 sea level is projected to be plus 2.4 feet at the low risk tolerance projection. For comparison, at the medium risk tolerance, the projection is plus 2.0 feet. At the high-risk tolerance, the projection is plus 1.7 feet. The risk tolerances correspond to the following percent probabilities that sea level will meet or exceed the stated value in a given year:

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

Figure 8: Projections of Sea Level Rise, University of Maryland Center for Environmental Science, 2018.

[10] Boesch, D.F., W.C. Boicourt, R.I. Cullather, T. Ezer, G.E. Galloway, Jr., Z.P. Johnson, K.H. Kilbourne, M.L. Kirwan, R.E. Kopp, S. Land, M. Li, W. Nardin, C.K. Sommerfield, W.V. Sweet. 2018. Sea-level Rise: Projections for Maryland 2018, 27 pp. University of Maryland Center for Environmental Science, Cambridge, MD. https://www.umces.edu/sites/default/files/Sea-Level%20Rise%20Projections%20for%20Maryland%202018_0.pdf

- High tolerance for flood risk: 17% probability
- Medium tolerance for risk: 1 in 20 chance, or 5% probability
- Low tolerance for flood risk: 1 in 100, chance, or 1% probability

For coastal planning purposes, University of Maryland Center for Environmental Science and Maryland Department of Natural Resources advise using projections associated with the low risk tolerance for flooding[11]. Using a low risk tolerance effectively means planning for avoidance, resistance, and the relocation of assets when adapting to flooding over time. In using a low risk tolerance, this Plan assumes that sea level rise values given for each year are unlikely to be exceeded in that year. In this way, conservative planning can be done so potentially severe consequences of flooding can be avoided, such as loss of life, public safety hazard, property destruction, and costly repair of infrastructure and buildings.

The low risk tolerance projection is used in this Plan can be explained in this way: there is 1% chance that sea level will be 2.4 feet or higher than the level recorded in 2000. It can also be explained by saying: there is a 99% chance sea level rise will be lower than 2.4 feet. Likewise, for the year 2100, the low risk tolerance projection used in this Plan means that there is 1% chance that sea level will be 5.8 feet or higher than the 2000 level and thus a 99% chance it will be lower than 5.6 feet.

If the Town were in the position now to design a new residential community, a town hall, a new water reclamation plan, or a fire company, it would adopt a low tolerance for risk for these assets. Each is vitally important and one of the design goals would be to ensure the long-term viability and safety of the asset or of public safety generally. For that reason, the Town would insist on locating and designing such assets to strictly minimize the threat of hazard. The fact that each asset type is already present in Chesapeake Beach, and located within a flood hazard area, only reinforces the need for conservative planning. In applying a low tolerance for risk, this Plan is aiming to guide adaptation of the town and such assets with the greatest concern for public safety and asset preservation.

By contrast, if the Town were now to design a new park, it would likely use a higher tolerance for risk because a park, in contrast to a fire company, can generally flood without causing major damage. In the future, as the Town and State of Maryland implement the ideas recommended in this Plan, engineers will make specific determinations about relative tolerances for risk. An evacuation route (such as MD Route 261) could be conservatively designed with a low risk tolerance and would ideally be elevated well above base flooding conditions, while a parking lot at the Kellam's Recreational Complex could be designed with a much higher tolerance for risk allowing for routine flooding without impact to public safety.

A Word About Storm Surge

The mapping used in this Plan shows the projected extent of future "still" water–that is, open water on a typical dry-weather day in the future (2030, 2050 and 2100). The mapping does

[11] Guidance for Using Maryland's 2018 Sea Level Rise Projections, Kate McClure University of Maryland Sea Grant Extension and Allison Breitenother and Sasha Land, Maryland Department of Natural Resources, March 2022.

not incorporate the storm surge associated with hurricanes or nor'easters. Storm surge is the level of windblown water that arrives at the shoreline above the normal tide levels. In Hurricane Isabel (2003), the local storm surge was estimated to be 4 to 5 feet -- that is, the water was 4 to 5 feet above the normal tide level on that day in 2003. When one considers the mapping of open "still" water in this report, it's helpful to layer storm surge on top of that higher sea level to appreciate the extent of future risk. If, for instance, the sea level in 2050 is about 2.4 feet higher than it was during Hurricane Isabel (as projected), a comparable storm surge will arrive at roughly 6.4 to 7.4 feet above the 2003 tide level, rather than at 4 to 5 feet. This gives greater credence to this Plan's decision to use the low risk tolerance for coastal resiliency planning.

Mapping

The Eastern Shore Regional GIS Cooperative (ESRGC) assisted the Towns of Chesapeake and North Beach with flood analyses and prepared the maps in this Plan. An ESRGC prepared document summarizing its methodology is provided in the Appendix. The ESRGC used the most current (2017) LiDAR topographic mapping data to establish land elevations, meaning that any topographic changes following 2017 were not captured on the maps presented in this report. To address this, the Town surveyed lands in 2022 known to have been raised since 2017 and updated the mapping as needed. The updated maps are not incorporated into this report but were considered in this study, presented at public work sessions, and remain available on the webpage the Town created for public review.

Maps are used in this report to explain existing or projected conditions. They are also provided at a higher resolution for more detailed examination in the Appendices. Maps are provided for the years 2030, 2050, and 2100. For the year 2100, two series of maps were produced. The first series is based on the 2100 projection for sea level rise (RCP 4.5) which assumes global society is able to stabilize carbon emissions following 2050. The second series (RCP 8.5) assumes global carbon emissions continue to grow beyond 2050[12]. This second scenario shows a greater extent of inundation and flooding than the stabilized emission scenario. Both series of maps were considered in formulating the recommendations of this Plan, but only the stabilized emissions scenario is presented in the body of this document.

The maps contain content that is particularly useful to understanding vulnerability to sea level rise. Figure 18 provides guidance for reading the maps. As noted previously, the maps show the extent of inundation in future years under dry-weather conditions. In other words, the water coverage one could expect to see on a typical dry-weather day. So, as shown in Figure 18, areas marked with the darkest blue color are projected to be open water on a typical dry-weather day.

[12] See the aforementioned report, Sea Level Rise, Projection for Maryland, 2018.

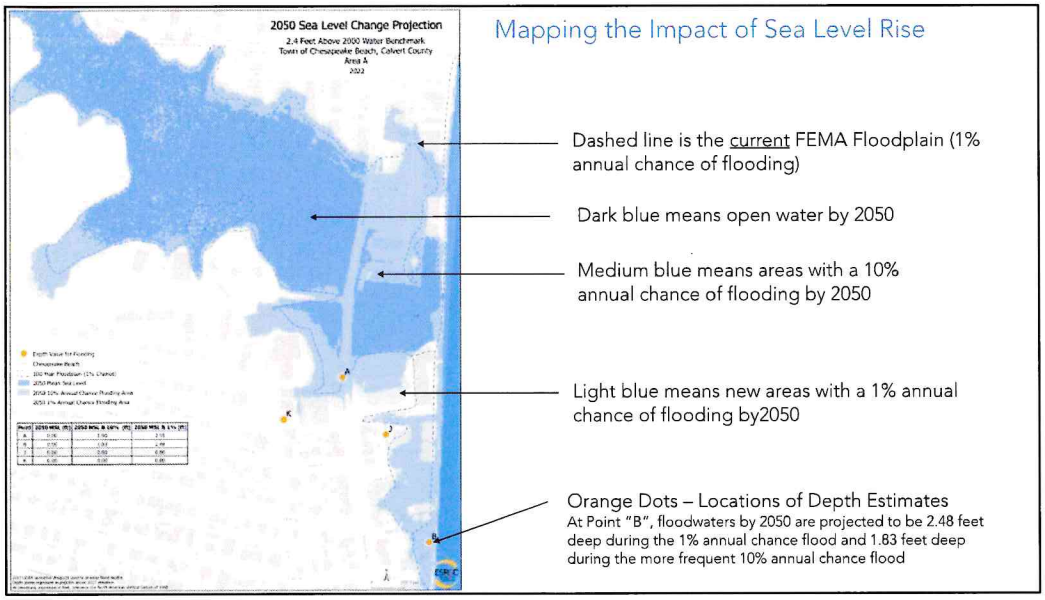


Figure 9: A Guide to the Content on the Sea Level Rise Maps.

It is important to note that the maps do not show the impacts of storm surges or of heavy rains which would lead to more land being covered in water, at least temporarily. To better understand the increased vulnerability to flooding that the Town's coastal areas will face in the years ahead, the maps also show the existing FEMA 1% annual chance flood area, a projected 1% annual chance flood area, and a projected 10% annual chance flood area. Land contained within 1% annual chance of flooding, would have a one in 100 chance of being flooding in the given year. Land contained within 10% annual chance of flooding would have a one in 10 chance of being flooding in the given year.

Vulnerability Areas

To allow for detailed examination of the effects of projected sea level rise on neighborhoods, infrastructure, and community assets, this Plan focuses on three subareas within the Town (See Figure 19).

The maps that follow document the extent of future inundation, flooding, and vulnerable community assets within each of these areas. Later in Chapter 4, this Plan's recommendations are also organized by area.

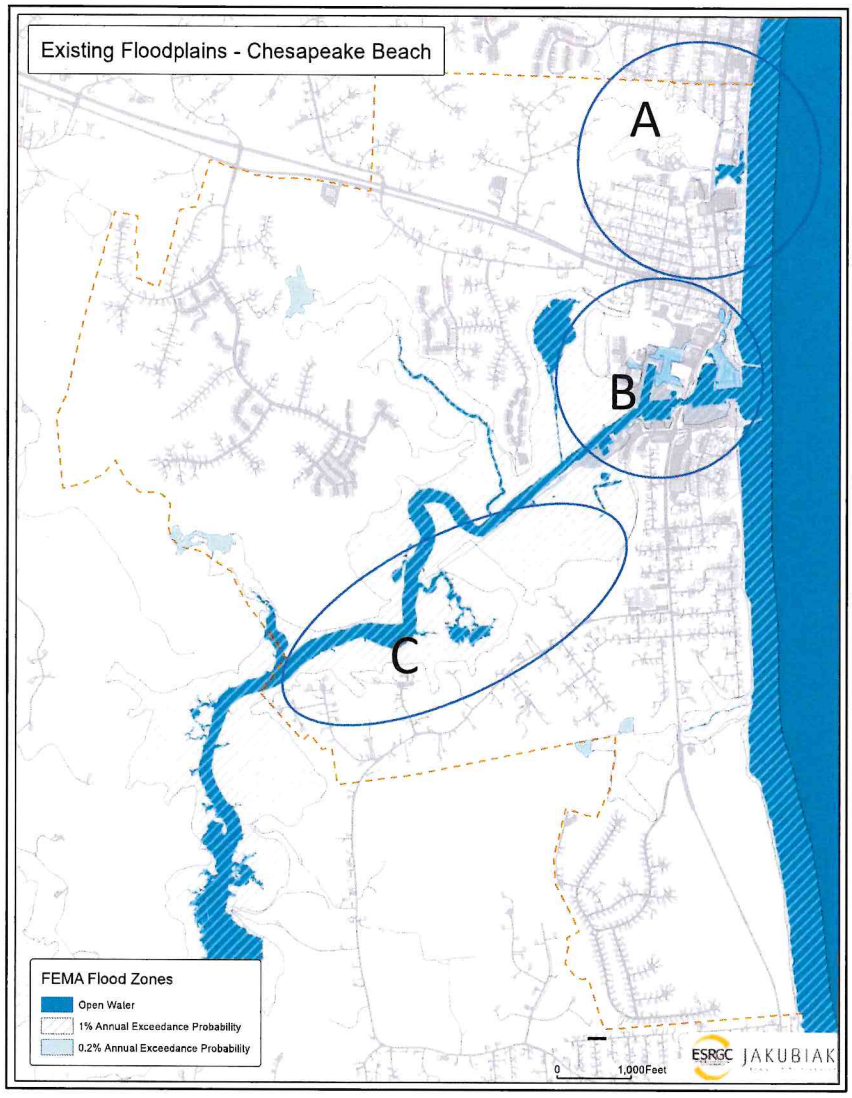


Figure 10: Three Vulnerability Areas.

Area A

Area A extends from about 27th Street north to First Street. It encompasses the South Creek estuary or inlet to the Bay. Shown here is the area in 2030 (with a sea level rise of 1.3 feet), in 2050 (with a sea level rise of 2.4 feet), and 2100 (with a sea level rise of 5.8 feet. The most dramatic change projected between 2030 and 2050 is the near complete conversion of the marsh to open water. Over time the floodplain would extend both north and south encompassing residential and commercial properties that today are not within the FEMA floodplain.

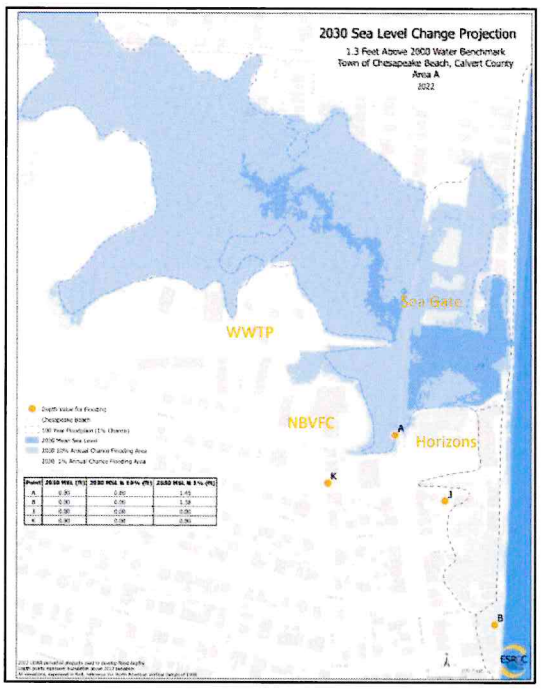


Figure 11: 2030 Sea Level Rise Projection, Area A.

The community assets shown in the maps are the Chesapeake Beach Water Reclamation Plant (WRP) and the North Beach Volunteer Fire Company (NBVFC). The Sea Gate residential community, consisting of 30 townhouses, is projected to be increasingly vulnerable to flooding in the decades ahead. By 2100 the area South Creek estuary is projected to be fully engulfed in water covering the grounds of Sea Gate and nearby properties.

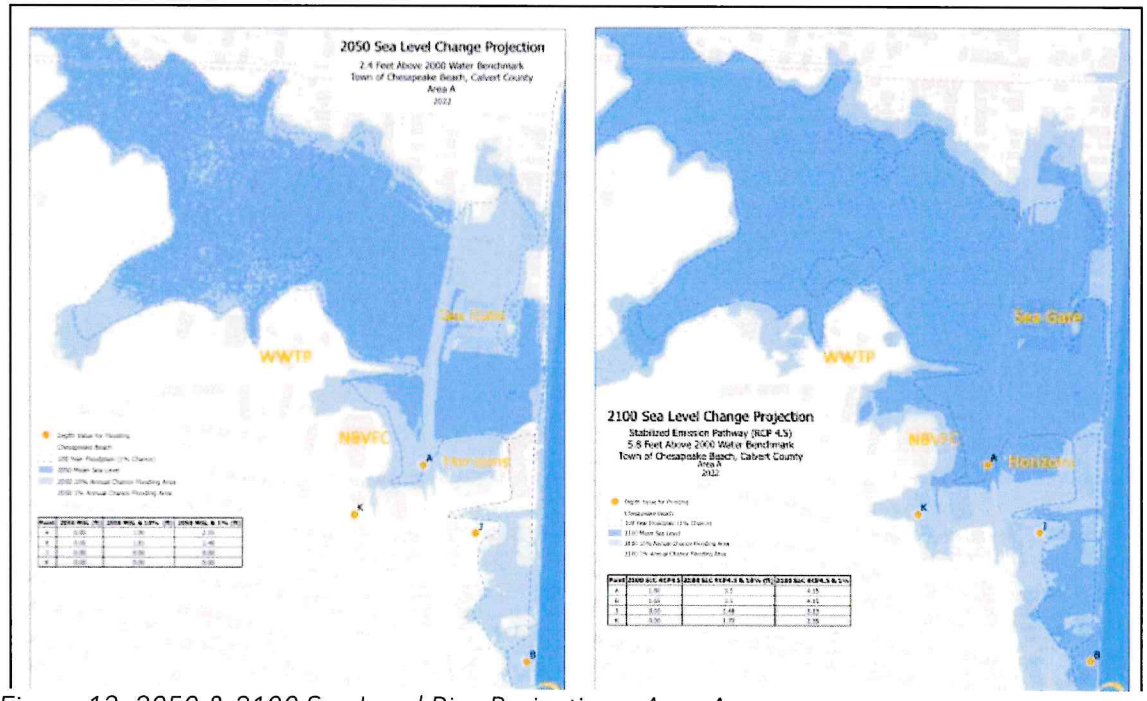


Figure 12: 2050 & 2100 Sea Level Rise Projections, Area A.

Area B

Area B encompasses the historic center of Chesapeake Beach and the Fishing Creek inlet to the Bay. Shown here is the area in 2030 (with a sea level rise of 1.3 feet), in 2050 (with a sea level rise of 2.4 feet), and 2100 (with a sea level rise of 5.8 feet.

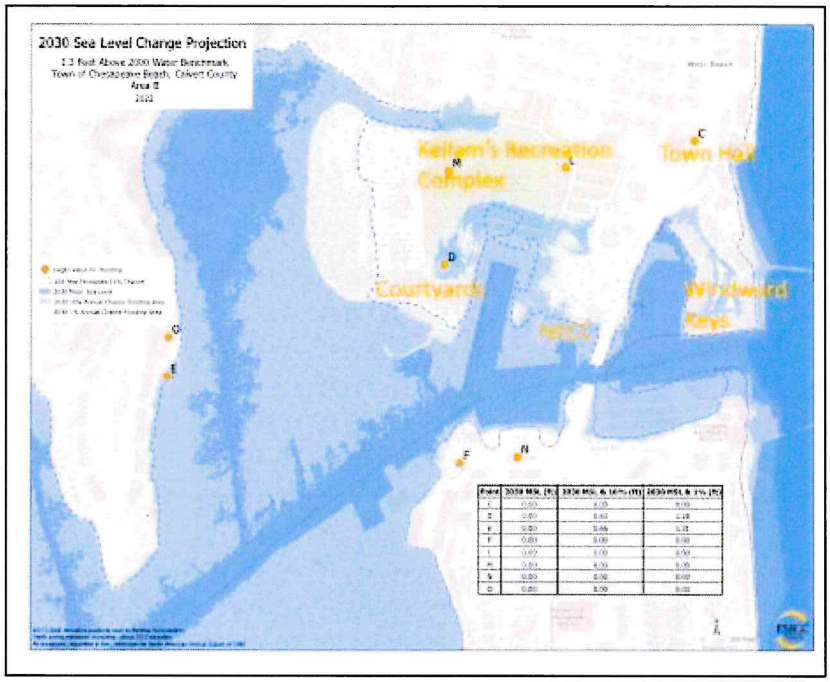


Figure 13: 2030 Sea Level Rise Projection, Area B.

The community assets shown in the maps of Area A are the Chesapeake Beach Town Hall, the Kellam's Recreation Complex, and the Northeast Community Center (NRCC). The Chesapeake Beach Waterpark and Public Boat Landing are also located here. The Courtyards at Fishing Creek Townhouses and Apartments (Courtyards) and Windward Key are also located in this area of Town. Both are projected to be increasingly vulnerable to flooding in the decades ahead, the Courtyards especially.

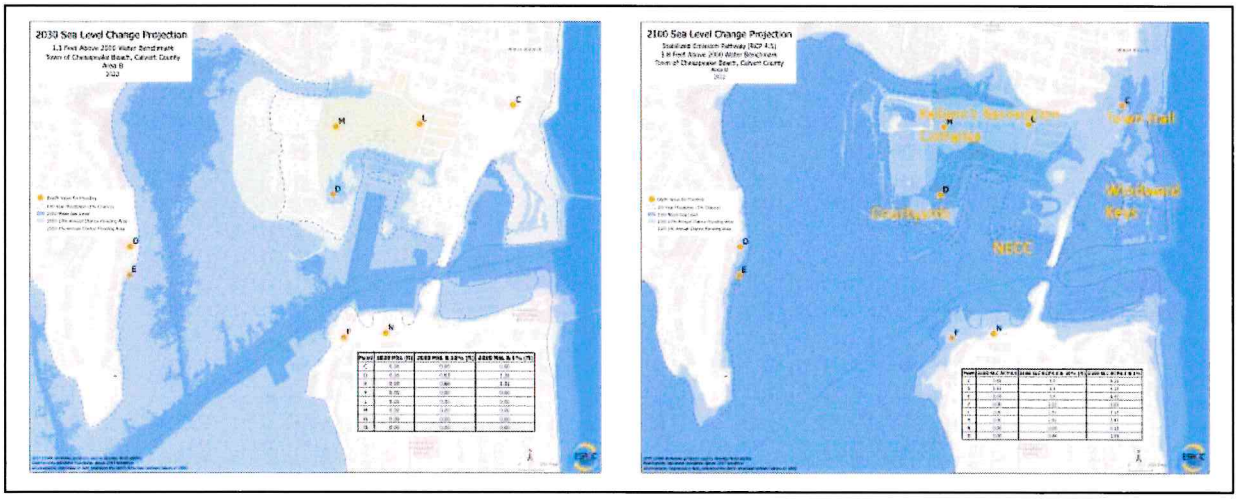


Figure 14: 2050 & 2100 Sea Level Rise Projections, Area B.

Area C

Area C encompasses the southern section of the Fishing Creek marsh. Shown here is the area in 2030 (with a sea level rise of 1.3 feet), in 2050 (with a sea level rise of 2.4 feet), and 2100 (with a sea level rise of 5.8 feet.

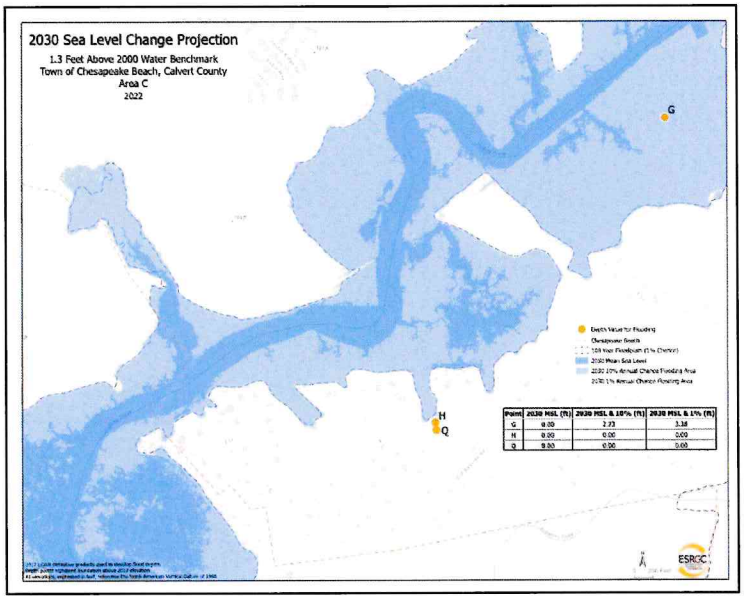


Figure 15: 2030 Sea Level Rise Projection, Area C.

Sea level rise in Area C is almost entirely contained within the current FEMA flood plain, through some expansion of the flood plain in lower lying areas is projected over time. This area of Chesapeake Beach is largely wooded and sparsely developed. It is zoned for low density residential development and falls within the Limited Development Area (LDA) of the Critical Area. There are no community assets here and no public streets or utilities are anticipated to be impacted by sea level rise.

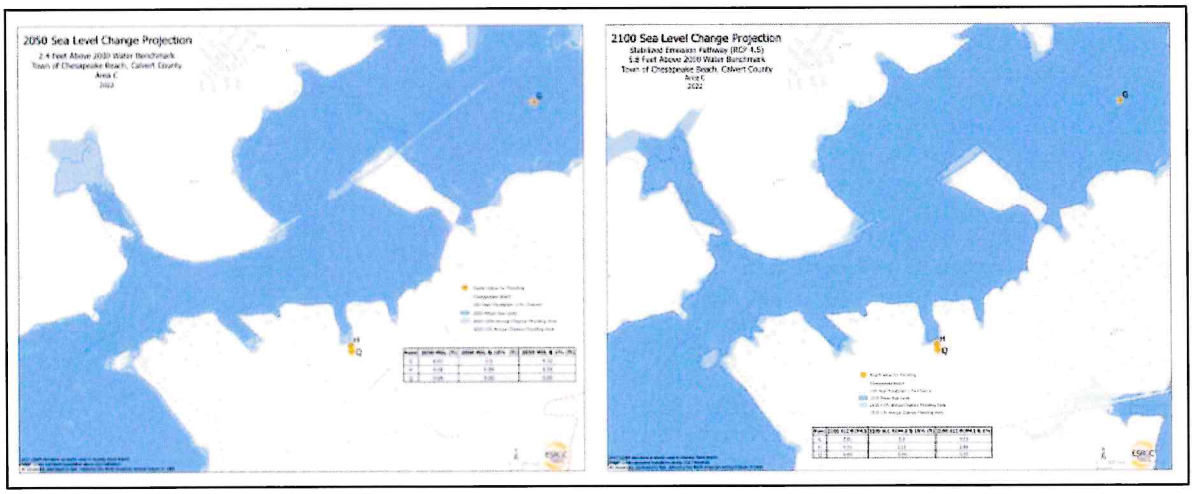


Figure 16: 2050 and 2100 Sea Level Rise Projection, Area C.

Summary of Impacts

Housing developments have been built within areas and at elevations which present significant future flood hazard. Circulation within Chesapeake Beach is also vulnerable to multiple day disruptions during both tidal events and major storms. Over the long term, beyond 2050, some streets are also at risk of being permanently inundated as sea level fills low lying areas. This includes MD Route 261 between 27th Street and First Street, several Town owned streets including parts of 31 Street, C Street, D Street, E Street, David Street, and Gordon Stinnett Avenue. A major section of this road is elevated only 2.5 to 3.0 feet above the current sea level and is routinely flooded during 1% annual storm events.

Gordon Stinnett Avenue is the only access route between the Courtyard at Fishing Creek housing community and the Town street system. The Courtyards was established in 1989 under the federal Low Income Housing Tax Credit program (LIHTC) and was constructed on filled wetlands. It provides 76 units for Town households earning below the median housing income. Multiple private community streets are also at risk including those at the Courtyard at Fishing Creek, Windward Key, and Sea Gate.

Essential community facilities are at risk, including the North Beach Volunteer Fire Department, the entrance road to the Chesapeake Beach Water Reclamation Plant, the grounds of the Town Hall, and the Northeast Community Center (which is a designated hazard resource center). The entire Kellam's Recreation Complex was constructed on filled wetlands and a large portion sits at, or under, five feet above sea level. The Chesapeake Water Park is a site of significant subsidence as mentioned elsewhere in this report and its ability to function over the longer term, in the absence of resiliency solutions, is at risk due to flooding. The extent of these and other risks is explored further in Chapter 4, Action Plan Strategies and Recommendations.

Chapter 4 Plan Strategies, Recommendations

Overall Approach

The purpose of this Plan is to provide a coordinated and long term approach to making Chesapeake Beach more resilient to the effects of rising water levels and the flooding associated with it.

This Plan aims to be holistic in its approach. It considers the natural resource systems and the Town's settlement pattern. As documents in this report, the Town developed in a way that placed current and future populations increasingly at risk, mostly within and adjoining the tidal estuaries associated with South and Fishing Creeks. So, this Plan for resiliency is largely about retrofitting those patterns.

Solutions must be comprehensive, flexible, sensible and consensus driven. This plan for coastal resiliency is a plan about embracing the reality of the landscape and its limitations and making Chesapeake Beach safer and more environmentally sustainable, walkable, beautiful, and enjoyable. The solutions that address flood risk most optimally therefore will be solutions that provide other community benefits too.

The overall approach can be broken into two main strategic frameworks. The first is about strategic flood management and sustainable drainage. These recommendations are universally applicable within the Town's coastal areas most notably within lower lying areas at risk of flooding or permanent inundation. The recommendations include changes to the regulations that govern development activities and land use in the floodplain. The second strategic framework is about tactical retrofitting. These recommendations are location-specific and include both policy and project-based proposals. Recommendations are provided for each of the three subareas described elsewhere in this report: Areas A, B, and C.

Strategic Flood Management and Sustainable Drainage

In order to operationalize the recommendations in this section, the Town must periodically track projected changes in sea level and map the effects of these changes on the landscape. In other words, it must update the maps presented in Chapter 3. The Maryland Commission on Climate Change Commission updates the projections every five years so the Town could periodically select and adopt a sea level rise projections, based on the Commission's published projection. With the new projections in hand, the Town could then revise its geo-spatial mapping and take account of any local topographic changes. The updated mapping would then provide the base for drawing flood hazard zones wherein certain types of regulations would apply.

Tying regulations to consensus projections of sea level rise means the regulations can be reasonably applied in the short term and adjusted over the longer term as changing conditions or improved information warrants. For now, the recommendations that follow reflect this Plan's adoption of the 2.4 foot increase (projected to occur by 2050), and the mapping which derives from that projection, and the 5.6-foot increase (projected to occur by 2100) and the mapping which derives from that.
For guidance to the recommendations that follow, note that when the recommendations refer to the "2050 Maps" or "2100 Maps" they are referring to the maps in Chapter 3 of this report. The 2050 Maps show areas of open water, areas with a 10% annual chance of flooding and areas with a 1% annual chance flooding under the assumption that relative sea level is 2.4 feet over the year 2000 baseline. The 2100 Maps show the same geographic areas and the same categories but assume relative sea level is 5.6 feet over the baseline established in the year 2000. Please refer to the maps in the Appendix.

1. Amend the Floodplain Management Ordinance (Chapter 149 of Town Code) to apply flood management regulations to all properties mapped on the 2100 Maps as a Flood Area. The regulations would include among other things applying a required minimum flood protection elevation (FPE or "freeboard"), and requiring flood resistance materials, the elevation of electrical building components, and anchoring of accessory structures. This effectively means broadening the geographic area and expanding the number of properties subject to floodplain regulations.

2. Amend the Floodplain Management Ordinance to incorporate a higher flood protection elevation (FPE, or freeboard). For all areas mapped in the higher risk 10% Annual Chance Flood Area on the 2100 Maps, the Town should require that development or redevelopment projects incorporate a FPE of at least 4.5 feet. This is 2.5 feet higher than the current 2-foot flood protection elevation required in the Town's Floodplain Management Ordinance. The extra clearance is intended to account for the projected 2.4 feet of sea level rise through 2050. This Plan assumes over time FEMA will continually update its base flood elevation and while the 2 -foot FPE should continue to be adequate generally, all properties mapped as 10% Annual Chance Flood Area, will need to adhere to this new higher standard for freeboard: 2-foot FPE plus at least 2.5 feet.

3. Amend the Zoning Ordinance (Chapter 290 of Town Code) to require that all site plans for any development or redevelopment on properties mapped on the 2100 Maps as Flood Area include certification by a Professional Engineer that all principal buildings have a demonstrated capability to withstand the storm surge associated with the Town's projected sea level rise. Specifically, for the next decade, the certification will need to demonstrate that flood tolerant construction methods would be used appropriate to the projected storm surge assumed with the 2.4-foot rise. This is the "Isabel plus 2.4-foot test". It takes the Town's experience with the last recorded Hurricane and assumes it arrives on a tide level 2.4 feet higher.

4. Amend the Zoning Ordinance (including Critical Area regulations) to require that all required stormwater management practices and techniques for development or

redevelopment projects in areas on the 2100 Maps as Flood Area be proven effective with the 2.4-foot rise in sea level assumed as a base condition. This includes stormwater management evaluations required for development activities within the Critical Area. The Town will need to coordinate with Calvert County Department of Public Works to incorporate this standard, or a comparable standard, into the Department's administration of Maryland stormwater management regulations.

Amend the Zoning Ordinance to prohibit from areas mapped as 2100 Flood Area, all group homes, convalescent centers, nursing homes, and hospitals. These uses would be especially vulnerable to coastal hazards and would present difficulties for emergency evacuation. These Zoning Ordinance amendments can be re-evaluated as mitigation measures are implemented and the projected 2100 Flood areas are adjusted.

5. Thoughtfully evaluate the Zoning Ordinance to determine what regulatory obstacles may impede property owners from raising buildings and improving their properties in ways that would protect public health and safety and advance the resiliency goal of this Plan. Examples of obstacles might include structure height, where the structure height is measured from, permitted hardscape elements, alternate entrances to a lot, etc.

Tactical Retrofitting

This section is organized into three parts. The first describes the spatial tactics and the techniques which may be applicable within the Town generally. The second and third part describe the tactics and techniques specially recommended as applicable to Area A, B, and C respectively. Recall areas A, B, and C are described and mapped in Chapter 3.

The tactics and techniques are summarized in the framework set forth in Figure 26 below. Some of the tactics can work in coordination with each other and in fact may be codependent. All of them can be used to ensure the most effective and comprehensive approach.

Spatial Tactic	Techniques	Description
Attenuate	General open space protection. Forest preservation and tree planting. Steep slope -- preservation in wooded condition. Shoreline, rip rap or naturalizing shoreline.	Reduce the velocity of flood waters and increase the time water takes to move along a pathway
Alleviate	Allowing marsh migration. Re-establishing wetlands. Spill-overs and retention zones.	Increase the capacity to withstand floods, provide safe areas that can be flooded to limit vulnerability

	Building new landforms to contain water. Sustainable drainage. Best Management Practices.	elsewhere, manage stormwater in all forms of development, retro-fit existing neighborhoods. Absorb.
Restrict	Building, rebuilding revetments and bulkheads. Building, rebuilding floodgates and seawalls. Building new landforms to block water.	Restrict the entry of water. Hold the line against flooding.
Realign	Elevating streets, sidewalks, parking lots. Redeveloping neighborhoods. Elevating individual buildings. Managed retreat, relocating buildings and community assets. Bringing about land use changes.	Reposition and thus reduce exposure by moving infrastructure and buildings, either vertically or horizontally.

Figure 17 Spatial Tactics and Techniques

Attenuate. Attenuation is the foundation for the Town's coastal resilient approach. While sea level rise is a coastal phenomenon, good land use and stormwater management further inland, (in the drainage basins of South and Fishing Creeks) can reduce the Town's vulnerability to flooding. Healthy forests, especially on steeply sloped terrain and along streams, and healthy wetlands work to reduce the velocity of floodwater and increase the time it takes to flow into the lower lying areas of coastal Chesapeake Beach.

Alleviate. Alleviation is also foundational to coastal resiliency in Chesapeake Beach. The local context described in Chapter 2 of this report indicates the potential latent in the Town's natural resources to help cushion sea level rise and withstand floods. This tactic is in part about allowing natural or nature-like processes, like the migration of wetlands and sustainable drainage, to absorb floodwater so that overall vulnerabilities are lowered.

Restrict. Restricting the entry of water into critical zones through floodgates, sea walls, bulkheads, and other structures is a must in certain locations but it's viability within the unique environmental context of Chesapeake Beach is limited. Because the Town has been built on and among two estuaries, flood waters comes from the Bay while stormwater flows to the shoreline. The structures that would be required to hold back the water along the shorelines of the Bay and Fishing Creek would displace much of the Town and the drainage pipes and pumps necessary to convey floodwaters over and through those structures back to the Bay would be monumental.

Realign. Realignment is about moving things like roads, houses, business, and community assets so they can withstand flooding or avoid it altogether. Some buildings, and infrastructure can be raised so water passes under or around and some can be relocated to

safer locations. The Realign and Alleviate tactics can be especially complementary. For example, allowing tidal marshes to expand (alleviate) may depend on relocating buildings and infrastructure (realign).

Many of the recommendations assume multi-disciplinary engineering studies and design work. Teams of experts in coastal engineering, structural engineering, hydrology, infrastructure, land planning, landscape architecture, and town planning would be called upon. These studies would be conducted under the guidance of this Plan, and they would in turn help refine and detail this Plan as they are completed and accepted. Detailed engineering, particularly at the scale of small areas or even individual properties, may reveal actual elevations of some locations that differ from the geo-spatial assessments shown in this Plan. These findings will, of necessity, inform how the recommendations of this Plan are refined and detailed.

Area A

Overview

As described elsewhere in this report, Area A is dominated by the confluence of South Creek and the Bay and home to essential community assets and residential communities. The prominent scenic and environmental feature in Area A is the South Creek tidal marsh which now extends along the west side of MD Route 261 roughly from the entrance to the Volunteer Fire Company north to 31st Street. On the east side of the roadway, the marsh is hemmed in by Seagate to the north and Horizon's on the Bay to the south. The blue lines on Figure 27 show the approximate limits of land projected to become mostly open water through this century. This is an area of heightened concern.

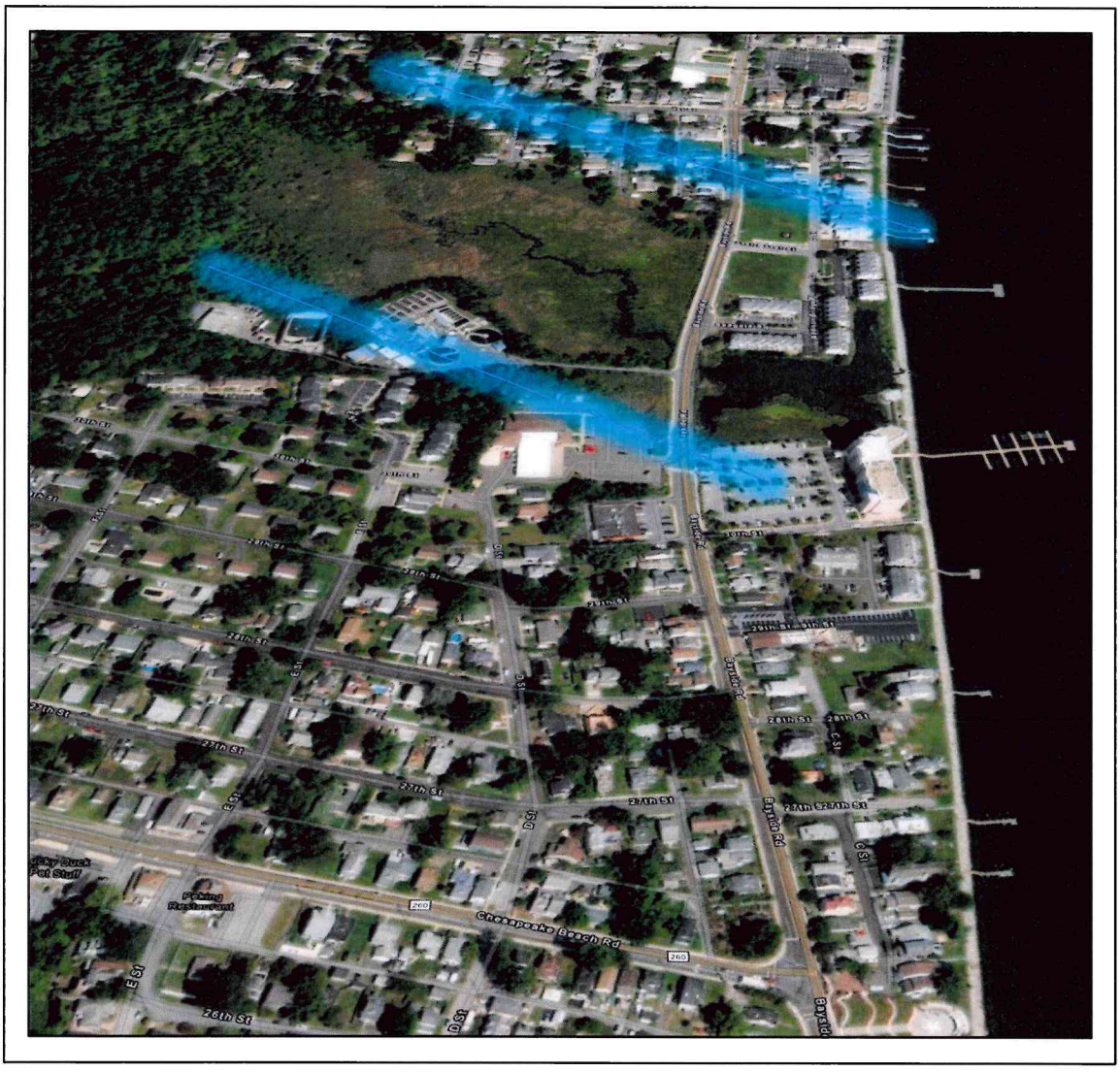


Figure 18: Defining the limits of the South Creek Estuary for planning.

The sea level rise mapping in Chapter 3 shows that relative sea level rise is projected to render much of the area between the blue lines in the figure above permanently inundated in still water conditions. Even by 2050, the marsh that exists today is projected to be open water and the edges of that marsh are likely to have migrated further north and south in response to expanding high water tables. Future storm surges (on par with the hurricanes of the past) would be far more devasting to any structures not substantially elevated or capable of floating. For context, Hurricane Isabel is reported to have soaked the insulated undersides of the elevated first floors in the Seagate community when its storm surge passed under the townhouses in 2003.

The optimal long-term approach to coastal resiliency in this area is to allow, to the greatest extent possible, the natural functions of the estuary to be re-established and to prevent the introduction of any residential population. How that might optimally be achieved over the decades ahead will depend on considerable consultation with all parties including residents, property owners, and the Maryland Department of Transportation, State Highway Administration. Holding back the water in this area with structures along the Bay or along the marsh is not practical for every situation and maintaining essential community services and infrastructure to the limited population over the long term could prove exceedingly challenging.

As this area continues to flood and transform, the potential for property damage and risk will rise. This subarea within Area A is subject to flooding from both the Chesapeake Bay to the east and South Creek to the west. Consequently, the existing development (especially residential uses) within this subarea of Area A will require much study and consultation with property owners in the decades ahead. Some of the potential responses that flow from the realization that this estuary may become open water are:

- Access to the North Beach Volunteer Fire Company would need to be modified in conjunction with realignments to MD Route 261 to ensure the entire service area could be supported.

- MD Route 261 would need to be reconstructed as a bridge over the marsh/open water, allowing for safe travel over the marsh and the freer movement of waters to and from the Bay while protecting the vital transportation needs between North Beach and Chesapeake Beach. The question of costs and feasibility would need to be studied.

- The access route to the Water Reclamation Plant would need to be elevated significantly in combination with MD Route 261, or if that is not practical, a new access route would need to be developed likely to the south side of the facility from a point north of 30th Street. The ground of the treatment plant itself, while at increased risk of flooding, is elevated above projected inundated levels even in 2100.

- Many of the residences on C Street would be surrounded by water on both their Bay and street sides and subjected to hazardous conditions. At minimum, C and 31st Street and the infrastructure and utilities within their rights-of-way would need to be reconstructed and raised to considerably higher elevations, which would affect driveway access to adjoining properties.

- The residences along the north side of the marsh would be flooded and a wide band of homes extending from the marsh would be subjected to hazardous conditions. The southern ends of E Street, David Street, and D Street are projected to be inundated making vehicular access to the houses closest to the marsh impractical. The ends of these streets collect the drainage flowing southward from First Street and they encounter the northern overflow from the marsh. Mitigation techniques such as berms and/or a functional flood gate might be possible to direct increased flooding away from these areas.

- Engineering studies that are conducted to evaluate solutions related to MD Route 261 should also consider the effects on the townhouses in the Sea Gate community and the surrounding area. This area is projected to be surrounded by water with the private streets and grounds fully inundated. The October 2022 tidal events foreshadow this condition (see Figure 15 in Chapter 2 under the heading Drainage).

Recommendations for Area A

The following recommendations are intended for the next 10 years.

Attenuate Recommendations

Land preservation in the South Creek watershed is essential. The adopted 2040 Comprehensive Plan designated most of the remaining stands of forest within Town boundaries for resource conservation. Following the adoption of the Comprehensive Plan in 2022, the Town Council adopted zoning ordinance amendments and a new map which largely removed development potential from these areas and rezoned them "Resource Conservation".

Moving forward, the Town should seek to minimize any further forest removal through adjustment to its zoning regulations, implement recommendation for an urban forest program to increase forest cover within the watershed, and coordinate with Calvert County and North Beach to ensure continued preservation and appropriate land use strategies in the parts of the watershed that extend beyond town limits.

Alleviate Recommendations

1. Through 2050, facilitate outward migration of the South Creek tidal marsh. To the north, allow the growth toward E, David, and D Streets. This can be optimally accomplished by coordinating with the most impacted property owners to buy out impacted owners and convert the land to open space. On the south side of the marsh, wetlands are migrating into the Volunteer Fire Company and its parking areas. Identifying near-term and long-term solutions for preserving emergency services to the Twin Beaches via the North Beach Volunteer Fire Company should be prioritized and evaluated for financial feasibility. Application of State and federal regulations preventing the disturbance of tidal wetlands and wetland buffers must continue to be enforced along the edges of the marsh. Development activities in this area are further restricted by the Town's Critical Area regulations.

2. Assert rightful public ownership and maintenance of the 20-foot-wide historic trolley right-of-way that runs along the east side of MD Route 261. The section from First Street in North Beach to 31st Street is shown in Figure 15 . This area may be used for flood management as conditions and opportunities warrant and/or to provide space needed by the State Highway Administration to elevate MD Route 261. Prevent the

encroachment of any further private development activities within this area and coordinate with adjoining property owners to eliminate the several private structures (sheds, fences, and similar structures) that have been constructed on this public land.

3. Incentivize or require the retrofitting of parking lots in Area A and to the extent possible convert unneeded parking area to open space for flood management. Figure 28 shows an example.

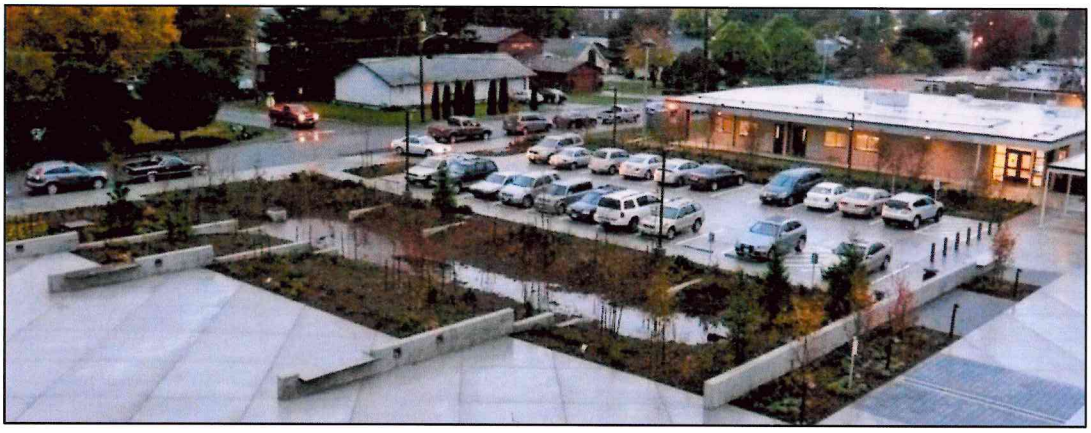


Figure 19: Image of parking lot providing stormwater management.

4. Address the drainage issue at Seagate and the storm drainage pump at 31st and C Streets, which is described in Chapter 2 of this report. The design should align with the long-term objective of allowing natural processes to work in this area and be designed in combination with other sustainable methods to absorb stormwater while protecting public safety. Any option that makes public health and safety dependent on a mechanical solution must also have built-in redundant systems which are preferably nature based and include substantial physical space for the alleviation of flood risk.

Restrict Recommendations

1. Elevating the revetment along the bayfront in Area A over the next decade is recommended between 30th Street and 27th Street (see Figure 29). This area is presently subject to coastal flooding, is projected to have a 10% annual chance of flooding by 2050 and have a much higher likelihood of being open water by 2100 absent a solution.

   The area of Town is not directly connected hydrologically to the South Creek tidal marsh which is just north so a higher revetement along the Bay stands as a viable option. In other words, a physical barrier at this location will not impede the discharge of water from South Creek to the Bay.

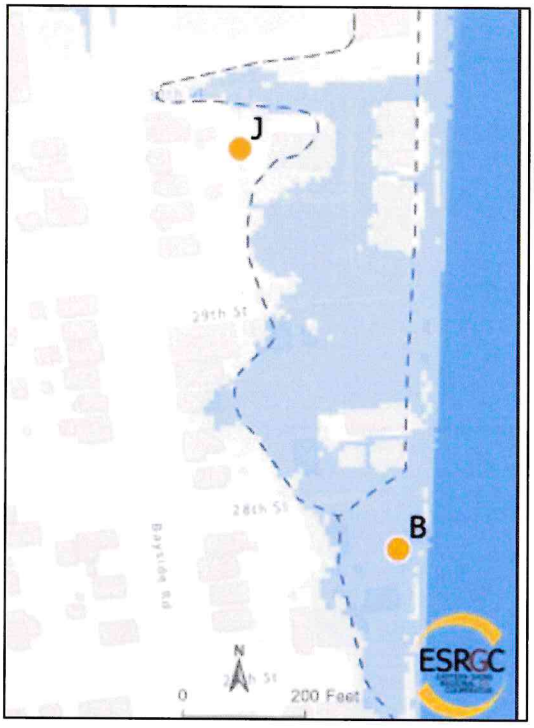
   

   Figure 20: Flood Zone from 30th Street to 27th Street.

   However, any elevation of the revetment in this area should be evaluated against any planned changes to the land, structures, and infrastructure immediately behind the revetment. Any master planning efforts for this area should specify a recommended elevation of the land, the minimum elevation of structures, the location and vertical alignment of drainage facilities, standards for sustainable development and building construction, the assignment of private and public costs, the allotment of land for public and private open spaces, and broad public access to and along the Bay front. Elevating the revetment is best performed in conjunction with a plan for raising the land and/or structures, creating open spaces, and enhancing public access to the water. This Plan does recognize that the revetment could be raised, especially in the short term to dissipate projected wave energy, prior to the implementation of the aforementioned plan.

2. Conduct an engineering study in coordination with the State of Maryland to determine how much longer the floodgate in its current configuration can remain viable and investigate the optimal solutions for flood control in the area. This Plan foresees the gradual transformation of the South Creek estuary into open water and marsh and that a combination of natural and manmade solutions will be necessary.

Realign Recommendations

1. Evaluate a spectrum of solutions for preserving facilities and transportation to the current North Beach Volunteer Fire Department location and prioritize preserving emergency services to the Twin Beaches for funding.

2. Reconstruct MD 261 through Area A. The optimal design for reconstruction would emerge after significant engineering studies, but this Plan recommends that the elevated roadway or bridge be constructed as the top priority of this plan, acknowledging that this vital transportation link has a low tolerance for flood risk. The optimal design will incorporate pedestrian and bicycle facilities.

3. Use voluntary purchase and removal plans to remove houses located along the north side of the marsh and return the land to open space use allowing the marsh to expand.

   While the ultimate location of retreat lines may differ based on more precise elevation surveys, Figure 30 shows planned "managed retreat lines" signifying roughly the properties that could be eligible for a purchase and relocation option over time. The Town should consider making the first purchase offers to those properties between the marsh and the 2050 Managed Retreat line shown.

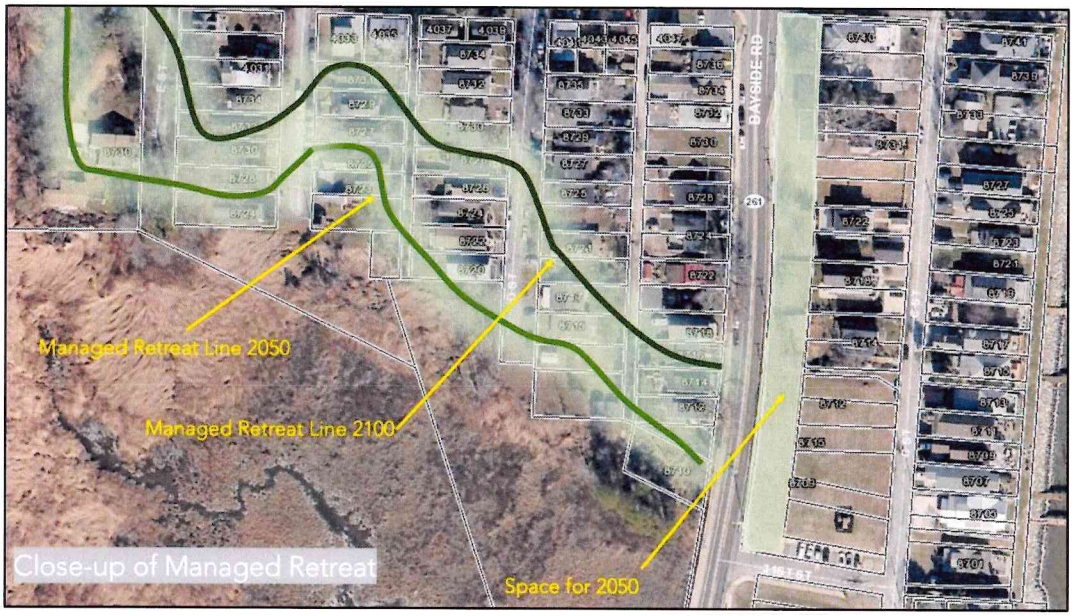


Figure 21: Managed Retreat Lines

4. Ensure any future development on the open parcels in Area A, especially within the subarea between the two blue lines in Figure 27, occurs in concert with any planned mitigation efforts in the surrounding area, this could potentially require revisions or caveats to the Town's Zoning Map and Zoning Ordinance.

Alternatively, or in combination with the above, the Town and/or State could acquire the land for parkland and flood management. In the meantime, the Town should adopt the recommendations in the prior section of this Chapter under the heading Strategic Flood Management and Sustainable Drainage and strictly minimize the risk to future residents and the impact to local flooding conditions in light of the sea level rise projected in this Plan.

5. Conduct a study to determine the practical and financial feasibility of elevating the Sea Gate community and the neighboring residences. As recommended in the Chesapeake Comprehensive Plan, the Town should also be open to modern construction techniques that allow housing to be flexibly designed to adapt to floodwaters. For example, modern flood adapted houses can be anchored to the land but made capable of rising and falling with the tides and flood waters. Flood resilient houses, as diagrammed below, are already constructed throughout the world and may be viable in this location.

Area B

Overview

As described elsewhere in this report, Area B is where Fishing Creek meets the Bay, the mixed-use town center. It is home to assets including the Town Hall and the Northeast Community Center, emergency command and control and evacuation centers, respectively. The following recreational assets are located here too: Chesapeake Beach Waterpark, Kellam's Recreational Complex, the Public Boat Landing, and the Chesapeake Beach Railway Trail. The area is also home to maritime and other commercial activities including a hotel and restaurants, two large residential communities, and a standalone apartment building at the end of Harbor Road.

Fishing Creek has been channelized and much of the once extensive marsh was filled and is now the Kellam's' Recreational Complex, Fishing Creek Marina, and Courtyards at Fishing Creek Apartments and Townhouses. The Fishing Creek channel is routinely dredged, and the spoils are deposited at the dredge disposal site located in the marsh along the western edge of the Courtyards at Fishing Creek complex. The Town has documented surface subsidence of up to 16 inches over 15 years at Kellam's, the Northeast Community Center, and along the right-of-way of Gordon Stinnett Avenue.

The optimal long-term approach to coastal resiliency in Area B is to allow the natural functions of the estuary to become re-established, where appropriate, while sustaining the maritime mixed-use center. Through zoning changes adopted by the Town Council in 2022, the development of new residential uses is no longer permitted in Area B. The existing residential communities are at risk and considerable consultation with all parties will be needed in the decades ahead to address the effects of flooding.

In Area B Fishing Creek has been channelized and the land along its edge has been developed intensively. In these locations, property owners have found it necessary in recent years to raise bulkheads and elevate land. For this reason, even with a 2.4-foot sea level rise, open water is projected to mostly be contained within the channelized Fishing Creek, the boat inlets, and the boundaries of the marsh. As shown on Figure 32 below, the marsh itself is projected to be almost entirely open water by 2050.

While the extent of open water coverage would be limited through 2050, the areal extent of recurring flooding is projected to be substantial by 2050. All the aforementioned community assets, Gordon Stinnett Avenue, and the private streets and grounds of the Courtyards at Fishing Creek and Windward Key, are projected to have a 10% annual chance of flooding. Through 2050, The Kellam's Recreational Complex is projected to flood from both the north and the south leaving a 250-foot-wide strip of slightly higher elevated ground just above the floodplain. The 2100 Maps in Chapter 3 show that open water would extend quite far into the Recreational Complex with the projected 5.6-foot rise. The depth of the 10% annual chance flood on the remaining land area at Kellam's would exceed 2.5 feet in 2100.

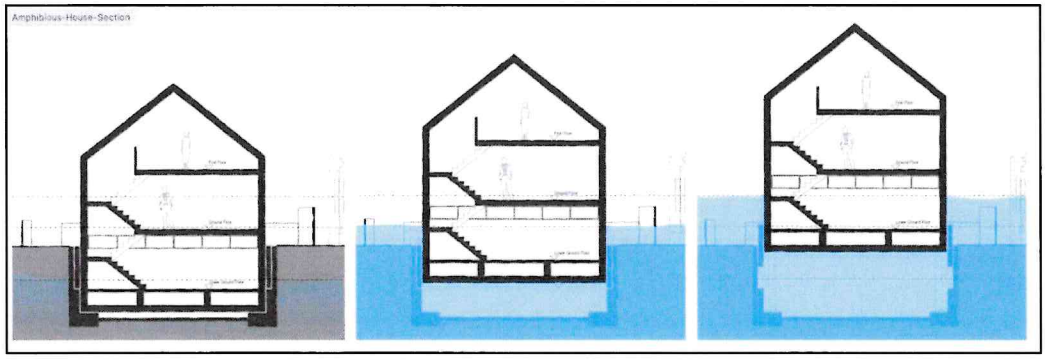
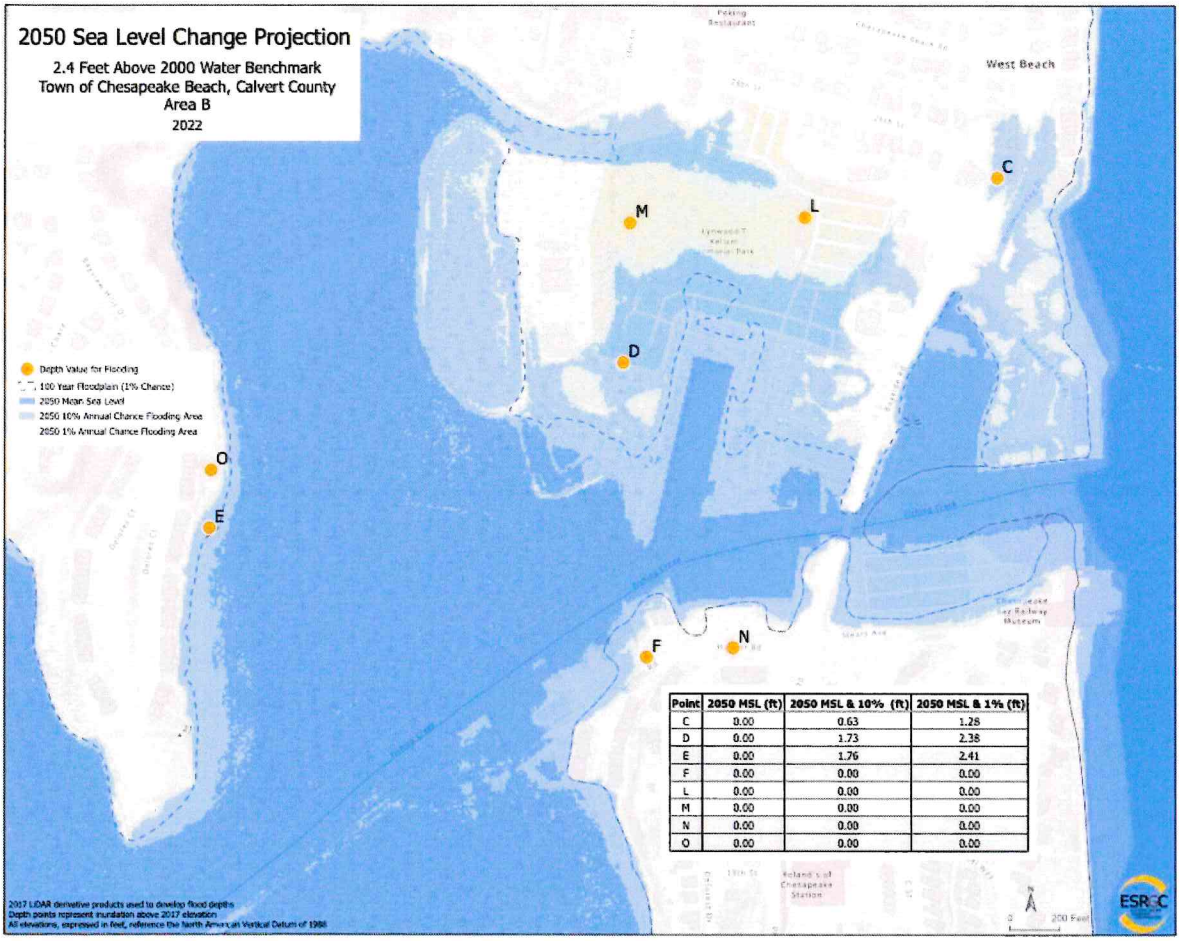


Figure 22: Source of illustration is Bacca Architects London, Amphibious House.



Point	2050 MSL (ft)	2050 MSL & 10% (ft)	2050 MSL & 1% (ft)
C	0.00	0.63	1.28
D	0.00	1.73	2.38
E	0.00	1.76	2.41
F	0.00	0.00	0.00
L	0.00	0.00	0.00
M	0.00	0.00	0.00
N	0.00	0.00	0.00
O	0.00	0.00	0.00

Figure 23 2050 Sea Level Change Projection Map

The entire shoreline of Fishing Creek and its boat inlets is structurally supported until the shoreline merges with the natural marsh west of Fishing Creek Marina. All of it is owned privately except for the Public Boat Landing which is owned by the Town of Chesapeake Beach. The boat landing is a break in what is otherwise a solid structure currently containing the water. The October 2022 tidal events demonstrated how far water can enter through the boat landing and it foreshadows permeant conditions if no changes are made.

The private structures along the north side of Fishing Creek and the Fishing Creek Marina help protect Kellam's Complex. There are no structures along the western edge of the marsh and flood protection afforded to the Courtyard's housing project is partly a function of the elevated dredge spoils site. Elevating the existing structures and building new structures and/or landforms would be needed to secure Courtyards at Fishing Creek and the Kellam's Complex against projected sea level rise.

As this area continues to flood and to transform, the potential for property damage and risk will rise. Whether the existing residential development within this Area B can be sustained, and in what form, will require much study and consultation with property owners in the decades ahead.

Recommendations for Area B

The following recommendations are intended for the next 10 years.

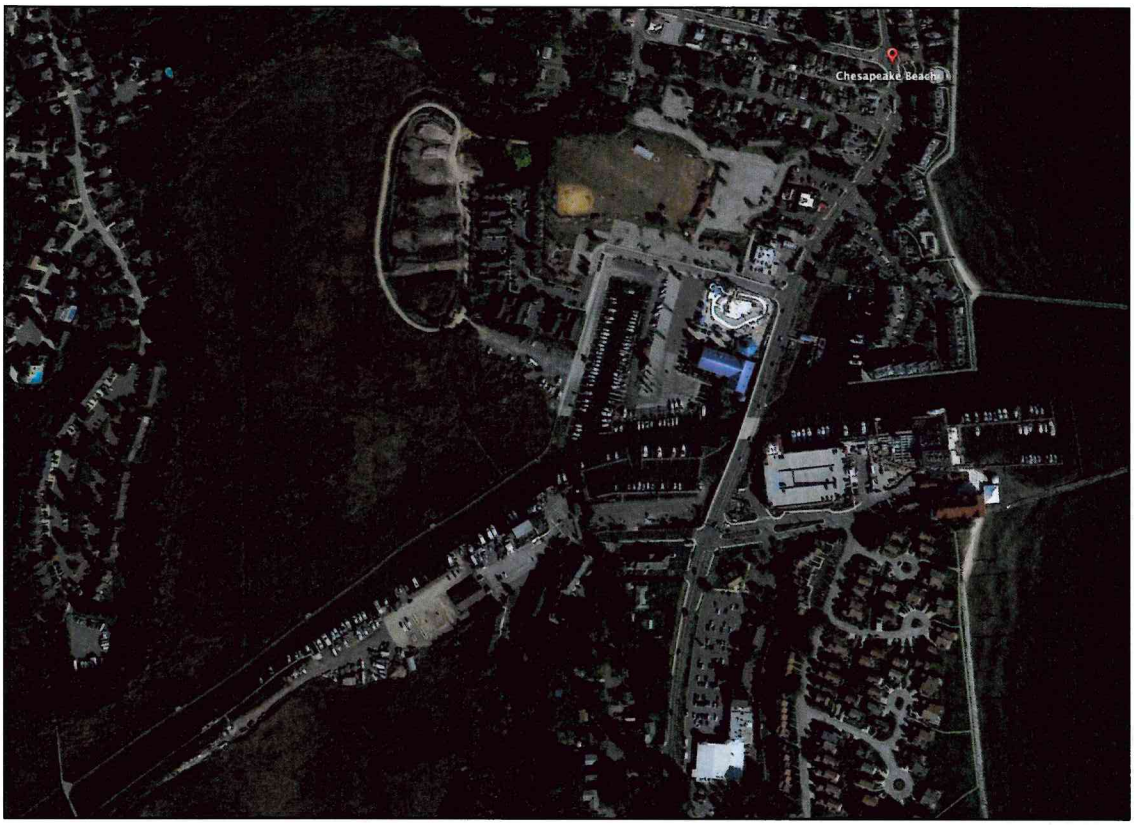


Figure 24: View of Area B.

Attenuate Recommendations

Land preservation in the Fishing Creek watershed is essential. The adopted 2040 Comprehensive Plan designated most of the remaining stands of forest within Town boundaries for resource conservation. Following the adoption of the Comprehensive Plan in 2022, the Town Council adopted zoning ordinance amendments and a new map which largely removed development potential from these areas and rezoned them "Resource Conservation". Additionally, the Comprehensive Plan recognizes the importance of protecting the forested lands identified as the FIDS Protective Area.
Moving forward, the Town should minimize any further forest removal through adjustment to its zoning regulations, implement recommendation for an urban forest program to increase forest cover within the watershed, and coordinate with Calvert County to ensure continued preservation and appropriate land use strategies in the part of the watershed that extends beyond town limits.

Alleviate Recommendations

Beginning now and carrying through 2050, use landscape design and civil engineering to gradually adapt to rising water and flooding conditions in and around the Kellam's Recreational Complex. Wetlands would be allowed to migrate and gradually evolve from newly planned spillover areas (flood retention zones) to

Figure 25: An imagined blue-green park excerpted from the Comprehensive Plan.

Figure 35: Blue - Green Approach at Kellam's Recreational Complex.

open water, contained by berms and other landforms.

The goal would be to merge both flood management and recreation into what would be a large blue – green park as generally imagined in the image in Figure 34. This Plan recommends beginning a master plan process within the next couple of years to establish the feasibility and engineering parameters and then to begin phasing the work by the end of this decade.

The basic idea is conceptually rendered for Kellam's in Figure 35. Areas shaded blue are projected to be open water in the decades ahead which would be contained by berms and

other landforms (the green lines)[13]. The dredge spoil site has potential to be incorporated into this design approach. The new landforms (along with drainage solutions) could then sustain an open area for ballfields and other activities, which itself could safely accommodate periodic flooding.

The created landforms could become part of the park experience. Figure 36 below shows a recreational cycle track which could become an integral element of a blue - green park and the adjoining Chesapeake Beach Railway Trail.

Figure 26: Source, American Ramp Company. A potential recreational use for the landforms that would be established to help protect Kellam's Recreational Complex.

Restrict Recommendations

1. This Plan assumes private property owners will continue to maintain and as needed elevate the bulkheads which line Fishing Creek and secure their marinas and commercial properties. The Plan supports these efforts, but as noted in Chapter 5, this Plan endorses the Town's Comprehensive Plan recommendation that the Town Council re-establish the Chesapeake Beach Board of Port Wardens to provide oversight to these projects in conjunction with the Planning Commission approval processes. (See Chapter 290 of the Town Code, Article IX).

2. This Plan also assumes that the Windward Key Homeowners Association will secure its property against coastal flooding which may be expected in future decades to come over and through its current revetment and bulkheads. Since the property is not

[13] As drawn, this approach might possibly help sustain the Courtyards at Fishing Creek Apartments and Townhouses, which would also require the elevation of Gordon Stinnett Avenue and supporting infrastructure. However, the low-lying conditions and the fact that the property was developed on wetlands raises questions about the viability of this property as a residential community over the long term. A recommendation for considering relocating the housing to a safer location in Town is discussed later.

directly threatened by upland flooding, overflow of the marsh (at least for the foreseeable future), or wetland soils, these efforts should secure the neighborhood against major flood hazard. These efforts could also have the ancillary benefit of protecting the Town Hall (at MD Route 261 and 26th Street), which receives coastal inundation in large tidal events that passes through the Windward Key property. The HOA should initiate and plan for these upgrades.

Realign Recommendations

1. Evaluate a spectrum of solutions for preserving the Northeast Community Center, the Chesapeake Beach Water Park and continued transportation access to each.

2. Study the range of options to mitigate potential flooding of Gordon Stinnett Avenue as part of a Master Planning effort in Area B and/or the development of a replacement access route. The full length of the current road is the only means of vehicular access to the western side of the Fishing Creek Marina and Courtyards at Fishing Creek Apartments and Townhouses. Maintaining public street access to these two properties will require substantial costs for reconstruction and maintenance. The Town needs to decide the feasibility of elevating the road and its infrastructure, or of building an alternative road, and how such a project might be incorporated into a long term approach to flood management.

3. The Courtyards at Fishing Creek Apartments and Townhouses was established in 1989 under the federal Low Income Housing Tax Credit program (LIHTC). The 76 units in the development are set aside for households making less than 60% of the area median household income and rents are generally capped at 30% of a household's income. The development thus meets an important housing need in Town, but it was constructed on filled marsh and at an elevation that puts the residents at risk over the long term. Evaluate a spectrum of solutions for preserving this critical housing and the associated infrastructure supporting it.

4. Redesign the Public Boat Landing. The net effect of subsidence and sea level rise is already compromising the functionality of the landing. During high tides and storms, the Landing allows water to enter the southeast side of the Fishing Creek Marina and flood the parking lot and access drive.

5. Study and evaluate the infrastructure needs that support vital assets in this area, inclusive of water distribution, sewer services, roads, and electric transmission.

Area C

As shown in Chapter 3, Area C includes the southwestern extent of the Fishing Creek marsh within the Town. The area of concern encompasses the residential properties north of Old Bayside Road at the ends of E, H, I, and J Street.

Figure 37 shows that the open water is projected to be contained largely within the exiting FEMA 1% Annual Chance Floodplain with the projected 2.4-foot rise. However, the encroachment of ground water and periodic flooding may potentially degrade the on-site septic systems in the rear yards of these properties. The Town's long-term plan is to connect these residences to the public wastewater collection system. Sea level rise may hasten this. This Plan recommends that the Town and the Calvert County Department of Health coordinate with property owners through the next decade to track conditions.

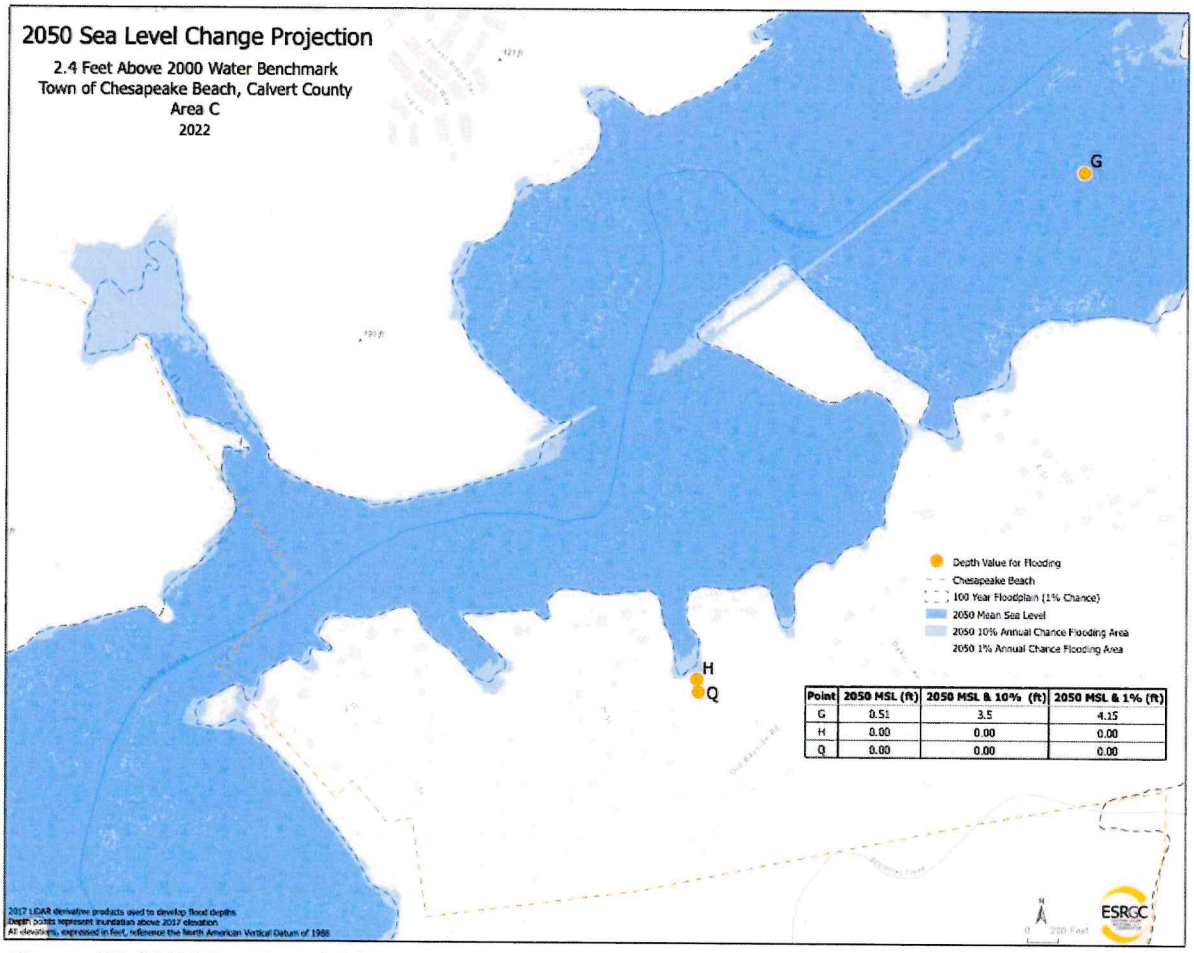


Figure 27 2050 Sea Level Change Projection

Chapter 5 Implementation and Conclusion

The previous chapter of this Plan described the most important recommendations over the next 10 years. Here are the critical steps necessary to facilitate the implementation of those recommendations.

1. Formally adopt this Plan by resolution of the Mayor and Town Council and transmit copies to the Town of North Beach and Calvert County. Transmit a copy to the Maryland Department of Natural Resources, Chesapeake, and Coastal Service.

2. Formalize the Coastal Resiliency Steering Committee into a standing committee or commission within Town government with the main task being to guide the implementation of this Plan and to regularly advise the Mayor and Council. A standing committee or commission, with funding to support professional analysis and studies, would allow development of the specialized local knowledge, institutional capacity, and community trust necessary to deal with the challenges this Plan has highlighted. The commission or committee should be staffed by town employees and/or consulting engineers and planners. This Plan and the Town's adopted Comprehensive Plan both recommended reconstituting the Board of Port Wardens.

3. Identify priorities for capital improvements related to this Plan and update this Plan every five years. Report on progress and refine and detail the recommendations as conditions warrant. Establish a process for tracking progress and providing updates to interested parties including the key Departments in State government. Further develop the Town's webpage devoted to the topic into a community outreach tool to residents and property owners.

4. Continue the work begun under this Plan to document in detail the condition and ownership of the drainage systems in Town and as part of that effect undertake a town-wide coastal survey to refine and detail the elevations of the land, streets, open drainage ways, buildings, revetments, and bulkheads. Much of this today is available but needs to be assembled and updated into a quickly deployable data set that can be used both in planning, preliminary engineering, and disaster recovery and/or rebuilding.

5. Coordinate with Calvert County and North Beach in the periodic update of the Calvert County All-Hazard Mitigation Plan and incorporate the findings and recommendations of this Plan.

6. Identification of Funding.

a. Assemble a package of federal and state grant and loan programs that the Town can be used to undertake the detailed engineering studies recommended in this report. Some sources will require a local match and over the next several years the Town will need to strategize about how to fund this work and the infrastructure upgrades and modernization that will flow from these studies. Examples include the federal Building Resilient Infrastructure and Communities (BRIC) program and the federal Flood Mitigation Assistance program.

b. Assemble a package of federal and state and loan programs that the Town can use to assist property owners in making property more resilient to the effects of flooding and to facilitate the relocation of those buildings which lie within the hazard areas designated in this Plan and future studies for "managed retreat". The aforementioned BRIC program is also available for this purpose.

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Appendices

Intended Use and Limitations: The datasets represent projected still water depths (ft) in a forecast sea level change scenario. The layers are an aid for researchers seeking to identify potential vulnerabilities along Chesapeake Beach's shoreline. The data supports Chesapeake Beach's leadership and planners as they endeavor to mitigate or prevent the impacts of sea level change resulting from land surface subsidence and rising sea levels. The product uses sea-level projections to forecasts areas of inundation for a given scenario. The data may be used and redistributed for free but is not intended for legal use, since it likely contains inaccuracies. The User assumes the entire risk associated with its use of these data and bears all responsibility in determining whether these data are fit for the User's intended use. The information contained in these data is dynamic and will change over time. The data are not better than the original sources from which they were derived, and both scale and accuracy may vary across the data set. These data may not have the accuracy, resolution, completeness, timeliness, or other characteristics appropriate for applications that potential users of the data may contemplate. The User is encouraged to carefully consider the content of the metadata file associated with these data. These data are neither legal documents nor land surveys, and must not be used as such. Eastern Shore Regional GIS Cooperative should be cited as the data source in any products derived from these data. Any Users wishing to modify the data should describe the types of modifications they have performed. The User should not misrepresent the data, nor imply that changes made were approved or endorsed by the Eastern Shore Regional GIS Cooperative. The Eastern Shore Regional GIS Cooperative, nor any of its employees or contractors, makes any warranty, express or implied, including warranties of merchantability and fitness for a particular purpose, or assumes any legal liability for the accuracy, completeness, or usefulness, of this information.


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