Naval Air Stations Patuxent River Installation Resilience Review













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Executive Summary

Naval Air Station Patuxent River (NAS PAX) was commissioned in 1943 and serves as a "one-ofa-kind" research, development, testing, and evaluation center for manned and unmanned aircraft, aircraft support systems, and ship/shore/air operations (Military One Source, 2024). While the entire NAS PAX complex encompasses more than 15,000 acres in five Maryland counties (Department of the Navy, 2024), mission operations are performed within NAS PAX Main Station located in Lexington Park in St. Mary's County, Maryland, and Webster Outlying Field (WOLF) in St. Inigoes, which is situated on St. Mary's County's southern end. NAS PAX is St. Mary's County's largest employer and provides the highest percentage of high-tech employment in the region.

St. Mary's County and NAS PAX have a mutual interest in protecting the people, infrastructure, assets, and resources that are essential for maintaining base operations as well as the quality of life across the County. This has been exemplified by the planning and communication processes that have been implemented over the past ten years, beginning with the Joint Land Use Study managed and produced by the Tri-County Council for Southern Maryland in 2015. Additional joint strategic planning efforts include the establishment of the Intergovernmental Support Agreement between the County and base that spells out the County's commitment to providing road maintenance and paving, striping, testing and heavy equipment at NAS PAX (St. Mary's County Commissioners, 2022). These intensive planning exercises are augmented by regular communications between County and Base leaders, including:

- A bi-annual Encroachment Mitigation and Prevention Joint Meeting between the Commissioners of St. Mary's County and NAS PAX leadership that serves as a forum to discuss and mitigate encroachment and other topics of concern;
- + District 5 quarterly meetings organized by the State which include the counties of St. Mary's, Charles, Anne Arundel, and Calvert, with representation from NAS PAX;
- Involvement of NAS PAX in County-led planning activities such as project reviews and comprehensive plan development; and
- + Conservation partnerships, including those funded through the Department of Defense's (DoD) Readiness and Environmental Protection Integration (REPI) Program.

In addition, as part of the Military Installation Resilience Review process, the County engaged in a Tabletop Exercise which brought together members from diverse County agencies and NAS PAX to explore and discuss hypothetical disaster scenarios and role play emergency response activities to build awareness, increase coordination, prepare for and improve disaster response efforts.

This project was designed to build on these planning efforts, focusing specifically on addressing the threats to the base and the community that will result from the impacts of climate change.



Adapting to the Impacts of Climate Change

St. Mary's County has to this point been largely insulated from major climate change disasters. This will not always be the case. Over time, the prevalence of flooding, heavy rains, increased intensity and frequency of hurricanes and tropical storms, sea level rise, subsidence, and saltwater intrusion are projected to increase. The County can take steps to mitigate the impacts of climate change. This includes protecting essential economic infrastructure assets such as roads and transportation, homes and buildings, private and public water and sewer infrastructure, and energy delivery systems. In addition, many of the adverse impacts of climate can be mitigated through conservation of existing natural resources that protect and help the community rebound from natural disasters. Intact forests, wetlands, riparian buffers and vegetated shorelines absorb storm surge and provide areas for flood water to collect while also recharging aquifers. They help to cool ambient temperatures, making urban areas more livable, and they provide a host of other ecosystem services and biodiversity benefits that have enormous economic and social returns. Simply by protecting these areas from future development, the County can mitigate the impacts of climate change, while at the same time protecting the mission and function of NAS PAX.

Assessment Process and Key Findings

The project team conducted a three-part assessment of asset risk and vulnerability. First, the team undertook an in-depth review of existing county planning documents and resources to identify key topics of importance to both St. Mary's County and NAS PAX. Second, thematic discussions were held with County and NAS PAX staff, stakeholders, and subject matter experts to provide a deeper understanding of the primary threats to critical assets and potential approaches to mitigate those threats. Finally, the project team applied the findings to evaluate key community assets and resources based on two community resilience parameters:

- NAS PAX/Community Interface. Special attention was given to the infrastructure, programs, and actions that impact the NAS PAX/community interface.
- Climate Adaptation as a Component of Community Resilience. The project team addressed climate adaptation and resilience within the context of long-term social, environmental, and economic sustainability. Based on this three-part assessment process, the project team identified the following.



I.The resilience of NAS PAX and St. Mary's County is deeply tied to water

Surrounded by the Patuxent, Potomac and St. Mary's Rivers and the Chesapeake Bay, the area's history, culture, and economy is shaped by its relationship with these water resources, making the long-term resilience of its water systems a priority. The water infrastructure system in St. Mary's County and NAS PAX resembles that of other Mid-Atlantic coastal communities and

consists of three primary subsystems: wastewater management; drinking water supply and delivery; and stormwater management. Each of these subsystems is essential for both quality of life and base operations. While water is an important asset in St. Mary's County, it also represents the most significant climate threats to critical infrastructure, in the form of storms, flooding, and sea level rise.

2. The community must balance multiple economic development priorities

St. Mary's County's economy is heavily dependent upon NAS PAX and associated defense contracts. NAS PAX is a major economic driver, supporting more than 52,317 direct, indirect, and induced jobs in Lexington Park and the surrounding area. This includes the military, civilian, and contractor employees responsible for carrying out the installation's mission and the employment opportunities generated by local spending on goods and services. This has resulted in an annual economic output of \$6.3 billion and employee compensation totaling \$4.2 billion. However, while NAS PAX is the community's primary economic driver, community leaders have invested significant time and resources into protecting and marketing the region's rural, small-town character. Maintaining the region's rural heritage and associated economic activity requires natural resource protection and land use decisions that can be at odds with economic growth plans based on the region's military infrastructure.



3. There will be heightened risks to public health

Climate change is a significant public health threat in St. Mary's County. Rising temperatures increase risks of heat stroke, air quality degradation, and vector-borne diseases like Lyme disease, West Nile virus, and Zika. These challenges are particularly severe for vulnerable groups, including children, older adults, and those without stable housing. The County's extensive coastline faces additional risks from pathogens such as Vibrio due to warming waters. Sea-level rise and rising groundwater levels threaten the County's reliance on septic systems, posing risks of water well contamination. Climate change is also expected to worsen infectious diseases and antimicrobial resistance, shifting disease transmission patterns.

4. Fiscal and budgetary risks will increase moving forward

Finally, fiscal and budgetary risks are expected to increase as climate impacts intensify. Local governments like St. Mary's County are on the frontlines of financing climate action and resilience. Historically, state and local governments have shouldered most of the infrastructure spending in the U.S. As a result, St. Mary's County should expect to bear the brunt of climate infrastructure and resilience investments within its communities. To effectively address these challenges, County leaders, in partnership with NAS PAX, will need to expand and restructure the capital project and programmatic investment system around three key components:

- + Expanded revenues and funding sources sufficient to implement the project portfolio
- + Innovative, comprehensive financing mechanisms that reduce the cost of capital, mitigate risk, and support action
- + Institutional structures that streamline and scale the resilience investment process, making project implementation more efficient and effective

Recommendations

The report presents seven key recommendations organized into three successive phases. The intent is to define a progression of steps that St. Mary's County can take to build on existing capacities to better position the County to plan for and meet future needs in an environment of increased uncertainty and dwindling resources. The steps outlined set a course for the County to more efficiently and effectively identify, prioritize, finance and implement resilience projects. The report establishes the need for mechanisms to grow and diversify governmental capacity and coordination including establishing key leadership roles and a dedicated resilience authority. It highlights the need to develop a process to identify vital projects and build a solid portfolio of resilient infrastructure investments that are supported by an evolving and robust revenue strategy. Lastly, it underscores the need for strategic partnerships, like NAS PAX and regional communities, to identify synergies and strengthen alignment that will harness support and drive implementation.

Phase I Recommendations: Foundational

The initial phase focuses on what the County can do immediately, meeting it where it is. Key goals of phase one include utilizing existing revenue as efficiently as possible, considering avoided costs versus the cost of inaction, protecting assets and revenue, and improving interagency coordination to understand internal priorities and resources that can reveal strategic projects and co-benefits. Phase I prioritizes improving the effectiveness of the current system without making structural changes, ensuring that top-priority projects are fully integrated and prioritized in the County's budget.

Recommendation I: Establish/Appoint a Chief Resilience Officer

To effectively address climate action and resilience challenges, it is recommended that St. Mary's County establish leadership roles to streamline planning and oversight of disaster mitigation and climate resilience projects. This effort should start with the creation of a Chief Resilience Officer (CRO) position, which would play a crucial role in supporting both the County and NAS PAX, including the following:

- + Organizing stakeholders
- + Fostering comprehensive community resilience
- + Catalyzing action and investment

Recommendation 2: Establish a Permanent Climate Action Committee

The significance of NAS PAX to the County's economy and culture highlights the need to maintain and expand existing partnerships. This project established processes for St. Mary's County and NAS PAX leaders to assess climate resilience risks and opportunities. A next step is to solidify these efforts by forming a permanent NAS PAX – St. Mary's County Climate Action and Resilience Committee. The purpose of this Committee is to build on existing County/base collaborations to advance environmental, economic, and social initiatives through the following actions:

- + Enhancing inter-departmental collaboration
- + Engaging a wide array of stakeholders
- + Leading local resilience strategy development
- + Serving as the community's "resilience point of contact"
- + Identifying funding sources

Recommendation 3: Create A Comprehensive Project Portfolio

The risk and vulnerability assessment, coupled with the asset inventory, creates the initial structure for a detailed mitigation and adaptation strategy and project portfolio. The community resilience portfolio will enable local leaders to codify a resilience plan of action. The action plan should be organized around three key elements: 1) project and programs typology, 2) the timing of impacts and project implementation, and 3) the costs associated with taking action.

Phase 2: Expanded Implementation

Phase two focuses on expanding existing capacities by enhancing leadership in existing agencies, broadening and capturing additional funding and revenue tools under a dedicated resilience revenue strategy, and strengthening external partnerships with NAS PAX and other communities to advance strategic projects through implementation.

Recommendation 4: Develop a Long-term Regional Resilience Revenue Strategy

Effectively mitigating climate impacts will place significant pressure on the County's budgets and fiscal resources. Currently, there is insufficient public revenue available to support both infrastructure development and climate change mitigation needs, which will exacerbate existing revenue shortages. Simply reallocating current resources is not enough; additional revenue sources are needed to address climate impacts. Therefore, St. Mary's County must make some complex and nuanced policy decisions, such as those listed below:

- + Balancing costs and benefits
- + Achieving fairness in financing
- + Ensuring equity in financing and implementation
- + Expanding cooperation

Recommendation 5: Develop a Long-term Cash-flow Management and Financing Plan

A foundational component in the resilience investment system is financing and cash flow management, which includes borrowing, lending, investing, and forecasting. The financing process represents the culmination of resilience planning, project development, and revenue generation processes. Without the success of these other components, financing capacities are weakened. Conversely, a strong financing process ensures that project development and revenue allocation are efficient and effective.

Phase 3: Sustained Funding and Financing

Phase three lays out how the County can transition to a dedicated institution or resilience authority able to manage a large resilience investment portfolio, take on fiscal responsibilities, broker private sector partnerships and establish and accelerate diverse revenue streams that fund resource efficient and innovative resilience projects that fuel economic growth and safeguard the community.

Recommendation 6: Expand Institutional Structures

A key component of the investment system is institutional capacity. Some communities in Maryland have begun to utilize a new institutional opportunity in the form of resilience financing authorities to enhance capacity. A financing authority can serve multiple roles in the resilience investment process, such as pooling and distributing public and private capital to facilitate large-scale infrastructure investments. The anticipated scale and complexity of long-term climate impacts may overwhelm the existing investment system, making it difficult to manage comprehensive resilience infrastructure project portfolios. Current institutional structures are insufficient to meet the needs of a comprehensive, countywide portfolio that includes resilience-based programs and project implementation, scaled revenue development, and associated financing. Establishing new institutional structures would enable the County to expand its programming and infrastructure to meet these needs.

In 2020, the Maryland General Assembly passed Senate Bill 457, authorizing local governments to establish resilience authorities to finance projects that mitigate climate change impacts. This provides St. Mary's County with the option to establish and delegate responsibility to a resilience authority to incentivize, scale, and coordinate community-based resilience and renewable energy investments. Key functions could include the following:

- + Managing a climate action project portfolio
- + Overseeing fiscal responsibilities
- + Financing projects

Recommendation 7: Establish an Infrastructure Resiliency Fund

Alongside the potential establishment of a resilience authority, St. Mary's County should establish a dedicated fund to support climate infrastructure projects and programmatic investments. The Infrastructure Resiliency Fund (the Fund) aims to expand resilience investments by achieving efficiencies, economies of scale, and political synergies. The Fund would provide multiple benefits, including the following:

- + Prioritizing resilient infrastructure projects
- + Accelerating and scaling capital through diverse revenue streams
- + Establishing effective private-sector partnerships
- + Reducing pressure on County budgets
- + Stimulating innovation and economic growth

Introduction

Naval Air Station Patuxent River (NAS PAX) is a critically important asset of the Department of Defense (DoD) and St. Mary's County. The NAS PAX Complex, which includes NAS PAX Main Station and Webster Outlying Field (WOLF) in St. Mary's County – specializes in the research, development, testing, and evaluation of naval aviation aircraft, components, and related products. The local economy of St. Mary's County heavily relies on NAS PAX. In 2023, St. Mary's County, Maryland, received a grant from the DoD Office of Local Defense Community Cooperation (OLDCC) to develop an installation resilience review for the community surrounding NAS PAX. Enhancing the economic, social, and environmental resilience of St. Mary's County and the installation community strengthens local defense capabilities and supports the broader mission of NAS PAX. Several key deliverables were identified for this project:

- + **Convening a Project Working Group:** Establish a team of County agencies, NAS leaders, and experts to guide project implementation and decision-making.
- Researching and Reviewing Key Data: Gather and analyze relevant research, plans, and data to assess climate risks and vulnerabilities affecting critical infrastructure and services in St. Mary's County and at NAS PAX.
- + Preparing a Draft Climate Mitigation Action Strategy and Project Portfolio: Develop a strategy and project portfolio to coordinate climate action around key resources, including both natural and built environments. This portfolio will outline actions that can be implemented by the County and provide recommendations for structural and capital infrastructure projects.
- Creating a Climate Action Funding and Financing Roadmap: Develop a strategy to identify and secure funding for resilience activities, initially focusing on federal grants and eventually building toward a sustainable and diverse long-term revenue system.

This report summarizes the project's research, findings, and recommended actions, including data and expert input on sectors affected by climate change. Recommended actions focus outside NAS PAX to protect communities where personnel, contractors, and their families live. The projects and sustainable financing roadmap offer a holistic approach to ensuring the county is prepared for future challenges.

How This Report is Organized

- Section One provides an overview of St. Mary's County and NAS PAX, detailing the study area, demographic changes, and the relationship between the County and the base. It also introduces projected climate hazards and risks that may impact the community over time.
- Section Two discusses asset risk and vulnerability, based on reviews of planning documents and interviews with subject matter experts. It highlights the greatest threats to key assets and proposes potential mitigation and resilience measures, focusing on four major findings.
- Section Three presents the final recommendations, organized into three phases of implementation. It begins with immediate steps to enhance resilience and then outlines a phased approach to expanding institutional capacities and financing mechanisms. The goal is to establish a portfolio of resilient infrastructure investments and a diverse range of financing tools to meet increasing needs during times of uncertainty.

A Case for Resilience

St. Mary's County Today

Background

St. Mary's County is a rural community in southern Maryland approximately 55 miles southeast of Washington, DC. Situated on a peninsula with 535 linear miles of coastline (St. Mary's County Government, 2023) bordered by the Patuxent River, Chesapeake Bay, and the Potomac River. St. Mary's County is a coastal community immensely connected to and impacted by the waters that surround it.

Infused with agrarian tradition, the County boasts a rich cultural history drawing from native peoples including the Piscataway, Europeans, and Africans. In more recent years the County has been molded by a significant military presence that has heavily influenced the local economy.

NAS PAX has played an instrumental role in the community since it was commissioned in 1943. It is St. Mary's County's largest employer, providing an estimated 52,317 jobs directly, indirectly, or induced in 2021, making it the third highest total employment and total employee compensation (\$4,169,392,025) of Maryland's fourteen major military installations (Maryland Department of Commerce, 2023).

Today, the mission of NAS PAX is "...to develop, deliver and sustain Navy and Marine Corps aircraft weapons and systems and serve as the Navy's principal research and development, test, evaluation, engineering and fleet support activity for naval aircraft and their support systems" (Tri-County Council for Southern Maryland, 2015, p. 3-8)." The installation includes two separate locations within St. Mary's County – NAS PAX Main Station and WOLF (Tri-County Council for Southern Maryland, 2015). NAS PAX serves as headquarters for the U.S. Naval Air Systems





Figure 1. NAS PAX locations in St. Mary's County, MD.

Command (NAVAIR), Naval Air Warfare Center Aircraft Division (NAWCAD), Naval Research Laboratory, Flight Support Detachment Air Test and Evaluation, and is home to over 200 high-tech defense contractors (St. Mary's County Government, 2023, p.1-9).

Modern day St. Mary's County is complex and unique. As the County continues to grow and evolve, it must grapple with somewhat contrasting and competing goals. The desire to preserve its rural legacy and prevent encroachment of the Air Installations Compatible Use Zones (AICUZ) can be at odds with the aspiration to establish St. Mary's County as an incubator of innovation able to keep pace with the growing labor, infrastructure, and technological demands of NAS PAX. In the context of climate change, these contrasting goals are further complicated.

DoD OLDCC inventoried 79 Installation Resilience Grant Recipients from FY20-FY22 to understand perceptions about the most pressing anthropogenic and natural risks and challenges the bases are facing (U.S. Department of Defense Office of Local Defense Community Cooperation, n.d.). NAS PAX identified the following seven challenges as priorities for the installation:

- + Hurricane/Tropical Storm
- + Tornado and Severe Storm
- + Air Space and Land Uses
- Income-Based Housing
- Urban Growth
- Installation Access
- + Transportation



St. Mary's County and NAS PAX have a mutual interest in protecting the environment while securing assets, operations, and, most importantly, people both on and off the base from the effects of global warming. Through this Installation Resilience Review process, both entities continue to enhance their partnership and commitment to building a more resilient future for St. Mary's County.

Study Area

The project's study area encompasses NAS PAX Main Station, WOLF, and the surrounding areas identified by the County due to a high concentration of employees serving at or supporting NAS PAX (see Figure 2). This includes the community of Lexington Park, which is both adjacent to the base and includes the County's highest concentration of lower income and minority residents (St. Mary's County Government, 2023), as well as Leonardtown (the County Seat), Hollywood, California, Great Mills, Piney Point, St. Mary's City, Ridge, and Scotland.



Figure 2. St. Mary's County Study Area

Demographics

Between the 2010 and 2020 U.S. Census, the County's population grew from 105,151 to 113,777. By 2040, it is projected to increase by an additional 32,573 people (Maryland Department of Planning, 2020). According to the 2020 decennial census, the County's racial composition is predominantly White (70.5%) followed by Black or African American (14.1%), two or more races (5.9%), Hispanic or Latino (5.8%), Asian (2.9%), American Indian and Alaska Native (0.3%), and some other race (0.5%) (U.S. Census Bureau, 2020). The study area's racial composition is similar but includes a slightly higher populations of Hispanic or Latino (6.8%), Black or African American (15.9%), Asian alone (3.7%), and two or more races (6.3%), and a smaller white population (66.5%) (U.S. Census Bureau, 2020).



Figure 3. 2020 Decennial Census Demographics for Study Area

The County is experiencing growth in its population of seniors aged 65 and older. The American Community Survey (ACS) for 2018-2022 reported that 12.1% of the population was aged 65 years and older, up from 10.7% in the 2013-2017 ACS (U.S. Census Bureau, 2018). The County is also seeing a slight increase in the percentage of the population 5 years and older that speak English less than "very well". Between the 2013-2017 ACS and the 2018-2022 the percentage of the population 5 years and over that did not speak English "very well" grew from 2.3% to 3.3% (U.S. Census Bureau, 2023).

Table 1. St. Mary's County ACS Data

Factor	Percent		Change
	2013-2017 ACS	2018-2022 ACS	
Percentage below the poverty level	5.2%	7.7%	2.5%
Percent of population without health insurance	5.3%	3.5%	-1.8%
Percent of population over 16 years in civilian labor force that is unemployed	4.6%	3.3%	-1.3%
Single householder with children under 18 years	24.2%	28.1%	4.0%
Communication Barrier			
Percent of population 5 years and over that speak English less than "very well"	2.3%	3.3%	1.0%
Percent of population over 25 years without a high school diploma or GED equivalent	10.2%	7.9%	-2.3%
Percent of population age 18 and over with a disability	14.3%	14.0%	-0.3%
Percent of population aged 65 years and above	10.7%	12.1%	1.4%
Percent of households without a vehicle	5.1%	4.9%	-0.2%
Percent of households without broadband internet subscription	14.6%	7.6%	-7.0%

The County is also experiencing an increase in poverty. Information from the ACS shows a 2.5% increase in the percentage of the population living below the poverty line when comparing the 2013-2017 American Community Survey (5.2%) to the 2018-2022 survey (7.7%) (U.S. Census Bureau, 2023). Additionally, there has been an almost 4% rise in the percentage of single householders with children under 18 years, moving from 24.2% during the ACS 2013-2017 period to 28.4% during the ACS 2018-2022 (U.S. Census Bureau, 2023).

Several quality-of-life indicators have shown improvement in St. Mary's County. The percentage of the population without health insurance dropped from 5.3% to 3.5% (American Community Survey, n.d.). The percentage of the population over 25 years without a high school diploma or GED equivalent decreased from 10.2% (ACS 2013-2017) to 7.9% (ACS 2018-2022) (U.S. Census Bureau, 2023). During the same period, the percentage of households without a vehicle fell slightly from 5.1% to 4.9%, and the percentage of the population over 16 years in the civilian labor force that is unemployed dropped 1.3 percentage points to 3.3% (U.S. Census Bureau, 2023).

The County has also made significant strides to increase broadband internet access. Between the ACS five-year estimates for the periods of 2013-2017 and most recent datasets for 2018-2022, shows the County has seen a 7% drop in households without internet subscription translating to 92.4% of households with internet subscriptions (U.S. Census Bureau, 2023).

As the County's population continues to grow and demographic composition shifts, the County must keep a pulse on its most vulnerable populations to ensure that planning and resilience efforts reflect shifting needs.



Climate Hazards and Trends

Understanding historical and future risks within the context of climate warming projections is essential for developing strategies to enable St. Mary's County to withstand and recover from climate shocks and stressors. The following sections identify some of the climate hazards and trends and the associated public health and economic impacts affecting St. Mary's County to help pinpoint where resilience strategies are most needed.

Sea Level Rise

Sea level is expected to increase by ten to twelve inches over the next 30 years, on average, across the US coastline (Walls et al., 2023). For Maryland, the projected relative sea level rise is even greater. This is partly attributed to sinking land. Tidal gauges and satellite measurements have recorded unusually high rates of sea level rise along the U.S. Atlantic coast in recent decades (Boesch et al., 2023). In southern Maryland, aquifer depletion is believed to be contributing to observed negative vertical land movement (Boesch et al., 2023).

As sea levels rise and lands subside, communities across Maryland are facing increased hardships due to more frequent flooding and erosion and more intense storms. Rural communities, such as St. Mary's County, where significant populations rely on septic systems for waste management and wells for potable drinking water, are at risk of infrastructure failure and contamination of aquifers and nearby surface water bodies. The potential public health consequences from septic system inundation and aquifer contamination can also impact local aquaculture and tourism economies. Saltwater intrusion, brought on by sea level rise or aquifer depletion, is also transforming once healthy forests into "ghost forests", consisting of dead trees and emerging marshland species. Valuable farmland is also at risk of becoming unproductive. A study examining saltwater intrusion between 2011 and 2017 found that approximately 20,000 acres of farmland across Maryland, Delaware, and Pennsylvania had been converted to saltwater marshes (Mondal et al., 2023). The study estimated economic losses ranging from US\$39.4 million and US\$107.5 million annually (Mondal et al., 2023).



Figure 4. NOAA Sea Level Rise Scenarios in the Study Area

Figure 4 presents different scenarios of sea level rise and highlights locations within St. Mary's County that are susceptible to permanent loss if sea level increases by at least one foot from mean higher high water. With just a one-foot increase in sea level rise, coastlines along the Chesapeake Bay, Patuxent River, and Potomac River will become permanently inundated with potential for significant property damage to waterfront properties.



Figure 5. Projected Drowned Lands

Figure 6. Wetland Adaptation Areas

Figures 5 and 6 depict the potential for additional loss of land due to saltwater intrusion. Figure 5 on the left shows drowned lands that could be permanently underwater by 2050 through 2100. Figure 6 on the right shows areas of land that are projected to transition to saltwater wetlands. The maps together reveal that saltwater intrusion is expected to extend beyond the coastland into the interior of the County with potential impact to aquifers and drinking water, farmland and forests. Future planning efforts should take into account the combined impacts from sea level rise, subsidence, and saltwater intrusion.

Severe Storms

Thunderstorms

Between January 1950 and January 2022, a total of 158 thunderstorm wind event days were recorded in St. Mary's County, resulting in nine injuries and \$1.457M in property damages (St. Mary's County Government, 2023). From December 1, 2022, to December 31, 2023, four thunderstorm wind event days were reported in the County Causing \$5.285M in property damages (NOAA, n.d.).

Tornadoes

The St. Mary's County 2023 Hazard Mitigation Plan notes 25 tornado event days between January 1950 and January 2022, with four injuries reported and \$4.120M in property damage. On May 27, 2022, a category EF-1 tornado with wind speeds up to 90 MPH was tracked near the St. Mary's County and Charles County line in Charlotte Hall (Delmarva Now, 2024). Less than two weeks later, on June 8, 2022, a category EF-0 tornado touched down near Mechanicsville, MD with peak winds of 85 MPH, a path length of 3.3 miles, and a max width of 75 yards (Constantino, 2022). In 2024, the state of Maryland has already experienced 12 tornado events, 9 occurring in one day, with a total of \$33M in property damage and five reported injuries to date (Delmarva Now, 2024).

Hurricanes and Tropical Storms

St. Mary's County has witnessed over 100 tropical weather systems dating back to 1859 (St. Mary's County Government, 2023). More recently, five tropical storm events were reported between September 1999 and August 2020 causing 154 injuries, almost \$91 million in property damage and \$50 thousand in crop damages (St. Mary's County Government, 2023). With warming oceans and sea level rise, higher coastal inundation levels from tropical cyclones are expected (Maxwell et al., 2021), higher rainfall rates are projected (Maxwell et al., 2021) and the intensity of tropical cyclones is predicted to increase (Balaguru et al., 2022). Figure 7 denotes the storm surge risk impacts from hurricane categories one through four based on the Saffir-Simpson scale of hurricane intensity. It utilizes the National Weather Service's Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model, the Chesapeake Bay (CP5) Slosh Basin for mapping, and Maximum of Maximum (MOM) storm tide elevations.



Figure 7. Hurricane Storm Surge Risk in the Study Area

Flooding

With increased total precipitation and the potential for more storms that bring heavy rain, St. Mary's County's vulnerability to various types of flooding is growing.

Coastal flooding

St. Mary's County 2023 Hazard Mitigation Plan notes 52 coastal flood event days over a 72-year period ending in January 2022 (St. Mary's County Government, 2023); an average of less than one flood event day per year. Between December 1, 2022, and December 31, 2023, National Oceanic and Atmospheric Administration (NOAA) stream/river gauge registered nine coastal flood events in St. Mary's County (NOAA, n.d.-b).

Nuisance flooding

Nuisance flooding, defined as high-tide flooding that causes public inconvenience (Maryland Department of Natural Resources, 2024) is included in the 2023 Hazard Mitigation Plan for St. Mary's County. In it, 41 roads are identified as being susceptible to nuisance flooding (St. Mary's County Government, 2023). As sea level continues to rise, the instances of high-tide flooding are also projected to increase. NOAA projected 7-10 nuisance flood events occuring at its Solomons Island gauge for the 2024-2025 year (NOAA, n.d.-c). By 2040, under lower emissions projections, the number of nuisance flooding events at the same tidal gauge is projected to increase to 50 days, while under higher emissions projections the County could see up to 60 high-tide flooding days per year (U.S. Federal Government, 2023). By 2090, the number jumps to almost daily occurrences of nuisance flooding with a lower emissions scenario projecting 330 days of nuisance flooding versus a higher emissions scenario estimating 360 nuisance flooding days per year (U.S. Federal Government, 2023).

Table 2. Observed versus Projected Annual High-Tide Flooding Days

Factor	Year			
High-tide Flooding	2023 (actual)	2040	2050	2090
Lower Emissions Scenario (days)	9 days	50	110	330
Higher Emissions Scenario (days)		60	130	360



Figure 8. Historical and Projected High-Tide Flooding

Note: Based on Two Different Emissions Scenarios | Source: U.S. Climate Resilience Toolkit Climate Explorer.

Other Climatic Events

Precipitation

St. Mary's County receives an average of 45.5 inches of rain annually. NOAA's Climate Explorer provides future rainfall projections based on two scenarios: a lower emissions climate change scenario (RCP4.5) which assumes drastic reduction in greenhouse gas emissions, and a higher emissions scenario (RCP8.5) in which the release of heat-trapping gases continues to increase through the end of the 21st century (U.S. Federal Government, 2023). Table 3 provides projections at three different points in time: 2040, 2050, and 2090. The long-range trend under either scenario, despite potential fluctuations, indicates the County should prepare for increased precipitation and utilize green and gray infrastructure practices that can handle increased volumes. This takeaway is especially relevant as the State of Maryland is implementing new stormwater management requirements for new development and redevelopment under the Advancing Stormwater Resiliency in Maryland (A-StoRM) initiative which utilizes more recent precipitation data.

Table 3. Observed versus Projected Precipitation for St. Mary's County

Total Precipitation	Year			
	1961-1990 Observed Average	2040	2050	2090
Lower Emission (inches)	41,95 inches	45.39	45.07	45.73
Higher Emissions (inches)		45.34	46.03	48.55

Note: Based on two different emissions scenarios. | Source: U.S. Climate Resilience Toolkit Climate Explorer.



Figure 9. Historical and Future Precipitation Predictions for St. Mary's County Source: (U.S. Federal Government, 2023)

Drought

Despite projections for increased precipitation over time, Maryland is also expected to see an increase in droughts, particularly during the spring and winter (Runkle, & Kunkel, 2022). This paradox is largely due to shifting climate patterns, where rising temperatures lead to greater evaporation rates, increased rate of soil moisture loss, and altered seasonal rainfall distribution. In St. Mary's County, these droughts could strain local water resources, impact agricultural productivity, and stress forests leading to an increased risk of wildfire during typically cooler seasons. Managing water conservation, reducing pressures on groundwater supplies, and adopting drought-resistant practices will be critical for mitigating these challenges.

Wildfires and Air Quality

The 2023 Hazard Mitigation Plan projects an increase in the occurrence of human-caused fires and the number of people and property at risk due to wildfires. A total of 893 fires were reported in St. Mary's County between 1990 and 2020, damaging an estimated 79 acres. Smoke from wildfires impair local air quality, causing significant human health risks. In 2023, Maryland experienced 5 days during spring and summer when air guality levels exceeded National Ambient Air Quality Standards for PM2.5 due to smoke from Canadian wildfires (Maryland Department of the Environment, n.d.). As the climate becomes warmer and periods of drought intensify, the number of wildfires is anticipated to increase (Runkle, & Kunkel, 2022). Through the BreathWell St. Mary's initiative, outdoor air quality sensors have been installed throughout the county to measure particulate matter, ozone, and nitrogen dioxide. The community can access real-time air quality conditions and stay informed about health alerts and recommended safety actions.



Figure 10. No Idling Sign from St. Mary's County Health Department Breathe Well Campaign



Head to a local cooling center to #BeatTheHeat

Figure 11. St. Mary's County Post Advising Residents about Upcoming High Temperatures and Available Cooling Center

Extreme Heat

Extreme heat is described as a prolonged event lasting at least two or three days marked by high heat and humidity, often in excess of 90 degrees Fahrenheit (FEMA, n.d.). On average, St. Mary's County experiences 4 days a year of temperatures at or above 95 degrees Fahrenheit (MARISA, 2022). Between June 1, 2024, and July 21, 2024, St. Mary's County experienced 11 days at or above 95 degrees Fahrenheit (NOAA, n.d.-a). The number of days at or above 95 degrees Fahrenheit is projected to jump to an average of 22 days (under a lower emissions scenario) and up to 43 days per year under a higher emissions scenario in less than 50 years (MARISA, 2022). By 2090 the County is projected to see between 31 and 70.5 days at or above 95 degrees Fahrenheit under low and high emissions scenarios respectively (U.S. Federal Government, 2023). Populations at risk of health impacts from exposure to extreme heat include the elderly, young children, people working outside, people with chronic disease and those who are pregnant. In 2023, Maryland registered nine heat-related deaths, with the first heatrelated death for 2024 reported on June 5 (Maryland Department of Health, 2024). Beyond the human toll, extreme heat can wreak havoc on infrastructure by damaging roadways and can overburden energy systems due to increased air conditioning use. Furthermore, heat can impact local industries including agriculture, aquaculture, and recreational fishing, with crops and fisheries unable to withstand rising air and water temperatures. Warmer waters also increase the threat of vector borne illnesses. Loss of tree canopy and increased impermeable surface area amplify local conditions making more urbanized areas unbearable.

Asset Risks and Opportunities

Following an analysis of climate hazards facing St. Mary's County, the next step was to identify assets and resources that are most at risk. To achieve this, the project team conducted a three-part assessment of asset risk and vulnerability. First, the team undertook an in-depth review of existing county planning documents and resources to identify key topics of importance to both the County and NAS PAX. Thematic discussions were held with County and NAS PAX staff, stakeholders, and subject matter experts to provide a deeper understanding of the primary threats to critical assets and potential approaches to mitigate those threats. Finally, the project team applied the findings to evaluate key community assets and resources based on two community resilience parameters:

- + NAS PAX/Community Interface. Special attention was given to the infrastructure, programs, and actions that impact the NAS PAX/community interface. Community resilience planning requires long-range visions, policies, and goals that can adapt to evolving threats, hazards, and pressures. These planning efforts must include strategies for achieving economic, environmental, and social outcomes. An effective response to climate hazards and threats involves considering a complex matrix of issues and potential actions. This challenge becomes even more complex within a regional context, where the goals and needs of multiple communities must be incorporated into long-term action strategies.
- Climate Adaptation as a Component of Community Resilience. The project team addressed climate adaptation and resilience within the context of long-term social, environmental, and economic sustainability. The focus was on actions necessary to mitigate, respond to, and recover from the impacts of climate change. The assessment process and associated recommendations emphasized the anticipated impacts of climate change and climate hazards on the project communities. The team focused on how to achieve climate resilience while supporting the economic, health, environmental, and social vitality of the community. Long-term resilience demands a broad and comprehensive approach to mitigating those hazards.

Based on this three-part assessment process, the project team identified the following key findings:

- I. The resilience of NAS PAX and St. Mary's County is deeply tied to water.
- 2. The community must balance multiple economic development priorities.
- 3. There will be increased risks to public health.
- 4. Fiscal and budgetary risks will increase moving forward.

The following sections outline asset risks and recommend projects and initiatives that can be taken forward to advance resiliency efforts. A table of the recommended projects and initiatives can be found in the appendix.



Water Resilience

The resilience of NAS PAX and St. Mary's County is deeply tied to water. Surrounded by the Patuxent and Potomac Rivers and the Chesapeake Bay, the area's history, culture, and economy is shaped by its relationship with these water resources, making the long-term resilience of its water systems a priority. The water infrastructure system in St. Mary's County and NAS PAX resembles that of other Mid-Atlantic coastal communities and consists of three primary subsystems: wastewater management; drinking water supply and delivery; and stormwater management.

Wastewater

Shifting weather patterns and extreme weather events present significant challenges for wastewater treatment plants. Heavy rainfall can overwhelm treatment facilities, leading to the discharge of untreated sewage into nearby water bodies. Additionally, rising temperatures can diminish the efficiency of treatment processes. Coastal areas like St. Mary's County are particularly vulnerable, facing risks such as flooding and storm surges that can damage wastewater infrastructure. Rising sea levels further complicate the management of coastal wastewater systems (JENKS2026, 2024).

St. Mary's County also faces increased pressure on its wastewater systems due to regional growth. This strain is amplified by rising demand for public sewer access as climate-related stress affects private septic systems. Projections indicate a need for expanded wastewater capacity by 2040. Furthermore, several of St. Mary's County Metropolitan Commission's (MetCom) facilities are at risk from potential dam failures.

NAS PAX does not operate its own wastewater treatment facilities. Like the County, it relies on MetCom. Currently, NAS PAX sends between 300-400 thousand gallons of wastewater per day to a 500,000-gallon holding tank near the Marlay-Taylor Water Reclamation Facility. If the holding tank exceeds its capacity, the excess wastewater bypasses it and enters the treatment system directly. Addressing climate change impacts on the wastewater system is essential for maintaining the base's operations. A formal sewage service contract with the Metropolitan Commission, in place since 1969, reserves an estimated 1,200,000 gallons per day (gpd) of capacity for NAS PAX, equivalent to about 4,800 Equivalent Dwelling Units (EDUs) at 250 gpd per EDU. This reservation affects demand "outside the gate."

The impact of climate change on wastewater systems will not limit itself to centralized systems. St. Mary's County has an estimated 26,000 private septic systems, many of which are aging and in unknown condition. Failing individual systems could create localized water quality issues. Rising sea levels, groundwater levels, and flooding pose particular risks to these septic systems, raising public health concerns if a weather event compromises them. Current public policy neither promotes nor discourages the use of septic systems.

MetCom is a quasi-governmental organization, structured as a nonprofit body politic and corporation, with primary responsibility for the long-term protection of critical infrastructure assets. It plays a key role in facilitating communication regarding the potential impacts of climate change on critical infrastructure. This is particularly important from the County's perspective, as it impacts financing processes. Although the County does not have direct control over MetCom's rates and fees, these charges can significantly affect household budgets and must be factored into the County's long-term revenue planning.

Drinking Water

The resilience of the St. Mary's County/NAS PAX region relies heavily on a stable drinking water supply. Factors such as drought, extreme heat, and sea level rise increase the vulnerability of the County's potable water systems, exacerbating issues like saltwater intrusion, land subsidence, and contamination from substances such as lead, arsenic, and PFAS (per- and polyfluoroalkyl substances). Storms also pose a significant threat to abandoned wells, increasing the potential for aquifer contamination.

St. Mary's County sources its drinking water from four aquifers: Piney Point-Nanjemoy, Aquia, Magothy, and Patapsco. Historically, the majority of the groundwater has been drawn from the Aquia and Piney Point-Nanjemoy aquifers. A 2001 report by the Maryland Geological Survey (MGS) indicated projected drawdowns of the Aquia aquifer could reach critical levels by 2020 (Klohe & Feehley, 2001). In 2005, MGS reported that based on then-County population projections through 2030, the Patapsco aquifer is of excellent quality and should meet the County's needs. To help relieve stress on the Aquia aquifer, MetCom has enacted a policy that requires new public wells to utilize the Patapsco aquifer (St. Mary's County Government, 2010).

Although MetCom does not directly supply water to NAS PAX, Maryland Department of the Environment (MDE) issues water appropriations or use permits for the base, and there are interconnections with various military housing developments throughout the County. However, NAS PAX is not prioritized by MDE as a water user. This lack of prioritization, combined with the fact that the aquifers serving the base have users beyond the County's borders and are under state control, poses significant risks in the face of climate-related impacts such as sea level rise and saltwater intrusion. These challenges are further compounded by the absence of a controllable alternative water supply, increasing the vulnerability of both the base and surrounding areas. Additionally, there are no physical connections between St. Mary's County, neighboring jurisdictions, or NAS PAX's water supply, underscoring the need for proactive measures to prevent potential water supply disruptions and ensure the resilience of the region's water infrastructure.

The County currently relies on water allocations from the state through water use permits. MetCom holds approximately 40 such permits for its water systems. Previous requests from the County to MDE for increased water allocations for specific communities have been denied. While the Aquia aquifer has historically been the primary water source, there has been a recent shift towards the Upper Patapsco aquifer due to water quality issues.

The County has implemented various water management and conservation measures to address

potential water shortages. Mutual Aid Agreements and membership in WARN (Water/Wastewater Agency Response Network) allow for emergency water purchases during shortages to protect public health. A water conservation program is actively enforced, and MetCom has actively conducted studies to identify and address the potential for precipitation and/or groundwater to enter sanitary-sewer pipes through, for example, leaky manholes, gutter downspouts, leaky joints, fractures, and other defects. While coordination on water withdrawal is the responsibility of the State of Maryland, MetCom closely monitors water allocations and issues notices to communities when 80% of the water allocation has been reached, urging limits to water consumption.

As is the case with wastewater, MetCom is responsible for developing, constructing, and managing the region's drinking water infrastructure. While neither the St. Mary's County government nor NAS PAX have direct oversight of the drinking water system, actions such as protecting source water from road salting and protecting wells from sea level rise and inundation will require the engagement and financial support of both institutions.





Beneficial Reuse of Treated Wastewater

Instead of relying solely on aquifers for water supply, it may be both feasible and beneficial to reuse treated effluent from the Marlay-Taylor Water Reclamation Facility for industrial, agricultural, and recreational uses both on and off the base. This would not only reduce groundwater use by NAS PAX but also help free up needed sewer capacity by lowering nutrient loading into the Chesapeake Bay. A water reuse feasibility study for NAS PAX, St. Mary's County, and MetCom was conducted in 2004, with funding efforts beginning in 2009, including substantial contributions from the Maryland Department of the Environment and Federal Stimulus Funding. The report indicated NAS PAX could significantly reduce its groundwater consumption by millions of gallons per day by using treated effluent for cooling towers, golf course irrigation (Cedar Point), pond fish culture, crop irrigation (ALA Cornfields), and grass irrigation at the Facility for Antenna and RCS Measurement (FARM).

Stormwater Management for Pollution and Flood Control

St. Mary's County's stormwater management program was established in 1997 to oversee a public network of storm drains, pipes, gutters, grassy swales, and other features designed to reduce flooding, pollution, and stream channel erosion. The County Department of Public Works and Transportation (DPW&T) is responsible for ensuring that the public storm drain infrastructure remains functional and complies with MDE regulations.

In 2018, the County was required to obtain coverage under the state's general stormwater discharge permit to further reduce the quantity of pollutants entering local waterways. This involved implementing best management practices (BMPs) to treat stormwater runoff from previously untreated impervious surfaces within the County. Initially, in 2017, the County estimated that treating 11,000 acres of impervious surfaces could cost up to \$74 million. However, the permit was ultimately restricted to the County's urbanized areas, targeting roughly 2,400 acres of previously untreated impervious surfaces with a then-estimated price tag of \$13 million (Babcock, 2018).

The permit stipulated that only 20% of the County's untreated impervious area needed to be restored by the end of the five-year term. Using 2015 as a base year, the County calculated its 20% restoration goal to be 428.18 acres. According to its 2020 progress report to MDE, the County had already implemented sufficient redevelopment and restoration projects to meet this goal (Maryland Environmental Service, 2020).

The County's focus has instead been on maintaining existing facilities in good condition, restoring failing facilities, and evaluating additional restoration opportunities for when the permit is renewed, and additional retrofit goals are put in place. The County's approved fiscal year 2025 budget allocated 5.5 full time staff and \$1,081,292 in operating expenses to the stormwater management program, including \$121,696 in repairs and maintenance (St. Mary's County Department of Finance, 2024).

Beyond regulatory-driven efforts to reduce polluted runoff, the County DPW&T is also responsible for mitigating shoreline erosion, flooding, and standing water—three issues increasingly exacerbated by sea level rise and changing climate patterns. Flooding is one of the most common hazards currently facing St. Mary's County, and more frequent and intense precipitation will only add stress to the County's stormwater systems. Additionally, with over 500 miles of shoreline—the most coastline of any county in the state—the County is increasingly vulnerable to coastal flooding issues.

Nuisance flooding has become a routine occurrence in St. Mary's County, causing damage to properties and impacting quality of life (St. Mary's County Government, 2023). County funding and resources have been insufficient to address the issue (St. Mary's County Government, n.d.-b). While the main gate to NAS PAX sits at the highest point in the County, St. Mary's County deals with intermittent flooding caused by intense rainfall, coastal inundation, and storms. This in turn indirectly impacts commuting patterns and access to the base. The 2020 St. Mary's County Nuisance Flood Plan includes 53 complaintidentified nuisance flood areas, along with four nuisance flooding mitigation sites. In addition, the plan includes a list of approximately 200 state, county, and privately owned road locations that have been identified by the County Highway Division and current Federal Emergency Management Agency (FEMA) mapping as vulnerable to nuisance flooding.

While nuisance flooding is the most acute water management challenge within the County, the County's proximity to tidal waters will expose the community to systemic sea level rise and inundation. This in turn will put additional pressure on the region's storm drainage system. The County's Hazard Mitigation Plan lists 16 critical facilities that lie in the 1% annual chance floodplain. Two key stormwater processing tanks at Marlay-Taylor Water Reclamation Facility are anticipated to be submerged at medium sea level rise projections.



Balancing Economic Development Priorities

Economic development is a priority for St. Mary's County. However, efforts to grow the economy are increasingly threatened by climate change. Nationwide, the annual number of extreme weather events has quadrupled since the 1980s, with direct costs rising fivefold (Lowe & Marx, 2020). The U.S. has experienced 376 weather and climate disasters during this same period, each exceeding \$1 billion in damages (NOAA National Centers for Environmental Information, 2024). In 2023 alone, 28 such events occurred, breaking the previous record of 22 in 2020 (Smith et al, 2024). The future impacts of climate change present significant fiscal challenges, particularly given the County's economic reliance on defense contracts and military operations. To build resilience, the County must invest in adaptation strategies that protect its critical infrastructure and key economic drivers, especially NAS PAX.

The County's economy is closely tied to NAS PAX, which supports over 52,300 jobs in Lexington Park and the surrounding areas (Maryland Department of Commerce, 2023). This includes military personnel, civilian employees, and contractors who contribute to the installation's mission, as well as jobs generated by local spending. NAS PAX contributes approximately \$6.3 billion in annual economic output, with employee compensation totaling \$4.2 billion.

Although St. Mary's County is a relatively affluent rural area, it faces significant challenges to its longterm economic health. Growth has been sluggish, reflecting broader trends across Maryland. An aging population, limited housing availability, and workforce shortages impact both NAS PAX operations and the broader community. Additionally, climate risks to critical infrastructure, including transportation, housing, and energy systems, pose a threat to the local economy. By investing in infrastructure and diversifying its economy, the County can strengthen its ability to weather economic shocks.

As St. Mary's County sets its priorities, it must balance two core objectives: leveraging the economic benefits of NAS PAX while preserving the region's rural character and natural resources. Addressing challenges like housing shortages, an aging population, and climate risks to infrastructure. To build economic resilience, the County should leverage its strengths in agriculture, aquaculture, and tourism while fostering the growth of emerging industries. These efforts will help expand the County's commercial tax base and position it for long-term, sustainable development.



Expanding Agribusiness, Aquaculture, and Sustainable Farming

St. Mary's County is committed to preserving its rural character by supporting its farming community, whether in agriculture or aquaculture. The County facilitates this through regulatory assistance, technical support, business and marketing assistance, and access to County-sponsored farmers markets. Its proximity to large urban markets like Washington, D.C., Baltimore, Annapolis, and Richmond also provides a strategic advantage.

St. Mary's County has already made strides in supporting oyster farming and agriculture, with market growth bolstered by agritourism and "farm-to-table" initiatives (Economic Development Commission & Department of Economic Development, 2017). The County can build on this momentum by expanding support for oyster aquaculture and sustainable fisheries by offering more technical assistance and marketing support for local seafood.

The County's farm-to-table initiatives and thriving vineyard, distillery, and agritourism industry—including popular destinations like Southern Trail Distillery and Port of Leonardtown Winery—have also fueled growth in the agricultural sector. These activities have supported new, value-added agriculture enterprises and created unique and popular gathering places for people to socialize. Expanding efforts to support farm-to-table programs and sustainable farming practices will further help local farms tap into emerging markets like organic produce and value-added products. Additionally, the County can foster innovation in agri-tech by seeking and providing funding and incentives for precision farming, drone technology, and sustainable farming techniques.



Expanding Tourism

The St. Mary's County Department of Economic Development recognizes that efforts to attract overnight visitors can also enhance the quality-of-life features needed to grow and retain a younger, more diverse workforce. With 500 miles of shoreline, St. Mary's City, and numerous historic landmarks, the County has strong foundations for tourism. By improving infrastructure for eco-tourism (such as trails, recreational centers, and water access), develop additional heritage tourism packages, and improve marketing, the County can attract more visitors and while creating quality public spaces for residents to enjoy. This, in turn, will generate valuable tourism revenue.

Eco-tourism and agritourism initiatives have already taken root through offerings like farm tours, vineyards, and seasonal events. Expanding experiential tourism offerings to include guided fishing trips, oyster harvest tours, and farm stays will further boost the local economy and support the County's rural communities.

Fostering Emerging Technological Industries

St. Mary's County has established itself as a technology powerhouse in aerospace and defense, with over 200 technology companies and more aerospace engineers per capita, as well as the highest percentage of science, technology, engineering, and/or math (STEM) jobs in the U.S. (St. Mary's County Government, n.d.-c). However, there is significant potential to diversify and extend this technological capacity to other sectors, particularly by attracting and supporting start-ups and early-stage companies that focus on renewable energy (solar, wind), unmanned and autonomous systems, and rapid prototyping and advanced manufacturing (St. Mary's County Department of Finance, 2024). The County should continue to collaborate with organizations like the Patuxent Partnership and Navy Alliance to bolster workforce development in STEM fields critical to both defense and emerging new tech.



Building Resilient Infrastructure

St. Mary's County must also ensure that the necessary infrastructure is in place to support this growth, as economic resilience depends not only on diversification but also on the County's ability to protect critical systems from climate risks and other disruptions. This growth requires robust transportation, housing, and energy infrastructure to withstand future challenges.

Investing in climate-resilient roads, bridges, energy systems, and other infrastructure will help safeguard the County's economic drivers, including NAS PAX, while fostering sustainable growth. Focusing on infrastructure upgrades and embracing smart technologies will allow the County to mitigate the risks climate change poses, reduce economic vulnerability, and create a foundation for resilient economic development.
Roads and Transportation

Safe, effective transportation infrastructure is a vital component of a resilient community. A welldeveloped and multimodal network supports both daily commuting and critical operations at NAS PAX. It also facilitates effective emergency response and evacuation during extreme weather events. As climate change intensifies, resilient transportation systems will be essential to minimizing disruptions caused by erosion, nuisance flooding, and rising sea levels.

In St. Mary's County, these needs are reflected in both small-scale and large-scale infrastructure projects. One notable example is the planned replacement of the two-lane Thomas Johnson Bridge, a vital transportation artery connecting St. Mary's County with the rest of Southern Maryland. The proposed four-lane bridge has been a regional top priority project included in the Consolidated Transportation Program letter since 2007. Plans for the new bridge feature dedicated shoulders and a shared bicycle/ pedestrian path, addressing both current traffic issues and future safety concerns. Such projects emphasize the importance of state and federal investments in transportation resilience that benefit both residents and defense operations at NAS PAX.

Coordination between the County and NAS PAX is essential to ensure that transportation infrastructure supports both military operations and civilian needs. By continuing to seek input from NAS PAX on road maintenance and transportation initiatives, the County can align its infrastructure projects with the operational needs of the base. The inclusion of NAS PAX's priorities in the County's Annual Transportation Priority Letter to the state can enhance the chances of securing state support for critical projects such as road improvements and bridge replacements.

The County's 2020 Nuisance Flooding Plan identified over 40 roads and intersections susceptible to nuisance flooding. FEMA mapping indicates that over 200 other roads and intersections in the County are at risk as climate impacts grow. This is particularly concerning to military communities, where reliable transportation is critical. Some flood-prone roads identified by the Nuisance Flood Plan have been addressed through culvert work. Many remain unaddressed due to funding constraints. The County has already allocated additional budget for the replacement of weather-damaged bridges and roads, reducing its road overlay period to 37 years, but additional investment is needed. Road maintenance budgets should focus on using materials and methods designed to withstand future climate impacts.

Pedestrian and cycling infrastructure are important components of a resilient transportation system and offer a host of solutions ranging from congestion reduction, greater connectivity, and improved health outcomes. The County continues to build out its pedestrian and cycling network, with extensions along FDR Boulevard and the Three Notch Trail. Prioritizing projects such as these positions the County to meet the needs of the community outside the base and encourages complimentary efforts inside the base.

Optimizing public transit options, such as the St. Mary's Transit System (STS), to better serve NAS PAX personnel would further reduce traffic congestion and enhance accessibility. Coordinating STS routes and schedules with base operations, especially during peak commute hours, would improve the transportation network's efficiency and support both military and civilian needs. Furthermore, promoting telework or remote work options for County employees would alleviate transportation strain during severe weather events.

Overview of planning level concepts

As part of the Installation Resilience Review process, three projects were selected for planning-level design concepts. These concepts are intended as a tool to invoke reaction, engage stakeholders, and foster productive conversations. They are the first attempt to get an idea onto paper and are useful to refine an idea as it moves to the planning phase and to include in proposals to seek funding.

Concept Highlight: NAS PAX Gate 2 Intersection

Existing Conditions

NAS PAX Gate 2 is located on Cedar Point Rd. where two large state-owned roads meet: MD-24 (Three Notch Rd.) and Great Mills Rd. Current pedestrian and cycling infrastructure in this area is inadequate and incomplete. The current sidewalk along MD-235 does not comfortably accommodate both pedestrians and cyclists and no cycling infrastructure currently exists.

Despite a newly installed pedestrian crosswalk across the eastern side of MD-235 and another crosswalk across Great Mills Rd, both the western crossing area of MD-235 and the crossing at Cedar Point lack a designated zebra stripe crosswalk. This creates a burden for anyone accessing the base from the western side of MD-235 who must cross Great Mills Rd. and then MD-235 to cross safely at a crosswalk and access the park and ride or NAS PAX facility.



Rendering of proposed recommendations

Recommendations

- Extend sidewalk to a 10-foot width to create a shared pedestrian and cycling path that will establish multimodal accessibility between points of interest. A wider sidewalk provides a buffer for pedestrians traversing the busy road and space for cyclists to pass safely.
- Add crosswalk on the western side of MD-235 and across Cedar Point Rd.

Next steps

- Coordinate safety improvements with State Highway Administration and NAS PAX.
- + Coordinate sidewalk extension with Royal Farms.

Coordinating agencies

- + NAS PAX
- + State Highway
- + Royal Farms
- St. Mary's County Department of Public Works and Transportation



Housing and Structures

Housing stability is another critical element in building economic resilience, especially as climate change intensifies. Housing is the primary determinant of financial security and generational wealth in the U.S., yet it also remains the largest expense for families. Over 38 million U.S. households live in unaffordable housing, leaving them less able to cope with unexpected expenses. Climate-related disasters have worsened the affordable housing crises in disaster-prone areas. Without significant intervention, these areas will continue to face housing instability (Gauthier & Financial Security

Program, 2021).

To address this issue proactively, St. Mary's County can explore innovative funding mechanisms such as a community wealth fund or a housing reserve fund. These options allow the county to generate revenue for affordable housing without raising taxes or fees, ensuring a stable housing market that supports both military personnel and the civilian workforce critical to NAS PAX.

The housing challenges facing St. Mary's County are twofold: providing sufficient housing for military personnel and ensuring sufficient affordable housing stock for the civilian workforce essential to the base's mission. This is especially challenging in St. Mary's County, where its housing stock is rural and is limited geographically. The County can explore adopting strategies more commonly used in larger jurisdictions, such as issuing requests for proposals to developers for building affordable housing units. Offering developers reductions in fees or taxes in exchange for the creation of affordable housing could be an effective way to incentivize development in a market that might otherwise struggle to meet demand. Such measures not only bolster housing availability but also help attract and retain a younger, diverse workforce, which is vital for the county's long-term economic resilience.

In addition to expanding housing stock, the resilience of existing structures is also a concern. Many homes in St. Mary's County were built before 2000, and do not meet modern building codes that reduce vulnerability to climate threats. While new construction will improve resilience overall, established communities with older housing stock remain exposed (Gauthier & Financial Security Program, 2021). Retrofitting existing housing should be a priority to safeguard families and protect the civilian workforce essential to NAS PAX operations. St. Mary's County was recently accepted into the voluntary FEMA National Flood Insurance Program (NFIP) Community Rating System (CRS). The County entered the program at a Class 7 rating, which provides homeowners, renters, and business owners an opportunity to receive a 15% discount on NFIP flood insurance, demonstrating the County's commitment to comprehensive floodplain management and protecting properties from future flooding.

The National Institute of Building Science estimates that one year of new construction built to current codes will suffer \$13 billion less in losses over their lifetime compared to those built to 1990 standards. Moreover, retrofitting older homes and structures provides greater benefits than merely enforcing codes for new buildings (National Association of Home Builders, n.d.). The federal government spends approximately \$1 billion annually on mitigating risks to existing buildings, preventing an estimated \$6 billion in future losses (Multi-Hazard Mitigation Council, 2020). St. Mary's County should explore similar measures to protect its housing stock, both to support its workforce and maintain housing stability as climate risks increase.

Energy Systems

Energy infrastructure is another crucial component of the County's economic development strategy. The responsibility for maintaining and restoring the region's energy delivery system lies primarily with Southern Maryland Electric Cooperative (SMECO). However, the County has a vested interest in working with SMECO to ensure energy systems are protected from large-scale outages caused by extreme weather, wind events, and human-induced threats like black sky events— catastrophic disruptions to critical infrastructures.

NAS PAX has taken steps to enhance energy resilience by installing small-scale on-base solar power systems, ground source heat pumps, and green roofs to reduce electricity demand. The base is also exploring hydrogen hub partnerships with Bloom Energy to further its clean energy goals. Microgrid capabilities are being developed to mitigate black sky events and improve overall energy



security. However, concerns remain regarding the security of solar and wind projects, particularly due to the use of foreign-sourced materials and the potential for interference with radar systems at NAS PAX.

While the County has made strides in reducing energy demand through measures like the Empower MD program, there is no comprehensive, ongoing effort to systemically reduce operational power consumption at the County level. St. Mary's County should follow NAS PAX's lead by exploring an energy efficiency retrofit program for all local government facilities, including public schools, to maximize energy savings. Such programs are often structured so that efficiency upgrades are paid for through future energy cost savings, making them cost-effective in the long term. In addition, transitioning the County's fleet, including public transit, to renewable energy vehicles would reduce greenhouse gas emissions and align with state and federal sustainability goals. A phased replacement program could make this transition more feasible while enhancing the resilience and environmental performance of the County's infrastructure.

The Chesapeake Conservancy has identified areas in St. Mary's County suitable for solar development, leading to a zoning rewrite to accommodate such projects. However, the County has not actively promoted solar initiatives, leaving entrepreneurs to drive project initiation. While Maryland mandates a 14.5% Renewable Portfolio Standard, SMECO is only required to reach 2.5%. Despite this, SMECO aims to achieve carbon neutrality by 2045. St. Mary's County could encourage both residents and businesses to participate in SMECO's renewable energy credits program, possibly by setting an organizational example through its own energy purchases. This approach would support energy independence and improve resilience against grid disruptions. Additionally, the Maryland Energy Administration's Resilient Maryland program offers grants to establish microgrids and resilience hubs. Such systems can ensure continued operation of essential services in the event of a grid failure.



Protecting Community Character, Cultural, and Natural Resources

St. Mary's County's rural character, historic sites, outdoor recreation, and waterfront access are key attractions, but these amenities face threats from sea level rise, shoreline erosion, and, if not managed correctly, population growth. Many parks and historical sites situated along the water, including Piney Point Lighthouse, are at risk from eroding shorelines and rising sea levels. As climate change intensifies these challenges, proactive measures are essential to safeguarding the County's coastal assets and ensuring the long-term resilience of waterfront areas. Leonardtown, one of Maryland's fastest-growing municipalities, is grappling with managing growth while maintaining its small-town charm.

The County has taken several steps to protect its rich heritage and natural spaces. For example, the County is developing a management plan for the Southern MD National Heritage Area. It also enforces a septic bill to limit large-scale development in rural areas by restricting rural properties to seven built units. This effort supports concentrated growth in designated growth districts like Lexington Park and Leonardtown, which are expected to house 70% of the County's future population.

As growth continues, the need to preserve and enhance community character becomes increasingly important. Investing in streetscape improvements and beautifying spaces around schools, recreational facilities, and libraries can strengthen placemaking and community pride. In Lexington Park, balancing growth with increased greenery, trees, and parks can not only improve the quality of life but also mitigate the urban heat island effect, making the area more enjoyable and resilient to rising temperatures.

Efforts to preserve waterfront resources include constructing a new museum on St. Clements Island and collaborating with the Maryland Department of Natural Resources (DNR) to fortify piers against sea level rise, funded by a \$500,000 grant. Additionally, Leonardtown, recognized as a Main Street and a Maryland Department of Housing and Community Development (DHCD) *Sustainable Community*, is advancing waterfront plans to create a network of walking trails and revitalize downtown areas with funding from Program Open Space.

While the County effectively directs growth to its Priority Funding Areas (PFAs), more could be done to limit growth in rural areas and preserve rural character. Balancing landowner rights with the need to restrict rural growth is challenging, especially as climate migration may further increase population pressures in Leonardtown and other small towns.

Concept Highlight: Safe Routes to School

Existing Conditions

A 2021 Safe Routes to School survey conducted by St. Mary's County Health Department revealed several safety concerns at multiple schools across the County. Lexington Park Elementary School was identified in the survey and presents a good use case from which other schools can draw inspiration for safety and placemaking interventions. Speeding cars, trash accumulation, and the lack of designated crosswalks and cycling infrastructure are some of the concerns identified for Lexington Park Elementary School. The lack of trees and vegetation along the existing sidewalk creates inhospitable conditions for walking and cycling on hot days.



Existing Conditions

Recommendations

- Install a raised colorful sidewalk, designed to accommodate plow trucks, to slow down traffic and visually alert drivers they are in a school zone.
- Plant native shade trees and native landscaping along the sidewalks on Shangri-La Dr. to provide shade, intercept rainwater, and improve aesthetics.
- Install High-Intensity Activated crosswalk (HAWK) sign or Rectangular Rapid Flashing Beacon (RRFB) to reduce driver speed.
- Install bollards to shorten the distance to cross the road.
- Paint the road and add Shared Lane Markings (SHARROW) to indicate a shared environment for bicycles and automobiles.
- + Place trash and recycling receptacles to encourage proper waste disposal.

Next Steps

- Coordinate with DPW&T on proposed enhancements.
- Coordinate with the school and local community on community building projects such as crosswalk painting, tree planting, and trash clean-up efforts.



Rendering of proposed recommendations

Coordinating Agencies

- St. Mary's County Department of Public Works and Transportation
- + St. Mary's County Public Schools
- Parent teacher association
- + Students, teachers, staff and local community

Concept Highlight: Tulagi Place Placemaking



Existing Conditions

Directly across from NAS PAX Gate 2, an existing block of midcentury commercial buildings along Tulagi Pl. will be demolished and replaced by a Royal Farms. On the opposite side of Tulagi Pl. is the Elmer Brown Freedom Park, which includes a monument dedicated to the contributions of African Americans to St. Mary's County, and adjacent to the park is Three Notch Theater for performing arts. The planned redevelopment will reshape the area with an increase in vehicle traffic. No cycling infrastructure currently exists.

11' 9' 8' 8' 11' 10' Travel Travel Parallel Green Shared Green Parking Lane Lane Space/ Path Space BMP

Plan and cross-section of proposed recommendations

Recommendations

- Install a 10' wide shared path on the east side of Tulagi Pl. for pedestrians and cyclists to provide connectivity to the base and other points of interest.
- Implement placemaking features such as accented crosswalks, native shade trees, and stormwater BMPs.
- Designate the southern half of Tulagi Pl. for activating community events to promote placemaking and social cohesion.
- Encourage Royal Farms to install a vegetative buffer that acts as a screen and provides shade to improve pedestrian walking experience on the west side of Tulagi Pl.
- Establish Tulagi Pl. as an exemplary green and complete street to replicate throughout the County.

Next Steps

- Work with local partners to design green street elements.
- Coordinate with Royal Farms to install trees and vegetation Tulagi Pl. right of way.
- Establish a committee to review temporary pedestrianization and placemaking activities for Tulagi Pl.

Coordinating agencies

- St. Mary's County Department of Public Works and Transportation
- + Royal Farms
- + St. Mary's County Economic Development



Natural Assets and Resources

Protecting natural resources is central to St. Mary's County's economic development priorities, including safeguarding water quality, supporting agriculture and aquaculture, preserving open spaces and historic sites, and investing in nature-based solutions. These approaches work with natural systems to reduce flood risk, improve water quality, protect coastal property, stabilize shorelines, and mitigate urban heat (Nature-based Solutions Initiative, n.d.). St. Mary's County should continue to explore and coordinate its land preservation activities with NAS PAX to support military readiness while advancing conservation goals. Programs like the Department of Defense's Readiness and Environmental Protection Integration (REPI) Program utilize cost sharing agreements between the military and different levels of government and private organizations to increase resilience efforts on land adjacent to military installations, while addressing incompatible environmental restrictions to military operations. Similarly, the Middle Chesapeake Sentinel Landscape is a partnership which pools funding to pursue projects that protect and conserve natural resources and agriculture land that co-benefit and strengthen military readiness. Programs like these can complement local efforts such as the Rural Legacy Program, Program Open Space, and the Maryland Agricultural Land Preservation Foundation (MALPF). Maryland DNR owns 11 properties in St. Mary's County including Saint Inigoes State Forest, a 911-acre parcel adjacent to WOLF (St. Mary's County Recreation & Parks, 2022).

Nature-based resilience practices can be applied at both the watershed and site-specific scale. Largescale efforts, such as land conservation and greenways, require long-term planning and coordination. At the site-specific level, practices like bioretention cells or permeable pavement reduce stormwater runoff and increase resilience. In coastal areas, shoreline stabilization, erosion control, and buffers against storms are critical. (FEMA, 2024). St. Mary's County and NAS PAX should collaborate to develop a comprehensive shoreline management plan. Nature-based solutions such as living shorelines, oyster reef restoration, and marsh migration corridors should be prioritized, particularly on public lands like parks and other permanently preserved areas. This plan could also include dual-benefit initiatives like expanding oyster aquaculture, which both supports local economies and enhances coastal resilience.

Resource management in St. Mary's County adheres to state guidelines, such as 100-ft setbacks from stream banks to safeguard floodplains and habitats during the development review process. The County also has a strong land preservation program. The County should evaluate existing guidelines to ensure they are sufficient for protecting natural resources against flooding, sea level rise, and extreme weather events. Moving forward, the county should prioritize land preservation based on strategic areas rather than focusing solely on acreage. Prioritizing key areas near NAS PAX will offer greater ecological and operational benefits.

Partnering with NAS PAX on conservation efforts also opens up funding opportunities through programs like the REPI program, which protect biodiversity, enhance resilience, and prevent encroachment into critical military areas. For example, REPI funds were used to acquire Shannon Farm, a large 212-acre parcel located just southeast of NAS PAX Main Station which the County has since acquired with the intention of establishing it as a county park. The County has also expanded the Mattapany Rural Legacy Area several times to increase protected land adjacent to NAS PAX Main Station and WOLF while also providing environmental benefits. Maryland's Rural Legacy Program funds the preservation of large, connected parcels of land that protect the environment, natural resources, and agriculture and support sustainable natural resource based industries. Resource Conservation and Development (RC&D) and NAS PAX are working together on a large shoreline protection project along the Hog Point Campground, located next to the Potomac River. The project seeks to protect 4,870 linear feet of shoreline and associated helicopter operation areas at NAS PAX Main Station.

Moving forward, the County and NAS PAX should continue to identify joint projects and funding opportunities that advance their shared goals for resilience, conservation, growth management, and military readiness. Development of a comprehensive shoreline management plan can help create a pipeline of strategic projects to build resilient shorelines that protect both the community and the base. Other areas for collaboration include wildlife management. There are opportunities for the County and DNR to work with NAS PAX to mitigate risks from deer and wildfowl populations that could impact military readiness, for example. The recent establishment of the Maryland Woodlands National Wildlife Refuge provides additional opportunities, and coordinating local, state, and federal efforts under this new designation will be crucial, especially where goals align with NAS PAX to protect both natural resources and military operations.

Land Use

St. Mary's County is in the early stages of updating its 2010 Comprehensive Plan. This presents an opportunity to plan for and address rapid population growth, shortages of affordable and workforce housing, base encroachment, resilience, and quality of life priorities. Population growth in the County is projected to outpace state averages. Climate migration could further intensify these trends, leading to increased pressure on local resources like aquifers and land use. As part of the planning process, the County should align itself with ongoing discussions around climate migration and ensure its growth projections account for multiple stressors, including those exacerbated by COVID-19 and land use shifts that historical migration patterns may not fully capture. This plan update also provides an opportunity to formalize coordination with NAS PAX on encroachment issues, moving beyond the current informal practice of consulting with the base.

The County's impressive land preservation programs, including Program Open Space, which provide state funding for conservation and expansion of recreational initiatives, play a significant role in limiting sprawl and protecting natural resources. However, applying a "base lens" to these programs could enhance efforts to prevent encroachment around NAS PAX. Adding encroachment considerations as a factor in land preservation decisions, particularly in Program Open Space-funded projects, would help safeguard mission-critical areas. The County could also lobby the state to allow state Program Open Space funds to be used for land preservation efforts that benefit both the County and NAS PAX. For example, overlapping Rural Legacy Area designations with encroachment zones could provide a dual benefit for both land preservation and base protection. With these updates, the County can adopt more ambitious conservation and stormwater management regulations that consider future flooding and rainfall projections. It also allows for interventions to combat projected climate stressors and shocks facing St. Mary's County such as heat and saltwater intrusion.

Encouraging growth within designated growth areas while discouraging development outside these zones aligns with both the County's land use priorities and NAS PAX's mission to limit encroachment. To maintain this balance, the County should pursue policies that ensure growth areas are resilient to climate impacts, such as flooding and heat, which will become more significant as population density increases. St. Mary's County has expressed plans to update its zoning ordinances once the Comprehensive Plan update is complete. Updating zoning ordinances to reduce parking minimums, lower impermeable surfaces, and incorporate resilient infrastructure can help reduce development pressures while improving sustainability in growth areas.

As municipalities like Leonardtown continue to grow, the County should coordinate resilience planning efforts not only with NAS PAX but also with municipal governments. This will ensure that resilience measures and land use policies are consistent across jurisdictions, reinforcing long-term resilience goals and mitigating climate impacts throughout the region. Ensuring resilience in growth areas, while protecting NAS PAX's mission, will require cooperation among all local, state, and federal stakeholders.

Long-term resilience and growth management in St. Mary's County require a merging of interests between the County and NAS PAX. By coordinating closely with the military, the County can better anticipate where development is likely to occur and alleviate encroachment concerns.



Rising Public Health Risks

Climate change is a significant public health threat in St. Mary's County. Rising temperatures increase risks of heat stroke, air quality degradation, and vector-borne diseases like Lyme disease, West Nile virus, and Zika. These challenges are particularly severe for vulnerable groups, including children, older adults, and those without stable housing. The County's extensive coastline faces additional risks from pathogens such as Vibrio due to warming waters.

Sea-level rise and rising groundwater levels threaten the County's reliance on septic systems, posing risks of water well contamination. Climate change is also expected to worsen infectious diseases and antimicrobial resistance, shifting disease transmission patterns. In the next 5-10 years, these challenges are likely to intensify, yet resource constraints limit the County's ability to respond effectively.

Extreme weather events, such as severe storms and extreme heat, further strain public health resources, impacting food safety, medication access, and services for the homeless. A 2019 Point in Time count identified 85 homeless individuals in St. Mary's County (Calvert-Charles-St. Mary's, n.d.). The St. Mary's County Health Department, through its Division of Community Engagement and Policy, works closely with partners to address these issues, with environmental health identified as a key focus. Efforts include maintaining strong communication with NAS PAX, assisting in cooling center activations through the Department of Emergency Services, providing shelter during cold weather through the Wrapping Arms 'Round Many (WARM) program, and improving access to mental health services through the Health Hub. The Health Department is also active in educating the public about safety measures during events like sewer overflows and power outages, further demonstrating its commitment to safeguarding public health in the face of climate change.

To effectively mitigate the growing health impacts of climate change, increased investment in resources and infrastructure will be needed. Without this, the County will struggle to protect its most vulnerable residents and address the evolving public health challenges posed by climate change.

Emergency Preparedness & Response

An effective emergency preparedness and response system is essential to minimize loss in disasters. A key climate threat to the base and County's emergency response systems is severe storms, while cybersecurity and terrorist attacks are also significant concerns. The County also faces challenges in its emergency response system due to declining volunteerism.

NAS PAX and the County's emergency response teams communicate regularly. NAS PAX is on the County radio system, and the two provide reciprocal emergency aid and assistance. Emergency staff from NAS PAX and the County engage in joint training exercises to ensure interoperability between their communication systems. St. Mary's County operates three stations 24 hours a day, with others functioning 12 hours per day. The County currently has a 12-minute response time from dispatch to scene, with career staff responding in seven minutes. One challenge in emergency response noted by the County is the lack of reliable cell coverage, as service in high-density buildings can be lacking.

An Emergency Medical Services (EMS) study to assess program effectiveness and anticipate future needs is currently ongoing. Additionally, the County is transitioning to a combined career service model, supplementing its volunteer EMS workforce with 48 career Emergency Medical Technicians and paramedics. A significant milestone is the completion of the Catastrophe Risk Management Solutions (CAT RMS) system upgrade to enhance data management and operational efficiency. Communication infrastructure has also been upgraded with a P25-compliant radio system, improving interoperability with neighboring jurisdictions and NAS PAX. The County has also transitioned to Next Generation 911 and is addressing communication dead spots through a multi-million-dollar equipment refresh initiative. Comprehensive continuity of operations plans (CoOP) are in place at the County level to ensure preparedness in emergency scenarios, with Leonardtown having its own plan. NAS PAX's involvement in County CoOP plans is currently limited.

In case of disruptions, the County has robust redundancy systems to ensure that facilities remain operational. The local hospital conducts drills with partners like NAS PAX, the Department of Emergency Management (DEM), the Health Department, and EMS. The hospital is equipped with generators, water supplies, and auxiliary fuel, and receives additional support from the state.

Concept Highlight: Resilience Hub

Existing Conditions

The County is exploring a resilience hub in Lexington Park, which has the highest concentration of minority and low-income households, to address needs gaps to build resiliency and improve emergency preparedness. The Bay District Volunteer Fire Department serves as a use case to demonstrate different services that can be provided through a resilience hub. Features in the concept are based on feedback from County and NAS PAX experts, gathered through a brief questionnaire.

Recommendations

- + Prepare for power outages by installing solar panels with back up battery, back-up generator, and solar powered EV charging stations.
- + Provide space for people to charge phones, connect to the internet, and access health and safety information.
- + Plan for food, water, and supplies storage/distribution and ensure refrigeration is available to store medicine.
- + Acquire mobile units, such as vehicles and tents, to serve as additional covered gathering spaces for larger crowds, with the capability to provide heating or cooling as needed.
- + Establish a medical, testing, and/or vaccination zone.
- + Consider whether a single location or network of resilience hubs is the best configuration.
- Provide adequate bathrooms/showers/laundry facilities.

Next Steps

- + Establish a task force consisting of County and NAS PAX subject matter exports to explore the idea.
- Engage local community to understand needs, preferences, and goals.

Coordinating Agencies

- + St. Mary's County **Emergency Services**
- + NAS PAX
- + St. Mary's County Health Department
- Community Based Organizations



Resilience Hub Concept Plan at Bay District Volunteer Fire Department in Lexington Park, MD

LEGEND

VISITOR PARKING

BICYCLE PARKING SOLAR PANEL



Increasing Fiscal and Budgetary Risks

Fiscal and budgetary risks are expected to increase moving forward. St. Mary's County's capacity to fund and finance future climate action and resilience projects was also assessed by estimating the potential scale and complexity of these challenges and evaluating the County's investment systems.

Climate action and resilience investment challenges

Local governments, including St. Mary's County, are on the frontlines of financing climate action and resilience. Historically, state and local governments have shouldered most of the infrastructure spending in the U.S., covering approximately three-quarters (\$15 trillion) of the total \$20.4 trillion spent on infrastructure construction and maintenance between 1956 and 2017. In 2014, states and local governments funded 88% of the maintenance and operating costs for transportation and water infrastructure (Wesseler, 2022). As a result, St. Mary's County should expect to bear the brunt of climate infrastructure and resilience investments within its communities. This presents arguably the biggest infrastructure financing challenge in generations.

Given that climate change will affect nearly all aspects of community life, commerce, and development, local and regional leaders must adopt investment systems that anticipate the scale of climate impacts and embed resilience into infrastructure and the community's economic fabric. Several studies have attempted to quantify the financial impacts of climate change on local and state governments. In Ohio, researchers estimate that municipal spending will need to increase by \$1.8 to \$5.9 billion annually by 2050, potentially raising local budgets by up to 80%, to address the ten costliest climate impacts (Power a Clean Future Ohio et al., 2022). In Alaska, infrastructure building and maintenance costs could rise by 20% by 2030 (Larsen et al., 2008). Meanwhile, Pennsylvania municipalities may face yearly adaptation costs of \$4,930 per capita (Center for Climate Integrity, 2023).

Infrastructure spending for local governments will likely focus on transportation and storm drain improvements and repairs. Ohio's estimated \$5.9 billion spending, for example, includes \$2.7 billion for road elevation and repair, \$2.2 billion for drinking water treatment, and \$590 million for stormwater drainage (Power a Clean Future Ohio et al., 2022). Similarly, Pennsylvania anticipates \$15.47 billion will be spent on climate adaptation by 2040, with half allocated to increasing storm drain capacity and 27% to protecting and adapting roads and transportation infrastructure (Center for Climate Integrity, 2023). In Alaska, roads and airport runways could account for half of the state's added infrastructure costs incurred due to climate by 2030, with water and sewer systems comprising 30% of this spending (Larsen et al., 2008).

Beyond high adaptation costs, climate change may also make financing infrastructure projects more difficult and costly. Municipalities with higher heat stress may face increased costs in accessing bond markets, while natural disasters and climate events may result in worsening returns on revenue bonds, making local financing more expensive as damaging weather events become more frequent (Wessel, 2023). Investors are increasingly factoring climate risks into decisions about municipal bonds, reflecting the long-term financial challenges posed by climate change (Painter, 2020).

The anticipated costs of fortifying and improving local infrastructure will be substantial, but they must be considered alongside the cost of inaction. The most common way to estimate inaction costs is by evaluating anticipated financial losses from weather and climate-related events (European Environment Agency, 2023). In St. Mary's County, failing to address climate impacts on critical infrastructure could harm two key economic drivers, including the long-term viability of the NAS PAX Main Station and WOLF. This decreased economic activity would likely reduce relative tax and fee receipts and exacerbate cost increases. Very simply, the cost of climate action and resilience efforts must be weighed against the anticipated cost of inaction.

Cost analysis should also account for the potential financial benefits of climate projects to St. Mary's County and NAS PAX, both directly and indirectly. Calculating avoided costs and losses to infrastructure, assets, and people is central to estimating the benefits of investment. Estimates may also include the effects on the local economy and the indirect benefits of adaptation, such as reducing future risks, improving resource productivity, boosting innovation, enhancing environmental benefits, and maintaining or improving ecosystem services (European Environment Agency, 2023).

Although calculating the County's return on its climate action and resilience investments is beyond this project's scope, various studies highlight the importance of this analysis and the potential benefits of such investments. For example, a recent study found that incorporating resilience best practices in new and redeveloped infrastructure assets could involve modest incremental costs (3% of total investment needs) while yielding significant benefits—an average of \$4 for every \$1 invested. Adaptation is not just about spending more; it's about spending for long-term benefits (Hallegatte & Li, 2022).

The fiscal impacts of climate change on local governments underscore the need for resilient and innovative investment and financing mechanisms to support adaptation and mitigation projects. To that end, the next step in the assessment was to evaluate the County's climate action and resilience investment system's capacity to address future infrastructure development, restoration, and protection efforts.

Assessing County Capacity for Climate Resilience

The financial challenges of large-scale infrastructure development and upgrades are clear, especially with the added complexity of climate impacts on public and private assets. The County's current investment systems rely heavily on a traditional local government model, which focuses heavily on the general fund to support long-term capital projects and baseline programs. While the general fund will remain a key part of the County's budgeting and investment processes, it will be insufficient to meet the long-term infrastructure and capital project needs as climate impacts intensify.

The County's traditional model includes enterprise programs for critical services like water, wastewater, and solid waste management. However, there are no enterprise funds for the infrastructure systems that will likely pose the greatest investment challenges in the future: storm drainage, transportation, and community health. To effectively address these challenges, County leaders, in partnership with NAS PAX, will need to expand and restructure the capital project and programmatic investment system around three key components:

- + Expanded revenues and funding sources sufficient to implement the project portfolio
- + Innovative, comprehensive financing mechanisms that reduce the cost of capital, mitigate risk, and support action
- + Institutional structures that streamline and scale the resilience investment process, making project implementation more efficient and effective

Component I: Revenue Portfolio

Securing new, sustainable, and scalable revenue streams is critical for St. Mary's County to support climate action and resilience. Access to capital and the composition of the County's revenue portfolio will be fundamental to long-term financing success. The County's revenue sources fall into two primary categories, with the first tier being those derived primarily from three powers constitutionally provided to local governments – namely taxation, proprietary revenues, and regulation (Bland & Overton, 2019):

Tier I: Traditional Revenue Sources

- Taxes. Taxation remains the cornerstone of local infrastructure investment, with the County's budget heavily relying on tax-based revenues. However, increasing general fund taxes is politically challenging, necessitating the exploration of alternative revenue sources. While the County has used an impact fee on new development to fund new highway, school, and recreation capital projects, this was replaced in 2023 by an excise tax, offering greater flexibility on capital and operation and management expenditures but only a marginal increase in funding.
- ★ Service Fees. Enterprise funds, which are self-supported through user charges, play a significant role in the County's revenue portfolio. These funds support essential services and assets like water, wastewater, and solid waste management. It is likely that capital projects within these enterprise programs—including those supporting climate resilience—will be financed within these enterprise programs. However, no enterprise funds currently exist to address critical infrastructure needs in transportation, stormwater management, and community health, leaving these areas reliant on the general fund. It should be noted that the County's transportation capital and operations and maintenance costs are partially supported through an excise tax.
- Regulations. St. Mary's County has the authority to generate revenue through in-lieu fee programs and mitigation banking. The County already utilizes this authority, for example, by providing fee-in-lieu provisions for meeting forest conservation regulations and by allowing developers to meet Transferable Development Right requirements using cash in lieu. Regulations also help avoid costs, particularly in coastal communities like St. Mary's County where development in hazardous areas can lead to significant long-term expenses.

Tier 2: Supplementary Revenue Sources

Tier 2 sources are derived from actions and activities outside of the three legal powers provided to local governments. These revenues will likely be important for augmenting the County's general fund system.

- Grants. Grants are a valuable resource for funding new initiatives or special projects without impacting County budgets. However, the competition for limited grant resources, the limits of scale, and the administrative resources required to secure and manage them are challenges. The County currently lacks a coordinated approach to grant management for climate action and resilience, however, which could limit its competitiveness.
- Private-market incentives. Market-based tools can encourage private investment in resilience projects. Incentives may be designed and instituted by governments or private parties, typically by using market demand for services, access, allowances, or commodities as a means for eliciting voluntary payments. Although immediate opportunities for such incentives are limited, it should be noted that the St. Mary's County—NAS PAX energy distribution infrastructure system is entirely based on private sector ownership and management by SMECO. This creates an opportunity for the County to partner with other Southern Maryland jurisdictions and SMECO to create marketlike incentives that enhance the reliability of the energy system.

Assessment Summary

The County's revenue system will need to expand over time to meet future infrastructure and programmatic needs. The scale of the revenue portfolio will ultimately be a function of both the composition and the timing of projects. Funding must be secured and available for timely deployment at a scale sufficient to fund all priority projects within a given period. Achieving climate action and resilience goals will necessitate a diverse suite of revenue streams, as no single source will be adequate to meet all needs. The County's revenue portfolio must be established within the context of the entire project portfolio, connecting an efficient mix of revenue sources with specific projects sufficient to achieve the suite of desired outcomes. Additionally, building redundancy into the revenue portfolio will be essential. The introduction of the excise tax is a positive step toward increasing both diversity and redundancy, but further efforts will be needed to identify and leverage new revenue sources, particularly through enterprise programs.

Component 2: Financing Mechanisms and Processes

The second component in the model resilience investment system is financing mechanisms and the management of money—including investing, borrowing, lending, and forecasting. In many ways, financing represents the culmination of resilience planning, project development, and revenue generation processes. Without success in the other elements of the system, financing is irrelevant. Conversely, the financing process is designed to ensure that project development and revenue allocation are efficient and effective. While effective financing span multiple functions across the investment process, two stand out as being foundational:

Debt Management. Local government infrastructure development typically relies on low-cost debt. St. Mary's County utilizes general obligation (GO) bond financing for capital projects, providing the County with access to a low cost of capital. The GO bond financing system is expected to remain a cornerstone of the County's financing strategy. However, as capital project needs grow, reliance on GO bonds may be limited by the difficulty associated with increasing general funds.

Procurement Systems. Procurement is central to infrastructure financing, yet St. Mary's County's current procurement system, like most communities, is not equipped to address the unique risks and opportunities of resilience project portfolios. To effectively support climate action, the County's procurement processes will require restructuring to combine the transparency and oversight of public systems with the innovation and efficiency of the private sector. By expanding the capacity of local procurement systems, the County can enable a variety of innovative financing mechanisms that reduce capital costs, mitigate risk, and accelerate the implementation of climate action and resilience projects. This may involve taking on risks that public institutions traditionally avoid, but doing so is essential to directly invest in the ingenuity needed for effective climate resilience.

Assessment Summary

The St. Mary's County Department of Finance manages all aspects of financing, budgeting, and cash flow. The current system, reflected in strong ratings from Moody's, Fitch, and Standard & Poor's, functions efficiently for existing infrastructure needs (St. Mary's County Government, n.d.-a). However, as climate impacts increase, the County's financing system will need to adapt to future resilience investment demands. Key areas of adjustment include debt backed by reliable funding sources and procurement systems that effectively manage cash flows and incentivize contractor performance for resilience outcomes.

Component 3: Institutional Leadership and Technical Capacity

Protecting critical infrastructure assets from the impacts of climate hazards will require County leaders to make project development, investment, and policy decisions with impacts well beyond the current political time horizons. In addition, the scale, complexity, and timing of the County's response to climate hazards and impacts will necessitate unprecedented cooperation and engagement, particularly between the County and NAS PAX. Establishing institutional structures that can streamline and scale the project development and investment process will be critical to ensure long-term implementation efficiency and effectiveness.

The specific details and structures of the region's resilience financing institutions will be shaped by necessary project development, funding, and financing needs. However, their effectiveness will depend on key attributes and abilities, including:

- Fostering internal collaboration. An effective resilience financing institution must be capable of working across government departments and agencies to enhance coordination and improved communication.
- + Encouraging regional collaboration. While climate impacts are highly localized, neighboring communities will face similar challenges. Effective institutions capitalize on these commonalities to gain efficiencies, increase scale, and enhance competitiveness.
- + Engaging diverse community stakeholders. Effective resilience financing institutions ensure governance structures reflect the geographic and demographic diversity of the community, leading to more informed and equitable investment decisions.
- + **Prioritizing resilience projects.** An effective resilience financing system focuses on addressing the most important and urgent needs, minimizing the influence of politics.

Assessment Summary

The County's current climate action and resilience system relies on two main institutional structures and functions. Firstly, project development is handled by individual agencies and departments. Capital projects, financed primarily through the general fund, are largely the responsibility of the Department of Public Works, while programmatic activities are managed by multiple departments. This system functions well under existing conditions and for current project priorities. A lack of centralized institutional leadership and oversight for climate action and resilience projects may lead to organizational constraints in the future.

Secondly, the County's financing and investment system is managed and administered by the Department of Finance (DoF), which oversees the budget, financing, accounting (including cash management), and procurement processes. This is reflective of the County's traditional general fund financing structure. While DoF does not directly manage the development and prioritization of climate action and resilience projects, its strong performance in financing priority projects is exemplified by the County's high credit ratings across the three major rating agencies. The department has a proven ability to coordinate with internal County government departments and programs, as well as with external entities such as MetCom. However, while DoF currently provides sufficient capacity to handle existing climate action and resilience needs within the budget, future investment and financing needs are likely to stretch the department beyond its current capacities. As a result, expanded institutional capacity and structures will be necessary in the future.

Recommendations for Climate Resilience Implementation

Extreme heat, flooding, increased precipitation, and saltwater intrusion pose mounting challenges to St. Mary's County and NAS PAX. It is anticipated that funding and financing strategies will need to adjust to community needs as they evolve. The following recommendations for establishing a climate action and resilience implementation and investment system take a phased approach designed to progressively expand St. Mary's County's capacity to implement and finance projects over time.

Phase 1: Foundational

The primary goal of Phase I is to enhance St. Mary's County's ability to implement and optimize its existing funding and financing resources. Since expanding these resources in the short term is unlikely, the focus is on directing them toward actions and projects that deliver the highest return on investment. Phase I prioritizes improving the effectiveness of the current system without making structural changes, ensuring that top-priority projects are fully integrated and prioritized in the County's budget.

Key Financial Outcomes:

- Avoided Costs. Cost avoidance refers to the money saved by preventing unnecessary expenses or choosing more cost-efficient ways to deliver services. This is vital for governments aiming to minimize spending on emergency preparations or climate-related changes, such as the long-term impact of higher temperatures on road infrastructure or building in floodplains. While cost avoidance measures may involve additional upfront spending, it can significantly reduce future costs. For instance, the World Bank reports that every \$1 invested in climate resilience can generate a \$4 return by reducing the need for continual repairs and rebuilding (Hallegatte et al., 2019). Additionally, the National Institute of Building Sciences estimates that each \$1 spent on mitigation efforts like adopting stronger building codes and upgrading infrastructure saves society an average of \$13 in avoided losses (Multi-Hazard Mitigation Council, 2019).
- Asset and Revenue Protection. Asset and revenue protection is similar to avoided cost financing in that mitigation actions are prioritized to protect critical assets that are essential for generating long-term income to the community. The purpose is to protect properties and structures that generate tax revenues. This can mean preemptively mitigating acute hazard impacts such as storm damage through often aggressive structural infrastructure projects; or it can mean protecting long-term asset value by mitigating systemic climate impacts such as sea-level rise and tidal flooding. In both cases, relatively short-term investments in the form of project financing are made to ensure long-term fiscal returns.
- Inter-Departmental Efficiencies. Coordinating efforts across departments, though challenging, helps ensure that projects align with County priorities, reducing internal competition for limited resources and preventing conflicting initiatives. Some Maryland counties, including Anne Arundel, Charles, and Baltimore, have either established or are in the process of exploring resilience authorities to lead such efforts.

Recommendation I: Establish/Appoint a Chief Resilience Officer

To effectively address climate action and resilience challenges, it is recommended that St. Mary's County establish leadership roles to streamline planning and oversight of disaster mitigation and climate resilience projects. This effort should start with the creation of a Chief Resilience Officer (CRO) position, which would play a crucial role in supporting both the County and NAS PAX, including:

- + Organizing stakeholders. Achieving comprehensive, long-term resilience measures will require meaningful engagement and participation of myriad stakeholders across all sectors. The County's role as an overarching facilitator and organizer of stakeholders is critical for creating opportunities to catalyze, coordinate, and incentivize action. This is especially true as it relates to the on-the-ground projects that protect critical assets and communities.
- Fostering comprehensive community resilience. A community-centered approach to resilience reflects the specific needs, conditions, and political realities of its community. Local governments, either directly or via special-purpose entities, can play a guiding role to ensure resilience actions within a community are comprehensive and home-grown. The goal of the CRO would be to promote the adoption of resilient systems following the principles outlined in the 'City Resilience Framework' characterized by adaptability, robustness, redundancy, flexibility, resourcefulness, inclusivity, and integration (The Rockefeller Foundation & Arup, 2014).
- + Catalyzing action and investment. One critical role of local governments is to catalyze climate action and investment. Local climate planning and project implementation are largely focused on protecting assets and infrastructure. While climate impacts are universal, they manifest in highly localized ways, placing responsibility on the public sector—local governments, in particular—to ensure their communities are prepared to withstand and recover from these risks. Local governments spur broad action on climate resilience and mitigation. The intent of this process is to offer St. Mary's County leaders options for making iterative changes to existing financing processes.

An immediate role the CRO can provide is to actively seek and coordinate responses to public and private grant funding opportunities, especially those that support regional collaboration and support innovation. An important first step in developing a grant funding program is to understand where the opportunities are and the timing of application deadlines, matching requirements, etc. A CRO should lead efforts to identify and leverage opportunities associated with State, Federal, and private foundational funding resources.

Recommendation 2: Establish a Permanent Climate Action Committee

The significance of NAS PAX to the County's economy and culture highlights the need to maintain and expand existing partnerships. This project established processes for St. Mary's County and NAS PAX leaders to assess climate resilience risks and opportunities. A next step is to solidify these efforts by forming a permanent NAS PAX – St. Mary's County Climate Action and Resilience Committee. The purpose of this Committee is to build on existing collaborative efforts between the County and NAS PAX to advance environmental, economic, and social initiatives. The Committee's primary role should be to ensure that resilience planning and implementation systems collectively address and promote the key needs and characteristics of a resilient community. This will involve (The Rockefeller Foundation, 2014):

- + Enhance inter-departmental collaboration. Improve internal communications and coordination within the County's government to support cohesive resilience strategies.
- + Engage a wide array of stakeholders. Bring together government officials and representatives from the private sector, non-profits, and civil society to better understand local challenges and build broader support for identified initiatives.

- + Lead local resilience strategy development. Guide the development of local resilience strategies by involving a diverse group to identify challenges, assess capabilities, and address gaps.
- Serve as the community's 'resilience point of contact.' Ensure that both County and NAS PAX leaders apply a resilience perspective in decision-making, encouraging a more effective use of resources and maximizing the impact of projects.
- + Identify funding sources. Focus efforts on securing a broad array of local, state, and federal government funding sources.

Recommendation 3: Create A Comprehensive Project Portfolio

The risk and vulnerability assessment, coupled with the asset inventory, creates the initial structure for a detailed mitigation and adaptation strategy and project portfolio. The community resilience portfolio will enable local leaders to codify a resilience plan of action. The action plan should be organized around three key elements: (1) project and programs typology, (2) the timing of impacts and project implementation, and (3) the costs associated with taking action.

Resilience project typology

The County's resilience projects will likely take many forms. From a management perspective, they can be grouped into two main categories:

- Baseline projects and programs. These projects provide the foundational structure to the region's resilience efforts, including staff support, initial studies and assessments (such as ongoing risk and vulnerability analyses), and project implementation.
- + Capital and infrastructure projects. These are the primary focus of the resilience financing process and are often implemented to meet specific community needs, including:
 - Protecting essential assets. This includes targeted projects to safeguard specific assets threatened by climate change.
 - Protecting asset classes or systems. Many community resilience projects are designed to protect a suite of assets, such as transportation networks, residential and commercial buildings, or public utilities. These projects are often coupled with regulatory or permit changes (e.g., building codes, floodplain management).
 - Protecting threatened geographies or communities. Large-scale projects are often designed to protect specific communities or neighborhoods from multiple climate hazards, such as flood mitigation/abatement and transportation improvements. This is critical for protecting the mission and activities of NAS PAX.
 - Incentivizing outcomes. Projects may also be designed to address a particular hazard or desired outcome. These are often linked to enterprise fund activities but can also include other community priorities such as habitat restoration and protection.

Project timing

Climate impacts across NAS PAX and St. Mary's County region are expected to intensify over time. As a result, the collective response to mitigate risks will need to evolve. This will require flexible and adaptable resilience systems and processes – including financing processes. The project portfolio should address short-, mid- and long-term needs and time horizons.

Short-term needs (0-3yrs). Short-term risks represent immediate infrastructure and financing needs, supported by codified, stable funding streams like general obligation bonds, general funds, enterprise programs, or dedicated fees. Projects should have a clear understanding of their useful life, i.e., how long the project will effectively meet changing resilience needs.

- Mid-term needs (3-15yrs). Mid-term risks and infrastructure needs are the systems that replace or enhance short-term infrastructure projects. The scale of these needs will likely grow over time. Efforts to establish future revenue streams should begin now.
- + Long-term needs (15yrs+). This includes major projects to address significant climate impacts like sea-level rise, temperature and precipitation changes, and catastrophic storms. Community leaders should begin establishing the necessary financing systems and processes in the short-term to meet long-term needs, including favorable conditions for investment, identifying anticipated revenue streams, and building capacity by establishing appropriate financing institutions.

Anticipated project costs

Project cost estimation involves forecasting the fiscal resources needed to complete a project within its defined scope. This includes accounting for every element required for the project and calculating a total amount to form the project's budget. Accurate cost estimates are crucial for understanding the revenue needed and determining when specific resilience projects can advance. As climate resilience infrastructure projects move through the design and implementation process, it is essential to accurately account for all direct and indirect expenses, including labor, materials, equipment, facilities, and associated risks. Initially, the resilience planning and implementation processes require a high-level or preliminary evaluation of project costs in each category over time. This initial assessment helps the County identify the necessary institutional and revenue systems to achieve long-term resilience.

Phase 2: Expanded Implementation

In Phase 2, the focus shifts to expanding existing systems to meet the growing needs and demands of climate resilience efforts. This involves enhancing leadership of existing departments, increasing the capacity to identify and secure funding and revenue, and partnering with NAS PAX and potentially other communities to advance project development and implementation.

Traditionally, local governments have paid for community services, programs, and capital projects by tapping into a mix of local, state, and federal funding sources along with private financing mechanisms such as bonds, public/private partnerships, and grants. Addressing the impacts of climate change will increase the complexity of these financing processes.

Recommendation 4: Develop a long-term regional resilience revenue strategy

Effectively mitigating climate impacts will place significant pressure on the County's budgets and fiscal resources. Currently, there is insufficient public revenue available to support both infrastructure development and climate change mitigation needs, which could exacerbate existing revenue shortages. Simply reallocating current resources is not enough; additional revenue sources are needed to address climate impacts.

The scarcity of public revenue is further compounded by the increased risk and uncertainty associated with climate change impacts. Uncertainty disrupts funding and financing processes, affecting revenue flow. In addition, there are real uncertainties associated with the performance of capital projects over time, the scale and nature of future climate impacts, and the potential benefits of infrastructure investments. Therefore, St. Mary's County must make some complex and nuanced policy decisions, such as:

 Balancing cost and benefit. Resilience infrastructure projects often require balancing substantial short-term costs with significant long-term gains. Converting avoided costs into cash flow is challenging and puts pressure on local revenues.

- Achieving fairness in financing. Fairness in infrastructure financing suggests that the cost burden matches the benefits received from a project. This balance is difficult to achieve when public revenues are used to create private benefits in specific places.
- + Ensuring equity in financing and implementation. Achieving equity in the financing system can complicate resilience efforts, as not all citizens have the same ability to contribute to public funding. This is often at odds with achieving fairness.
- + Expanding cooperation. Addressing climate change effectively will require a high level of cooperation between the County and NAS PAX. This involves collaboration within a complex system of intra-community (among planning, budgeting and finance, operations, and legal departments) and inter-community engagement and implementation.

While grants provide a good starting point for supporting resilience projects and action strategies, St. Mary's County leaders must eventually establish a more sustainable and comprehensive revenue system. An effective revenue strategy should identify where and when revenue gaps will occur and provide a plan for how those gaps and funding needs will be met in the future. Additionally, it is important to take into account that even grant-funded projects require dedicated funding to cover match requirements, management, and oversight responsibilities.

A mix of revenue sources including fees, taxes, and grants could provide temporary or permanent support for regional resilience projects and activities. When evaluating the potential efficacy of a revenue source include:

- Connection to long-term resilience needs. The most sustainable revenue sources are directly linked to community infrastructure or programmatic needs, such as enterprise funds or value-added taxes.
- Scale of the revenue source. Successfully financing community resilience over the long-term will require a suite of funding resources to support various infrastructure and programmatic needs. Each asset class and project within that asset class should be connected to revenue source(s) sufficient to achieve desired outcomes. Redundancy is essential, both in resilience and financing systems, meaning communities should have multiple funding options for achieving infrastructure goals.
- + Longevity of the revenue source. While short-term grant funding may be an appropriate option in the near-term, St. Mary's County will need to establish permanent, dedicated, and long-term revenue streams.

When developing a revenue plan to support resilience project priorities, it should be assumed that existing local revenues are limited. Any new funding needs and priorities will require new or expanded funding resources. Without new revenue, resilience projects will compete with existing County programs and capital infrastructure projects. Therefore, the focus should be on estimating the necessary increases in public funding to implement the project portfolio over time. The appropriate sources of revenues will be determined as the project portfolio evolves.

Recommendation 5: Develop a long-term cash-flow management and financing plan

A third component in the resilience investment system is financing and cash flow management, which includes borrowing, lending, investing, and forecasting. The financing process represents the culmination of resilience planning, project development, and revenue generation processes. Without the success of these other components, financing capacities are weakened. Conversely, a strong financing process ensures that project development and revenue allocation are efficient and effective.

An effective financing system allows local governments to exercise all powers necessary to undertake, finance, manage, acquire, own, convey, or support resilience infrastructure projects. This includes the ability to:

- Finance using a variety of debt-borrowing mechanisms. As revenue scales up, so must the capacity to manage cash flows through different financing mechanisms. This includes developing and using customized debt instruments such as tax-free municipal bonds, state revolving loan programs, green bonds, and social impact bonds to fund capital projects.
- + Develop financial, contractual, and procurement arrangements. A comprehensive resilience project portfolio requires more than just debt financing; it should also leverage the capabilities and efficiencies of the private sector. Resilience authorities, mentioned in more detail in the next phase, can engage directly with the private sector or establish more complex arrangements, such as design-build-finance-operate-maintain contracts.
- Implement value capture financing mechanisms. These include special assessment districts, tax increment financing, and joint project development. Projects designed to mitigate the impacts of climate change often have specific benefits to communities, requiring specialized, localized financing mechanisms. Public entities responsible for creating and maintaining climate action and resilience infrastructure systems will likely seek mechanisms to financially support these investments. One such mechanism is value capture, which recovers a portion of the increased value public investments bring to private properties. By "capturing" this added value public investment provides to private real estate, governments can recoup costs and potentially generate benefits for other communities. Resilience authorities can play a direct role in providing these value capture services.

Phase 3: Sustained Funding and Financing

Phase 3 focuses on making structural changes to the financing system. This includes expanding institutions and establishing the revenue streams outlined in the Phase 2 strategy.

Recommendation 6: Expand Institutional Structures

A key component of the investment system is institutional capacity. Some communities in Maryland have begun to utilize a new institutional opportunity in the form of resilience financing authorities to enhance capacity. A financing authority can serve multiple roles in the resilience investment process, such as pooling and distributing public and private capital to facilitate large-scale infrastructure investments. The anticipated scale and complexity of long-term climate impacts may overwhelm the existing investment system, making it difficult to manage comprehensive resilience infrastructure project portfolios.

Current institutional structures are insufficient to meet the needs of a comprehensive, countywide portfolio that includes resilience-based programs and project implementation, scaled revenue development, and associated financing. Establishing new institutional structures would enable the County to expand its programming and infrastructure to meet these needs.

In 2020, the Maryland General Assembly passed Senate Bill 457, authorizing local governments to establish resilience authorities to finance projects that mitigate climate change impacts. This provides St. Mary's County with the option to establish and delegate responsibility to a resilience authority to incentivize, scale, and coordinate community-based resilience and renewable energy investments. Key functions may include:

- + Managing a climate action project portfolio. By partnering with County departments and program leaders, the authority can take on the responsibility of establishing and managing a comprehensive climate project portfolio.
- Overseeing fiscal responsibilities. Focusing on project implementation at scale will require developing and maintaining diverse revenue streams. Although S.B. 457 (2020) prohibits authorities from directly assessing taxes or tax-based fees, they can receive funds from a variety of sources, including grants, asset-based revenues, and non-tax-based fees.
- Financing projects. The authority can also be set up for managing traditional debt financing tools like revenue bonds, as well as more innovative mechanisms such as public-private partnerships (P3s), performance-based contract, environmental performance bonds (e.g., green bonds), and value capture programs such as tax increment financing and special service districts.

The charter of a resilience authority should provide it with both independence and the ability to work closely with County officials, staff, and other local leaders to ensure alignment with the needs of the County and NAS PAX community.

Recommendation 7: Establish an Infrastructure Resiliency Fund

Alongside the potential establishment of a resilience authority, St. Mary's County should establish a dedicated fund to support climate infrastructure projects and programmatic investments. The Infrastructure Resiliency Fund (the Fund) would aim to expand resilience investments by achieving efficiencies, economies of scale, and political synergies. The Fund would provide multiple benefits, including:

- + **Prioritizing resilience infrastructure projects.** The targeted nature of the Fund would allow it to focus fiscal resources on the most critical projects. The project prioritization process would enhance the financing process without replacing existing procedures.
- Accelerating and scaling capital through diverse revenue streams. The Fund would focus on targeting investments in projects identified in the resilience plan, potentially enabling the County to incentivize private investment in infrastructure and resilience projects.
- + Establishing effective private-sector partnerships. Public-private partnerships are essential for local resilience design, implementation, maintenance, and financing. The Fund would enable the development of innovative relationships with a wide range of private entities.
- Reducing pressure on County budgets. While the Fund will not eliminate the need for public investment in resilience infrastructure, it could potentially reduce the financial strain on local budgets by creating efficiencies, attracting private investment, and lowering capital costs.
- Stimulating innovation and economic growth. In addition to streamlining financing processes, the Fund could also incentivize investments in industries and businesses that are key to local resilience efforts. This dual economic development -financing focus would ensure that infrastructure investments provide multiple community benefits.

Resiliency Fund Revenues

The Resiliency Fund would support key functions and activities outlined in a future climate action and resilience action plan. It would coordinate key programs and project investments, potentially operating like an enterprise program to manage climate mitigation and adaptation efforts within the county government. Unlike typical enterprise programs that rely on single revenue streams such as service or regulatory fees, the Fund should be designed to secure and leverage multiple revenue streams. A Chief Resilience Officer, through the auspices of the Resiliency Authority, would be responsible for developing a resilience infrastructure revenue plan that addresses the unique needs of both baseline and capital infrastructure projects.

Conclusion

The resiliency of NAS PAX is inextricably linked with activities, decisions, and investments that are made outside of its gates. Climate projections, even under the best case emissions scenario, still present a very different future that will require more coordinated planning and project identification amongst the County and NAS PAX leadership. Infrastructure investments must take into account increased frequency and intensity of storms, flooding, and other extreme weather events and rapidly adopt mitigation and adaptation measures that will safeguard the community from climate change. This cannot be achieved without a sustainable and diverse financing system, or the support of leadership and a governance framework that continually pushes the envelope to identify efficient yet innovative solutions to address the challenges of tomorrow.

The following appendix is the culmination of this Installation Resilience Review process. The table includes actionable steps and a clear list of projects that can be discussed, reflected upon, and built out by the next cohort of stakeholders tasked with moving the County's and NAS PAX's climate resilience ambitions to the next phase.

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Acronyms

ACS- American Community Survey **AICUZ-** Air Installations Compatible Use Zones **A-StoRM-** Advancing Stormwater Resiliency in Maryland **BMPs-** Best management practices **CAT RMS-** Catastrophe Risk Management Solutions **CoOP-** Comprehensive continuity of operations plans **CRO-** Chief Resilience Officer **CRS-** Community Rating System **DEM-** Department of Emergency Management **DHCD-** Department of Housing and **Community Development DNR-** Department of Natural Resources **DoD-** Department of Defense **DoF-** Department of Finance **DPW&T-** Department of Public Works and Transportation **EMS-** Emergency Medical Services **FEMA-** Federal Emergency Management Agency **GO-** General obligation **HAWK-** High-Intensity Activated crossWalK **IRC-** International Residential Code **MDE-** Maryland Department of Environment MetCom- Metropolitan Commission **MGS-** Maryland Geological Survey **MOM-** Maximum of Maximum **NAS PAX-** Naval Air Station Patuxent River **NAVAIR-** U.S. Naval Air Systems Command **NAWCAD-** Naval Air Warfare Center Aircraft Division

NFIP- National Flood Insurance Program

NOAA- National Oceanic and Atmospheric Administration

OLDCC- Office of Local Defense Community Cooperation

P3- Public-private partnership

PFAs- Priority Funding Areas

PFAS- Per- and polyfluoroalkyl substances

RCD- Resource Conservation and Development

REPI- Readiness and Environmental Protection Integration

RRFB- Rectangular Rapid Flashing Beacon

SHARROW- Shared Lane Marking

SLOSH- Sea, Lake, and Overland Surge from Hurricanes

SMECO- Southern Maryland Electric Cooperative

STEM- Science, Technology, Engineering, and/or Math

STS- St. Mary's Transit System

WARM- Wrapping Arms 'Round Many

WARN- Water/Wastewater Agency Response Network

WOLF-Webster Outlying Field

Photo Sources

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Appendix

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline
I	Countywide	All community assets	Prepare a Climate Action Plan	Prepare a Climate Action Plan for the County with greenhouse gas (GHG) emissions reduction targets for identified sectors responsible for the greatest emission (e.g., energy, transportation, waste, procurement processes). Include detailed actions the County can take to help meet those goals.	Short-term (0-3yrs)
2	Cultural Resources	Cultural Resources	Development of Cultural & Historical Resources Plan	Develop a comprehensive Cultural & Historical Resources Plan to safeguard the County's 148 historic sites that are increasingly vulnerable to flooding, erosion, and sea level rise. Identify at-risk structures, assess their vulnerability, and propose adaptive strategies such as elevation, relocation, or floodproofing. Explore the use of protective zoning, grants, and incentives for property owners to preserve these landmarks. By proactively addressing the risks to historic sites, the County can protect its rich heritage and enhance resilience to climate change. Develop the plan in coordination with the Historic Preservation Commission, local stakeholders, and environmental experts, ensuring that the preservation of St. Mary's cultural legacy is balanced with modern hazard mitigation efforts	Short-term (0-3yrs)
3	Cultural Resources	Amish Community Culture	Provide Outreach to the Amish Community on Climate Initiatives	Develop and implement outreach initiatives on climate impacts and best practices for the Amish community, ensuring respect of their cultural heritage and addressing their specific concerns through traditional values and communication methods.	Short-term (0-3yrs)
4	Economic Development	Agriculture	Strengthen Economic Resilience Through Agricultural Innovation and Sustainable Practices	Expand and diversify St. Mary's County's agricultural sector by supporting sustainable farming practices, agribusiness, and aquaculture, creating new economic opportunities and promoting resilience. Build on the growing oyster aquaculture industry by increasing support for oyster aquaculture and other sustainable fisheries through technical assistance and marketing support for local seafood. Encourage innovation in agri-tech by providing funding and incentives for precision farming, drone technology, renewable energy usage, and regenerative farming. Expand initiatives to support farm-to-table programs and sustainable farming practices to help local farms tap into emerging markets.	Med-term (3-5yrs)
5	Economic Development	Emerging Technologies	Foster Growth in Emerging Industries to Build Economic Resilience	Grow emerging industries such as renewable energy, drone technology, and cybersecurity to diversify St. Mary's County's economy. While the county has a strong base in aerospace and defense, there is significant potential to diversify into renewable energy, cybersecurity, and drone technology. Expand partnerships between local businesses, TechPort, and the Southern Maryland Higher Education Center to attract investment and foster innovation in these fields. Integrate oyster aquaculture into the broader blue economy, which includes maritime technology, sustainable seafood, and water-based recreation. Become an EDA Tech Hub Designee through its Tech Hubs Program to access support and benefits from departments and agencies from across the federal government to further the County's tech industry.	Med-term (3-5yrs)
6	Economic Development	Housing and Structures	Improve Emergency Communication through Enhanced Communication Infrastructure	Improve emergency response capabilities and overall public safety through enhanced communication infrastructure in critical buildings. Collaborate with local emergency services to determine minimum signal strength requirements and conduct a survey of existing buildings to identify areas with poor signal reception. Update the building codes to mandate the installation of repeater towers or signal boosters in buildings with poor cellular and radio coverage and to establish guidelines for testing and maintaining signal strength. Consider providing incentives or grants to encourage property owners to retrofit older buildings that do not meet the updated code. Partner with NAS PAX to identify areas where poor communication coverage could affect military operations or the safety of military personnel and their families.	Short-term (0-3yrs)

Potential Grant and Other Supplemental Funding Opportunities

Report Preparation: (*Federal*) **EPA** Climate Pollution Reduction Grants (CPRG) Program, Local Government Climate and Energy Program | (*State*) **MDE** Greenhouse Gas Reduction Act (GGRA) Grants | Bloomberg Philanthropies | The Kresge Foundation

Implementation: (Federal) DoD OLDCC Defense Community Infrastructure Program (DCIP), Readiness and Environmental Protection Integration (REPI) Program | DOE Energy Efficiency and Conservation Block Grant (EECBG), Better Buildings Initiative (BBE) | USDA Rural Energy for America Program (REAP), Climate-Smart Agriculture and Forestry Initiative | (State) MDE Climate Resilience Grants | MEA Clean Energy Communities Low-to-Moderate Income (LMI) Grant Program

(Federal) **FEMA/MDEM** Hazard Mitigation Program, Building Resilient Infrastructure and Communities (BRIC) program

(*Federal*) **EPA** Environmental Education Grant | **NOAA** Climate Program | (*State*) **CBT** Outreach and Education grants | | Maryland Environmental Trust

(Federal) USDA Specialty Crop Block Grant Program, Value-Added Producer Grant (VAPG), Environmental Quality Incentives Program (EQIP), and Rural Business Development Grants (RBDG) | (*State*) DNR Aquaculture Development Fund | MDA Maryland Agricultural Water Quality Cost-Share Program (MACS)

(Federal) DOE Renewable Energy and Energy Efficiency Grants | EDA Tech Hubs Program and Economic Adjustment Assistance grants | USDA Rural Energy for America Program (REAP) and Local Food Promotion Program (LFPP) | (*State*) MDC Advantage Maryland grants (MEDAAF) | RMC Rural Maryland Prosperity Investment Fund (RMPIF) | MEA Clean Energy Grant Program | TEDCO Rural Business Innovation Initiative (RBI2)

(Federal) DHS Urban Areas Security Initiative (UASI) | DoD OLDCC Defense Community Infrastructure Program (DCIP), Community Partnership Program, and Cooperative Agreements | FEMA/MDEM Homeland Security Grant Program (HSGP) and Assistance to Firefighters Grant (AFG) | HUD/DHCD Community Development Block Grants (CDBG) | (Other) Publicprivate partnerships with utility or telecom services

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline
7	Economic Development	Housing and Structures	Incentivize Affordable Housing Development through Public-Private Partnerships	Proactively incentivize the development of affordable housing to address the growing need for housing that is accessible to all income levels while fostering economic growth and community development. Consider issuing a Request for Proposal (RFP) to attract developers willing to construct mixed-income residential units with a focus on affordable housing. As part of this initiative, offer incentives such as reductions in fees, tax abatements, and streamlined permitting to encourage development that aligns with the county's housing and economic development goals.	Long-term (5yrs+)
8	Economic Development	Tourism	Expand Tourism through Heritage, Nature, and Agritourism	Capitalize on St. Mary's County's historic landmarks, waterfronts, and rural landscapes by developing heritage tourism packages, improving eco-tourism infrastructure (e.g., trails and water access), and expanding agritourism offerings. Further promote the county's thriving vineyard and agritourism industry, including popular destinations like Slack Winery and Port of Leonardtown Winery, to enhance agritourism. Enhance experiential tourism with activities like farm stays, vineyard tours, guided fishing trips, and oyster harvest tours to attract more visitors, support rural communities, and boost the local economy.	Med-term (3-5yrs)
9	Economic Development	Workforce	Strengthen Workforce and Housing to Attract Younger Workers and Support Economic Growth	Make St. Mary's County more attractive to younger workers by prioritizing the development of affordable housing and enhanced local amenities, particularly in Lexington Park and California, which are near NAS PAX. These areas are ideal for mixed-use developments that combine residential, commercial, and recreational spaces, creating vibrant, affordable communities attractive to younger workers. Additionally, support entrepreneurship through public markets, shared workspaces, financial incentives, and "Buy Local" campaigns to foster an innovative, community-driven economy. Creating "third spaces" such as internet cafes, recreation centers, and co-working spaces will further enhance quality of life and promote long-term settlement.	Med-term (3-5yrs)
10	Emergency Preparedness and Response	9-1-1 and Emergency Operation Centers	Enhance Backup Capabilities for 9-1-1 and Emergency Operations Centers	Upgrade the backup power and communication systems for the County's 9-1-1 dispatch center and Emergency Operations Centers (EOC) to ensure uninterrupted service during emergencies. Install redundant power supplies (e.g., additional generators and battery storage) and secondary communication systems that can operate independently of the primary network. Doing so will improve the County's ability to maintain continuous emergency response and coordination, even during power outages, natural disasters, or cyber incidents. Assess current vulnerabilities. Secure funding for upgrades and integrate new technologies that bolster resilience in emergency management to ensure the safety and preparedness of residents, reduce response times, and maintain operational integrity during crisis situations.	Med-term (3-5yrs)
11	Emergency Preparedness and Response	Emergency Operation Center	Design and Construct New Emergency Operations Center	Demolish the former Garvey Center and construct a new three-story, 25,500 SF Emergency Operations Center in its place. Finalize the construction drawings in FY 2026, with demolition of the Garvey Center in and construction of the new building in FY 2030.	Short-term (0-3yrs)
12	Emergency Preparedness and Response	Emergency Preparedness	Conduct and Align CoOP Exercises with Tabletop Resilience Drills and NAS PAX Coordination	Conduct regular exercises of the Continuity of Operations Plan (CoOP) to identify areas for improvement and ensure the plan remains relevant and effective. During these exercises, update inconsistencies or outdated information. Coordinate resilience-related tabletop exercises with NAS PAX and incorporate updates to the CoOP to maintain a unified and comprehensive approach to emergency preparedness and operational resilience.	Short-term (0-3yrs)
13	Emergency Preparedness and Response	Emergency Response	Analyze Staffing Needs to Improve Emergency Response Efficiency	Conduct a comprehensive analysis of response data from St. Mary's County emergency stations to identify areas where additional staff and paid positions are necessary. By making informed manning decisions, the County can enhance response times, reduce dependency on neighboring communities like Charles County for assistance, and strengthen overall emergency service.	Short-term (0-3yrs)

Potential Grant and Other Supplemental Funding Opportunities

(Federal) HUD/DHCD HOME Investment Partnerships Program and Community Development Block Grants (CDBG) | FHFA Fannie Mae, Freddie Mac | (Other) Payment in Lieu of Taxes (PILOT) Agreements | Inclusionary Zoning Fees, Development Impact Fees | Waiving of Adequate public facilities (APF) provisions | Bonus densities | Establishment of a Local Housing Trust Fund | Establishment of a Employer-Assisted Housing (EAH) program | General Obligation bonds | Revenue bonds | State Infrastructure Bank (SIB) Ioans; Federal and state Low-Income Housing Tax Credit (LIHTC) programs

(Federal) EDA Public Works and Economic Adjustment Assistance Program |(State) MDC Rural Maryland Economic Development Fund | MHAA Grants | MTDB Grants | USDA Rural Economic Development Loan & Grant Program in Maryland

(Federal) EDA Good Jobs Challenge, STEM Talent Challenge | HUD/DHCD Community Development Block Grants, Community Legacy Program, HOME Investment Partnerships Program, Sustainable Communities Program | USDA Rural Development Multifamily Housing

(Federal) **DHS** State and Local Cybersecurity Grant Program | **FEMA/MDEM** Emergency Operations Center (EOC) Grant, Emergency Management Performance Grant (EMPG), and Homeland Security Grant Program

(Federal) **FEMA/MDEM** Pre-Disaster Mitigation (PDM) grant program

(Federal) FEMA/MDEM Emergency Management Performance Grant (EMPG) and Homeland Security Grant Program | DHS Targeted Violence and Terrorism Prevention Grant Program | DoD OLDCC Defense Community Infrastructure Program (DCIP) grants

(Federal) FEMA/MDEM Emergency Management Performance Grant (EMPG) and Homeland Security Grant Program | DHS Targeted Violence and Terrorism Prevention Grant Program | DoD OLDCC Defense Community Infrastructure Program (DCIP) grants
No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline
14	Emergency Preparedness and Response	Flood Prone Assets	Update the Nuisance Flood Plan and Identify Evacuation Route Improvements	As the nuisance flood plan is updated, consider dividing the County by drainage areas to make the process more manageable. Assign each area a flood protection level of service (FPLOS) and prioritize them accordingly, referencing the South Florida Water Management District. Identify and prioritize long-term infrastructure improvements within each area, focusing on implementing low-cost measures first and moving to full replacements only when necessary. Install permanent flood signs along roads, particularly in flood-prone areas, to ensure evacuation routes remain visible during emergencies. Raise community awareness to familiarize residents with these routes, and prioritize the heightening of roads leading to emergency shelters and designated evacuation routes.	Short-term (0-3yrs)
15	Emergency Preparedness and Response	Flood Prone Assets	Continue Efforts to Inventory and Analyze Areas at Greatest Risk of Frequent Flooding	Ensure issues identified in the state-mandated nuisance flood plan have an associated action for resolving the cause of the flooding, not simply managing incidents as they occur. As sea levels rise and more frequent and intense storms take place, the locations identified in these plans will flood more often and with greater intensity, and additional locations will qualify for inclusion in the plan. Use data to identify areas at greatest risk of frequent flooding and propose CIP project(s) to mitigate flood impacts.	Ongoing
16	Emergency Preparedness and Response	Flood Prone Assets	Elevate, Relocate, Floodproof, or Demolish Properties Experiencing Repetitive Loss from Floods	Evaluate repetitive loss structures for potential elevation projects; provide opportunities for property owners to relocate when desired.	Med-term (3-5yrs)
17	Emergency Preparedness and Response	Flood Prone Assets	Modify Substantial Improvement Standards to Enhance Property Protection	Update the County's Substantial Improvement Standards to strengthen property protection against flooding and other hazards through more robust enforcement of building codes and floodplain management regulations. Revise the definition and thresholds for "substantial improvements" to ensure that any significant renovation or repair project on properties within flood-prone areas meets modern flood protection standards. By requiring elevated construction, floodproofing, or other mitigation measures, these updated standards will reduce the risk of property damage and improve public safety. Enhancing these regulations aligns with the County's broader floodplain management strategy, helping to protect residents, lower flood insurance premiums, and ensure compliance with FEMA's National Flood Insurance Program (NFIP) requirements.	Med-term (3-5yrs)
18	Emergency Preparedness and Response	Flood Prone Assets	Implement Neighborhood Drainage Improvements and Rehabilitation Projects on and along County Maintained Roads and Bridges	Design and correct drainage deficiencies on County maintained roads and bridges in response to 311 citizen complaints on flooding where detailed design work is necessary. Proactively design projects to address increased water volume and velocity in drainage systems based on Maryland A-StoRM draft recommendations. Focus efforts to assess drainage in communities throughout the County identified through the County Nuisance Flooding Plan inventory process. Mitigation sites include but are not limited to: Golden Beach Subdivision, St. Clements Shores, Tall Timbers, Green View Knolls (Belvoir Rd), Cecils Mill Subdivision, Hickory Hills Subdivision, Broadcreek Subdivision, Ellis Road, and Sandgate Road, as well as many other areas with either historical flooding or vulnerable locations to drainage issues.	Ongoing
19	Emergency Preparedness and Response	Flood Prone Assets (State)	Implement Drainage Improvements and Rehabilitation Projects on State Highways, Bridges, and Other Roads	Work with the State to correct drainage deficiencies on State maintained highways, bridges, and other roadways. Proactively design projects to address increased water volume and velocity in drainage systems based on Maryland A-StoRM draft recommendations. Focus efforts to assess drainage in communities throughout the County identified through the County Nuisance Flooding Plan inventory process. Mitigation sites include but are not limited to: MD 5 from MD 246 to MD 471; MD 249 St. George Island Shore Erosion Shoreline Resiliency Project; MD 243 Newtown Neck Rd Flooding Correction; Elevating MD Route 243 near McIntosh Run and where Nelson Run joins it.	Short-term (0-3yrs)
20	Emergency Preparedness and Response	Resilience Hub	Conduct Preconstruction Planning for Micro-Grids and Resilience Hub	Conduct preconstruction planning for the establishment of micro-grids and resilience hub in Lexington Park to complement emergency response efforts during and after disasters. Lexington Park is both adjacent to the base and includes the County's highest concentration of lower income and minority residents.	Short-term (0-3yrs)

Potential Grant and Other Supplemental Funding Opportunities

(Federal) FEMA/MDEM Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP) Pre-Disaster Mitigation (PDM), and Building Resilient Infrastructure and Communities (BRIC) | USACE Silver Jackets (technical assistance) | HUD/DHCD Community Development Block Grants (CDBG) | (*State*) DNR Grant Gateways Outcome 2 | MDE Comprehensive Flood Management Grant Program (CFMGP)

(Federal) FEMA/MDEM Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Pre-Disaster Mitigation (PDM) | HUD/DHCD Community Development Block Grants (CDBG) | USACE Flood Risk Management program (*State*) DNR Grant Gateways Outcome 2 | MDE Comprehensive Flood Management Grant Program (CFMGP)

(Federal) **FEMA/MDEM** Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program, Building Resilient Infrastructure and Communities (BRIC), and Severe Repetitive Loss Program | **HUD/DHCD** Community Development Block Grants (CDBG)

(Federal) FEMA/MDEM Flood Mitigation Assistance Program

(Federal) DOT Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) grants | FEMA/MDEM Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Pre-Disaster Mitigation (PDM) | USACE Continuing Authorities Program | NFWF National Coastal Resilience Fund | (State) CBT Watershed Assistance Grant Program | DNR Grants Gateway Outcome 3 | MDE Comprehensive Flood Management Grant | MDEM Resilient Maryland Revolving Loan Fund (RLF)

(Federal) **DOT** Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) grants | (*State*) **MDOT** Transportation Trust Fund

(Federal) **FEMA/MDEM** Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Pre-Disaster Mitigation (PDM) | (*State*) MEA Resilient Maryland Program

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline
21	Emergency Preparedness and Response	Volunteer Emergency Coordinators	Strengthen Volunteer Recruitment, Retention, and Support for Emergency Response Preparedness	Develop and implement strategies to incentivize and retain volunteers in emergency response roles by providing enhanced benefits and professional development opportunities. Potential approaches include granting access to benefits or retirement savings programs, covering the cost of certifications and training, creating a supportive environment that recognizes the critical role volunteers play in community safety and disaster preparedness, and offering a stipend per call for volunteer staff.	Med-term (3-5yrs)
22	Energy	Energy systems	Establish Partnerships and a Renewable Energy Plan to Transition Existing County-owned Facilities and Vehicle Fleets to Renewable Energy.	Partner with other Southern Maryland jurisdictions and SMECO to create market-like incentives that enhance the reliability of the energy system. Consider transitioning government operations, beginning with public schools, to 100% renewable energy and develop a comprehensive GHG reduction plan aligned with state goals. Implement an energy efficiency retrofit program for government and school facilities, funding upgrades through future energy cost savings. Establish a phased replacement program to transition the county's vehicle fleet, including public transit, to renewable energy sources. Encourage residents and businesses to participate in SMECO's purchase of renewable energy credits program and work with SMECO to transfer meeting this new demand signal to production locally.	Short-term (0-3yrs)
23	Fiber Optics	Fiber Optics and Broadband	Continue to Build out Broadband Network to 100%	Continue to strategically build out the County's wired broadband network to 100%, specifically including "orphaned" areas such as homes and communities with long driveways or private access roads. The County is on track to reach 98% of County addresses where a request for connection has been received. There are approx. another 912 registered addresses with no request received for wired broadband. Find ways to personally contact and survey unserved households to inform them about the broadband expansion project and gauge their interest and/or address barriers preventing them from requesting broadband. Continue to extend broadband regardless of formal requests.	Short-term (0-3yrs)
24	Fiber Optics	Fiber Optics and Broadband	Enhance Network Resilience and Equity	Subsequent to achieving 100% broadband coverage countywide, develop a comprehensive plan to enhance the survivability of vulnerable network elements, including burying cable to reduce exposure to environmental damage; implementing strategies to minimize dependence on WiFi; monitoring outages and evaluate impacts on different communities, particularly for underserved populations; prioritize improving the resilience of critical areas closest to NAS PAX; coordinate with NAS PAX representatives to ensure seamless alignment and prioritization during implementation.	Med-term (3-5yrs)
25	Fiber Optics	Fiber Optics and Broadband	Implement a Comprehensive Cybersecurity Strategy	Implement a comprehensive, robust cybersecurity strategy enhance the county's resilience to cyber threats and safeguard critical systems and data. Ensure staff are trained and equipped to recognize and respond to threats; strengthen network defenses by utilizing advanced firewalls to prevent unauthorized access; engage third-party experts for ethical hacking to preemptively ID vulnerabilities in the system; establish county positions solely focused on managing and advancing cybersecurity efforts; ensure sensitive data is securely encrypted to protect against breaches and unauthorized access; and implement dual factor authentication.	Short-term (0-3yrs)
26	Finance	All community assets	Establish/Appoint a Chief Resilience Officer	Create a Chief Resilience Officer (CRO) position, which would play a crucial role in supporting both the County and NAS PAX by streamlining planning and oversight of disaster mitigation and climate resilience projects.	Short-term (0-3yrs)
27	Finance	All community assets	Establish a Permanent Climate Action Committee	Form a permanent NAS PAX and St. Mary's County Climate Action and Resilience Committee to build upon existing collaboration to advance environmental, economic, and social initiatives.	Short-term (0-3yrs)
28	Finance	All community assets	Create a Comprehensive Project Portfolio	Expand upon initial risk and vulnerability assessment and asset inventory to build a detailed mitigation and adaptation strategy.	Short-term (0-3yrs)
29	Finance	All community assets	Develop a Long-term Regional Resilience Revenue Strategy	Identify sustainable revenue sources that take into considerations balancing cost benefits, achieving fairness in financing, ensuring equity in financing and implementation, and expanding cooperation.	Med-term (3-5yrs)

(Federal) **FEMA/MDEM** Emergency Management Performance Grant (EMPG) | **CNCS** AmeriCorps Grants

(Federal) **DOE** Energy Efficiency and Conservation Block Grant (EECBG)

(*Federal*) **FCC** Rural Digital Opportunity Fund (RDOF) and Affordable Connectivity Program (ACP) | **HUD/DHCD** Maryland Broadband Equity, Access, and Deployment (BEAD) Broadband Challenge Process | **USDA** Community Connect Grants | (*State*) **OSB** Connect Maryland Grants

(Federal) FCC Rural Digital Opportunity Fund (RDOF) and Affordable Connectivity Program (ACP) | HUD/DHCD Maryland Broadband Equity, Access, and Deployment (BEAD) Broadband Challenge Process | USDA Community Connect Grants | (State) OSB Connect Maryland Grants

(Federal) **FEMA/MDEM** State and Local Cybersecurity Grant Program

(Federal) **FEMA/MDEM** Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) |

-N/A-

(Federal) DoD Defense Community Infrastructure Program (DCIP) | EPA Climate Pollution Reduction Grants (CPRG) Program, Local Government Climate and Energy Program | FEMA/MDEM Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) | HUD/DHCD Community Development Block Grant (CDBG) Program -Mitigation | (State) DNR Grants Gateway Outcome 2

Future task

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline	Potential Grant and Other Supplemental Funding Opportunities
30	Finance	All community assets	Develop a Long-term Cash-flow Management and Financing Plan	Establish cash flow management and financing plan that includes borrowing, lending, investing, and forecasting.	Med-term (3-5yrs)	-N/A-
31	Finance	All community assets	Expand Institutional Structures	Broaden institutional capacity, such as through the creation of a resilience financing authority, which can aggregate and distribute public and private capital for large infrastructure investments.	Long-term (5yrs+)	-N/A-
32	Finance	All community assets	Establish an Infrastructure Resiliency Fund	Establish a dedicated fund for climate focused infrastructure projects and programmatic investments.	Long-term (5yrs+)	-N/A-
33	Housing and Structures	Structures	Increase Freeboard in Moderate and Minimal Flood Risk Areas	Within riverine and tidal influenced floodplains, encourage 2 feet of freeboard for non-critical structures such as housing, community centers, independent living for the elderly, commercial activities, and non-critical roads and bridges which do not serve as the sole egress from flood-prone areas to the base flood elevation. Encourage 3 feet of freeboard to the base flood elevation within riverine and tidal influenced floodplains for hospitals, nursing homes, fire and police stations, and critical roads and bridges providing sole egress from flood-prone areas. Encourage a minimum of 1 foot of freeboard to the base flood elevation in all other Moderate and Minimal Flood Risk Area.	Short-term (0-3yrs)	(Federal) FEMA/MDEM Flood Mitigation Assistance (FMA) Program USACE Floodplain Management Services (FPMS) Program, Siver Jackets (both technical assistance)
34	Natural Resources, Water Resources	Drinking Water, Wastewater, Agriculture, Natural Resources	Prepare a Saltwater Intrusion Plan	Coordinate with the Maryland Geological Survey and Maryland Department of Natural Resources to better understand the impacts of saltwater intrusion and salinization on St. Mary's County and NAS PAX. Work to Identify vulnerable wells and underground infrastructure within the projected inundation areas that could negatively impact groundwater via saltwater intrusion. Identify vulnerable water users of superficial aquifer within sea level rise inundation areas. Encourage and support state efforts to conduct water-level and water- quality monitoring, as well as a systematic assessment of the effects from domestic withdrawals, the extent to which the aquifers are being recharged, and identify areas at greatest risk of saltwater intrusion affecting groundwater wells.	Short-term (0-3yrs)	(Federal) NOAA Coastal Resilience Grants Program and National Coastal Zone Management Program USGS WaterSMART Program (technical assistance) and Cooperative Matching Funds (CMF) Program (State) DNR Grants Gateway Outcome 2 MDE Drinking Water Supply Assistance Program
35	Natural Resources	Floodplain	Preserve Cleared Floodplain Land as Permanent Open Space	Adopt an ordinance to ensure that any floodplain land cleared for flood mitigation or property buyout remains designated as permanent open space to prevent future development in high-risk flood areas, reduce the potential for flood damage, and enhance natural floodplain functions. Submit the ordinance for approval to the County Commission and Leonardtown Commissioners, emphasizing the importance of maintaining these areas as green spaces to support stormwater management, habitat conservation, and recreational opportunities. Preserving these floodplain areas in perpetuity will safeguard public safety, improve water quality, and strengthen community resilience to flooding events, while also aligning with FEMA's open space preservation goals under the National Flood Insurance Program (NFIP).	Long-term (5yrs+)	(<i>Federal</i>) FEMA/MDEM Building Resilient Infrastructure and Communities (BRIC) (<i>State</i>) DNR Community Parks and Playgrounds, Grants Gateway Outcome 2, and Program Open Space MDE Comprehensive Flood Management Grant Program MDOT Recreational Trails Program
36	Natural Resources	Land Preservation	Coordinate Land Preservation Efforts with NAS PAX	Strengthen alignment of County land preservation efforts with NAS PAX mission concerns and initiatives. Leverage DoD and federal programs, such as the Readiness and Environmental Protection Integration (REPI) and Sentinel Landscapes, to complement local and state programs like Rural Legacy, Program Open Space, and the Maryland Agricultural Land Preservation Foundation (MALPF) for enhanced conservation impact. Consider establishing a new or expanded Rural Legacy Area boundary to focus on the NAS PAX mission buffer area, ensuring long-term protection and compatibility with military operations.	Short-term (0-3yrs)	(<i>Federal</i>) DoD Readiness and Environmental Protection Integration (REPI) (<i>State</i>) DNR Program Open Space, Rural Legacy Program MDA Maryland Agricultural Land Preservation Foundation MALPF
37	Natural Resources	Land Preservation	Prioritize the Protection of Strategic Areas in Land Preservation Efforts	Incorporate prioritized areas into St. Mary's County's land preservation goals, focusing on the importance of specific locations rather than solely on meeting acreage targets. "Where" land is preserved should take precedence over "how much" is preserved to maximize the effectiveness and impact of conservation efforts.	Short-term (0-3yrs)	(Federal) DoD Readiness and Environmental Protection Integration (REPI) (State) DNR Program Open Space, Rural Legacy Program MDA Maryland Agricultural Land Preservation Foundation MALPF
38	Natural Resources	Land Preservation	Maximize Resource Allocation Efforts around the Southern MD Woodlands National Wildlife Refuge	Coordinate local, state, and federal initiatives under the new MD Woodlands National Wildlife Refuge designation in collaboration with NAS PAX to maximize resource allocation and enhance conservation efforts. The future establishment of the Southern Maryland Woodlands National Wildlife Refuge across Anne Arundel, Calvert, Charles, Prince George's, and St. Mary's counties will create additional funding and partnership opportunities for land preservation efforts in St. Mary's County.	Med-term (3-5yrs)	(Federal) NOAA Coastal and Estuarine Land Conservation Program USFWS Land and Water Conservation Fund; USFWS National Wildlife Refuge System (<i>State</i>) DNR Maryland Agricultural Land Preservation Foundation and Program Open Space

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline
39	Natural Resources	Shoreline	Prepare a Shoreline Management Plan for Coastal Resilience	Develop a comprehensive shoreline management plan that incorporates nature-based solutions to enhance resilience against nuisance flooding, sea level rise, and coastal storms. Focus on public lands such as parks and permanently preserved properties, and prioritize dual-benefit initiatives like oyster reef restoration, oyster aquaculture expansion, and the creation of living shorelines that facilitate marsh migration and wildlife corridors. Coordinate closely with NAS PAX on shoreline restoration efforts to ensure continuity and reduce the potential for gaps in protection.	Short-term (0-3yrs)
40	Roads and Transportation	Roads	Integrate Climate- Resilient Materials and Planning into Road Infrastructure Projects	Prioritize the use of materials designed to withstand extreme weather, natural disasters, and the long-term effects of climate change in all road infrastructure projects. During the county's annual budget process, establish an administrative process to ensure that capital projects are planned with projected climate impacts in mind. This process should account for how climate change may affect future user groups, ensuring that infrastructure remains safe, functional, and resilient over time.	Med-term (3-5yrs)
41	Roads and Transportation	Roads and Transportation (general)	Integrate State Scoring Model and Evaluation Criteria for Transportation Projects	Utilize the Maryland State Chapter 30 Scoring Model when communicating priority transportation projects to state authorities. Ensure all projects are evaluated for environmental stewardship, cost-effectiveness, and their contribution to improving resilience.	Short-term (0-3yrs)
42	Roads and Transportation	Roads and Transportation (general)	Optimize Public Transit Coordination and Remote Work Opportunities	Collaborate with NAS Patuxent River (NAS PAX) to align St. Mary's Transit System (STS) routes and schedules with the base's operations, focusing on optimizing transit availability during peak commute times. Ensure the coordination includes efficient internal distribution across the base to reduce traffic congestion and improve accessibility for personnel. Additionally, enhance remote work opportunities for County employees by maximizing telework policies and support systems, aiming to reduce overall commuting demand and improve work-life balance.	Short-term (0-3yrs)
43	Roads and Transportation	Sidewalks	Provide Safe Routes to Schools in St. Mary's County	Ensure safer, more accessible routes for students at St. Mary's County's Schools, especially in higher traffic volume areas like Lexington Park (e.g., Carver Elementary and Lexington Park Elementary). Install high-visibility crosswalks with pedestrian signals and traffic-calming measures near school entrances to reduce the risk of accidents and promote walking as a viable and healthy option. Consider adding raised crosswalks, curb extensions, and flashing beacons to slow traffic and make students more visible to drivers. Integrate street trees and other green infrastructure along routes to schools to improve stormwater management, provide shade, and enhance pedestrian comfort.	Med-term (3-5yrs)
44	Roads and Transportation	Thomas Johnson Bridge/MD 4	Replace and Expand Thomas Johnson Bridge/ MD 4	Replace the two-lane bridge spanning the Patuxent River and linking Calvert and St. Mary's Counties on MD 4 with a new four-lane bridge on the south/east side of the existing bridge. Include shoulders on both sides and a separate bicycle/pedestrian path.	Long-term (5yrs+)
45	Water Resources	All community assets	Implement Watershed Assessments and Floodplain Studies Utilizing NOAA Atlas 14 Precipitation Data	Require comprehensive Watershed Assessments and Floodplain Studies for development and infrastructure projects to integrate the latest precipitation frequency estimates from the NOAA Atlas 14 Precipitation Table. Evaluate community characteristics, identify flooding issues, and provide actionable alternatives to mitigate flooding hazards. By leveraging updated rainfall data, the County can better identify flood-prone areas, evaluate causes of flooding, and design effective flood mitigation solutions. As NOAA prepares to release Atlas 15, the County should commit to proactively updating precipitation data in future flood assessments to account for evolving climate model projections. This forward-thinking approach will ensure that St. Mary's County is equipped to manage both current and future flood risks, enhancing community resilience and public safety.	Short-term (0-3yrs)

Potential Grant and Other Supplemental Funding Opportunities

(Federal) DoD Readiness and Environmental Protection Integration (REPI) Program | HUD/DHCD Community Development Block Grant | NOAA Bipartisan Infrastructure Law Coastal Zone Management Habitat Protection and Restoration and National Coastal Resilience Fund grants | USACE Section 204 of the Water Resources Development Act | (State) DNR Coastal and Estuarine Land Conservation Program and Maryland Agricultural Land Preservation Foundation (MALPF) | (Other) Community Development Financial Institutions (CDFI)

(Federal) DOT Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grants | FEMA/MDEM Hazard Mitigation Assistance (HMA) Program | FHWA Resilience Pilot Program; Better Utilizing Investments to Leverage Development (BUILD) and Infrastructure for Rebuilding America (INFRA) grant programs | FHWA Climate Challenge Program

-N/A-

(Federal) DoD Defense Community Infrastructure Pilot Program (DCIP) | DOT Congestion Mitigation and Air Quality Improvement (CMAQ) Program | FHWA Surface Transportation Block Grant Program (STBG) | FTA Sec. 5307 Urbanized Area Formula Grants, Sec. 5311 Rural Areas Formula Grants, and Transportation Alternatives Program | (State) MDOT Statewide Transit Innovation Grant

(Federal) **MDOT** Safe Routes to School (SRTS) Program and Transportation Alternatives Program (TAP); U.S. Department of Transportation (DOT) Safe Streets and Roads for All (SS4A) Grant Program

(Federal) DoD Defense Community Infrastructure Program (DCIP) and Military Access, Mobility & Safety Improvement Program (MAMSIP) grants | DOT Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Federal Lands Access Program (FLAP) grants | FHWA Bridge Investment Program, Bridge Formula Program, and Infrastructure for Rebuilding America (INFRA), Nationally Significant Freight and Highway Projects (NSFHP), and Surface Transportation Block Grant (STBG) | (State) MDOT Transportation Trust Fund

(Federal) FEMA/MDEM Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program, and Building Resilient Infrastructure and Communities (BRIC) | USACE Silver Jackets (technical assistance) | HUD/DHCD Community Development Block Grants (CDBG) | (*State*) DNR Grant Gateways Outcome 2

No.	Category	Community Asset(s) Addressed	Projects and Initiatives	Description	Timeline	Potential Grant and Other Supplemental Funding Opportunities
46	Water Resources	Drinking Water	Address Declining Groundwater Levels and Reduce Reliance on Groundwater for Potable Water	Consider alternative sources like a surface water plant (potentially with NAS PAX), purchase agreements with other jurisdictions, or other controllable sources for drinking water. Mitigate groundwater contamination risks from sources like abandoned oil and gas wells, drinking wells, or septic systems at risk of becoming submerged due to sea level rise. For non-potable water, explore water reclamation options to reuse treated wastewater (e.g., treated effluent from the Marlay-Taylor Water Reclamation Facility) or stormwater for irrigation, industrial uses, and other non-drinking purposes, reducing pressure on potable water supplies. Identify areas where water reuse projects may be feasible.	Short-term (0-3yrs)	(Federal) USBR WaterSMART Water and Energy Efficiency Grants USGS WaterSMART Program (technical assistance) and Cooperative Matching Funds (CMF) Program (<i>State</i>) MC Drinking Water Supply Assistance Program
47	Water Resources	Drinking Water	Build and Maintain Drinking Water System Redundancy and Efficiency	Build water system redundancy to provide greater resilience. Capital projects should be planned and projected within the capital budget. Conduct periodic preventive maintenance and regular testing of existing redundant infrastructure features to ensure functionality.	Long-term (5yrs+)	(Federal) USBR WaterSMART Water and Energy Efficiency Grants USGS WaterSMART Program (technical assistance) and Cooperative Matching Funds (CMF) Program (State) MC Drinking Water Supply Assistance Program
48	Water Resources	Drinking Water	Complete a Lead Service Inventory	Complete a lead service line inventory to identify lead service lines in the drinking water system and take action to address any locations with high lead levels, including any that may exist aboard NAS PAX.	Short-term (0-3yrs)	(Federal) EPA Reducing Lead in Drinking Water Grant (WIIN) EPA/MDE Drinking Water Revolving Loan Fund (DWRLF)
49	Water Resources	Drinking Water, Wastewater	Increase Water System Efficiency through I&I Initiatives	Continue to plan for and fund annual projects aimed at increasing water system efficiency (Inflow & Infiltration initiatives) including leak location and repairs as well as voluntary consumption restrictions. Further ensure that pipes are protected from groundwater infiltration due to climate-change-induced sea level rise.	Ongoing	(Federal) EPA Climate Ready Water Utilities (CRWU) Initiativ (technical support) FEMA/MDEM Building Resilient Infrastructure and Communities (BRIC) Program and Hazard Mitigation Grant Program (HMGP) USDA Water and Waster Disposal Loan and Grant Program
50	Water Resources	Stormwater	Update and Strengthen Stormwater Regulations	Proactively update stormwater regulations to address increased water volume and velocity in drainage systems based on Maryland A-StoRM draft recommendations. Establish clear policies among local government, developers, HOAs, and private property owners on the maintenance responsibilities of stormwater facilities. Effectively communicate and enforce regulations, with a focus on equitable solutions. Plan for phased retrofits of existing infrastructure, with shared costs between public and private sectors, ensuring long-term resilience in stormwater management.	Short-term (0-3yrs)	(<i>Federal</i>) FEMA/MDEM Hazard Mitigation Grant Program and Building Resilient Infrastructure and Communities (BRIC) Program
51	Water Resources	Wastewater	Build Redundancy in NAS PAX Wastewater Treatment	NAS PAX does not treat its own wastewater. Explore options to build redundancy between wastewater treatment facilities to store and treat NAS PAX-generated wastewater to increase community resiliency. Identify options to divert flow to alternative facilities to provide greater protection against contingencies.	Med-term (3-5yrs)	(Federal) DoD Defense Community Infrastructure Pilot Progr (DCIP) FEMA/MDEM Hazard Mitigation Grant Program and Building Resilient Infrastructure and Communities (BRIC) Program USDA Water and Waste Disposal Loan and Grant Program
52	Water Resources	Wastewater Pumping Stations	Floodproof MetCom Pump and Lift Stations	Floodproof any MetCom wastewater pump stations or lift stations that have been identified through hazard mitigation planning efforts as being impacted in the event of a dam breach. These need to be flood proofed.	Med-term (3-5yrs)	(<i>Federal</i>) FEMA/MDEM Building Resilient Infrastructure and Communities (BRIC) program; (<i>State</i>) MDE Comprehensive Flood Management Grant program.

Federal Acronyms

Corporation for National and Community Service (CNCS) | U.S. Army Corps of Engineers (USACE) | U.S. Department of Agriculture (USDA) | U.S. Department of Defense (DoD) | U.S. Department of Energy (DOE) | U.S. Department of Homeland Security (DHS) U.S. Department of Housing and Urban Development (HUD) U.S. Department of Transportation (DOT) U.S. Bureau of Reclamation (USBR) U.S. Environmental Protection Agency (EPA) U.S. Federal Communications Commission (FCC) U.S. Federal Highway Administration (FHWA) | U.S. Federal Housing Finance Agency (FHFA) | U.S. Federal Transit Administration (FTA) | U.S. Fish and Wildlife Service (USFWS) | U.S. Economic Development Administration (EDA)

State Acronyms

Chesapeake Bay Trust (CBT) | Drinking Water State Revolving Fund (DWSRF) | Maryland Department of Agriculture (MDA) | Maryland Department of Commerce (MDC) | Maryland Department of Emergency Management (MDEM) | Maryland Department of Housing and Community Development (DHCD) | Maryland Department of Natural Resources (DNR) | Maryland Department of Transportation (MDOT) | Maryland Energy Administration (MEA) | Maryland Heritage Areas Authority (MHAA) | Maryland Technology Development Corporation (TEDCO) | Maryland Tourism Development Board (MTDB) | Office of Statewide Broadband (OSB) | Rural Maryland Council (RMC)

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