Jamestown Resiliency Plan

Jamestown Island, VA

OCTOBER 2022



PREPARED FOR

Preservation Virginia

PREPARED BY

VHB

Stemann | Pease Architecture

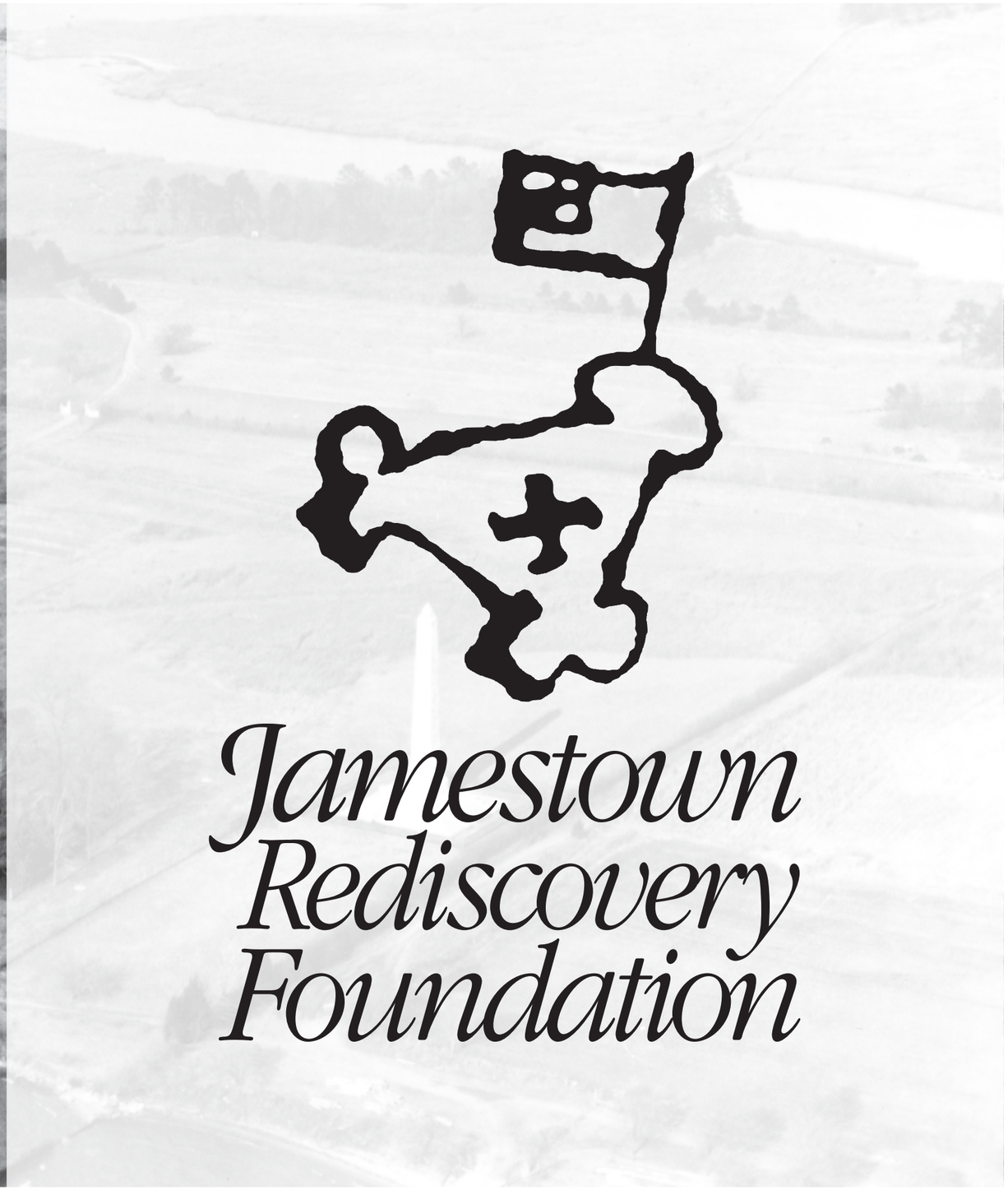
Jamestown Rediscovery Foundation



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Jamestown Rediscovery Foundation

Purpose and Need

Observed hazards at Jamestown Island including sea level rise, extreme storm events, increased inundation, rising saltwater aquifer, land subsidence, and an aging and insufficient infrastructure system pose an immediate threat to two thirds of Preservation Virginia's (PV) 22.5-acre property. In order to preserve the mission of the Jamestown Rediscovery Foundation (JRF) for the next 50-75 years, Jamestown Island will need to implement a suite of resilience strategies that respond to these threats. JRF/ PV will have to research, prioritize, and archaeologically mitigate 14 acres from the *original historic* site most threatened by flooding, implement the resilience strategies, adapt, and educate more than 200,000 annual visitors to Jamestown Island not only about the foundation of our nation, but also about what it takes to adapt and preserve this unparalleled site for future generations.

The strategies set forth in this plan are intended to protect the PV property from recurring nuisance flooding, rising sea levels, and stormwater inundation for the next 50-75 years. This will provide JRF the time needed to conduct archaeology and work towards fulfilling the mission of the Foundation to uncover, preserve, and share Jamestown's diverse history and its contributions to the foundations of America. Over the next century, inundation will become more prevalent and a retreat strategy from Jamestown Island may need to be considered. In the meantime, the complete story of Jamestown is yet to be discovered. If action is not taken immediately, untold stories of the origins of the United States may be lost forever.

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Jamestown Rediscovery Foundation is an active public archaeology project. The 22.5-acre property where it operates is owned by Preservation Virginia. The site is the birthplace of democracy in the United States.



Flooded Preservation Virginia site during May 2022 tidal flood from offshore Nor'easter.

Section 1: Executive Summary

Jamestown was England's first permanent settlement in America and a place of sustained cultural encounters among different peoples, which laid the foundation of modern America's richly diverse society. As such, it is a historic site of incalculable national and international significance. The challenges faced by Jamestown are multifaceted. The effects of flooding, increasingly severe storms, and weather-related hazards are most visible on the surface, in the form of flooded landscapes and pathways. Hundreds of thousands of visitors come to Jamestown Island each year to explore the landscapes where Virginia Indians, European colonists, and Africans created the foundation of modern America. The challenges posed by hazards at Jamestown threaten not only the visitor experience, but also the archaeology that has revealed an entangled and elegant history of America's Birthplace.

Owing to the rapidly worsening hazards, especially flooding, Jamestown Island is under imminent threat. Documented change in the Tidewater region of Virginia shows that water levels have risen nearly 1.6 feet in the last 100 years, and NOAA projections show that this rate of rise is accelerating. In the next 50 years more low-lying portions of the island, including approximately 14 acres of Preservation Virginia's 22.5 acres where the Jamestown Rediscovery Project operates, surrounding the 1607 James Fort and Statehouse Ridge, may become inundated permanently. Jamestown Rediscovery's public archaeology program has continually revealed unparalleled discoveries for the past 28 years, and is now analyzing mitigation strategies, addressing deficiencies, and turning its attention to mitigation archaeology due to sea level rise, flooding, and migrating wetland areas. More frequent and severe storms are compounding flood issues. Rainfall rates of 1 to 2 inches per hour and nuisance flooding associated with these events overwhelm the antiquated existing infrastructure designed in the 1950s. These severe storms are overwhelming out-of-date drainage infrastructure, resulting in recurrent flooding and damage to the site's priceless archaeological assets.

Rising waters below ground, though harder to see, pose no less of a threat to Jamestown Island. The island overall is low-lying, with groundwater several feet below the ground surface. As rainwater and rising tides raise groundwater levels, previously dry archaeological features become inundated. Moisture—particularly intermittent moisture associated with rising and falling groundwater levels—can be extremely damaging to archaeological resources. Bones, both human and animal, are susceptible to water damage and may dissolve completely, leaving an untold story of our Nation's beginning. Human remains are one of the most informative types of artifacts examined by archaeologists, as they have the potential to reveal detailed information about the biology, environmental conditions, diet, disease, and life experiences of past people. This biological profile will be irrevocably lost if burials become inundated due to rising groundwater levels, robbing us of the ability to truly understand and connect to our shared past.

Environmental conditions related to water have always been a challenge on Jamestown Island. The colonists adapted to the lack of potable water on the island. Severe drought in the past led to hundreds of deaths in the region. Erosion over the last 400 years erased a significant portion of the historic landscape. Past preservation efforts, such as the installation of the seawall and infrastructure improvements attempted to address these problems. Unfortunately, water is once again a challenge to be dealt with, as flooding continues to threaten to drown Jamestown Island. When addressing these issues, the Jamestown Rediscovery Foundation (JRF) and Preservation Virginia (PV) must balance its responsibility to investigate and understand the past through archaeology and historical research, its mission to preserve the site, and the need to engage with the public in an educational capacity. Site resiliency interventions require archaeological excavation before implementation. Jamestown Island is not just an archaeological site, a public park, or an outdoor classroom. It is all of these and more. The preservation of Jamestown's future will demand creative solutions and significant investment to maintain.

The JRF/ PV have been combating these issues since 1994, gaining experience managing the archaeological excavations and public interaction on Jamestown Island. Over the past three decades of research, the archaeology team has adapted to challenging weather conditions in the past, fostered partnerships with domestic and international organizations, and implemented cutting-edge technologies to support its research. From this learned experience the team will employ all available technologies and innovative approaches to combat the damage from the hazards it experiences. The threats to Jamestown will require resiliency and flexibility in the face of these dangers but cannot succeed alone. Changing environmental conditions are not limited to Jamestown Island and will be insurmountable obstacles without support.

The scientific literature points to a consensus that sea level rise does not affect all coastal areas the same. Fortunately for Jamestown Island, relative sea level rise (i.e. the experience of land and water levels in a given place) is a widely studied phenomenon and there are a range of design strategies for resilience that can help places adapt to their unique, site specific changes. Unfortunately for Jamestown Island, Virginia's coasts have "one of the highest" relative sea level rise rates in the United States and "the rate appears to be accelerating" (Ezer and Atkinson 2015, 355), which means that action must be taken now to preserve this historic place and help it stay above water for as long as possible.

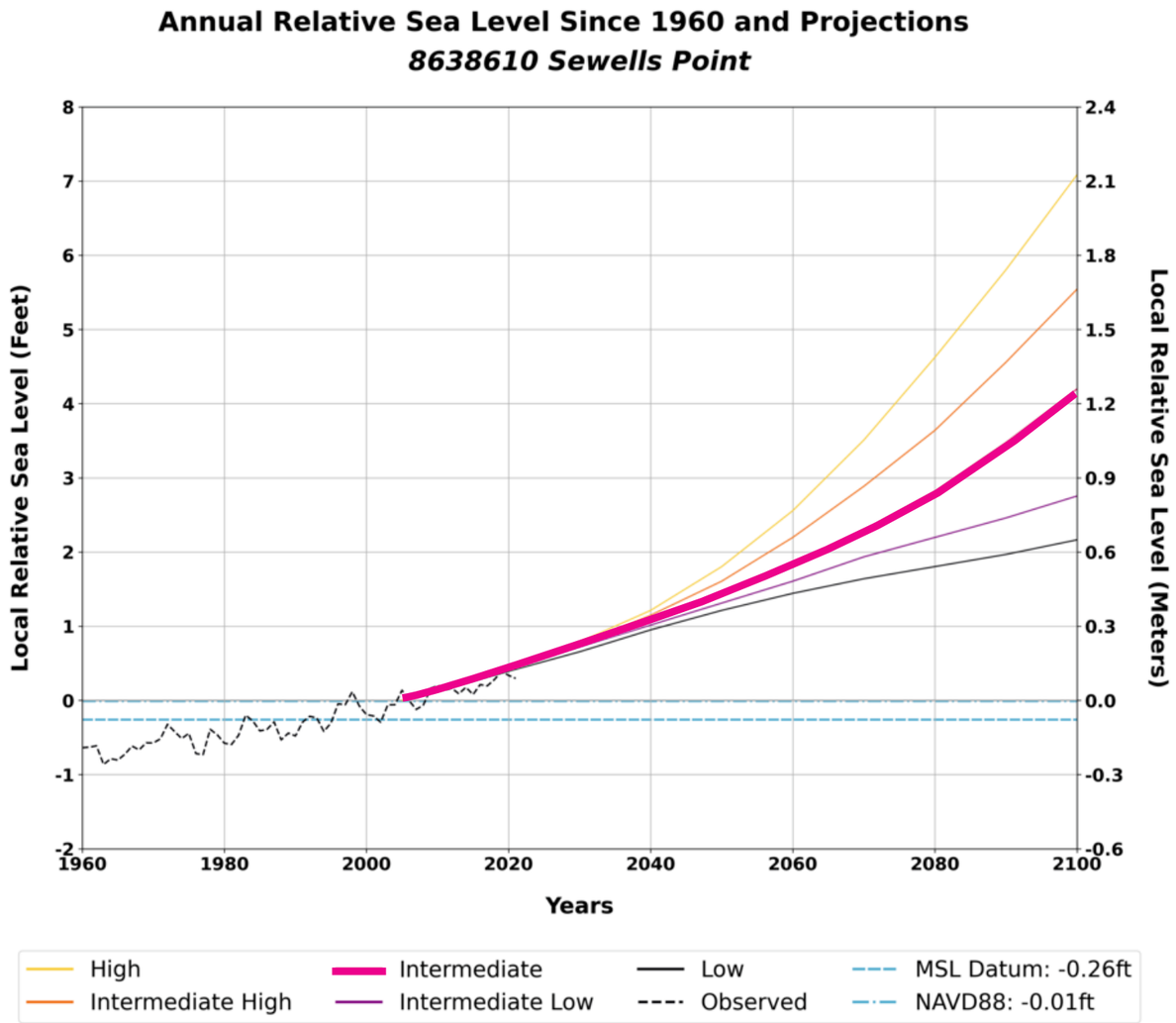
Selecting the appropriate resilience strategies in response to observed sea level rise at Jamestown Island requires understanding the science behind the phenomenon. Sea level rise, which we experience as flooding, will be contextualized at global, regional, and site-specific scales in the following



Preservation Virginia's property in the context of the greater Jamestown Island owned by the National Park Service. The original 1607 James Fort is located on the PV property, along with numerous other significant archaeological sites.



Hurricane Irene (2011) damage to Jamestown's 1901 Seawall.



This figure illustrates local tidal data at Sewells Point in Norfolk, Virginia. Historic data is indicated by the dashed black line. The local relative sea level rise curves diverge based on modeling parameters and show five possible future conditions at Sewells Point. Sewells Point is often selected for sea level rise projections because the data set includes long term measurements, which improves hindcasting and forecasting during the modeling and analysis processes. (Source: https://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml?id=8638610)

sections to foster a discussion of climate drivers. Synthesizing Ezer and Atkinson's 2015 review paper of Sea Level Rise in Virginia, we observe that some places experience more relative flooding than others due to three processes: "1. Global [sea level rise] due to warming ocean temperatures and melting land ice, 2. Local land subsidence (sinking) and 3. Ocean dynamics" (Ezer and Atkinson 2015, 356).

Sea level rise is an issue of global concern and Jamestown Island is already experiencing flooding that correlates with observed sea level rise trends. The Intergovernmental Panel on Climate Change has cited "heavy exploitation of limited water supplies" and "coastal, riverine, and urban flooding affecting communities and ecosystems will become a dominant risk to urban centers…, displacing people, compromising economic activity, disrupting transportation and trade infrastructure". These will cause "damage or loss to heritage resources" (IPCC 2022) among many threats predicted to become more widespread in North America. Jamestown Island is at imminent risk to suffer damage and permanent losses to unexcavated artifacts that are key to understanding the country's early history. There is still so much to discover and the land is already slowly turning into wetlands due to rising groundwater, sinking land, and increasingly frequent storm and flood events. Even small increases of sea level rise have an exponential impact on low-lying coastal lands and infrastructure.

Looking to the future, JRF/ PV is planning resilience and adaptation strategies that will respond to sea level rise and imminent flood hazards. The design interventions proposed in this report will provide continued access for ongoing archaeological excavations and new discoveries.

Every year at Jamestown Island, land area is being lost. To develop future resilience strategies, a thorough study was undertaken that helped designers and collaborators understand these projected site conditions using an intermediate scenario tidal inundation model, which is relatively conservative compared to high or extreme scenarios. Selection of a given scenario is based on both the statistical likelihood of it coming true as well as the amount of hazard risk decision makers are willing to shoulder. In terms of global mean sea level rise, it is very certain and with high confidence that the intermediate-low projection will come true in the future. While the intermediate scenario is less likely to occur, it does not count local factors such as subsidence and ocean dynamics in the estimate. Virginia's coastlines are some of the most imperiled coastlines in the world, so any planning below this threshold threatens to fall short of achieving desired gains toward resilience. Designing to current intermediate low sea level rise projections responsibly balances site preservation and visitor experience (i.e., historic viewsheds). Following the projection that was used in this study, water levels are estimated to be approximately three feet higher than conditions experienced today, which currently brings widespread flooding to the site. Without adaptation and mitigation, that much water would put about 62% of the 22.5-acre site under water—before modeling any future flooding conditions. This resilience strategy keeps Jamestown dry in the best of conditions and allows flooding during the worst (i.e., hurricanes).

The challenge is to identify where critical on-the-ground archaeological research must occur so it can be saved, while simultaneously pursuing landscape interventions to bolster resilience now and into the future. Site resiliency projects of this scale take time to move forward through design, permitting, and construction stages. For JRF/ PV, there is an urgent need to carry out archaeological explorations that overlap with the future footprint of the design and where floodwaters are projected to inundate. This will prolong the mitigation strategies from being implemented, for a good cause, but that means the next five years are critical. If we miss this window, the challenges going forward will become increasingly difficult and more costly to mitigate. Infrastructure urgently requires upgrading, essential maintenance, as well as the design and adoption of engineered solutions. The project team has developed a plan of action to address sea level rise and is summarized by five strategies:

- Repair the Existing Historic Seawall
- Elevate Buildings
- Improve Infrastructure
- Elevate Roads, Pathways, and Landscape
- Install Flood Control Berms

Combined, these measures will mitigate the worst effects of high tides and frequent storms that the site may encounter over the next 50-75 years. As these mitigation strategies are implemented, the visitor experience will need to adapt as well. A proposed Resiliency + Discovery Center will provide a new entry point to the historic area, educating visitors not only about the last 400 years at Jamestown, but also articulating preservation efforts for the future. While a price tag in the tens of millions to protect the property and advance archaeology may seem daunting, it is achievable. Recent local, state, and federal funding opportunities to address climate impacts, coupled with bipartisan support in Washington D.C., will enable the project to move forward and save America's Birthplace.

To save Jamestown, it is imperative to start the permitting, compliance, design, and engineering processes immediately. A comprehensive approach including detailed environmental assessments, hydrology, and geophysical studies while coordinating with regulatory agencies is required to commence the development of a construction plan to carry out the five strategies outlined and implement a reimagined visitor experience. A well-designed solution is necessary to adapt to sea level rise and provide unparalleled visitor amenities to this extraordinary historic site. The future of Jamestown hangs in the balance.



Although staff employ best management practices for protecting active dig areas from stormwater and flooding, perched water threatens resources hidden below in the soil because of its power to degrade and destroy artifacts.



After the basement of the old visitor's center was destroyed in Hurricane Isabel in 2003, the NPS and PV's Jamestown artifacts, which were flooded during that storm, were moved to the Jamestown Rediscovery's conservation and collections facility. The facility and the landscape immediately around the building are owned by NPS, although they no longer occupy the structure with PV.



Section 2

Background

The Association for the Preservation of Virginia Antiquities (APVA) was formed in 1889 and acquired the 22.5 acres of the south-western part of Jamestown Island around the church tower in 1893. APVA, now Preservation Virginia (PV), conducted excavations at the church starting in 1897 and completed them by 1905. They also excavated around the Ludwell Statehouse Group and 1665-1699 Statehouse on their property. In 1934, the National Park Service (NPS) took control over the rest of the island. NPS conducted archaeology on APVA property starting in 1939, 1941, and then again in 1949 led by J.C. Harrington for infrastructure upgrades. In preparation for the 350th anniversary, NPS archaeologists Shiner, Caywood, and Cotter mitigated areas for the Visitor Center just to the north of the 1907 monument.

Jamestown Rediscovery is an archaeology project created in 1994. Excavations at the island started in April of 1994 with a small team, led by Dr. William Kelso, Nicholas Luccketti, and Bly Straube, to search for remains of the original 1607 James Fort thought to be lost to erosion of the James River. Created as a 10-year public archaeology program, it was successful in locating about 85% of the fort on land. As of 2022, excavations are in their 28th year and continue to make substantial discoveries that point to our nation's founding.

To distinguish the site from Jamestown Settlement and after conducting a national review and survey, the new identity Historic Jamestowne, combined with the Zuniga map, was adopted by Preservation Virginia and NPS in February 2002.

Jamestown Rediscovery Foundation was formed in 2015 and manages the archaeology program, capital improvements, ticketing, gift shops, café, grounds as well as all of the fundraising for the new non-profit. The mission of the Foundation is: **To uncover, preserve, and share Jamestown's diverse history and its contributions to the foundations of America. This mission is now threatened by an aging infrastructure, environmental forces related to sea level rise, and increased storm events.**


Jamestown Island
James River
Back River
Project Area
Preservation Virginia
Jamestown Rediscovery Foundation
Colonial Parkway

Significance of Site and Site History

Jamestown is the site of the first permanent English settlement in North America. On May 13, 1607, 104 men and boys arrived, determined to establish an English colony in the unfamiliar and hostile environment of Tidewater Virginia, a beachhead for what they believed would become a great empire in North America to counterbalance the Spanish empire to the south. The society that these settlers helped to create significantly influenced the world we live in today. Jamestown laid the groundwork for English language, law, forms of government, culture, and Protestant religion in America. Encounters with local Virginia Indian peoples and enslaved Africans (who first arrived in Virginia in 1619) created a uniquely diverse American culture. Jamestown is where the first representative legislative body in the Americas met, paving the way for our modern system of democratic government, where the rule of law was first introduced, and where the Church of England took root. At Jamestown the English learned the hard lessons of what it took to establish a lasting settlement. All successful English colonies followed in the wake of Jamestown.

JRF is based at Historic Jamestowne, a historical and active archaeological site owned and managed through a longstanding private/public partnership. In 1893, the Association for the Preservation of Virginia Antiquities (APVA) recognized the importance of Jamestown to the emergence of modern America and acquired 22.5 acres of Jamestown Island around the only remaining standing structure of the original settlement, a seventeenth-century brick church tower. The APVA, now called Preservation Virginia (PV), is a private non-profit organization and the nation's oldest statewide preservation association. Since its founding in 1889, PV has saved more than 200 historic places across Virginia through its revolving fund program, property easements, and direct stewardship. In 1934, the National Park Service (NPS) acquired the remainder of Jamestown Island and began archaeological excavations in the "New Towne" area. In the 1950s, the NPS constructed a visitor center and tour roads around the island and completed the Colonial Parkway connecting Yorktown and Jamestown.

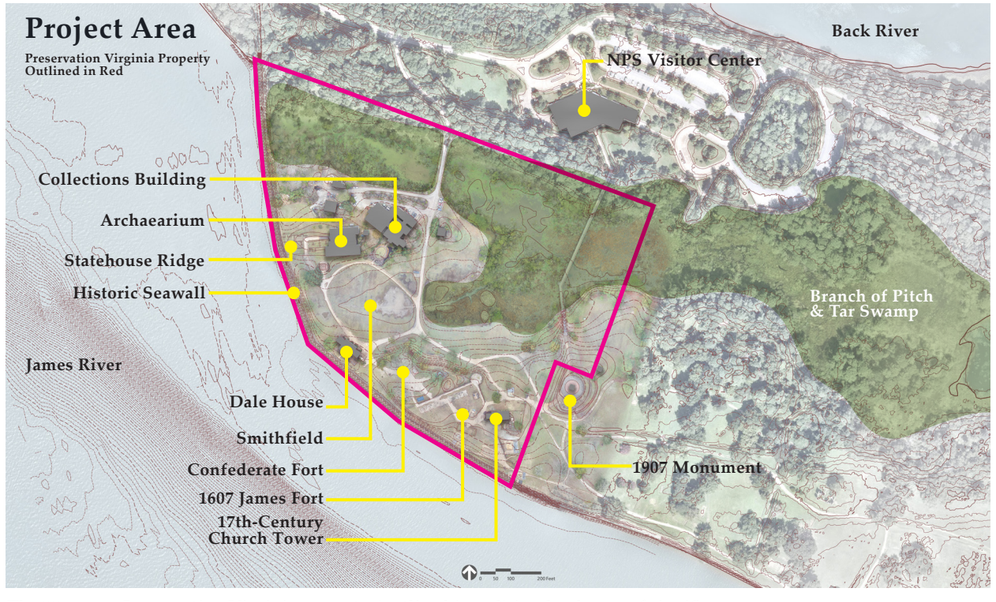
Real Place, Real People, Real Things: A Vision

Historic Jamestowne is jointly administered by JRF (under the authority of PV) and the NPS, two entirely separate entities. A new visitor center, opened to the public in 2008 and is shared by PV and the NPS and the entrance fee is split between the two organizations. APVA archaeological excavations started in 1897 and have occurred on the island at various times during the 20th century. After the NPS acquired the rest of the island, they conducted a series of archaeological projects. They excavated extensively on NPS property, defining many sites of "New Towne," the town that developed eastwards beyond James Fort from the early 1620s. Their systematic excavation approach was some of the finest historical archaeology of its day, locating many masonry foundations of the seventeenth-century capital port town. The NPS also conducted limited excavations on PV's property, finding early historical layers and features, but nevertheless concluded that the site of the 1607 fort was not to be found. The work of these early archaeologists was exemplary, but the signs of early fort construction were not well understood at the time of these excavations. They also lacked a base of knowledge to identify post-medieval material culture "signature" of the earliest fort period.

In 1994, in preparation for the 400th anniversary of the 1607 English landing at Jamestown, PV launched the Jamestown Rediscovery archaeology project hoping to uncover the site of the original James Fort, long considered lost to erosion in the James River. Excavations subsequently revealed that more than 85% of the original fort remains. To date, archaeologists have revealed approximately 80% of the original 1607 triangular fort and 50% of the expanded five-sided 1608 fort, yielding some 3 million artifacts from the settlement's early years. Significant post fort-period building and home lot sites that speak to the settlement's expansion in the second quarter of the seventeenth century have also been identified on PV's 22.5-acre property but remain mostly unexcavated.



Archaeologist screening artifacts from a dig site adjacent to the James River.



The 22.5-acre Preservation Virginia property (outlined in red) is a landscape of significance. It is home to several historic structures and archaeological sites of interest.



The Washington Post

Democracy Dies in Darkness

WEDNESDAY, MAY 4, 2022 • B3

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METRO

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8 a.m. 62° | Noon 72° | 4 p.m. 73° | 8 p.m. 74°

JOHN KELLY'S WASHINGTON

Artists and attendees see the Birchmere's sound — honed for over 40 years — as something special. B3

80°

THE DISTRICT

D.C. Circulator bus operators began a strike to protest wages and working conditions. B3

Colonial Jamestown, assailed by climate change, is facing disaster

400-year-old Virginia site, battered by flooding and other effects, is listed as endangered

BY MICHAEL E. RUANE

JAMESTOWN, VA. — The dig site where archaeologist Sean Romo has just found the ardent fragment of armor is surrounded by a double layer of green sandbags to keep out water.

A dig site nearby is covered by a grate where a tarp can be quickly spread if it starts to rain.

And out in the James River, barges filled with stone are waiting to bolster the century-old concrete sea wall that is failing under the relentless pressure of the river.

The 400-year-old colonial site here is losing its battle with climate change, experts say, and Wednesday the National Trust for Historic Preservation placed it on a list of the country's most endangered historical places.

"Jamestown is a world-class archaeological site and a place of national and international significance," SEE RETROPOLIS ON B3

TOP: Jamestown, site of the first permanent English settlement in what would become the United States, is seen from above, sandwiched between the James River and a swamp. ABOVE: Archaeologists Caitlin Dolmas, left, and Anna Shackelford work Friday at the site of a former cellar turned trash pit in Jamestown.

RETROPOLIS

'Subtleties of the past can easily be washed away'

RETROPOLIS FROM B1

said James Horn, president of the Jamestown Rediscovery Foundation, the nonprofit group that conducts archaeology and cares for this original settlement site. (The trust listing does not include the adjacent National Park Service Jamestown location.)

The threat to the site of one of the nation's "very first cultural hubs ... brings home the challenges that climate change pose to our entire society," he said.

Katherine Malone-France, chief preservation officer for the trust, said, "You've got resources there underwater that are staying underwater."

"Jamestown demonstrates that the threats to our cultural resources from a changing climate are incredibly urgent," she said. "We have a five-year window to make an impact. ... This isn't something that can wait 10 or 15 years."

"This is our collective heritage," she said Monday.

The trust was chartered by Congress in 1949, and for the past 35 years it has issued a list of 11 historical sites endangered by things such as development, neglect, decay and exposure to weather.

Another spot struggling with climate change on this year's list is Houston's Glenwood Cemetery, Malone-France said.

It is a 340-year-old African American burial ground with more than 4,000 graves. It suffers from chronic erosion, and after a 2017 hurricane, it was under 10 feet of water.

Jamestown, in 1607, became the place of the first permanent English settlement in what would become the United States. The earth here holds the bones of hundreds of the early colonists and the artifacts that are clues to their lives.

It is also the place where, in 1619, the first enslaved Africans arrived, and where generations of Native Americans had already lived for centuries.

It is an archaeological "trifecta," as one expert put it.

Queen Elizabeth II of Britain has visited. So have Presidents Franklin D. Roosevelt and George W. Bush, Supreme Court Chief Justice John G. Roberts Jr., and an array of political and public figures.

In recent years there have been spectacular discoveries, including the location of the colony's "fort" for the remains of colonial VIPs and evidence that the first settlers, facing starvation, may have resorted to cannibalism.

But the location is on a low-lying tidewater island menaced by the river on one side, a swamp on the other and what the archaeologists believe are increasingly frequent deluges of rain caused by climate change.

Drainage systems date back to the 1950s, said Michael Lavin, director of collections and conservation for Jamestown Rediscovery. And archaeologists have had to use sump pumps to empty water-filled excavations.

Part of the problem "is, of course, sea level rise," archaeologist Mary Anna R. Hartley said one day last week as she stood by a sandbagged excavation site that probably dates to about 1608.

"Some of it is groundwater coming up," she said. "The other thing is these tremendous rain events we're getting, I'd say, in the last 12 to 15 years. We'll get between 6 and 10 inches of rain all at once. And there are multiple instances and events like that."

She said the archaeologists keep their smartphones tuned to weather reports and one eye on the sky over the mile-wide river.

"When you see a storm directly across, it's almost too late," she said. "You better hurry up and close what you can."

"Our defenses are always the sandbags," she said.

"And, then we have this really high-quality plastic that we lay down ... to catch the water and pump it off or bail it off the sites," she said.

"If you get that much rain that fast, it's pretty much like a hurricane or a nor'easter," she said. "And almost on a weekly basis, we'll get one of those rain events. ... The inundation is outpacing us."

Already the small excavation has yielded pieces of "brigandine" armor and Native American projectile points that date back centuries. Both can be destroyed or altered by water.

Fragile layers of sediment that archaeologists use to read a site can be washed away. And human bones exposed to water can become like cardboard, one expert said.

None of Jamestown's high-status burials seem threatened so far because they are on higher ground in or around the main church site.

But at least one burial, and perhaps many more, are on lower ground and in the path of an encroaching swamp, said Romo, one of the archaeologists.

He said some areas where there may be artifacts already have been engulfed by the swamp, and others are in danger of that.

"The subtleties of the past can easily be washed away," he said.

Last week, as archaeologists scraped away dirt in the sandbagged pit, several construction barges were anchored in the river awaiting government permission to start shoring up the sea wall that has protected Jamestown for over 100 years.

Although the sea wall is made of huge blocks of concrete, it has been battered by the river for decades and now is being undermined by water seepage from the land.

"If the blocks start falling out ... at some point the whole thing is going to drop out, and you're going to lose the integrity of the sea wall," Lavin, the collections director, said last week.

Jamestown Rediscovery and its nonprofit affiliate Preservation Virginia have raised more than $3 million for the project to bolster the sea wall with tons of granite "armor" stone, he said.

Each stone weighs between 500 and 1,000 pounds, and they will be placed against the existing concrete blocks of the wall.

R. Neville Reynolds, managing director of VHB, the Williamsburg engineering firm doing the work, said the project could begin in a week and would take about two months to finish.

But Jamestown needs more than just a reinforced sea wall, Lavin said. The landscape needs to be adjusted to cope with the continuing impact of climate change.

Roads should be raised. A modern drainage system needs to be created. And a special flood berm needs to built on the site.

Lavin said the cost will be in the "tens of millions" of dollars. And time is critical.

"We want to raise this flag of awareness and urgency that one of America's premier historic and prehistoric, sites is at risk," he said.

Scan here to view the Washington Post Story



(Top) *This Michael Ruane Washington Post Article which ran on Wednesday, May 4, 2022, reads: "Colonial Jamestown, assailed by climate change, is facing disaster: 400-year old Virginia site, battered by flooding and other effects, is listed as endangered." The articles discusses the climate emergency, pointing out that "the National Trust for Historic Preservation placed it on a list of the country's most endangered historical places" (Ruane 2022).* **(Bottom)** *CBS News covered the issue of climate change at Historic Jamestown on July 7, 2022. The news bit, titled "Jamestown will be lost: Climate Change threatens to sink historic colony" talked about the work of Preservation Virginia and the Jamestown Rediscovery Foundation's project in the context of the hazardous environmental conditions that they are dealing with on their property (Van Cleave 2022).*

Recently, PV and the NPS partnered for Jamestown Rediscovery to excavate the site of one of the first African women forcibly brought to English North America. Funded through a Civil Rights Initiative grant, the two organizations successfully brought attention to a founding member for our Nation's history – a figure overlooked in the early years of the colony. A poignant example of how archaeology can reveal and recreate lost landscapes.

Preserving Jamestown Island

Increased intensity and frequencies of weather events are threatening the future viability of one of America's birthplaces being able to remain above water in the next half century. Rising tides and more intense storms are making Jamestown Island increasingly vulnerable to current and future flooding hazards. To better understand what the future may bring, this report starts with reviewing scientific literature to foster a discussion of various forces driving these changes: melting glaciers, subsidence, and ocean dynamics and how these factors will impact the Virginia coastline. Afterwards, the report will focus on understanding site specific hazards experienced at Jamestown Island that are impacting the historic landscape and facilities, archaeology, and visitor experience. Looking towards the future, the report will discuss how scientists develop and use climate projections to inform resiliency planning, strategy, and design. The planning and design process utilizes an intermediate scenario tidal inundation model that sets up criteria for setting up the mitigation and adaptation design strategy. This data-driven resilience plan is the product of a year-long collaborative process engaging numerous engineers, scientists, designers, and stakeholders to ensure this significant historic landmark is able to withstand chronic tidal flooding and extreme flood events.

Climate Science

The Earth system is dynamic and ever-changing. And while the bulk of the climate research has occurred since the 1960's, society's awareness of impacts to the climate since at least the Industrial Revolution as communities began to witness mass pollution of waterways and overexploitation of natural resources such as forests and mineral resources. Early writing about how carbon combustion might impact future weather patterns appeared in the March 1912 issue of *Popular Mechanics*, pointing to at least 100 years of awareness that humans are impacting the environment (Molena 1912). Today, the science behind climate change prediction is robust, and models of possible future conditions can help stakeholders prepare to mitigate climate hazards. The three factors cited earlier in this report—melting glacial ice, land subsidence, and ocean dynamics—interact on the global system are happening independently and in concert with each other.

Globally, the average rate of sea level rise over the past 100 years, measured from tide gauges, is approximately 1.7 mm/year. But in Virginia, the average rate of sea level rise in recent decades has been approximately 4 to 6mm/year (Ezer and Atkinson 2015). With the Jamestown/Scotland Ferry Tide Gauge, installed in 2015, there is a terminal data collection point that will help Jamestown and community stakeholders understand how soon future sea level rise will submerge the property.

Another factor that impacts relative sea level rise is subsidence, or the sinking of land. Subsidence is caused by two factors: groundwater extraction and ancient geological processes. Barring an earthquake or other catastrophic geological event, the geological changes that are occurring are often difficult to detect without vast time spans for comparison. On the other hand, groundwater extraction can result in dramatic landscape changes in relatively short periods of time. Although a cultural norm to draw on aquifers to satisfy our need for water, rates of groundwater extraction have exceeded the natural rate of groundwater recharge. This causes land to sink above areas where groundwater has been withdrawn. It is happening at detectable rates, especially where intensive extraction occurs. Across the region, subsidence is occurring at variable rates ranging from 1.1 to 4.8 mm/year, with an estimated 2.1 mm/year happening at Jamestown Island (Ezer and Atkinson 2015).

The third factor, ocean dynamics, is still the least understood aspect of the phenomenon, but there is a growing body of scholarship exploring how changes in our oceans and atmosphere create feedback loops. Essentially, the circulation of warm and cold water in the ocean drives wind currents and weather patterns. Melting glacial ice is introducing larger volumes of less dense fresh water into oceans, which disrupts heat transport, ocean currents, and associated weather patterns. As weather changes in response to ocean dynamics, this further exacerbates glacial melt in the poles and high elevations (Climate Signals 2022, Algarin 2022). The strength of the Gulf Stream, the current affecting Virginia's coasts, causes water levels to be higher or lower depending on its flow (Ezer and Atkinson 2015). At the local scale, sea level can be impacted by wind when waters are pushed inland, becoming trapped and causing nuisance flooding on both sunny and stormy days.

Recent Climate Impacts

Climate impacts at Jamestown Island are experienced as sea level rise, frequent and worsening flooding, increased frequency of rainfall events, loss of land, and land cover change. Comparing the modern shoreline to historical photographs and drawings of the original settlement, much has already eroded into the James River. These same erosive forces continue to pressure the island and seawall today, a problem noticeable during events such as Hurricane Irene in 2011 when part of the seawall collapsed from a battering of waves and undermining of the wall. The story of climate impacts on Jamestown Island are told through tide gauge data, aerial photography, survey information and first-hand observations. These impacts have affected the environment and social landscape. The changes experienced and need to preserve what is left has influenced archaeology and resilience approaches and how areas are prioritized for future research. Current dig sites must be pumped out after a flood, a process that is labor intensive, time consuming, and threatens to destroy potential discoveries.

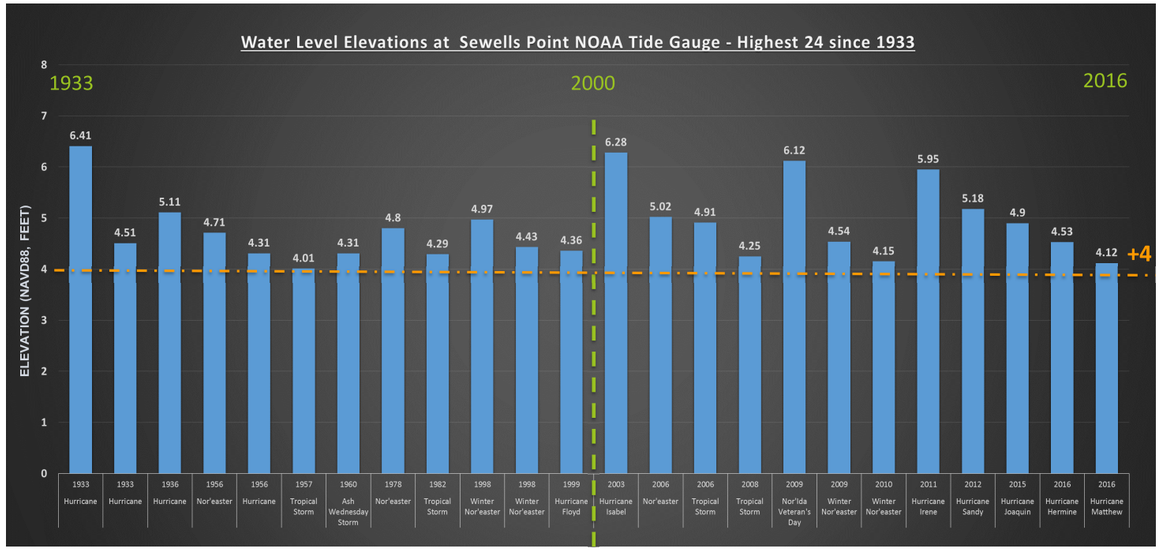
Regional tide data dating back to 1927 indicates approximately 1.6 feet of rise in sea level over the past 100 years. As a result of sea level rise, the region experiences frequent and intense flooding described above as well as fluctuating daily tidal dynamics, with record-breaking king tides reaching higher ground each year. Nuisance flooding from stormwater is also an issue on Jamestown Island. After a storm, it may take hours for stormwater to recede, because the land is so flat and low lying, which disrupts both the visitor experience and research activities. And after larger events, flood waters have destabilized structures and excavations, deposited sediment and debris, disrupted daily activities and functions, and created hazardous conditions in areas after flood waters recede, which results in increased financial costs for clean-up, restoration, and other activities.

Other sea level rise data comes from the Jamestown/Scotland Ferry Tide Gauge, installed in 2015. This gauge gives context for recent climate impacts through specific data points that tell us exactly when flooding events occurred and the height of those crests. Since its installation, the gauge has measured 37 crest events, averaging approximately 5.6 events per year. Heights above 2.77 feet signal minor flooding, where moderate and major flooding occurs at 3.27 and 3.77 feet, respectively.

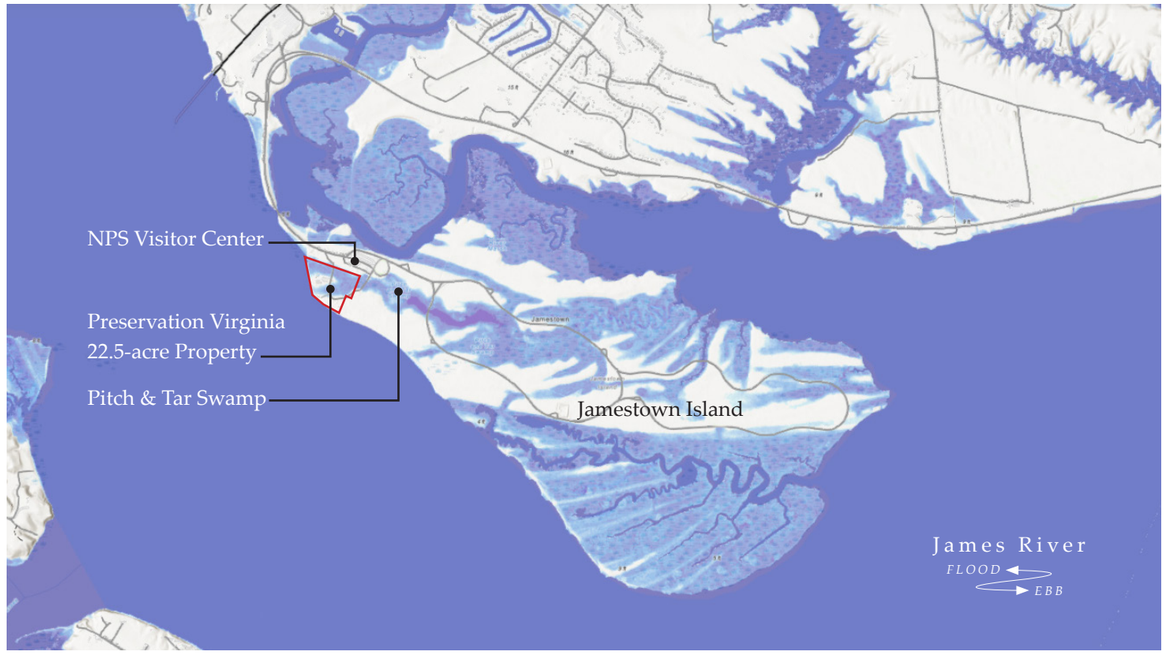
While continuous weather records for the region began in 1871, there are related written records of noteworthy Virginia storm events dating far back as 1635 (National Weather Service, n.d.). From this information, it is estimated that at least dozens of major storms have happened near Jamestown Island. With most being nor'easters, tropical storms or hurricanes, these storms bring large volumes of stormwater, storm surge, high winds, and hazardous conditions. At Jamestown Island, flood heights of 6.5 feet or higher overtop the historic seawall, which floods significant areas of the site and threatens structures and excavations. The Dale House, a visitor rest area and cafe, is particularly vulnerable to such flooding with a finished floor elevation of 5.67 feet.

In aerial imagery, it is evident that vegetative cover has changed dramatically in the past century. In the 30's, the property was maintained as pasture and farmland. Over time, vegetation shifted and changed in response to management practices and changes in soil moisture. The NPS visitor center was redesigned and relocated to higher ground after flooding from Hurricane Isabel in 2003 destroyed the original structure. Over time, canopy

Highest Recorded Tidal Events at Sewells Point



A regional increase in frequency of tidal flood events is evident at the Sewells Point NOAA Tide Gauge. (Source: Kyle Spencer, City of Norfolk Office of Resilience).



Three feet of tidal inundation over Jamestown Island. Note the branch of Pitch and Tar Swamp on the PV property is influenced by rising tides.

Datum Conversions - Jamestown/Scotland (JSFV2)			
Flood Level	MLLW	MHHW	NAVD88
Zero MLLW	0.00	-2.23	-1.23
Action	3.50	1.27	2.27
Minor	4.00	1.77	2.77
Moderate	4.50	2.27	3.27
Major	5.00	2.77	3.77

Flood Categories at Jamestown/Scotland Ferry Tide Gauge. NAVD88 Datum was used in this study. Note minor increases in water levels result in flood stages in this portion of the James River.

Jamestown (JSFV2) Historical Crests (P.O.R= Aug 2015-Present)						
Rank	MLLW	MHHW	NAVD88	Date	LST/LDT	Event (blue denotes Tropical)
1	6.27	4.04	5.16	10/4/2015	18:18	Hurricane Joaquin (offshore) *(7)
2	5.40	3.17	4.29	9/3/2016	14:48	Hurricane Hermine *(2)
3	5.09	2.86	3.98	5/10/2022	7:12	May Coastal Storm *(5)
4	4.96	2.73	3.85	1/3/2022	13:18	Jan Nor'easter
5	4.96	2.73	3.85	10/9/2016	5:18	Hurricane Matthew
6	4.93	2.70	3.82	4/1/2020	6:42	Apr Nor'easter
7	4.89	2.66	3.78	10/11/2019	23:06	TS Melissa (offshore) *(4)
8	4.78	2.55	3.67	5/19/2020	23:18	TS Arthur (offshore) *(2)
9	4.73	2.50	3.62	5/30/2021	3:36	Coastal Low
10	4.66	2.43	3.55	5/6/2016	0:18	Coastal Low
11	4.63	2.40	3.52	9/6/2019	19:36	Hurricane Dorian
12	4.60	2.37	3.49	8/26/2019	21:00	Onshore Winds
13	4.58	2.35	3.47	11/17/2019	15:06	Nov Nor'easter
14	4.56	2.33	3.45	9/10/2018	13:00	Onshore Winds
15	4.52	2.29	3.41	9/29/2016	23:36	Onshore Winds

Purple Shading indicates "MAJOR" Flooding — Red Shading indicates "MODERATE" Flooding

*(number) in event column denotes multiple tides hit at least Moderate flood thresholds

All Water Levels use Verified 6-min data when available

Historic Crests at Jamestown/Scotland Ferry Tide Gauge. This tide gauge was installed in 2015, providing a small sample size of storm events that does not include historic events such as Hurricane Isabel (2003) and Hurricane Irene (2011).

trees have been allowed to grow, offering resilience through their function as a natural buffer and provider of essential ecosystem services. It is also clear the land is getting wetter, a trend visible by comparing the extent of Pitch and Tar Swamp in recent decades. This migration of wetlands means that present-day landscape maintenance is limited, with some areas becoming impossible to mow as flooding results in inundated lawn actively trying to convert to swamp.

Projected Change and Landscape Impacts

What we know about climate change is that it is indeed happening and rates of change are accelerating (IPCC 2019). One data point the scientific community has been pointing to is the limiting of global warming to below 2°C to reduce the intensity of changes that are already occurring in the Earth-system (IPCC 2022). Climate change predictions are challenging to pin down exactly because of many uncertainties largely revolving around rate and magnitude of change. What we do know is that hazards are happening now at Jamestown and we can use existing climate science modeling to project potential future site conditions. In doing so, we can develop science-informed design interventions that will increase resilience for the landscape of Jamestown Island and buy precious time towards preserving history. The following section explains climate modeling and what it means for projected climate impact in general, the process for selecting a model to inform design and planning, and then discusses how we expect the landscape to change between now and 2075.

Climate modeling is based on well-studied environmental processes, using "mathematical equations to characterize how energy and matter interact in different parts of the ocean, atmosphere, and land" (NOAA 2022). Climate models are tested and vetted through a process called "hind-casting" where they are developed and then simulated in reverse to determine accuracy based on how well the model fits to measured past weather conditions. Models change and advance through ongoing research, and since the Intergovernmental Panel on Climate Change's Special Report on Emissions Scenarios (SRES) was released in 2000, the study of atmospheric emissions has become situated in a socioeconomic context. Larger, industrialized countries are the largest contributors to emissions, but tend to feel the effects of climate change disproportionately as compared to smaller, more rural countries, where increasingly extreme weather events and disasters have a larger impact because there are fewer financial resources to respond to disaster and infrastructure is often less robust. With significant emissions reductions, specifically from the largest contributors in the next two to three decades, the overall warming can be limited to between 1.5 and 2°C, which would drastically reduce the magnitude of future climate change in a world still adaptable to human life. Emission levels and the rate of reduction has become two of the dominant variables in developing climate change predictions (NOAA 2022) because anthropogenic emissions are driving change in the earth system.

These models are visualized through Representative Concentration Pathways (RCPs) that represent alternative future pathways based on global emissions and the overall warming that would occur for each. One of the most used climate change models comes from NOAA and is based on the research of Parris et al. (2012) and subsequent updates from Hall et al. (2016) which expanded the modeling from a global perspective down to the site-specific scale. The sea level rise graphs offer multiple future scenarios that can be applied to a given area of interest. In general, the six scenarios range from low to extreme, with anywhere from 0.3m to 2.5m of global mean sea level rise (GMSL) by 2100. It is important to note that relative sea level rise will depend on additional local factors, such as subsidence and ocean dynamics.

Using these GMSL rise scenarios, which can also be thought of as models of the maximum expected future change, planners and policymakers can visualize site specific changes and conditions over time. Several factors go into the selection of sea level rise curves for future planning based on the likelihood of a given scenario occurring and the level of risk that stakeholders are willing and able to plan for in the context of time and available resources. In the case of Jamestown Island, the intermediate scenario tidal inundation model was selected based on the following criteria and site circumstances:

1. Current impacts due to local storm events and the subsequent flooding are significant and impact normal activities, such as archaeological excavations and tourism, thus, there is a sense of urgency to act before too much time and land is lost to rising waters.

As discussed, Jamestown Island is experiencing nuisance flooding during local storm events. On sunny days, onshore winds result in water becoming trapped in Pitch and Tar Swamp, causing waters to rise in low lying areas, covering access roads and pathways. For staff, this means challenges to accessing the site for work, research, and maintenance activities. For visitors, this disruption means inability to experience the landscape or encounter closures due to high water. Flooding is encroaching on prospective archaeological dig sites and disrupts active dig sites. The conversion of dry land to wetlands will ultimately halt future exploration because the low-lying areas that are slowly going under water will eventually be inaccessible.

2. Recorded storm data and known flooding thresholds that impact the site for a given design storm provide a context for estimating future impact. Without adaptation and flood mitigation, minor to moderate flood conditions today will likely be the everyday norm for high tide in 50 to 75 years.

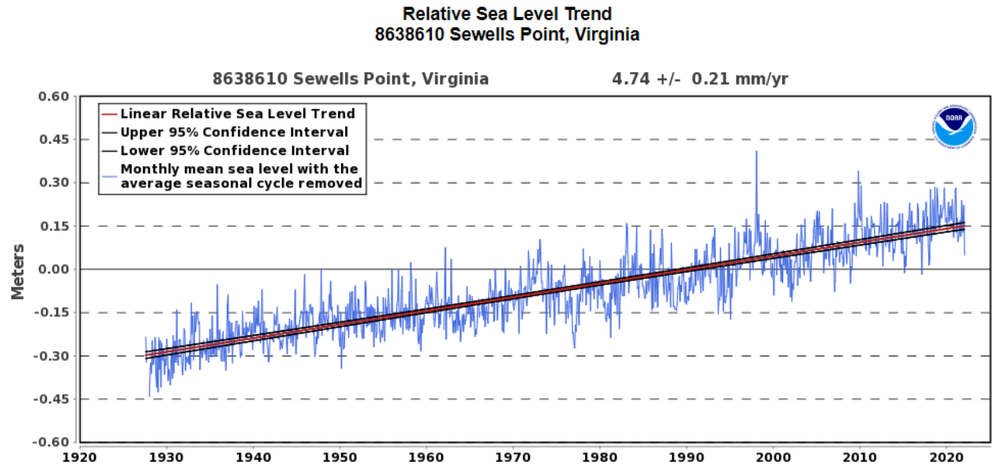
With minor flood events occurring when water levels are elevated by just 2.77 feet today, as GMSL rises, the threshold for minor flooding on the island is reduced. Since 2006, there have been three 100-year flood events, and on average, 5.6 flood events happening annually since recording began at the Jamestown/Scotland Ferry Tide Gauge in August 2015. With a future that is expected to experience increased regional precipitation, the frequency of flood events will rise (Sridhar et al. 2019).

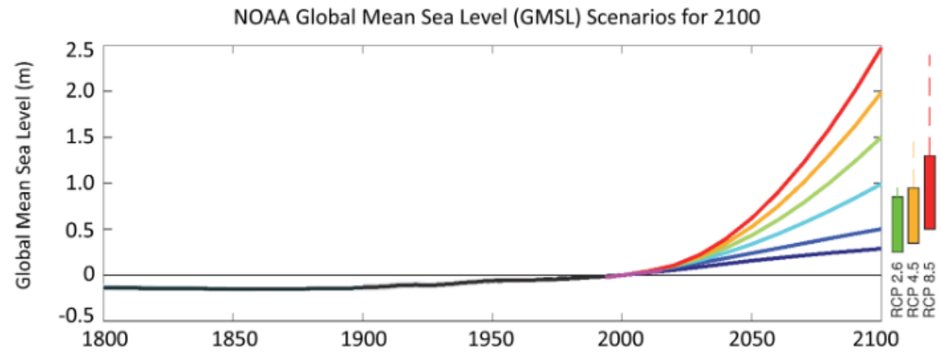
3. Design and planning strategies vary based on planning goals in the context of risk tolerance.

In professional contexts, designers and decision makers must work towards specific, yet uncertain points in the future. Typically, municipalities will develop near-term comprehensive master plans that guide planning and development for approximately 30 years beyond the date of document release. This allows room for growth, accepting that the plan may be revised many times before the end of the planning period. Long term planning exists beyond the near-term period and extends beyond 2100. Planning at this scale is not helpful for near-term problems because of future uncertainties. For instance, if global emissions were to reach net zero in three distinct scenarios by 2050, 2040, or even 2030, there would be significant differences in the future conditions of each scenario based on when emissions goals are met. Because it is impossible to know how conditions will change, or when, strategies are planned around what can be done in the near-term with the expectation and hope that future planners and stakeholders will revise mitigation strategies, correcting course in the future should the need arise.

For the purpose of this study, an intermediate model was chosen because it is the middle road between low and high projections and there is a greater probability of this or a similar outcome across contemporary models. Based on these parameters, this report predicts that by 2075, Jamestown Island is projected to receive approximately three feet of sea level rise, which would flood 14 of 22.5 acres of the property. And while most existing buildings will still be on dry ground during normal conditions, Smithfield - the open field north and west of James Fort - will have largely disappeared by that time.

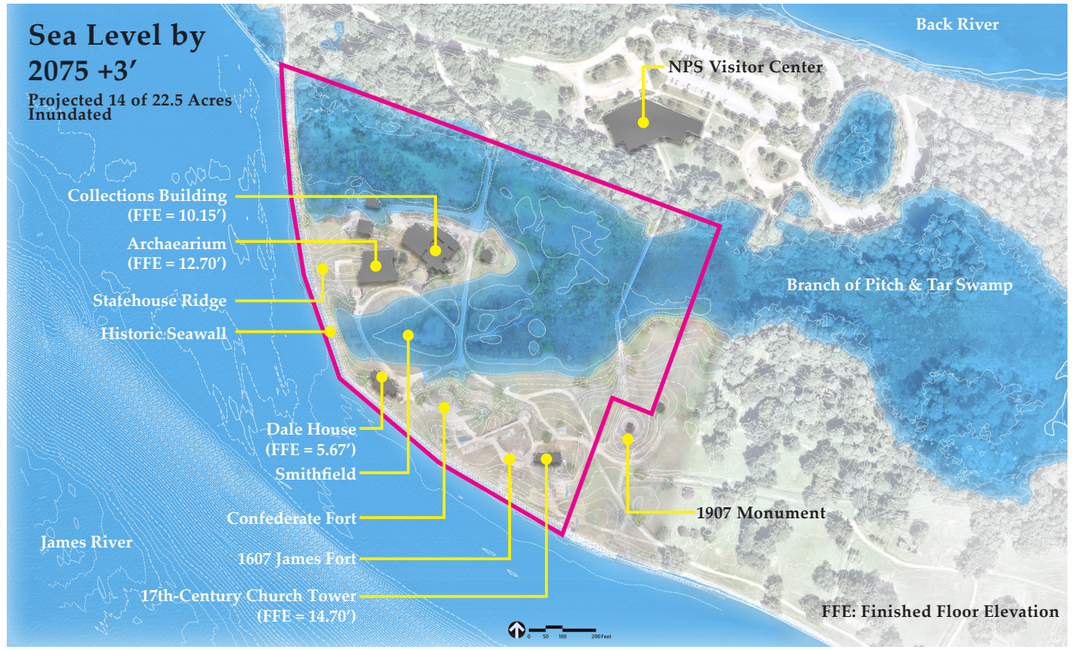
Land lost to rising waters becomes extremely difficult, if not impossible, to explore by any meaningful archaeological studies. Recent discoveries have revealed clues to the use of the space within the settlement. These finds suggest where researchers will recover features of Indigenous, enslaved Africans, and other marginalized communities on the island. Some of these clues point to locations in “less desirable” areas, which would have been low-lying areas at that time. Thus, the very land that is being damaged by flood waters and the slowly expanding swampland is the land most likely to hold secrets and discoveries about the very communities whose



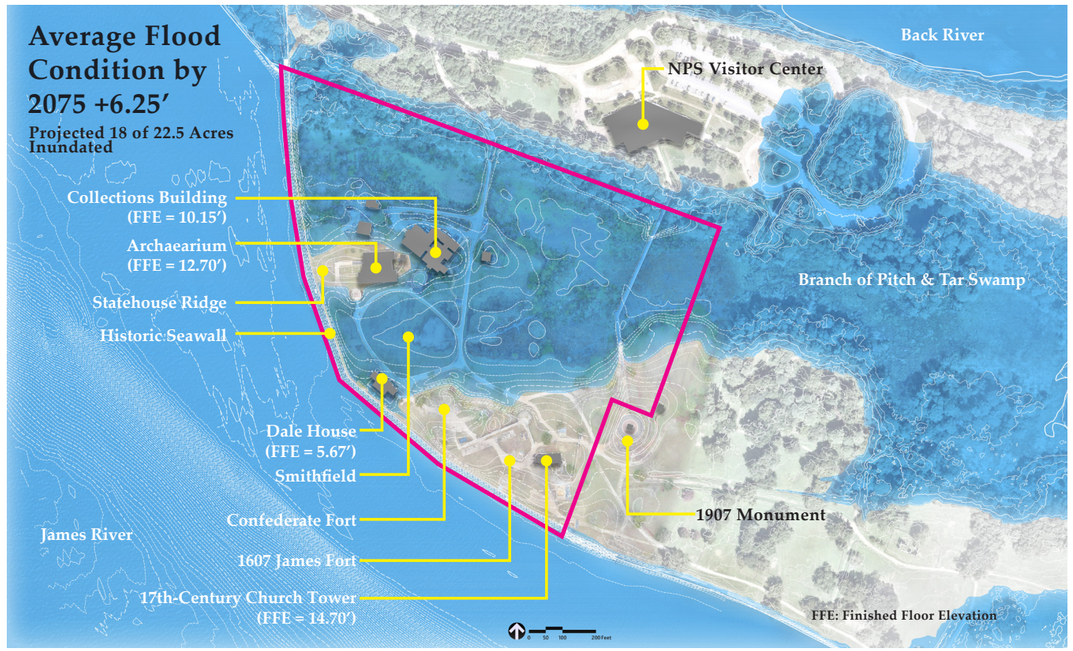


GMSL rise Scenario	RCP2.6	RCP4.5	RCP8.5
Low (0.3m)	94%	98%	100%
Intermediate-Low (0.5m)	49%	73%	96%
Intermediate (1m)	2%	3%	17%
Intermediate-High (1.5m)	0.4%	0.5%	1.3%
High (2m)	0.1%	0.1%	0.3%
Extreme (2.5m)	0.05%	0.05%	0.1%

(Top) *Relative sea level trends from Sewells Point, VA, with data from the late 1920s to now (NOAA 2022).* ***(Middle)*** *NOAA Global Mean Sea Level (GMSL) Scenarios on relative concentration pathways (red, orange, green, and various blue linear curves), which are projections based on future atmospheric carbon estimates (green, orange, and red vertical box and whisker plots labeled RCP 2.5, 4.5, and 8.5, respectively) which produces statistics for the likelihood of a given scenario taking place (NOAA 2022).* **(Bottom)** *Table associated with the NOAA GMSL Scenarios for 2100. Note that for more extreme RCP scenarios, the likelihood of a given sea level scenario increases (NOAA 2022).*



It is projected that 14 of 22.5 acres on site will be inundated with just 3 feet of relative sea level rise. It is notable that the 3 feet of flooding depicted here is what the 5-6 times per year nuisance flooding looks like. All elevations are NAVD88 vertical datum.



Projected sea level rise in 2075 coupled with an average flood of approximately 3.25 feet, nearly 80% of the site is under water.

stories we know the least about on Jamestown Island. As much of that land may already be lost, this impact alone robs future generations, especially communities of color, the opportunity to learn a more complete history of this country's birthplace.

The historic seawall is permanently fixed approximately at elevation 6.25+/-. Although it keeps the James River at bay in normal conditions, the hard barrier between the James River and the site is still subject to flooding during extreme events. If the wall were not in place, the slow creep of Pitch and Tar Swamp would eventually reach the James River and divide the island, subjecting the site to the harsh forces of flowing water and tidal dynamics. In the future, an average 2075 flood condition of 6.25 feet would breach the seawall and inundate 18 acres of the property, directly impacting buildings and structures below elevation 6.25. Larger flood events have a greater impact and an increased risk to buildings and structures around the site.

Resource Protection

Jamestown Island is home to abundant resources, both environmental and archaeological. The following sections will discuss this rich, dynamic landscape and begin to tell a story about the site's unique features and complexity. For more reading on the many vast resources at Jamestown Island, please refer to the Final Development Concept Plan/Environmental Impact Statement released by APVA and the NPS in 2002; citation is available in Appendix A: References.

Environmental Resources

There are rich environmental resources at Jamestown Island that create a unique sense of place. The combination of water, land, and sky in this setting is a perfect backdrop to capture the imagination of visitors because even today, it offers a glimpse at what the landscape was like here during the time of our Nation's early history. No doubt land cover and land use have changed over the past 400 years since the time of early settlement. Historical descriptions of landscape and aerial imagery tell a story of a dynamic and changing landscape that has undergone resource extraction, development and fortification, the cultivation of crops, commemoration, redevelopment, and discovery. Amid so much change, the island is anchored between crucial water resources that have defined the land and its people for centuries.

The island is bound by abundant water resources, but scarce sources of potable water. The James River, Back River, and Pitch and Tar Swamp all experience fluctuations in their levels of relative salinity due to local weather events and storms occurring in upland areas, but are all considered saltwater bodies. Luckily for the settlers, there is some accessible fresh groundwater, and by at least 1609, John Smith wrote of "excellent sweet water, which till then was wanting" (Smith 1607-1617, cited in Haile 1998, cited in Kelso and Straube 2008, 55). Over time, modern archeology efforts have since revealed several wells around the Jamestown settlement that supplied colonists with fresh water to drink.

At Jamestown the James River, is just over a mile wide at its narrowest point and functioned as a natural protective boundary for settlers to the west and south. To the north and east, the Back River functions similarly, where its serpentine flow through Sandy Bay and adjacent marsh varies between 300 and 375 feet wide, sheltering the settlement within this riverine and swampy border. The Pitch and Tar Swamp, located on the interior of the island and fed by runoff and flows from Back River, is slowly creeping upslope as the land is becoming wetter

through ecological processes. Comparison of today's modern shoreline with historical aerials and writings on the landscape tell a story about how erosion and deposition have changed the island's shoreline—cutting away at the western edge of the island along the James and carrying away the island's most precious environmental resource: dry land.

Today, large trees create a buffer on the periphery of Pitch and Tar Swamp and line the open fields, where groupings of trees and singular specimens cast precious shade, providing shelter and reprieve to modern tourists. The trees at Jamestown are predominantly native species, which offers crucial habitat to local wildlife. In a 1993 general management plan for the Colonial National Park, the NPS stated that "[t]he pitch and tar swamp near the present Jamestown visitor center will be protected. Erosion and sedimentation will be prevented to protect the fragile ecological integrity of the swamp. To prevent further degradation and adverse effects, traffic flow patterns from the new visitor center to the island's prime cultural resource areas will be managed and monitored to minimize impacts on the swamp" (NPS 1993, p. 22). An emphasis on the protection of wetlands is important for the future of Jamestown Island, although it can be argued that lack of communication and cooperation between the NPS and Preservation Virginia has hurt Jamestown Island. While well-intentioned, the regular maintenance of infrastructure between the Preservation Virginia property and the National Park Service property on Jamestown Island has been insufficient. A single 15-inch pipe responsible for relieving over 50 acres of stormwater away from the Preservation Virginia site and out to Back River is nearly completely silted in, which prevents adequate drainage and likely contributes to the slow expansion of the swamp. Looking to the future, recognition of the swamp's place in the landscape is critical for understanding site function and planning of future programs and initiatives.

Archaeological Resources

Jamestown is the first permanent English settlement in North America. This phrase—carefully crafted—reflects that Virginia was England's first successful colony. Earlier English colonies, such as Roanoke, either were lost, ran out of funds, or failed in the harsh climate of North America. Within this phrase is also the tacit recognition that Spain had succeeded in Florida decades before the Jamestown, and that Native Americans were in the land for centuries before the European settlers.

This "permanence" is cultural rather than physical, as the site of Jamestown was abandoned as a capital by 1699, and as a town following the American Revolution. The permanence of Jamestown reflects the enormous impact English culture has had on the economic, political, and legal foundation of the United States. To many, Jamestown is a "seed" that planted in North America a culture of rule of law and representative government.

To elite Virginians of the late 19th century—a social class reeling from defeat in the American Civil War—the most important concept was being "first". Jamestown was first and the more popular memory of the founding of English America at Plymouth in Massachusetts was not. But Plymouth in the 19th century was still a thriving town, while the site of Jamestown was a ruin. All that remained was a late 17th century church tower that was itself in need of saving.

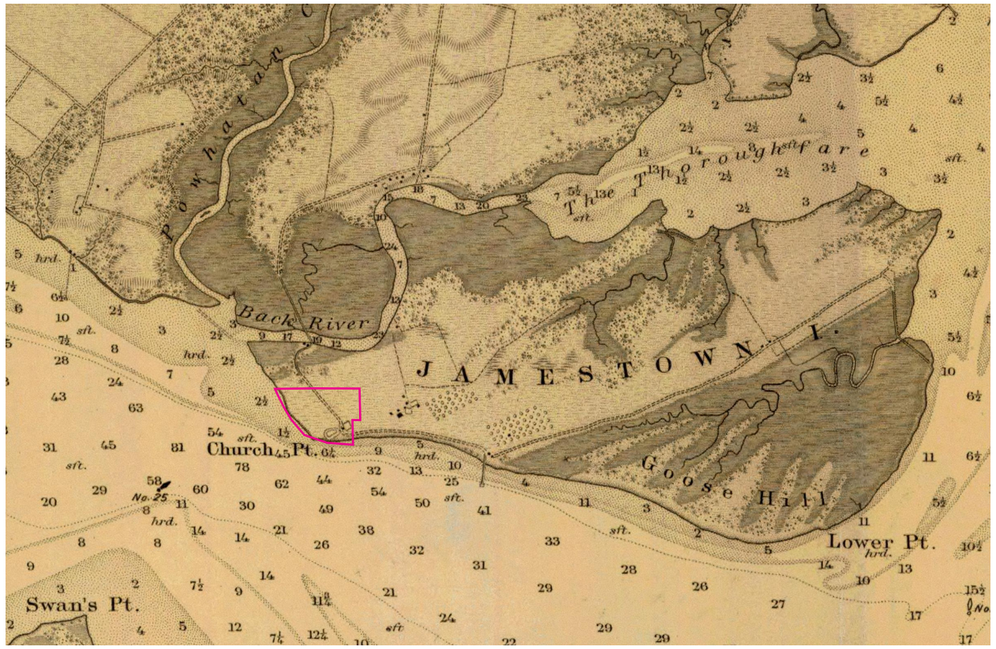
That salvation came from a group of Virginia society women who formed the Association for the Preservation or Virginia Antiquities (APVA). They formed in 1890 to save the Jamestown church tower and other icons of the state. This was both an effort to save the past and to restore Virginia's prominence in that past. After acquiring 22.5 acres of land and repairing ruins and gravestones, by 1907, and the erecting of several grand monuments, the site of Jamestown became a Virginia shrine.



The field west of James Fort (ca. 1607) before a tidal flood event.



The field west of James Fort (ca. 1607) during a tidal flood event.



Enlargement of an 1882 Coastal Survey suggests the majority of the Preservation Virginia site was dry; evidence that sea level rise has been relentless on the island over the last 140 years.



Archaeologists using ground penetrating radar (GPR) to search for clues to the past in an area recently overtaken by swamp as a result of sea level rise.

Even as the women of the APVA conducted early successful attempts at archaeology—finding the foundations of two historical churches behind the tower – they and the historians and museum professionals that came after them—concluded that the site of the James Fort had eroded away into the river. This "lost" fort itself became a part of the romantic narrative of Jamestown for generations. The narrative was two-fold: Virginia was the true birthplace of English America, but it was a birthright denied by the dominant narrative of the northern Pilgrims.

This was the lesson taught through statues and obelisks, and volunteer guides for many decades. It was a lesson that highlighted one culture's contribution to the establishing of Jamestown, and not others—not the Powhatan peoples native to the region or the enslaved Africans that arrived by 1619. The one exception was the celebration of Pocahontas, not as a Native American who symbolized the trauma of colonization, but as the little girl that rescued John Smith—a "princess" that married an English tobacco planter and was referred to as the "Mother of two nations".

Under the soil visitors were standing on—even as guides pointed toward the "lost" fort in the James River—was the buried truth. The vast majority of James Fort was not underwater, but long ago rotted away and left evidence of its walls and buildings in the soil. Millions of artifacts of the 17th century were inches below the surface. Finding this evidence would revolutionize the understanding of Jamestown and colonization during the 1600s.

In 1994, an archaeological project called Jamestown Rediscovery, was authorized for just 10 years. Its earliest researchers were hoping to find at least one remaining fort wall and as many artifacts as possible. Twenty-eight years and 3.5 million artifacts later, a fort in which 88% of the original wall's features have remained has emerged from the past. Artifacts, the foundations of buildings, and graves have painted a grimmer picture of life in the earliest years of the 17th century than had been told at the park. Jamestown was less of an image of English triumph, but in reality a picture of survival.

Wells, cellars, ditches, and even graves have yielded more than upper-class artifacts. The gentlemen soldiers with the evidence of hodge-podge pieces of armor and broken gun parts, lived more like "grunts" than landed gentry. The soldiers' barracks were spartan, their wells were polluted, and their many graves that have been identified have shown a group of men that often died young. Scientists have proven the existence of brackish water, a severe drought, and the bacteria that caused so many to die of typhoid and dysentery.

They were not alone: the first English women arrived in 1608. By 1609, women and children were about 20% of the new arrivals. Children's toys and women's hair pins and other daily items have been recovered, even as their names were not always recorded. Many of the earliest women and children came at the most inopportune time, as they were swept up in the 1609-10 *Starving Time*—a six-month period that took the lives of 90% of the English inside the fort. The Starving Time records were not exaggerated as once claimed, but have proven to be more gruesome than once imagined as archaeologists have found the remains of butchered cats, dogs, horses, and even the remains of a teenage English servant girl, "Jane," the first physical proof of survival cannibalism in American history.

The evidence is not just English. During western expansion, Jamestown was formed in a Pan-European economy, where colonists were supplied in large metropolitan cities and had access to trade items from Spain, Germany, Netherlands, Turkey, and China. In the same vein archaeologists have recovered thousands of Virginia Indian artifacts from the first years of the colony. These artifacts reveal evidence of support during times of peace with the native communities - a story unknown before archaeology.

The Powhatan dealt with the English on their own terms. They were not ignorant of Europeans and had been visited by the Spanish and others in previous decades. Some tribes may have viewed the English as a trade opportunity, while those nations closest to the fort felt more threatened. Nevertheless, the English encamped on land belonging the Paspahegh people —hunting lands vital to the tribe's survival that would be defended. A battle ensued before the fort was even built—a battle the English barely survived—with one discovered casualty being identified by archaeologists as a boy of 15 found with an arrowhead in his leg.

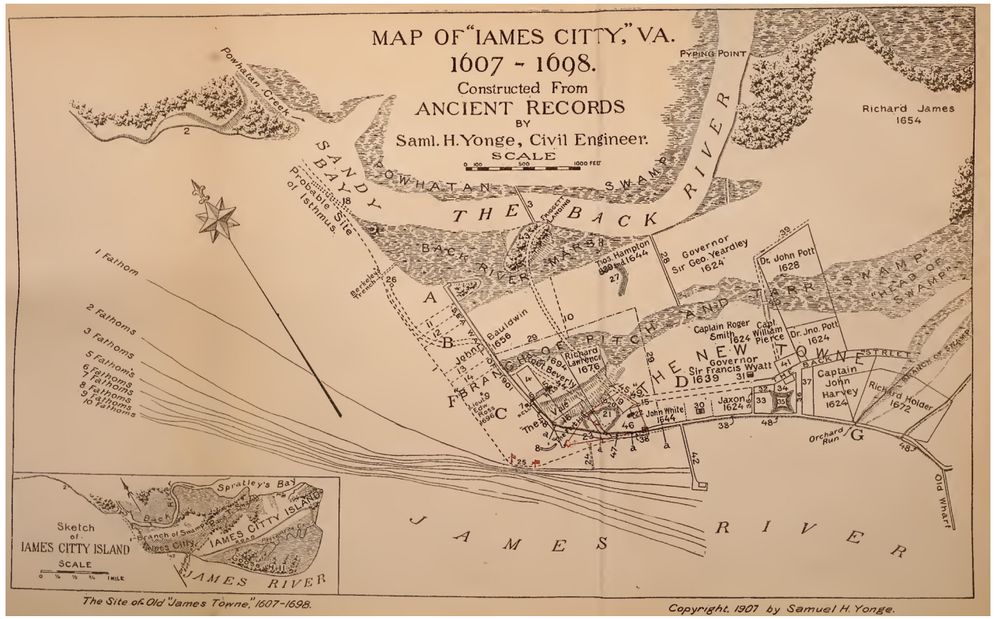
Yet the Powhatan and English were not always in conflict. There were periods of trade and peaceful interactions mentioned in the historical narratives. This had been proven true by archaeologists as food items such as pottery, corn cobs, deer bones, and acorns have been recovered next to English copper, Venetian trade beads, and iron hatchets. Both groups engaged in foreign policy and diplomacy and at times sought a co-existence. These periods of peace were often followed by prolonged conflict. These interactions would be repeated from east to west across America for centuries. The ultimate defeat of the Powhatan, the establishment of reservations, and the breaking of treaties would be as much a legacy of Jamestown as representative government.

That representative government would be first established at Jamestown in 1619. The First Assembly would be the greatest achievement in a series of reforms that allowed colonists to have the legal rights guaranteed by English law, private ownership of land, and the legitimacy of contracts. The rule of law established at Jamestown would provide a blueprint for future American concepts of liberty and justice. But these reforms were put in place in increase the growth and transport of tobacco, England's first economic success in Virginia.

To succeed in large scale tobacco cultivation required lots of land and labor. The often-hostile acquisition of farmable land would be at the expense of the Powhatan. The labor would be provided by poor European servants and enslaved Africans, who first arrived in 1619, a few weeks after the First Assembly—bartered and sold off English ships that had engaged in piracy in the Caribbean. Even as the legality of piracy and slavery were dubious under English law, Africans were forced to work in Virginia without the legal guarantees of the English servants. Eventually white servitude would be abolished, while the enslavement of Africans due to the basis of color would be established through law. As archaeologists have identified the site of the First Assembly, they have also worked to locate the site of where Angela, one of the original enslaved Africans of 1619 lived and worked.

For three decades, archaeologists have proven that Jamestown is a place where the past meets the presents. For every brief triumph, there is a tragedy. The English survived their first beachhead in America, but largely at the expense of the original inhabitants. Diverse peoples traded and interacted with one another, but also went to war. The colony made political and economic advances but was ignorant of basic hygiene. In 1619, they laid the foundations of American democracy, while enslaving others a few weeks later. It is the story of a land of opportunity that conflicts the native people's right to self-defense. In short, it is all of America's conflicted ideals and realities born over 400 years ago. It was not a gentle birth.

James Fort has been rediscovered from being rhetorically underwater. Ironically, now it faces a future of sea level rise and changing climate that may put it actually underwater. It is no longer a shrine to English America and Virginia that faces a grim future, but the birthplace of all Americans, including those yet born or yet to arrive to these shores. The lessons of Jamestown are what is worth saving for all of us.



Historical maps provide clues to modern historians and archaeologists and inform archaeological explorations.



Changes to the island's shoreline and ecology means that countless artifacts have already been lost.

Project Goals

The mission of this project is to develop a comprehensive plan to protect the site of America's beginnings, adapt Jamestown to continually changing environmental forces, and to preserve the landscape for the next 50-75 years. The following goals provide a holistic framework for the Jamestown Resiliency Plan.

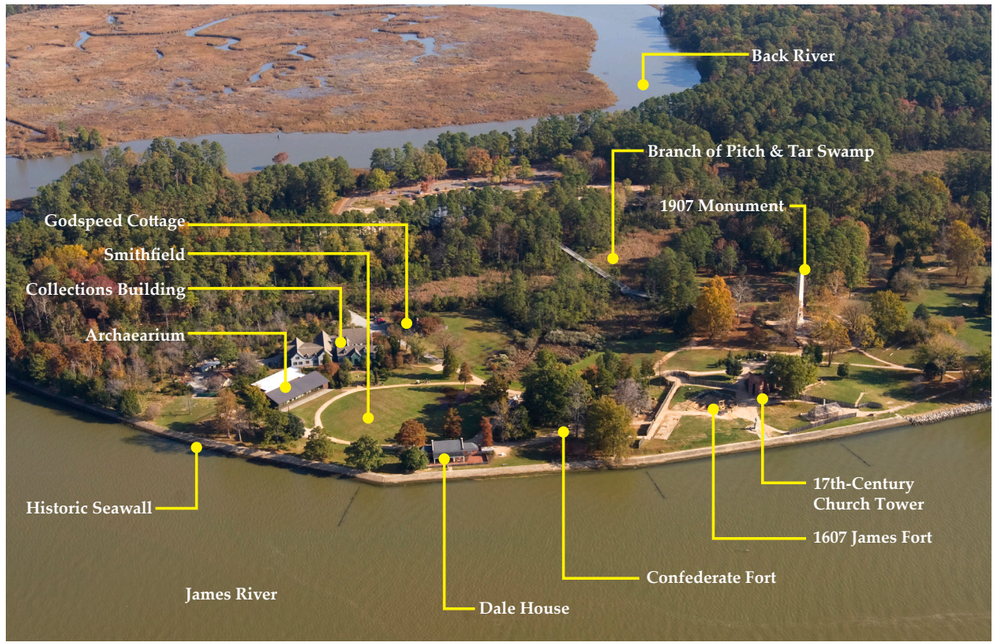
Leverage resilience strategies to maintain and protect Preservation Virginia's diverse archaeological site at Jamestown Island for the next 50-75 years by improving infrastructure, reducing coastal risk, and addressing sea level rise.

Share a more complete story of Jamestown Island's past, present, and future by adapting active archaeology sites to the changing environment and improving the interpretive sequence throughout the property's sensitive landscape.

Create a safe, accessible landscape that protects the integrity of the site by using Principles of Universal Design so visitors of all abilities can engage, explore, and discover the important historic, archaeological, and environmental resources found at Jamestown.

Section 4

Site Analysis



Bird's eye view of existing site and significant landmarks and features.



Existing visitor access via footbridge across the branch of Pitch and Tar Swamp to the PV and NPS sites.

Existing Facilities + Visitor Experience

As visitors are approaching Jamestown Island via the Colonial Parkway, they are afforded some spectacular views of the sheer expanse of both the James and Back Rivers, but brings visitors close enough to see wildlife, such as turtles, birds, and pollinators amongst and above the brackish marsh vegetation that buffers land from water in Sandy Bay. Crossing the bridge on the parkway from the isthmus to the island, the water on the James River side is particularly turbulent where these water bodies meet.

Upon reaching the parking area at the National Park Service's Jamestown Visitor Center, visitors can go inside to purchase tickets, browse an interpretive exhibit displaying selected artifacts and models, and prepare for the short walk across the Pitch and Tar Swamp footbridge to enter the site. Traversing the bridge, it is easy to see how changing water levels are already impacting the landscape: "ghost trees" soar above the low-lying marsh vegetation and water levels, which serve as a transition to the slightly upland woodlands that buffer the swamp. Walking further out across the footbridge, visitors can begin to get glimpses of the historical buildings and landscape they are about to experience. The footbridge turns slightly and visitors emerge just before the Tercentennial Monument, built in 1907 for the settlement's 300th anniversary, where the 104-foot obelisk (Jamestown Rediscovery Foundation, 2021) rises high above surrounding trees and leaves visitors with a grand first impression. This monument is a visual marker of the approximate border between the Jamestown Rediscovery Foundation site and the rest of the island which belongs to the National Park Service.

From here, visitors who choose to explore the Jamestown historic areas, which are the subject of this report, can follow compacted gravel pathways that take them to all the site's points of interest:

Memorial Church - The Memorial Church is sited over the original foundations of the 1617 Historic timber-frame church. The building, approximately 1,520 square feet, was constructed in 1907.

Church Tower - The 17th Century Church Tower is situated immediately west of the memorial Church and totals 330 square feet.

The Dale House - The Dale House, was constructed in 1906 as an on-site exhibit building for the Jamestown Exposition, held in Norfolk, VA to commemorate the 300th anniversary of the founding of Jamestown. The building totals 1,725 square feet and currently houses contracted food service.

The Mule Barn - The Mule Barn, ca. 1905, is a wood-framed building of 1,500 square feet that houses the Preservation Virginia restoration and Maintenance Shop.

Yeardley House/ Collections Building - The Yeardley House/ Collections Building was originally constructed in 1906 as a guest house. Additions in 1957, 1999, and 2005 bring the total area to approximately 12,000 square feet. The building currently serves as headquarters for Jamestown Rediscovery Foundation collections, conservation labs, and administrative offices.

Godspeed Cottage - The Godspeed Cottage is a two-story residence built in the early 20th Century totaling 750 square feet. The archaeologists offices are located in the building currently.

The Archaearium - The 5,400 square feet Archaearium is an exhibit building that opened in 2006 and houses over 4,000 artifacts recovered from the James Fort Site.

In addition to these extant standing structures, history comes to life at Jamestown through individuals who embody their stories and share about indigenous and settler cultures. Under the shade, visitors can take a rest and listen to the historians talk about life as it was in the time of early settlement. There are also many opportunities to get close to and interact with the Jamestown Fort, the Confederate Fort, and other features dispersed in the

landscape. It is in this landscape that visitors to the site on dry days can count themselves lucky to witness the archaeologists in action. Carefully excavating pits to reveal buried history, the disturbed soils leave traces that only their trained eyes can interpret.

Following the paths, visitors can make their way to the historic seawall and take in the sheer expanse of the James River. Recently armored to fortify the existing protection from wave action and erosion, the seawall has been in place since 1901 to protect Jamestown from the powerful environmental forces of the James River. While parts of the island have literally been lost to the river, the seawall buys time for modern Jamestown Island, as it is expected that it will be at least several decades before the seawall is permanently breached due to rising tides.

Interpretation and Education

One of the opportunities that visitors to Jamestown can experience is engaging with site features. Following delineated paths to historic structures and contemporary interpretive signage, visitors can enjoy a self-guided tour and take in the site at their own pace. One of the most engaging opportunities for visitors comes from interacting with archaeologists and Living Historians who can share stories about the lives of the Native Americans, Enslaved Africans, and American Settlers who lived here in the past. Interpretation should remain a focus, with information about the future of Jamestown as an added layer to the Jamestown curriculum.

Signage

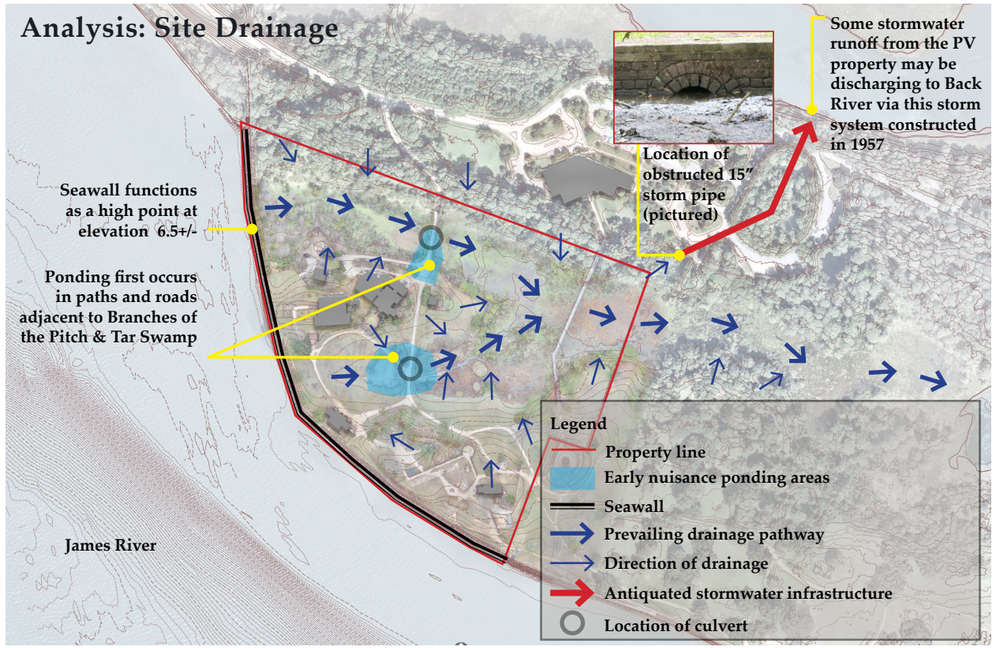
In 2019 Jamestown Rediscovery upgraded the aging graphic panels on their acreage and added all new signage highlighting the significant archaeological finds in and around the James Fort site. New wayfinding signage throughout the property aids visitor flow from the obelisk through the sites and to the Voorhees Archaearium Museum. With the completion of a three-year archaeological project defining the spot where the first representative government met in 1619 in the church at Jamestown, an exhibit in the brick Memorial Church was developed. New signage interprets the history and architecture of the 1617 timber frame structure, and glass floor portals are archaeological windows into the past. The revamped signage styles and panel structures are recommended to be carried through new improvements to tell the story of sea level rise and flooding at Jamestown.



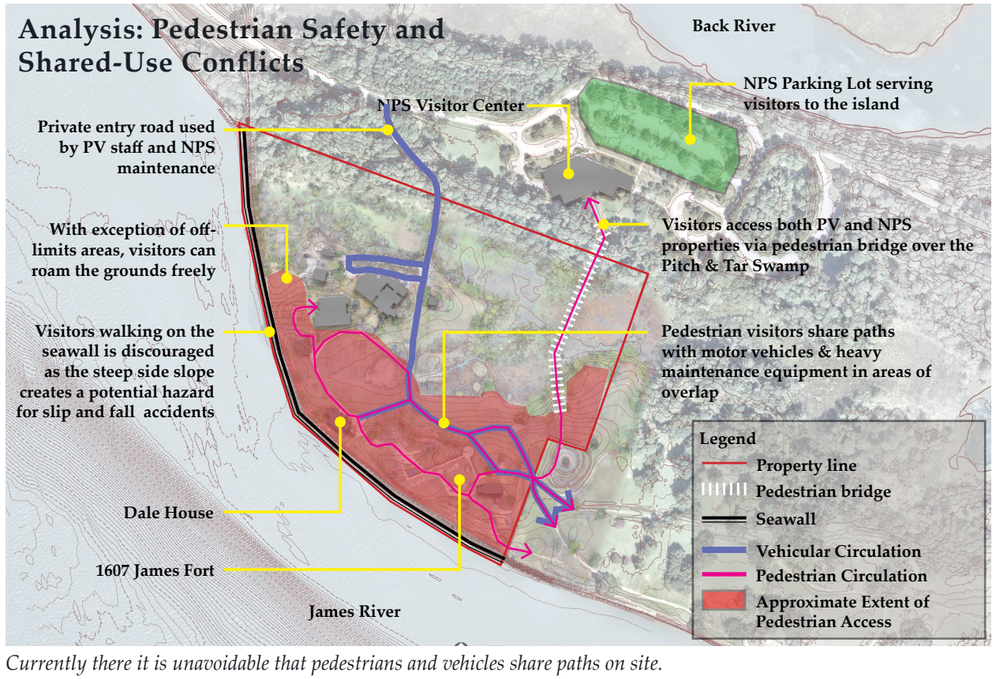
Living Historians at Jamestown engage with visitors to share about the experiences of the early peoples of Jamestown Island. In the image above, families listen to an Indigenous Living Historian describe methods of creating tools, customs regarding trade and commerce, hunting practices, and more.



Recent improvements to branding and signage for the PV property should be continued throughout the site for interpretive moments where appropriate.



Stormwater runoff primarily exits the site via Pitch and Tar Swamp. Some stormwater may be captured by the antiquated infrastructure.



Currently there it is unavoidable that pedestrians and vehicles share paths on site.

Existing Stormwater Facilities + Maintenance

The existing stormwater facilities were constructed when the NPS was preparing Jamestown Settlement for the 350th anniversary commemoration event. Before 1957, the island was not yet connected to the historical Colonial Parkway which began construction between Yorktown and Williamsburg in 1931. When the island was finally connected to the Colonial Parkway, and the NPS Visitor Center, parking lot, and vehicular circulation infrastructure were developed. Part of these site improvements included a brick headwall that was installed on the NPS property to support drainage of the PV and NPS properties. Over time, this outflow pipe in this low-lying landscape has become largely filled with sediment and the system no longer functions as it was originally designed. It is hypothesized that this impairment to the drainage facilities, along with sea level rise, has contributed to the upslope creep of the branch of Pitch and Tar Swamp extending into the PV property. This is because fresh water is being retained in upland areas for longer periods of time, which influences soil moisture balance and the expression of local ecology.

Because the area is so low-lying, nuisance flooding tends to occur very quickly during storm events. Water drains from upland areas toward Pitch and Tar Swamp. Often, the paths on site hold standing water as they passively become part of the stormwater conveyance system during a storm. There are areas where ponding occurs, which will inhibit access for site visitors and staff. This is caused by both shallow slopes, low points in the landscape, and a lack of prevailing positive drainage that is capable of moving water off site. Just two stormwater culverts divert water to Pitch and Tar Swamp under the access road on the PV property.

Existing Circulation + Safety

The private entry road is the only access point for NPS and PV to enter their historic sites with vehicles and equipment. While most PV vehicles park at the Collections Building, sometimes vehicles are traveling on the same paths as pedestrians. For example, vehicles must travel all the way to the Dale House in order to stock and supply the cafe. NPS maintenance equipment is too heavy to use the historic wooden bridges throughout their property, so they share PV roads until they make their way onto their property.

It has been observed that vehicular traffic, whether it be heavy equipment, mowers, or trucks, are traversing the property during visitor hours and often during live tours. Because the entire site may hold promising future archaeological discoveries, the operation of the heavy equipment and trucks outside the paths is hazardous for resources within the soil.

Shared use paths that mix vehicular and pedestrian traffic is hazardous for pedestrians, especially children and individuals with disabilities. This is because children may dart in front of or behind moving vehicles without the operator being aware, which could lead to injury or death. The same can be said for individuals with disabilities because they may not be able to perceive a moving vehicle and may not be able to react in the event of an emergency situation. It is a best practice to separate these uses if possible, and where not, to limit the mixing of these groups.

Other site considerations on circulation include the privilege of visitors to be able to freely roam the site. In general, visitors do stick to the paths, but they are able to walk around and take in views of the historic landscape from anywhere that access is not restricted. This is not necessarily an issue, except that there may be flood-related hazards that are hard to perceive, such as perched water, or accidents related to stormwater in archaeological dig areas. While visitors are strongly discouraged from walking along the seawall due to risk of slipping and falling either directly into the James River or onto the armor stone, it does happen.

Stormwater Flooding + Sea Level Rise

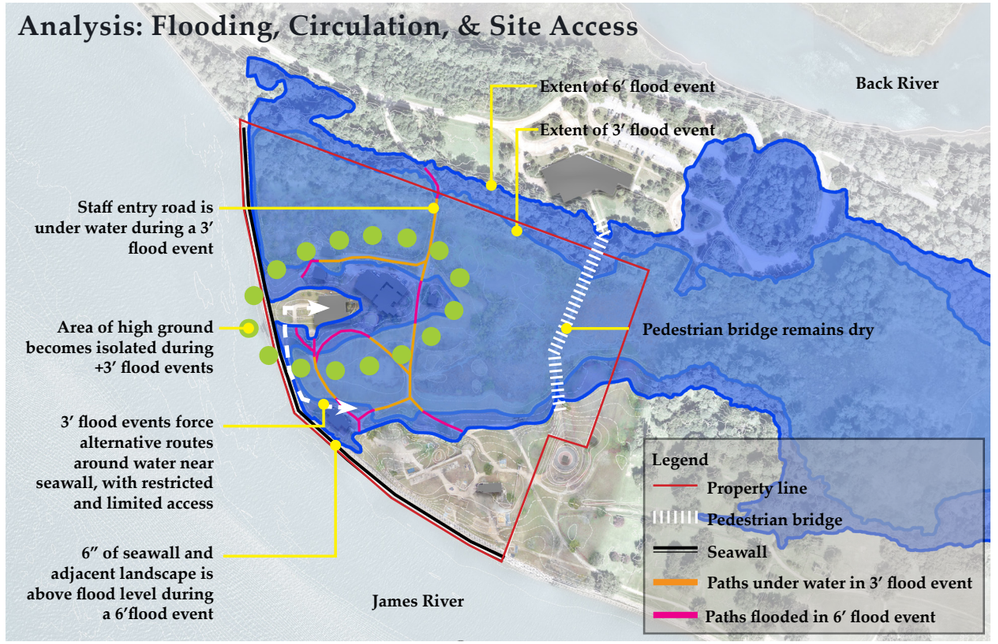
As discussed in Section 2, flood events often render the site inaccessible. On average, 5 to 6 times per year, the site experiences a flood of approximately 3 feet. Even with this minimal flooding, access roads and paths to the Archaeearium and Collections Building are inundated, with the only access via the top of the seawall, which is not a safe route for visitors. A 6 foot flood will further reduce access and begin to flood buildings, especially the Dale House with a finish floor elevation of 5.67 feet. The 100-year floodplain ranges from 7 to 8 feet throughout the property. It is standard practice in the region to elevate building finish floors to 3 feet above the 100-year floodplain to account for sea level rise. Some municipalities require all building mechanical infrastructure to be 3 feet above the 100-year floodplain. Elevating buildings and flood proofing others should be considered for each building at Jamestown to ensure resilience against extreme storm events.

With the seawall fixed at approximately elevation 6.5 feet, site flood protection measures above it may have a detrimental impact to the visual, interpretive, and historic landscape. In order to balance this historic landscape with a resilient strategy for the next 50 years, consideration should be given to allowing the site to flood in extreme storm events (more than 6.5 feet of tidal flooding) combined with elevating and/or flood proofing all buildings. In many resilience plans, building elevations are accomplished by putting structures up on "pedestals." This is not the appropriate approach to this intervention at Jamestown Island. In order to preserve site integrity, the buildings will be elevated and the surrounding landscape will be brought up to the new finished floor elevation of the structures. This will maintain sense of place minimally impacts existing viewsheds. Structural flood protection for the site should be considered up to 6.5 feet of elevation, protecting important archaeological resources and ensuring access to the site during more frequent moderate flood events.

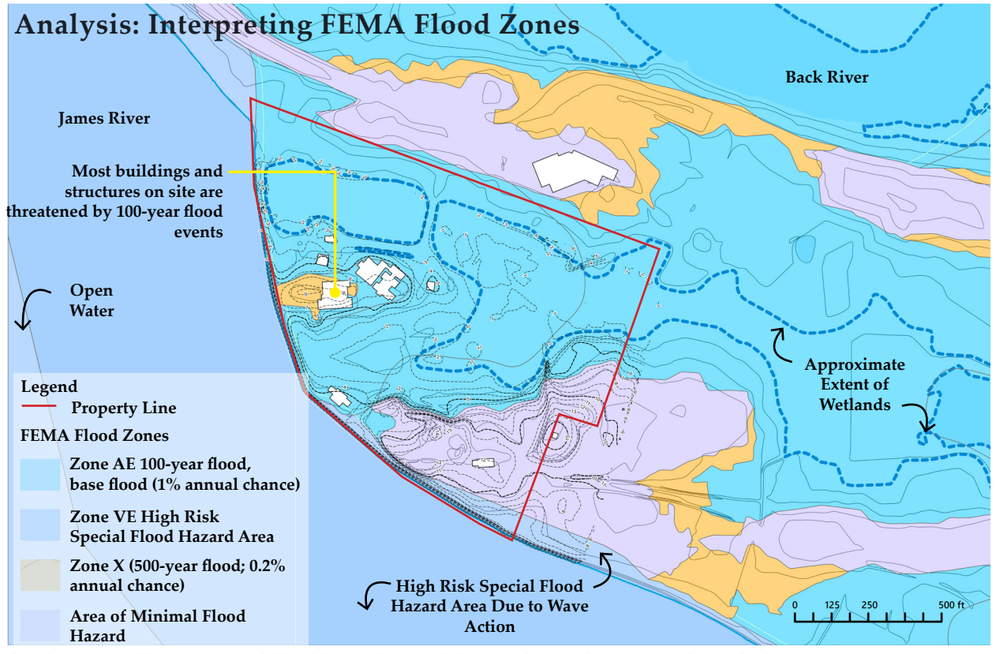
Along with rising sea levels and swamp creep, stormwater flooding is a consistent problem at Jamestown. The flat nature of the site does not allow for quick drainage and antiquated off site infrastructure does not function as originally intended. In-depth hydrological analysis will be required to develop a detailed plan to address stormwater flooding. Consideration should be given to regrading of portions of the site to create positive drainage and mechanical pumps to control stormwater flooding during tidal flood events.

Archaeology at Risk

The whole of PV's property is an archaeological site of global significance. Every square foot of land could potentially hold historic and/or prehistoric findings. While there have been past archaeological explorations on different areas across the PV site, there have been few *contemporary* archaeological explorations that have occurred outside the historic fort and adjacent land. This resilience plan is a response to the environmental threat to the integrity of the property from flooding. It can not be overstated that this project will require a light touch, especially with respect to preserving site integrity and viewsheds. The proposal is intended to suspend any further encroachment of the wetland areas until the archaeology can be completed with as small an impact on the wetlands as possible—in order to preserve precious dry land for conducting archaeological research. Because of sea level rise, increased frequency of storm events that bring flooding, and overall land subsidence, the land at Jamestown is becoming wetter due to changes in these environmental forces. Inundation is damaging to artifacts, and especially for artifacts made out of natural materials and burials. Time is of the essence for action to protect the landscape at Jamestown that allows archaeologists to continue to discover and share the evolving story of history and culture at Jamestown.



Flood events have a significant impact on site function and access.



Overlaying the FEMA National Flood Hazard Layer FIRMette data with a site aerial reveals that most of the Preservation Virginia property and Jamestown Island at large is at risk for a flood hazard.



Archaeologists pump river water out of an active dig site when James River flood waters caused portions of a wall to collapse.



An archaeological dig pit after a storm. Stormwater captured in the pits must either dry out or be removed by pumping. Perched water is hazardous for artifacts near the exposed soils.

To understand the process of flooding at Jamestown, this study looked at tidal, storm, and hydrograph data to conceptualize how waters flow and which areas are at greater risk of damage from inundation. The analysis map titled "Ranking Risk to Archaeology Under Existing Site Conditions" is the result of that investigation. Using contour lines as a proxy for relative elevation, the map shows the topography of the island broken up into 1' segments. The lowest-lying land, between elevation 0 to 1 feet, is bright red and can be found in most of the area that is also marked as Pitch and Tar Swamp within the blue dashed lines. The gradient changes from red to dark-green, where the highest elevations on this graphic are located within the 1607 James Fort. The NPS land beyond the property line tends to rise and is higher in general than the PV property.

Taking what is known about flooding up to the seawall, the height of which occurs between contours 6 and 7 on this map, the study makes assumptions about what is at risk. For instance, flooding that breaches the seawall puts huge swaths of the site underwater. Data revealed from FEMA mapping of 100-year and 500-year flood plains determined that the 100-year flood occurs at 8.5 feet and the 500-year flood plain occurs at 9.8 feet. Thus, the risk by elevation was visualized by the vertical grouping of contour intervals into a red, yellow, and green zone which correspond to nuisance flooding, 100-year floods, and 500-year floods, respectively.

The map also reveals that the land area that has experienced the most archaeological digs, the original Jamestown Fort, actually rests on the site's higher ground. This is another factor supporting PV's change in from conducting research archaeology to planning for preservation archaeology: the areas that haven't been explored yet are the ones most at risk of being lost forever.

What Do We Have to Lose?

For centuries, Jamestown has been commonly known only as the site of the first permanent English settlement in North America. This perception has always hidden the full truth. Jamestown was a multicultural place, where the First Europeans, First Peoples, and First Africans laid the foundations of modern America. Safe in the ground for hundreds of years, rising waters and severe storms now threaten to destroy the traces of this shared, diverse history.

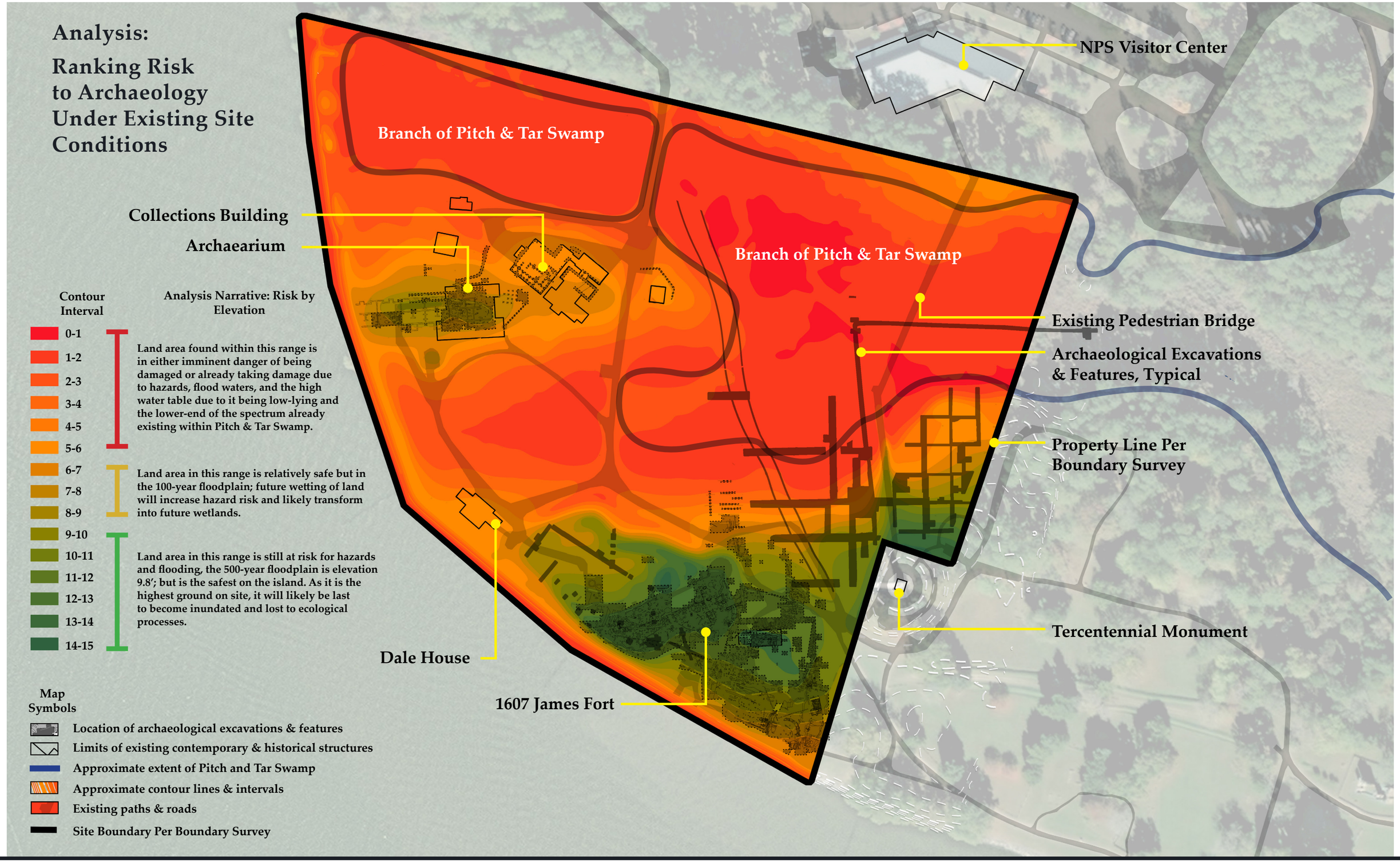
The Jamestown Rediscovery team has dedicated itself to uncovering this shared history since its inception. Until the project started in 1994, visitors to Jamestown Island were told that the site of the original 1607 James Fort had washed away into the James River. Two years after the excavations began, the team was able to disprove this theory. Now, after nearly three decades of continuous work, the archaeology team has uncovered an unparalleled collection of artifacts and features representing the actions and agency of hundreds of diverse individuals.

Water has always played a role in the shaping of Jamestown's history. The original English colonists built their fort next to a deep river channel, on a small ridge that provided a strong defense against water-borne assault. These same waterways served the local indigenous population as major thoroughfares for trade and communication within the expansive Powhatan Polity. In August of 1619, these rivers saw the forcible arrival of 32 enslaved Africans, brought to Virginia by English privateers.

Arriving during the worst drought in nearly 1,000 years, the English encountered some of the most challenging climactic conditions in millennia. The colonists dug deep wells in search of fresh water and cellars to survive harsh winter conditions. When no longer needed or useful, these same pits would be filled by trash from around Jamestown, representing a "democracy of deposition." Miraculously, these trash deposits have survived for over 400 years, and contain the objects, tools, and faunal remains representing food not only used by the English inhabitants of Jamestown, but also by First Peoples and First Africans. These artifacts provide an unprecedented, extraordinary, and extremely rare view into our shared past.

Analysis:

Ranking Risk to Archaeology Under Existing Site Conditions



Contour Interval

- 0-1
- 1-2
- 2-3
- 3-4
- 4-5
- 5-6
- 6-7
- 7-8
- 8-9
- 9-10
- 10-11
- 11-12
- 12-13
- 13-14
- 14-15

Analysis Narrative: Risk by Elevation

Land area found within this range is in either imminent danger of being damaged or already taking damage due to hazards, flood waters, and the high water table due to it being low-lying and the lower-end of the spectrum already existing within Pitch & Tar Swamp.

Land area in this range is relatively safe but in the 100-year floodplain; future wetting of land will increase hazard risk and likely transform into future wetlands.

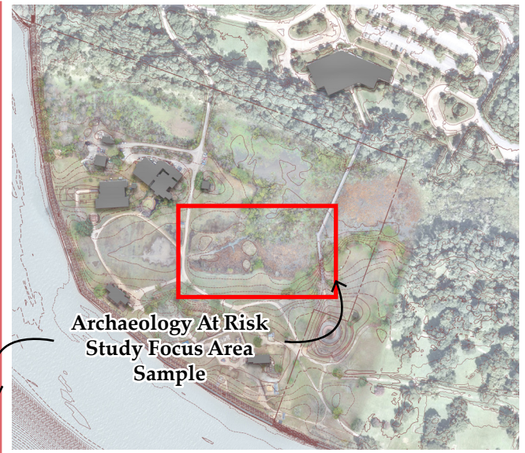
Land area in this range is still at risk for hazards and flooding, the 500-year floodplain is elevation 9.8'; but is the safest on the island. As it is the highest ground on site, it will likely be last to become inundated and lost to ecological processes.

Map Symbols

- Location of archaeological excavations & features
- Limits of existing contemporary & historical structures
- Approximate extent of Pitch and Tar Swamp
- Approximate contour lines & intervals
- Existing paths & roads
- Site Boundary Per Boundary Survey

Analysis:

Archaeology at Risk and Future Prospects



Present Extent of Surface Water Level

Extent of May 2022 Flood Event

Post Holes (3+)

The Great Road

Well

James Fort Ditch

Borrow Pit (3)

Boundary Ditches (3)

Burial

1607 James Fort

0 20 40 80 120 160 Feet

Legend

- Excavation Area
- Archaeologically-Identified Feature
- Flooded Excavation
- Ground-Penetrating Radar Identified Feature

Unfortunately, as climactic conditions continue to change, inundation threatens to close off access or even destroy these important artifacts and features. Human remains in burials near the branch of the Pitch and Tar Swamp—likely belonging to marginalized individuals like servants or enslaved Africans—can disappear completely if reached by rising groundwater. Ancient DNA (aDNA), which can show the regional origins of animals and humans and connect skeletal remains with living relatives, will degrade entirely in the same conditions. Jamestown Island undoubtedly holds the remains of the ancestors of many people in the region, including those of African descent. As many records have been lost, aDNA is the best, and often only, way to link the local community with their ancestors who lived and labored at Jamestown. In addition, the archaeology team has found numerous pits, cellars, and wells, many of which contain evidence for interactions between English colonists, Native American tribes, and enslaved Africans, most of which was undocumented in contemporary accounts. Deeper features like these will flood completely, making exploration of the unique and complicated history they contain impossible. As ground and surface water levels rise, the archaeological resources of Jamestown Island will be engulfed.

One particularly threatened area is immediately adjacent to the branch of the Pitch and Tar Swamp. This space has always been low-lying, but in the past was an open, dry field. The Swamp has been encroaching on this area in recent years, and has already flooded the central portion. During major storms, a much wider area is underwater including trenches dug by previous archaeologists in the 1940s.

It should be noted that most of this space has not been excavated. Archaeologists using GPR have recently identified major archaeological features - many of which may date to the early 17th-century - will be in danger from increasing inundation. Limited archaeology has shown burials located in this area are likely marginalized individuals such as indentured servants, enslaved Africans, or Virginia Indians. If surface and ground water reach these burials, these "hidden" figures of Jamestown's diverse past may disappear completely. A core mission of Jamestown Rediscovery is exploring all aspects of our shared history, and to give voice to historically-silenced peoples.



The mixture of shells, coins, ceramic shards, bones, and various artifacts are common finds during excavations. The range of artifacts found suggests rich cultural exchange among early Jamestown inhabitants.



Jamestown was historically a multicultural place. The ability to continue explorations of the land in areas threatened by rising waters is hypothesized to reveal the hidden and silenced stories of marginalized people.



Accessible seating and resting locations provide opportunities for all visitors to experience what Jamestown has to offer without the fear of physical exhaustion or exclusion.



Interpretive panels with pictorial, verbal, and tactile features provide a more holistic learning environment.

Universal Design at Jamestown

In the context of Jamestown, the Universal Design Principles should be used to update and improve visitor experience by considering them during the design of the different component parts of the proposed resilience plan. As the plan is implemented, the new site features will reflect this commitment to access and safety as each design intervention is phased into the landscape. When the site is more accessible and comfortable for visitors, they can focus on the significance of finding themselves in this historically significant landscape. The following guiding principles can help shape the vision for equity and inclusion at Jamestown.

Seven Principles of Universal Design

Developed in 1997 by a working group of architects, product designers, engineers and environmental design researchers, led by the late Ronald Mace at North Carolina State University, the purpose was to guide the design of environments, products and communications to be usable by all people, to the greatest extent possible, without specialized or adapted designs. It was not intended to constitute criteria for good design, only universally usable design. Universal Design does not specifically take into consideration aesthetics, cost, safety, gender, or cultural appropriateness. This creates a unique opportunity for landscape architects and designers to collaborate holistically on innovative solutions that are functional and integrated into the surrounding landscape.

Equitable Use

Design is useful and marketable to people with diverse abilities. These designs provide the same means of use for all users and avoids segregating or stigmatizing any users. These designs support the value of equal privacy, security, and safety for all and should appeal to all.

Flexibility in Use

The design accommodates a wide range of individual preferences and abilities, providing choice in methods of use. They can accommodate right- or left-handed access and use and they facilitate the user's accuracy and precision. These designs are configured to provide adaptability to the user's pace.

Simple and Intuitive Use

These designs are easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. They eliminate unnecessary complexity, are consistent with user expectations and intuition, and accommodate a wide range of literacy and language skills. In addition, these designs arrange information consistent with its importance while also providing effective prompting and feedback during and after task completion.

Perceptible Information

Designs communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. They use different modes (pictorial, verbal, tactile) for redundant presentation of essential information and provide adequate contrast between essential information and its surroundings. These designs maximize "legibility" of essential information and effectively differentiate elements in ways that can be described (i.e., making it easy to give instructions or directions). Lastly, these designs provide compatibility with a variety of techniques or devices used by people with sensory limitations.

Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions. In the design, elements are arranged to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded. For this to be effective, the design provides warnings of hazards and errors and also provides fail safe features. They also discourage unconscious action in tasks that require vigilance.

Low Physical Effort

These designs can be used efficiently and comfortably and with a minimum of fatigue. They allow the user to maintain a neutral body position. They use reasonable operating forces, minimize repetitive actions, and minimize sustained physical effort.

Size and Space for Approach and Use

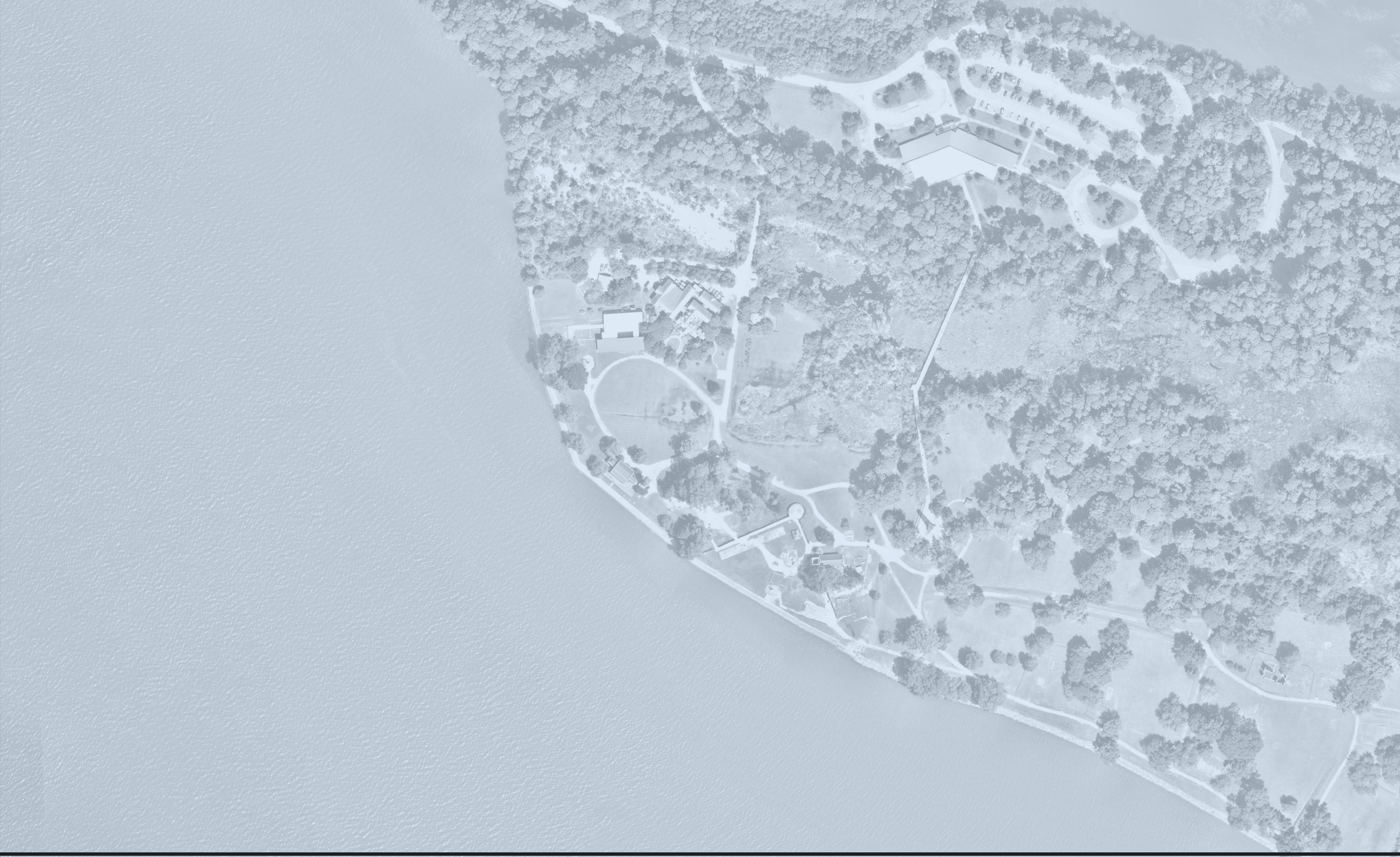
These designs ensure that the appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility. They provide a clear line of sight to important elements for any seated or standing user. They also make the reach to all components comfortable for any seated or standing user while accommodating variations in hand and grip size. In addition, these designs provide adequate space for the use of assistive devices or personal assistance.



Accessible bridge crossings allow all visitors to experience the full extent of the site.



Example of glass viewing panels that allow children and wheelchair bound individuals to visually connect with the landscape in otherwise inaccessible or obstructed areas.



Section 5

Design Strategies for Coastal Resiliency



One framework for describing resilience projects is based on how they function in the landscape. Projects tend to fall into three broad functional groups: fortify, adapt, and retreat, but there can be overlap depending on specific site conditions and performance of proposed interventions. Within this framework can be grouped into general categories or typologies which may not fall squarely into one of the three functional groups, but may have characteristics from all or some of them. (Graphic adapted from SASAKI, https://www.sasaki.com/projects/sea-change-boston/).

Implementing Resilient Strategies

In the context of landscape and environment, resilience is the ability of a place to withstand sudden change or disturbance from hazards and recover from it. Design for resilience is a rapidly growing field of study and practice among design and engineering professionals. Resilience design will vary for each place depending on location, hazards expected in that area, and site-specific opportunities and constraints. When it comes to coastal resilience, there are three basic ways to respond to hazards and risk: fortification, adaptation, and retreat. Fortification is when designers use strategies that keep water out of developed areas. Adaptation is when designers use strategies that call for communities to live with water at least part of the time or during extreme weather events. And retreat is when people and assets are relocated to upland areas out of harm's way and these previously developed areas are allowed to flood. Within each of these big-picture concepts are multiple categories of scalable strategies that can be used individually or in concert with others, to respond to unique and changing site conditions. Resilience strategies tend to focus on either improving infrastructure or improving environmental conditions and there may be considerable overlap in many cases.

It is important to recognize that resilience strategies also have a life span. As we consider adaptation measures for Jamestown Island, the goal of 50-75 years of protection for the site to perform archaeology must be considered. This report does not address full scale retreat from the island or resiliency beyond 75 years. It is recommended Preservation Virginia consider if retreat from the island is a probability within the next 75 years, or if more robust resiliency measures be adopted in the future as sea levels rise. It is important to continually monitor environmental changes once resiliency measures are installed to determine if additional measures are required, or long term strategy for occupation of the island should change.

Regional Resilience Projects

Jamestown Island is part of the Hampton Roads Planning District Commission (HRPDC), which was established in 1990 after the merging of the Peninsula Planning District Commission and the Southeastern Virginia Planning District Commission. There are three parts to the HRPDC mission: "*Serve as a forum for elected officials and chief administrators to deliberate and decide issues of regional importance; Provide the local governments and citizens of Hampton Roads credible and timely planning, research and analysis on matters of mutual concern; and Provide leadership and offer strategies and support services to other public and private, local and regional agencies, in their efforts to improve the region's quality of life*" (HRPDC 2002). HRPDC offers support for policymakers, providing open access data and reports across a broad range of categories, including planning, public engagement, economics, emergency management, environmental education, housing and human services, and water resource management—including coastal resilience.

The planning district has an online interactive GIS tool, the Hampton Roads Resilience Projects Dashboard, which reports on the resilience projects across the region that have been implemented to address flooding. To date, the HRPDC has been engaged with hundreds of these kinds of projects. As of the writing of this report, HRPDC reports that there have been 190 completed projects, 60 programmed projects, 171 proposed projects, 135 projects under design, and 50 projects under construction. There are 11 project typologies (categories) which range in scale and scope from individual residential lots to the sub-watershed and watershed scales. This list is not exhaustive and leaves room for interpretation and near-unlimited expression where the design meets the ground.

Resilience Project Typologies

Acquisition: when vulnerable or impacted properties are purchased so that individuals are not stuck with flooded land

Beach replenishment: supplementing eroded beaches with sand, typically by pumping sand from the floor of the ocean nearby onto the beach

Drainage improvements: projects that enhance stormwater and floodwater drainage

Elevations/flood proofing/buyouts: elevation refers to the raising of a structure so that there is greater distance between water levels and the building. Finished floor building elevation heights are typically at least 3' higher than the 100-year flood plain elevation. Flood proofing can be either wet or dry. Dry flood proofing refers to strategies that prevent water from encountering structures. Wet flood proofing refers to strategies that allow flooding to occur in places where inundation can be tolerated. Buyouts, like acquisitions, enable property owners to let go of vulnerable or flood-impacted properties.

Green stormwater management: using on-site stormwater best management practices to treat stormwater close to its origin, leveraging natural features, soil properties, and landscape interventions to improve water quality, reduce flooding, and protect downstream channels.

Natural shoreline management: use of interventions that support continuous natural or mimicked wetland gradients between open water and uplands. These could include living shorelines, riparian buffers, oyster reefs, and/or a combination of strategies to ensure that shorelines are not disconnected from nature by impervious surfaces and landscape barriers.

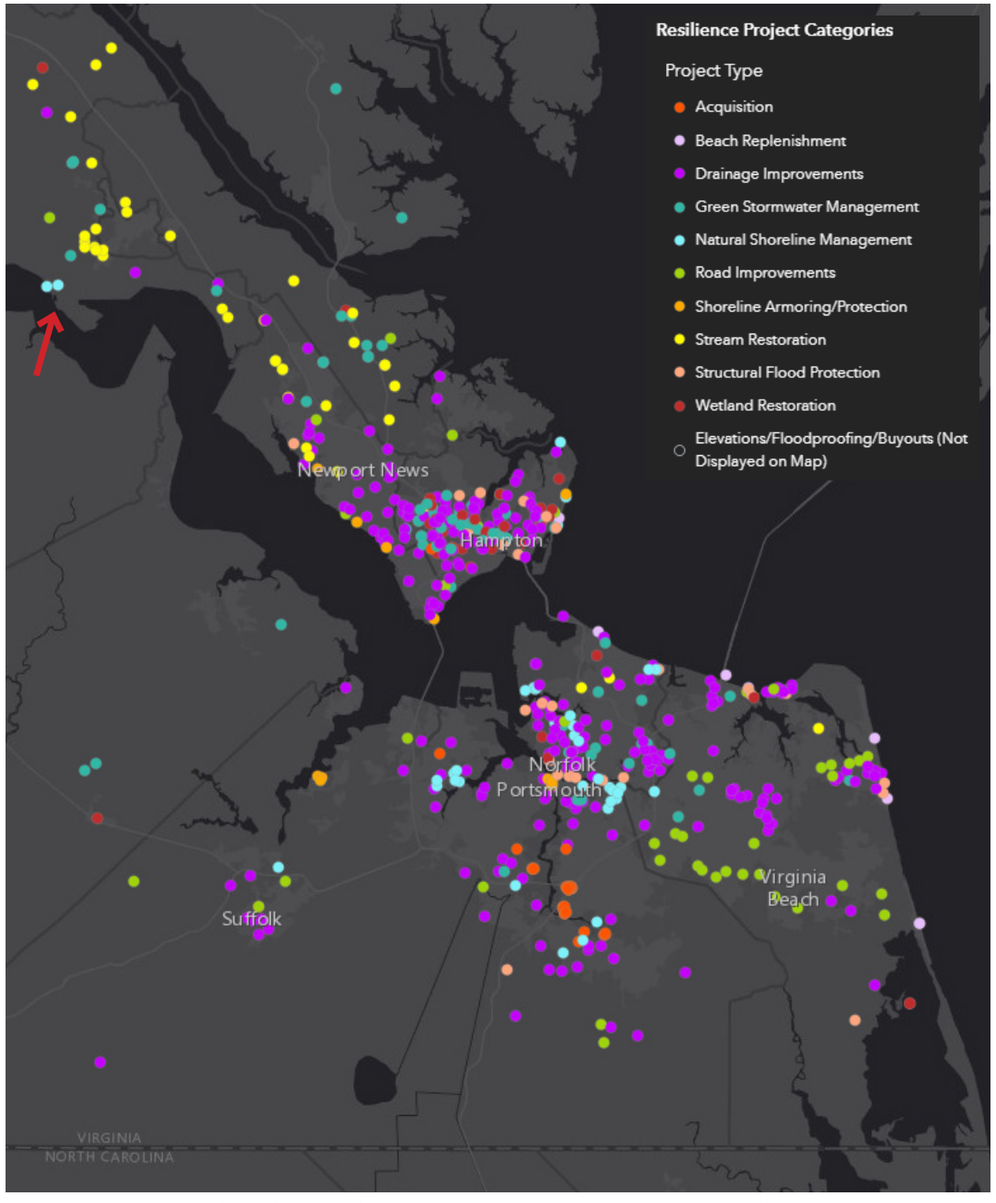
Road improvements: projects that enhance function and circulation of traffic on vulnerable roads, including bridges and tunnels.

Shoreline armoring/protection: approach that focuses on stabilization using impervious structures or materials.

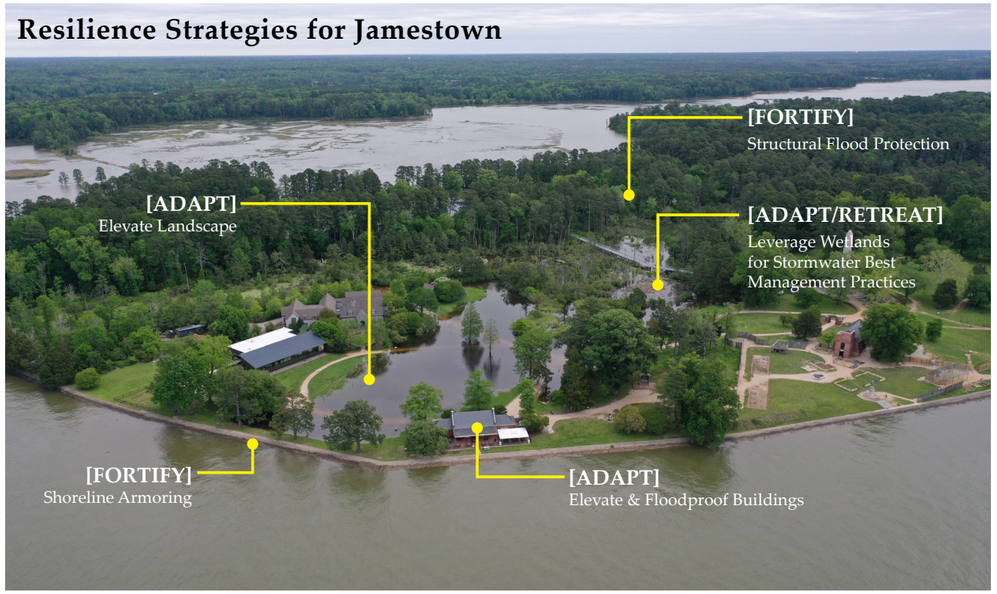
Stream restoration: using a variety of techniques, often calling for regrading of highly eroded banks and incised channels, paired with the establishment of native vegetation to improve the structure and function of a stream channel and its associated floodplain.

Structural flood protection: a suite of strategies which may include levees, berms, flood-control areas, dams and/or walls to protect people and assets from floodwaters.

Wetland restoration: enhancements in and around wetland areas to restore structure and function.



Map of current Hampton Roads Resilience Projects tracked by the Hampton Roads Planning District Commission. Projects are widespread across the region. Note the approximate location of the Preservation Virginia Property at Jamestown Island is called out by the red arrow (Source: https://www.hrgeo.org/apps/hampton-roads-resilience-projects-dashboard).



Aerial view of flooding at Jamestown Island, May 2022 annotated to describe the function of proposed resilience strategies which either fortify, adapt, or retreat from flood waters.



Structural flood berm planted with native wildflowers. The berm pictured here is approximately 6' tall on the land side, the height that would be required on the Pitch and Tar Swamp side of the site to provide protection matching the height of the existing seawall.

Five Resilience Strategies to Protect Jamestown

Five suitable strategies to adapt and protect Jamestown Island for the next 50-75 years and support the Jamestown Rediscovery Foundation's mission:

Shoreline Armoring Strategy: Repair of the Existing Historic Seawall.

A shoreline armoring/protection intervention to fortify the existing historical structure. Built in the early 1900s, the wall has been subject to flooding and harsh tidal forces for over 100 years. To increase resilience and prevent future degradation, the wall will be fortified with armor stone up to elevation 4. This stone will act to attenuate wave action on the face of the sloped seawall and provide weight at the toe of the wall to prevent further sliding towards the river. The project will be substantially completed by the end of summer 2022.

Structural Flood Protection Strategy: Earthen Berms and Pumps

A fortification technique, protection of the Jamestown Rediscovery Foundation property from regular flood events can be achieved through the installation of a flood berm. The berm would match the elevation of the existing seawall to complete the perimeter defense around the property. Significant environmental compliance, regulatory agency coordination, hydrology analysis, and engineering will be required for implementation. It is notable that this flood berm would prevent flood events occurring below the height of the seawall at 6.5 feet but would certainly be breached when flood heights exceed this elevation.

Green Stormwater Management Strategy: Drainage Infrastructure Improvements.

Sitewide drainage improvement project where antiquated systems both on and off site are recommended to be upgraded to modern day standards, including the use of best management practices for stormwater management. Additional infrastructure such as stormwater pumps may also be required. Significant environmental compliances, regulatory agency coordination, hydrology analysis, and engineering will be required for implementation.

Elevation Strategy: Road, Pathway, and Landscape Elevations.

This is an adaptation strategy that will improve visitor experience and site drainage. Where justified, roadways, pathways, and landscape areas should be elevated with earthen fill. Careful consideration should be given to the interpretive landscape and viewsheds when considering elevating land. This strategy is also intended to provide positive drainage to areas that are otherwise virtually flat on the property.

Elevation Strategy: Building Elevations and Floodproofing.

This is an adaptation project which changes a structure's finished floor elevation to allow for flooding to occur while also keeping it above future flood levels. All buildings intended to be inhabited and maintained for the next 50 years should be elevated to 3 feet above the 100-year floodplain or retrofitted with flood protection measures. The floodplain elevation on the island ranges from 7 to 8 feet. Therefore, depending upon the location, existing and proposed buildings should be elevated to 10 to 11 feet to protect from extreme storm events.



Tide gate at eastern end of the Ohio Creek Watershed Project. The gate is lowered using the crank pictured here when the threat of a tidal storm event is forecasted. The gray pump station building in the background was designed to fit in with the neighborhood and pump all stormwater back into the Elizabeth River when the tide gate is closed. When the tides recede, the gate is opened and stormwater flows freely back into the river.



Recently planted living shoreline at the Ohio Creek Watershed Project, Norfolk, VA.

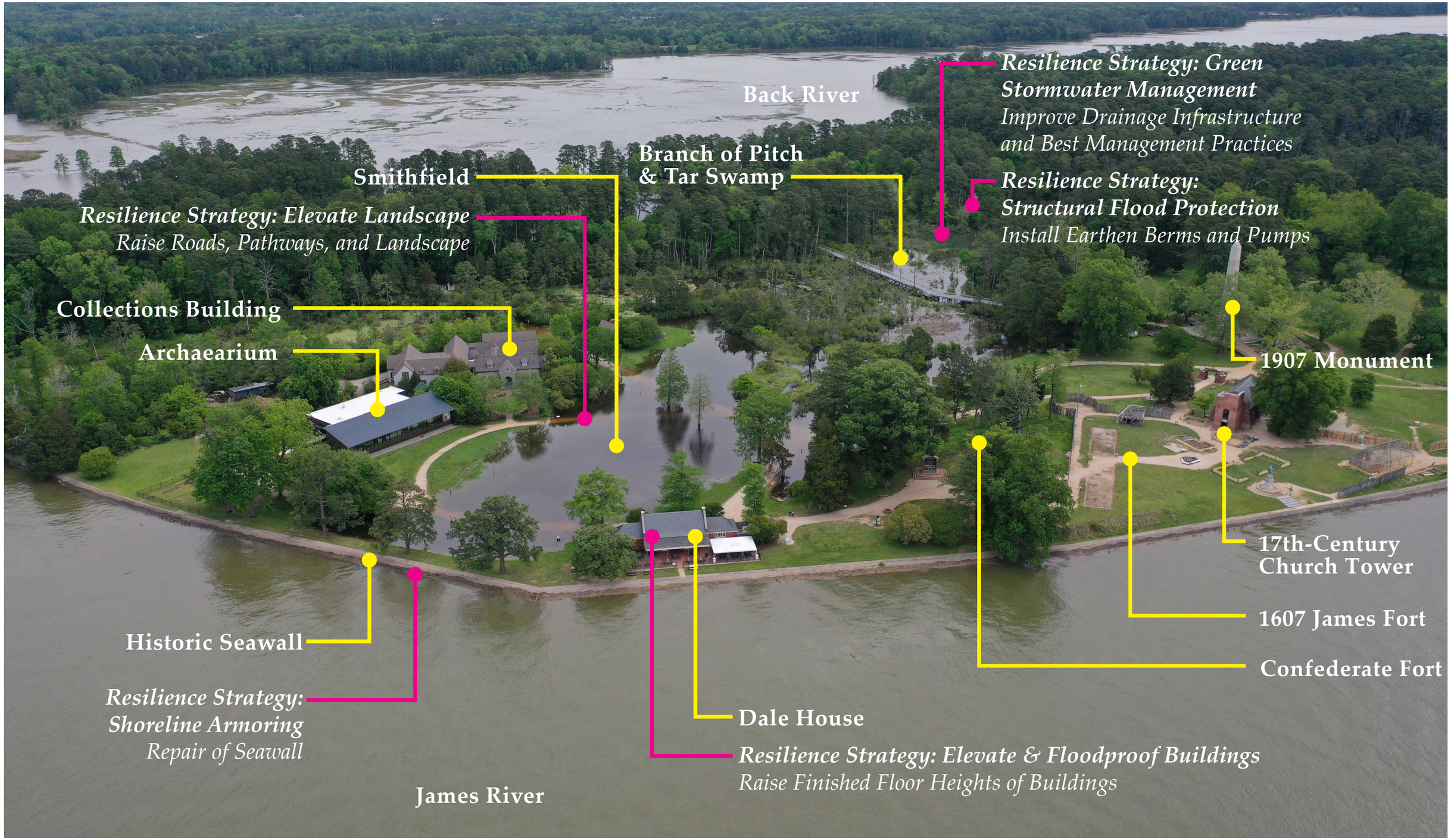


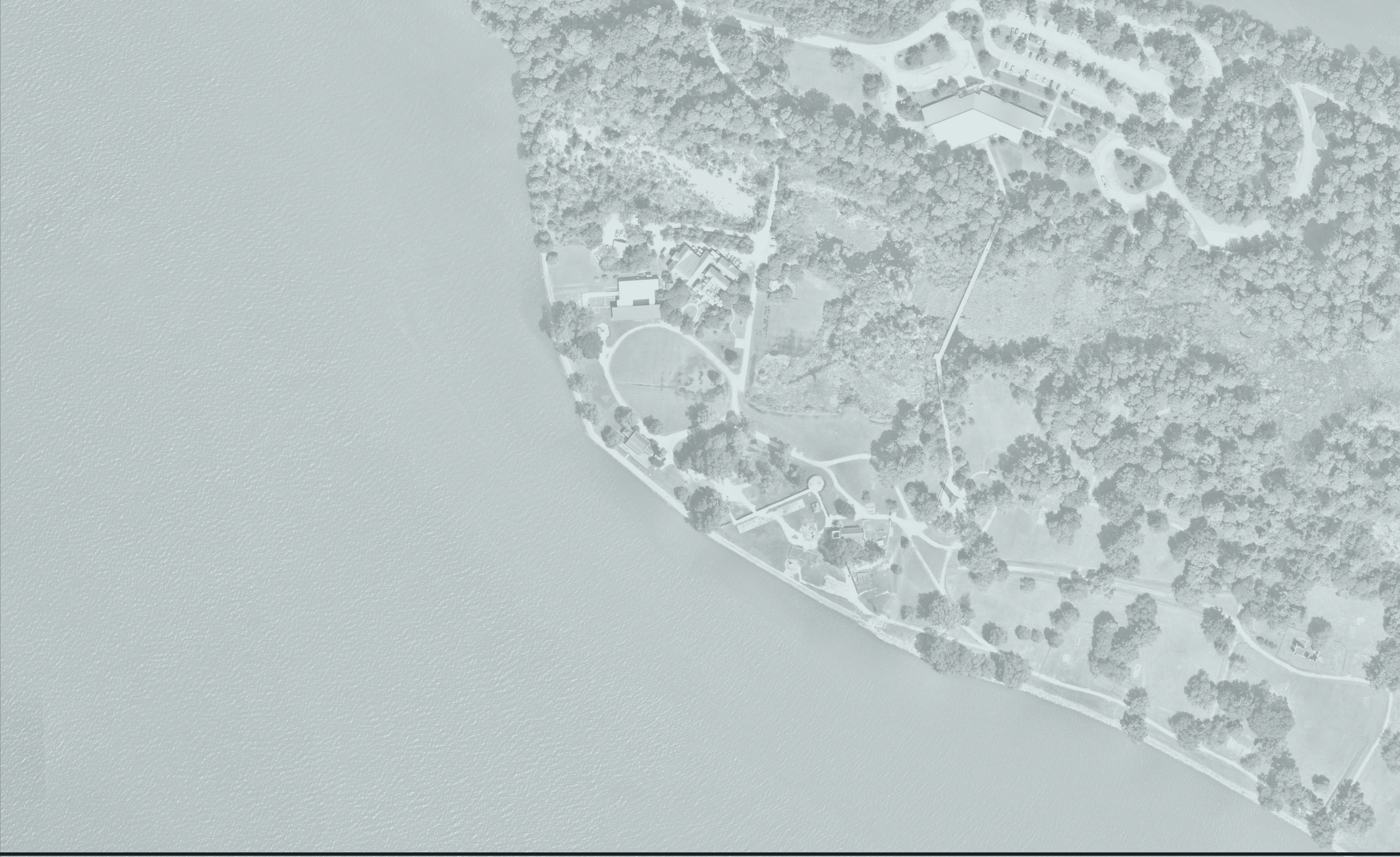
Flood berm and living shoreline used in nearby Norfolk, VA's Ohio Creek Watershed Project to protect historic Chesterfield Heights from flood events. This comprehensive resiliency project received a $112 million federal grant to design and implement cutting edge resiliency strategies to save this important historic neighborhood.



Existing seawall armoring under construction during Spring of 2022 at the PV site on Jamestown Island.


Back River
Branch of Pitch & Tar Swamp
1907 Monument
Collections Building
Smithfield
Archaearium
James River
Dale House
Historic Seawall
17th-Century
Church Tower
1607 James Fort
Confederate Fort


Back River
Resilience Strategy: Green Stormwater Management
Improve Drainage Infrastructure and Best Management Practices
Resilience Strategy: Structural Flood Protection
Install Earthen Berms and Pumps
Branch of Pitch & Tar Swamp
Smithfield
Resilience Strategy: Elevate Landscape
Raise Roads, Pathways, and Landscape
Collections Building
Archaearium
1907 Monument
17th-Century Church Tower
1607 James Fort
Confederate Fort
Historic Seawall
Resilience Strategy: Shoreline Armoring
Repair of Seawall
Dale House
Resilience Strategy: Elevate & Floodproof Buildings
Raise Finished Floor Heights of Buildings
James River



Section 6

Resiliency Plan

Jamestown Resiliency Plan

Legend

1. Potential Pump Station Site
2. Forested Wetland to Remain
3. Elevated PV Access Road
4. Existing NPS Visitor Center
5. Wetland to Remain and Retain Stormwater
6. Existing Visitor/ Pedestrian Access Bridge
7. Earthen Berm (elevation 6.5'+/-) w/ Tide Gate and NPS Maintenance Access Road
8. Resiliency + Discovery Center Site w/ Pump Station
9. Existing 1907 Monument
10. Connection to NPS Trails
11. Existing Historic Church
12. 1607 James Fort
13. Confederate Fort
14. Elevated Dale House + Adjacent Landscape
15. Elevated Smithfield
16. Elevated Primary Trail System
17. Earthen Berm (elevation 4.5'+/-)
18. Interpretive Bridge over Pitch and Tar Swamp
19. Elevated Godspeed Cottage
20. Employee Access and Service Area
21. Existing Collections Building
22. Existing Archaearium
23. Earth Fill to Buttress and Stabilize the Landward Side of the Seawall



Proposed Resilience Plan

The proposed resilience plan aims to strike a balance between the reality of sea level rise, the impetus to preserve dry land for archaeological exploration, and allow the Pitch and Tar Swamp to remain a functional wetland for the bulk of its existing footprint. The plan is intented to protect the site from regular nuissance flooding and adapt buildings and infrastructure for the next 50-75 years by implementing best practice coastal resilience strategies. This plan is resilient because it allows ecological processes to continue using two structural flood protection berms: an intermediate earthen berm set at elevation 4.5 feet and the main earthen berm set at elevation 6.5 feet. The berm system contains Pitch and Tar Swamp and keeps flood waters out of the interpretive and research-focused portions of the site so they remain accessible to visitors and staff alike. A tide gate located under the 6.5-foot-tall berm keeps the swamp hydrologically connected, but, if necessary, could be shut to keep the flood waters of larger storm events out. The 6.5-foot berm with tide gate would be located on the eastern PV/NPS property line and the 4.5-foot berm follows the approximate extent of Pitch and Tar Swamp in the uplands before tying into and elevating the existing employee and service road.

In extreme rain events, the intermediate berm at 4.5 feet would help retain any stormwater runoff into the Pitch and Tar Swamp. The 6.5-foot earthen berm is set to the same height as the recently armored historic seawall, so flood events that occur below this elevation would be kept out of the site entirely. During flood events, there are two potential pump station locations to help the site drain faster, reducing risks to the site's infrastructure and archaeological resources. Another feature of the 6.5-foot earthen berm is that it would provide NPS with direct access to their property for maintenance, reducing the number of vehicle-pedestrian conflicts that occur presently on site. As the site functions now, NPS vehicles enter from the existing PV employee and service access road, and travel across the PV property to access the NPS land. The location of the berm has been sited to both protect as much of the PV property from flooding as possible while also offering both NPS and PV new access points to their respective properties.

The new Resiliency + Discovery Center, sited on the PV property at the end of the pedestrian bridge, just north of the 1907 Tercentennial monument, would be the new visitor entrance portal and hub for site interpretation and programming. From the Resiliency + Discovery Center, visitors could choose to follow new site circulation loop which follows an elevated path system taking visitors past the monument, through the historic church and James Fort, to the Dale House, Archaearium, and Godspeed Cottage, before it follows atop the intermediate berm for a short period, then taking visitors over Pitch and Tar Swamp before returning them to the Resiliency + Discovery Center. There would be moments along this new path system that provide visitors with new viewsheds of the site and Pitch and Tar Swamp.

The Dale House, which has both the lowest finished floor elevation and is closest to the James River of all the existing historic buildings still in use, would be elevated to 11.5 feet, placing the new finished floor 3 feet above the 100-year floodplain (8.5 feet) as is recommended when floodproofing buildings. To preserve sense of place and site integrity, the landform surrounding the building will also be filled in to meet this new finished floor elevation. This eliminates out-of-place technologies and interventions that would negatively impact viewsheds. The elevation of the landform around Dale House includes parts of Smithfield, which will also be filled to tie in with the higher surrounding elevations. This action will simultaneously accommodate the grading that will occur around the Dale House while also improving drainage across Smithfield and adjacent pathways. Elevating Smithfield will reduce impact from any future flooding on site while also improving existing viewsheds by offering visitors higher vantage points for taking in the stunning views of and across the James River.

Immediate retreat from Jamestown Island could be considered as an alternative to these proposed resilience strategies. However, it was not widely studied in this report since it is contradictory to the mission of the Jamestown Rediscovery Foundation. Future retreat from the island may be considered as the rate of sea level rise increases and the site becomes unsafe to occupy.

Coastal Resiliency: Proposed Resilience Plan in Action

One of the big questions posed by this resilience plan is: How will it function during a moderate flood event? In the graphic below, the resilience plan is put to the test with a simulation of a 6 foot flood event. Once Pitch and Tar Swamp reaches a flood stage, the tide gate is shut, excluding additional flood waters from entering the property. Outside the berm, flooding continues as it would, where high water spills into low-lying areas but does not flood the PV site. During flood events of this magnitude, the proposed pump stations will pump out any rain water that would otherwise flood the PV property. Note the NPS Visitor Center is located on high ground and does not flood, regardless of any resiliency measures in place. Similiar resilience strategies could be considered further down the Pitch and Tar Swamp to protect more of the NPS land from nuissance flooding.

Flood events greater than 6.5 feet would breach the seawall and berm, filling the site like a bathtub. In flood events of this magnitude, the property would be evacuated. All buildings are proposed to be elevated to three feet above the 100-year floodplain, or be retrofitted with flood proofing technologies to protect the buildings. Once flood water recede below 6.5 feet, the pump stations will be triggered and begin to pump water out, drying out the site as quickly as possible. It is notable that even the major flood events that have occurred in the last decade could be completely eliminated with this proposed plan in place.



This graphic shows the proposed resilience plan in action. Local flood events are kept out of the PV property and the existing wetland areas. The PV property remains safe from flood hazards up to 6.5 feet.

Future Resiliency + Discovery Center

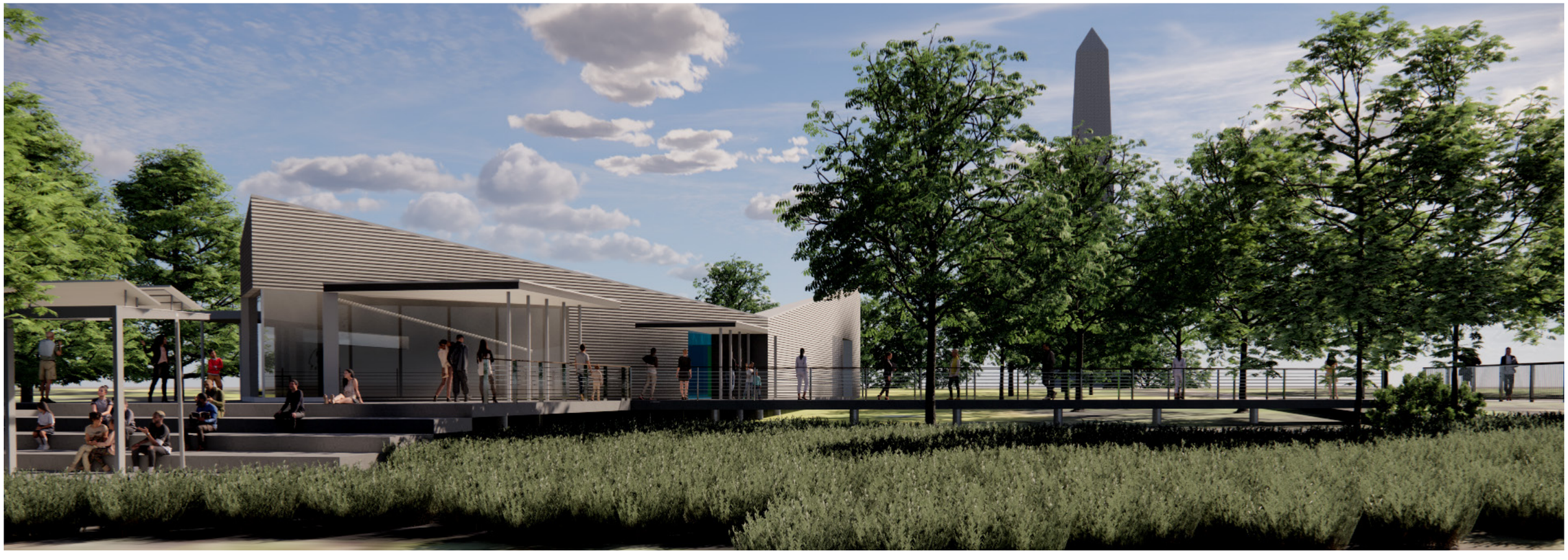
The Resiliency + Discovery Center is an education center focusing on sea level rise, hazards, and the environmental challenges that arise from that, as well as the increasing frequency of severe storms and their impact on Jamestown Island. It will provide a setting to demonstrate the specific threats to Jamestown and show what's at risk and what will be lost without serious mitigation efforts. It will also be a place for archaeologists to do real work regarding the care and conservation of artifacts. *(What is an artifact? Anything that's been touched by human hands.)*

The entire environment of the Resiliency + Discovery Center will be used to interpret Jamestown Rediscovery's work of securing a sustainable future for the island and its archaeological resources. It will also function as a hub for engagement and discourse on climate change impact. How the site is experiencing climate change will be incorporating into the facility's programming, including a tidal monitoring system that connects resilience strategies and communicates system performance to the public, to raise awareness on why the time to act is now.

The building will be designed with the goal to be a net zero facility, producing as much energy as it uses over the course of each year. This will be accomplished by reducing energy demand with a high-performance building envelope, daylighting, sun control and shading devices, passive solar heating, natural ventilation, water conservation and rainwater harvesting. By reducing the energy demands of the building, the energy loads can be met with efficient equipment and systems, such as energy efficient lighting, high performance HVAC and geothermal heat pumps. The remaining energy needs will be met using on-site renewable technologies, such as photovoltaics, solar water heating, and wind turbines.

With respect to site sustainability goals, new landscaping around the building will be resilient and high performing. One of the biggest benefits from Jamestown Island's environmental resources is the near constant breeze, which keeps site conditions especially comfortable on hot, sunny days. Situated near the pedestrian bridge, the building and landscape will benefit from being near the existing canopy trees, where abundant shade will be cast throughout the day. The landscape will also support the cycling community by locating bicycle racks outside the building.

The Resiliency + Discovery Center is a complement to the NPS's visitor center where visitors can engage to learn more about the Jamestown experience, enhancing the experience through guided tours and exploring their personal interests and special topics. The Resiliency + Discovery Center is focused on providing visitor-driven



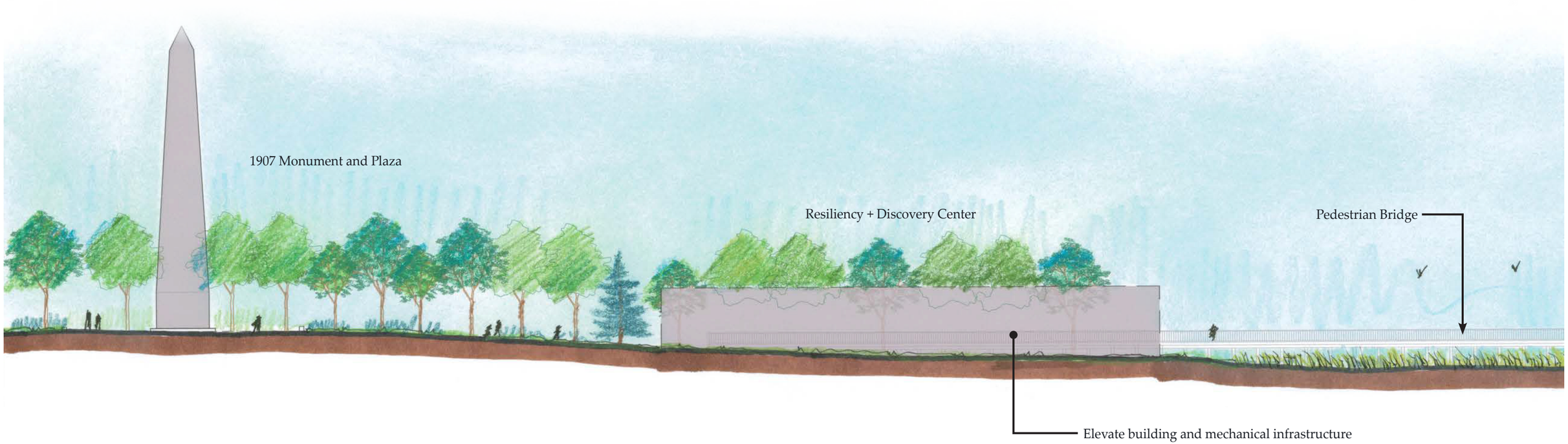
Conceptual rendering of the future Resiliency + Discovery Center.

hands-on experiences, such as special tours and opportunities for lineage groups and genealogy researchers to dive into archived data. As the purpose of the NPS visitor center evolves, the Resiliency + Discovery Center will function as a complement to existing facilities and will enhance the overall visitor experience; the future of Jamestown will include the goal of universal accessibility for all advertised programming, beginning with barrier-free ADA accessible site design.

The interior environment of the Center will have a combination of beautiful photographs, text, objects and online resources that will engage and inspire people of all ages. There will be a focus on the Virginia Standards of Learning, but the educational targets of the Center will be much larger. (An example of a successful program of this sort is "Q?rious: the Coralyn W. Whitney Education Center" at the Natural History Museum in Washington,

Preliminary specifications of the future Resiliency + Discovery Center:

- 2,500 to 5,000 square foot facility
- Visitor orientation and engagement area
- Capacity for special events, programs, and ticket sales
- Amphitheater with a stage and outdoor gathering space
- Abundant visitor seating
- Bathrooms and water fountains
- Open office area with individual employee stations
- Flexible multi-purpose meeting and lecture space for 75 people
- Visitor concierge service for refreshment and creature comforts
- Artifact education and demonstration area where visitors can interact with experts as items discovered in excavations are processed



Section View: Future Resiliency + Discovery Center

Collaboration with the National Park Service

Preservation Virginia and the National Park Service have a long history of working together to create meaningful experiences for visitors. The relationship between the two entities will continue well into the future as their work is closely linked. PV, along with the consulting team, collaborated toward a design proposal that would benefit the interests of both land owners. PV and NPS are also closely linked with James City County and many other academic, municipal, and non-profit entities from across the region and the Commonwealth. It is important to establish an inclusive dialogue with all stakeholders to develop a plan that would be acceptable and beneficial to all engaged parties. The consulting team recognizes and celebrates the cooperative partnership and collaborative efforts that will be required to solve the shared issues between the two sites. This report will be shared with the NPS Colonial National Historic Park and is intended to act as a framework for future collaboration and mitigation. Below are specific benefits the National Park Service could see from the implementation of this project.

Function and Design

The centerline of the flood protection berm is proposed to follow the property line as it crosses the branch of Pitch and Tar Swamp that is encroaching on upland areas of Jamestown Island. Managing for flooding in the low-lying areas of the PV property means protecting the archaeological resources and interpretive landscape that draw tourists to the region and visitors to the NPS site. Because the height of the berm is proposed to match the elevation of the top of the historic seawall, the berm will function as a shield for the island's most important assets.

Access Improvements

Another benefit of citing the berm on the property line is establishment of a clear and permanent access road for NPS to drive directly onto their property. The berm is being proposed with dimensions robust enough that maintenance vehicles and heavy equipment can be driven on it regularly, and first responder vehicles could be driven on it in case of an emergency. This also creates new opportunities for expanding access to specific populations who could benefit from being driven onto the site or for special events in the future.

Safety

Currently, NPS maintenance vehicles and machinery use the PV road and pedestrian paths to access the New Town site for maintenance. An easement does not exist for this access, and use of the pedestrian paths with heavy machinery creates an extremely unsafe condition for visitors and PV staff. With an NPS maintenance access road proposed across the new flood berm, these unsafe conditions can be eliminated and provide an added benefit to all stakeholders.

Maintenance Improvements

With the berm and overall site drainage improvements in place, certain existing maintenance tasks will be eliminated. NPS will save money and time with a more direct route onto their property. If NPS staff no longer have to drive the long way to the NPS property through PV property, they will cut down on distance traveled and drive time. NPS may expect to see overall fuel and operation savings due to less time spent driving slowly through PV property being mindful of visitors on the existing shared-use paths.

Ecosystem Support

The berm, which would be planted with native species, would blend into the landscape from an ecological standpoint. The sheer volume of planting creates a large enough patch that would provide at least some habitat and support for local populations of beneficial species, such as pollinating insects and birds.

Tourism Generator

A new landscape feature at Jamestown Island would be intriguing to the general public. Some visitors may choose to return to the site to see the resilient design interventions that are being proposed and constructed. It provides a unique opportunity to discuss the history and fate of the site in the context of global change. Using the berms as educational tools and interpretive moments or part of a larger landscape sequence brings awareness to the kinds of strategies that are available to fight relative sea level rise. There is already existing curiosity, excitement, and momentum from the general public. The NPS and PV are well positioned to use this and other landscape features in the design to generate fresh tourism dollars.

Another benefit of berm placement is that keeping water out of the PV site means that visitors have expanded access to both the PV and NPS sites. In the event of significant storms or tidal flux, the extent of the flooding can be so bad that the site will have to close to visitors. With the proposed structural berm, and other drainage improvements, the site would no longer suffer from nuisance flooding during a rainstorm or a small tidal event. Increasing the number of days out of the year that visitors can come to Jamestown Island is a strong economic decision for both PV and NPS.



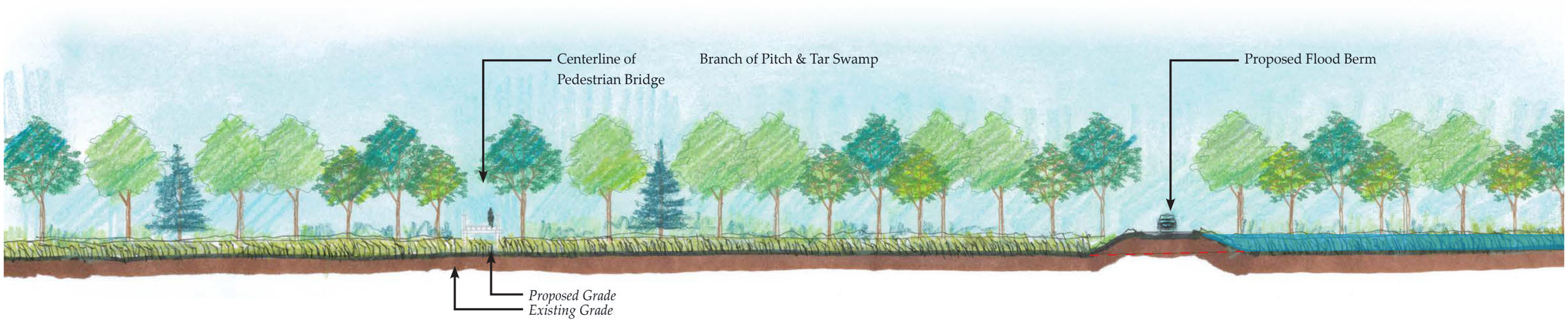
NPS maintenance vehicle utilizing PV pathways for access to NPS property. The proposed flood berm would double as a maintenance access road for the NPS, eliminating pedestrian conflicts on the PV site.



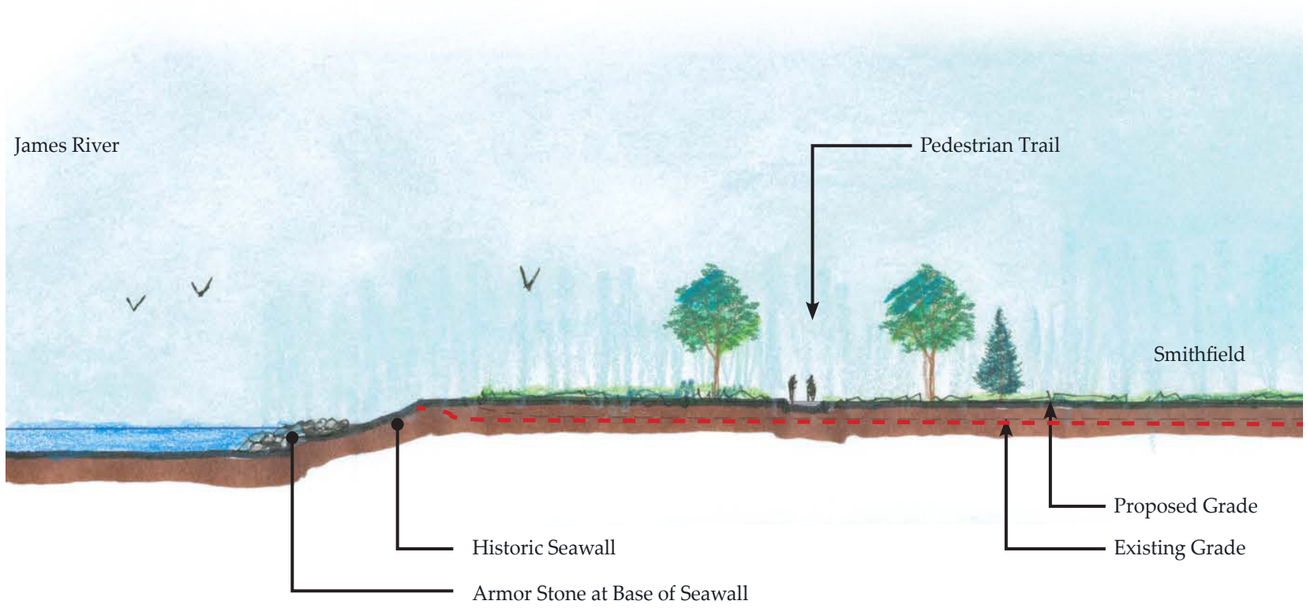
Flood berm and living shoreline used in nearby Norfolk, VA's Ohio Creek Watershed Project to protect historic Chesterfield Heights from flood events. This comprehensive resiliency project received a $112 million federal grant to design and implement cutting edge resiliency strategies to save this important historic neighborhood.

Resilience Strategy: Structural Flood Protection [Install Flood Berm]

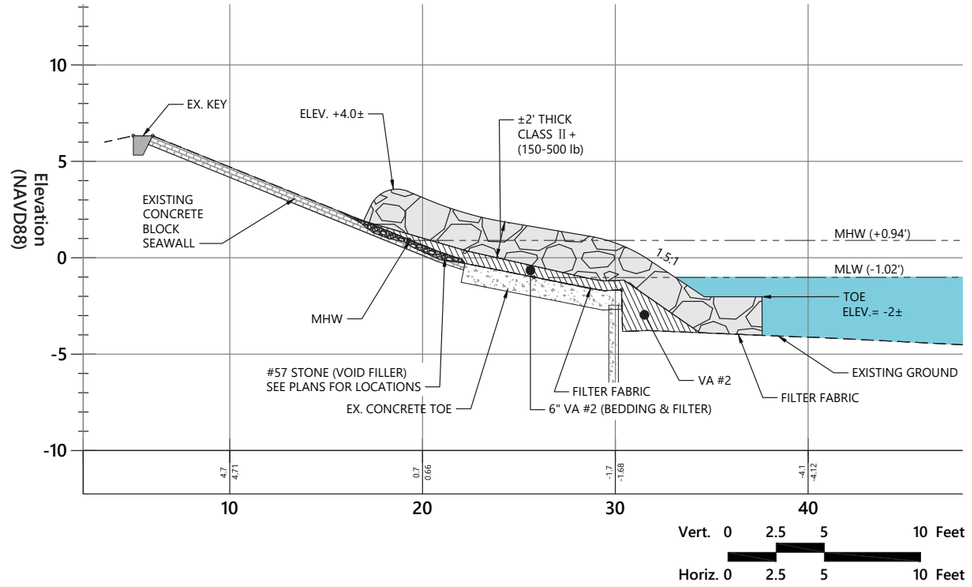
A flood berm is proposed to protect the Jamestown property from regular flood events. The landside berm would match the elevation of the existing seawall to complete the perimeter defense around the property. Significant archaeology, environmental compliance, regulatory agency coordination, hydrology analysis, and engineering will be required for implementation.



Section View: Branch of Pitch and Tar Swamp



Section View: Historic Seawall Repair



Typical Section - Seawall Repair



Historic seawall repair construction commenced in May 2022

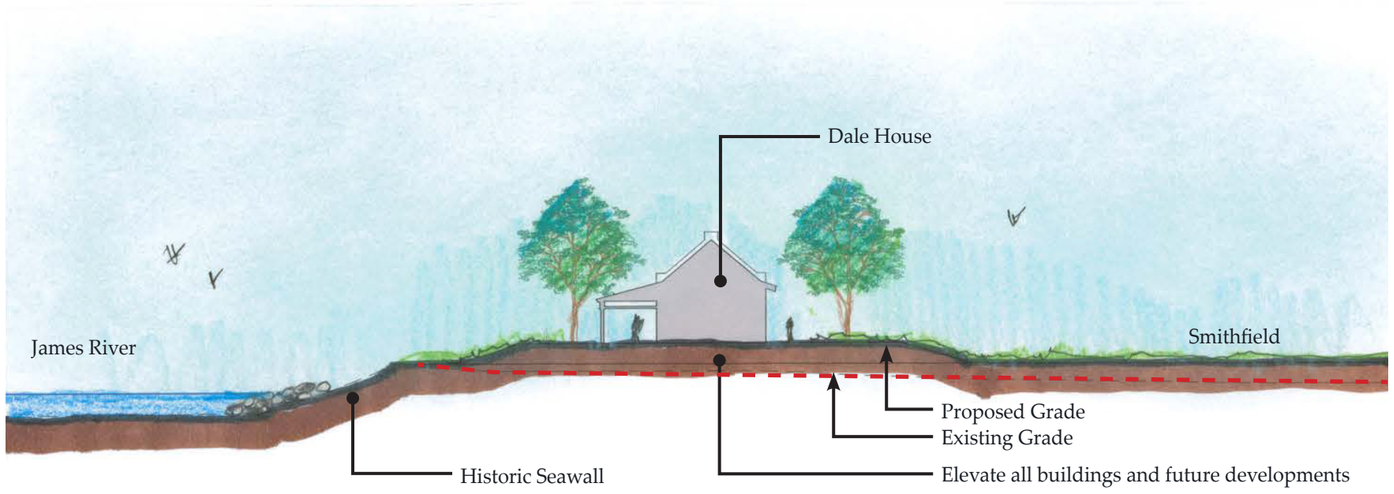
Resilience Strategy:

Shoreline Armoring [Repair Historic Seawall]

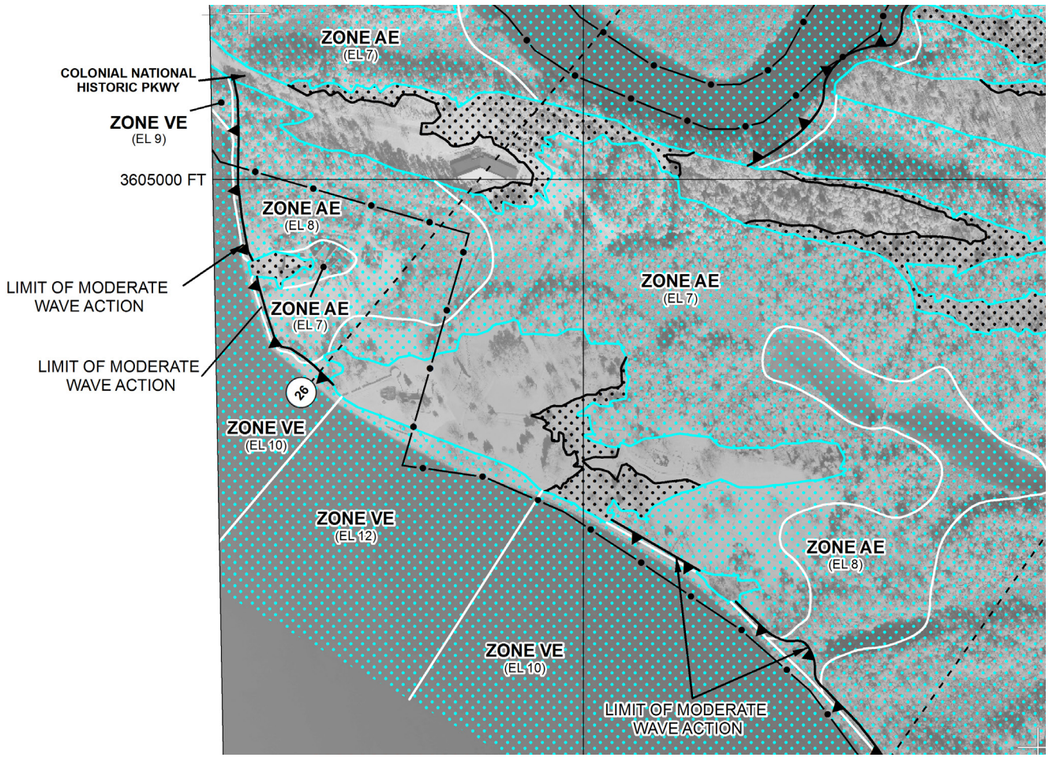
The 1,700-linear-foot historic seawall, built in the early 20th Century, was fortified with armor stone up to elevation 4 feet in spring and summer of 2022. This stone acts to attenuate wave action on the face of the sloped seawall and provide weight at the toe of the wall to prevent further sliding towards the river. These improvements only address the river side of the property.



Typical Dale House storm preparations include boarding windows and stacking sand bags for protection.



Section View: Elevate Buildings 3 Feet Above the 100-Year Floodplain



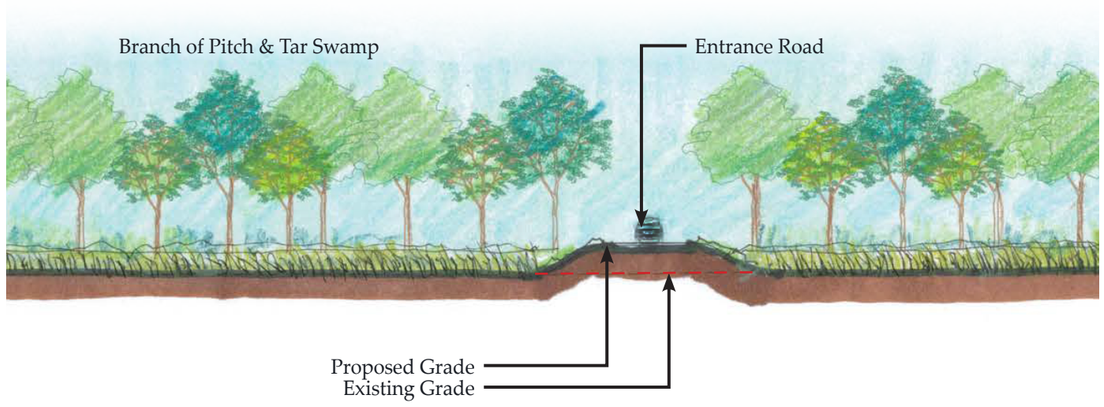
FEMA Floodplain Map

Resilience Strategy: [Elevate & Floodproof Buildings]

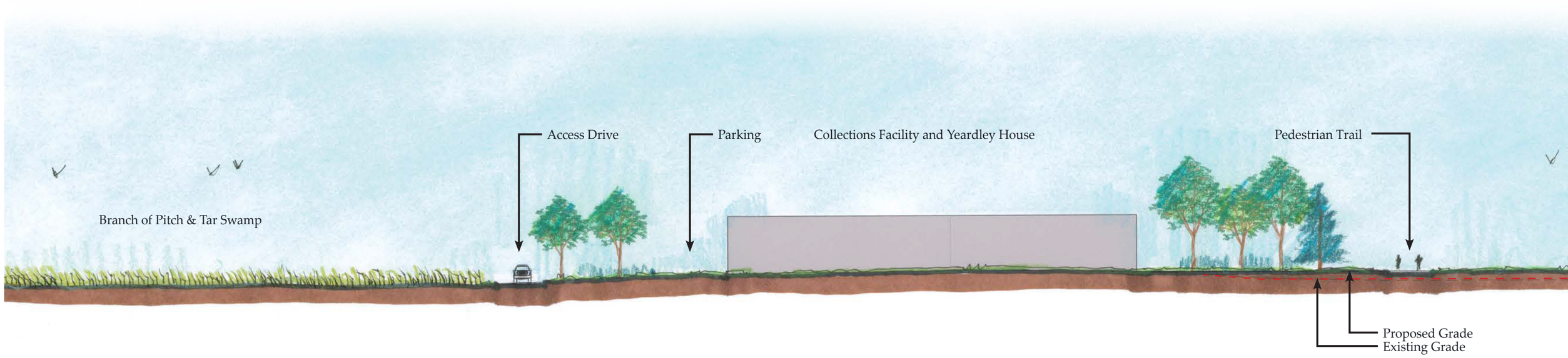
All buildings intended to be inhabited and maintained for the next 50 years should be elevated to 3 feet above the 100-year floodplain or retrofitted with flood protection measures. The floodplain elevation on the island ranges from 7 to 8 feet. Therefore, depending on location, existing and proposed buildings should be elevated to 10 to 11 feet to protect from extreme storm events. All building mechanical infrastructure should be elevated to 3 feet above the 100-year floodplain.

Resilience Strategy: [Infrastructure Improvements]

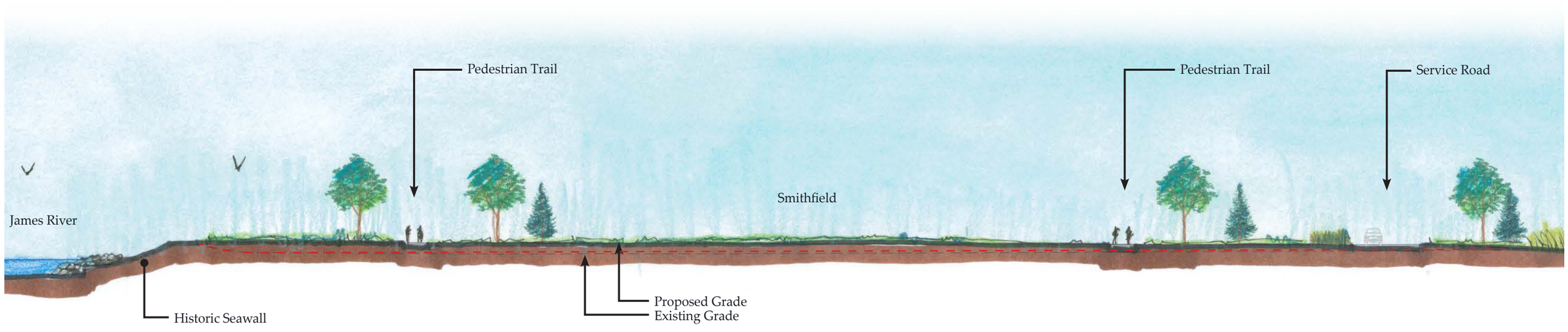
Antiquated storm drainage systems, both on and off site, must be upgraded to modern day standards. Additional infrastructure such as stormwater pumps may be required. Significant environmental compliance, regulatory agency coordination, hydrology analysis, and engineering will be required for implementation.



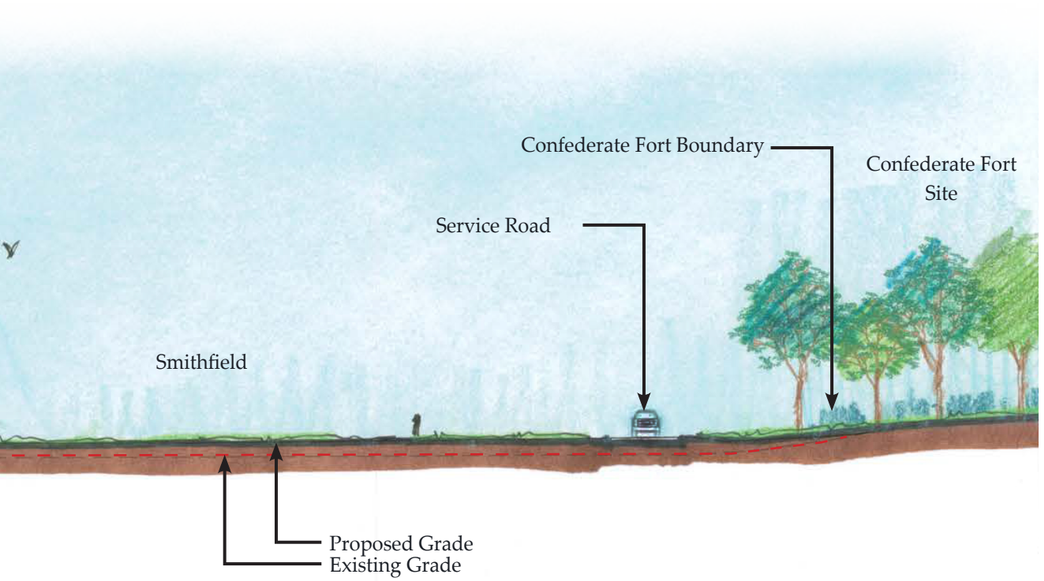
Section View: Elevated Entrance Road



Section View: North-South Through Elevated Smithfield



Section View: East-West Through Elevated Smithfield



Resilience Strategy: [Elevate Roads, Pathways, and Landscape]

Roadways, pathways, and landscape areas should be elevated with earthen fill where justified. Careful consideration should be given to viewsheds when elevating land. This strategy is also intended to provide positive drainage to areas that are otherwise virtually flat on the property.



Site tour during the September 15, 2022 workshop.



A well that was discovered just days prior to the workshop located less than 150 feet from the encroaching Pitch and Tar Swamp. These types of discoveries inform archaeologists and historians of the past, and help shape the complete story of Jamestown.

Resiliency Plan Review Workshop

On September 15, 2022, a team of consultants, industry experts, and PV staff assembled on Jamestown Island to review the Resiliency Plan set forth and strategize on how to implement resiliency best practices on this sensitive landscape. A spirited discussion about importance of the site, best practices, and funding opportunities took place. The following participants were engaged and provided meaningful input throughout the day:

- Jeff Stodghill, Facilitator, PMA Architecture and Preservation Virginia Trustee
- James Gunn, Coastal Design & Construction
- Genevieve Keller, Land and Community Associates, University of Virginia, and Preservation Virginia Board Chair
- J. Timothy Keller, Land and Community Associates and Emeritus, Iowa State University
- Rachel Llyod, Senior Landscape Architect, University of Virginia, Office of the Architect
- Robert Melnick, Professor Emeritus, Former Dean of the School of Architecture & Allied Arts, School of Architecture and Environment, University of Oregon.
- Kyle Spencer, Chief Resilience Officer at City of Norfolk, VA
- Skip Stiles, Wetlands Watch
- Jim Horn, COO of Historic Jamestowne and President of the Jamestown Rediscovery Foundation
- David Givens, Director of Archaeology
- Michael Lavin, Director of Collections and Conservation
- Jamie May, Director of the Voorhees Archaearium Museum
- Chris Frye, Coastal Scientist, VHB
- Stephen Talley, Landscape Architect, VHB
- Doug Mettler, Senior landscape Architect, VHB
- David Stemann, Architect, Stemann | Pease Architecture
- Ed Pease, Architect, Stemann | Pease Architecture

The consulting team and Preservation Virginia offers the sincerest thanks to all participants and looks forward to working together in the future to provide constructable and appropriate solutions for protecting Jamestown for the next 50-75 years.

Precedent Resilience + Education Facilities

In recent years, interest in and support for creating spaces that facilitate the ongoing work of coastal resilience while doubling as an interpretive, educational space for the general public has been on the rise. The following section shows three examples of comparable spaces that illustrate PV's vision for the Jamestown Resilience + Discovery Center. Two examples are from the Chesapeake Bay Foundation (CBF) and the third is from the Elizabeth River Project. The fourth example is from the Ohio Creek Watershed Project in Norfolk, VA that includes relevant resilient landscape interventions and interpretive moments. All examples are located within the Chesapeake Bay watershed.

Chesapeake Bay Foundation Environmental Centers

The Chesapeake Bay Foundation has a strong track record for developing green buildings that meet the needs of their organization while also exceeding sustainability standards. Two examples are the The Philip Merrill Environmental Center, built in 2001, and the Brock Environmental Center, built in 2014. These buildings were designed to meet LEED Platinum criteria, the Philip Merrill Environmental Center being the first of its kind to achieve this distinction. Later, when building the Brock Environmental Center, CBF exceeded LEED criteria. Designing to the International Living Future Institute standards for a Living Building, the Brock Environmental Center is the first of its kind in Virginia and one of only eighteen buildings like it on the U.S. East Coast with this designation. (Chesapeake Bay Foundation 2022).

Each building is unique, but both were constructed with sustainability and education in mind. Both buildings include energy- and water-efficient features that make them "net-zero" for both water and energy. In addition, they both provide public-facing "Building Dashboards" that report on the building's electricity use, solar photovoltaic system's electricity generation, baseline consumption, event-related consumption, rainwater harvesting, green features, weather, and wind power generation (Brock Center only). With respect to educational programs, both buildings are home to in-house and field programs for students and teachers, scholars and professionals, and the general public.

Brock Environmental Center [Virginia Beach, VA]

As-Built Building Specifications:

- Grade (ground level) is 4.5 feet above sea level
- Main building is 25.5 feet above grade/ground level
- Multipurpose room is 35.5 feet above grade/ground level
- Wind turbines (two) are 81 feet tall at their highest points
- Finished floor elevation is 13 feet 8 inches above sea level, allowing for future sea level rise and tidal flooding during severe weather events
- 260 feet long and 40 feet deep (without the pavilion) with a total square footage of just under 9,000 square feet
- 0.5 acre building footprint
- 0.65 acre paths and impervious



The Chesapeake Bay Foundation's Brock Environmental Center, located in Virginia Beach, is a state-of-the-art net-zero structure that exceeds LEED standards. (Source: https://www.smithgroup.com/projects/brock-environmental-center)



Aerial of the Chesapeake Bay Foundation's Brock Environmental Center. Note the mobile oyster restoration center floating in the Bay. (Source: https://www.cbf.org/assets/images/1171-x-593-px/brock-center-aerial-september-2020-1171x593.jpg)



The Philip Merrill Environmental Center is designed with a light footprint. The majority of parking occurs under the building, which is elevated to protect the structure from extreme flood events. (Source: https://www.cbf.org/about-cbf/locations/maryland/facilities/philip-merrill-environmental-center/)



The building utilizes green technologies to reduce the building's environmental impact. (Source: https://www.cbf.org/about-cbf/locations/maryland/facilities/philip-merrill-environmental-center/what-makes-us-green.html)

Space Configuration:

- 1/3 office space with open layout providing 27 desks serving CBF, Lynnhaven River NOW, the City of Virginia Beach Parks and Rec and 6 intern/volunteer spaces.
- Community meeting spaces for various group sizes: 85 to 100 people, 6 people, and 4 people
- 1/3 common space for lobby, bathrooms, deck, walkways, kitchen, and utility
- Outdoor pavilion accommodates 75 students

"The Chesapeake Bay Foundation built the Brock Environmental Center to engage, inform, and inspire generations about the environment and how we can all help Save the Bay™. The Center, located at Pleasure House Point in Virginia Beach, Virginia, is an innovative example of environmentally sensitive and smart building—among the first in the nation to embrace energy and water independence—and advances CBF's efforts to defend one of the nation's most valuable and threatened natural resources, the Chesapeake Bay. The Brock Environmental Center is designed to meet the strictest environmental standards in accordance with the Living Building Challenge™. The building's footprint uses less than an acre of CBF's 10-acre parcel, a very small percentage of the total area of Pleasure House Point.

The Brock Environmental Center is CBF's regional home for its award-winning environmental education programs, which provide experiences for 2,500 students and teachers across Hampton Roads each year. The Center also provides space for other local conservation partners, including Lynnhaven River NOW, and for community meetings and special events" (Chesapeake Bay Foundation 2022).

From the Brock Environmental Center's FAQ page:

Q: How are you preparing for major storm events, flooding, and sea-level rise?

"The center will sit on pylons which will allow any flood water entering the site to remain onsite and either permeate or recede without causing damage to the building. The proposed building's first floor elevation is 13.8' above sea level. The center will be designed with a 500-year storm event in mind (well beyond the required 100-year flood event preparedness). It will be unaffected in tidal ranges up to 7' above sea level. We believe that 13' 8" should give us a 500-year protection with an allowance for 5' of waves as well. Even accounting for the medium case sea level rise (~2.5' in 100 years), we'd have 3' of wave clearance in the 500 year storm event" (Chesapeake Bay Foundation 2022).

Q: Financially, what is involved with building the Brock Environmental Center?

A: A $20 million campaign has been launched to support creation of the Brock Environmental Center, enhance environmental education programs, improve habitat, and create a venue for community collaboration. The campaign includes $10 million to acquire the land and construct the building; $5 million for programs to improve water quality, including advocacy, environmental education, restoration, and outreach; and $5 million to endow the center and its education and community programs. We have named the building to honor Joan and Macon Brock for their generous leadership gift" (Chesapeake Bay Foundation 2022).

Philip Merrill Environmental Center [Annapolis, MD]

Another Chesapeake Bay Foundation facility, the Philip Merrill Environmental Center, is located in Annapolis, Maryland and serves as the state office for the CBF there. Opening in 2001, this was the "first building to receive the U.S. Green Building Council's Platinum rating for Leadership in Energy and Environmental Design (LEED), CBF's Philip Merrill Environmental Center continues to win international acclaim as a model for energy efficiency, high performance, and water conservation" (Chesapeake Bay Foundation 2022).

In addition to the "Building Dashboard" to report on building performance, the building manages itself for reduced consumption of electricity, facilitated by motion sensors throughout the building that turns off unneeded electronics when people are not in work spaces. The building temperature is regulated seasonally by geothermal wells, daylighting, and functional windows for natural ventilation and taking advantage of breezes. Built with sustainable building materials, such as recycled wood products, produced from sustainably grown sources, or materials created through processes that don't damage the environment the structure's construction had a reduced environmental impact at the onset. The building also features a green roof for increased insulation and stormwater management benefits, Clivus Multrum composting toilet systems that reduce the need for wastewater treatment, parking located under the building to nearly eliminate surface parking, and uses stormwater best management practices throughout the landscape for managing stormwater runoff and associated pollutants.

Elizabeth River Project

Much like the environmental advocacy work done by the CBF, the Elizabeth River Project (ERP) mission is "to restore the Elizabeth River to the highest practical level of environmental quality through government, business and community partnerships" (Elizabeth River Project 2022). A citizen-formed non-profit, the organization is cleaning up the river through education and restoration projects. The ERP has two noteworthy project sites in their watershed: Paradise Creek Nature Park, a 40-acre restored wetland with trails throughout and the Louis and Pru Ryan Resilience Lab, which is currently under construction to be a sustainable living laboratory that will provide educational opportunities for students and teachers, professionals and scholars, and the general public.

The Louis + Pru Ryan Resilience Lab [Norfolk, VA]

"As communities everywhere wrestle with the growing impacts of climate change, The Louis & Pru Ryan Resilience Lab of the Elizabeth River Project will serve as a global model for urban coastal living that protects both the ecosystem and humans as sea levels rise. Now being built along Knitting Mill Creek on one of Norfolk's fastest growing commercial corridors, this $8 million living laboratory is funded through the future-minded philanthropy of its namesakes, Louis and Pru Ryan of Norfolk, and many generous donors to our Next Wave Campaign" (Elizabeth River Project 2022).

The resilience lab is:

- Engineered to withstand flooding and respond to sea level rise
- Environmentally sustainable design + construction techniques
- For residents, businesses, and developers
- Solar equipped/net-zero energy consumption goal
- Toilets flushed with 100% harvested rainwater
- Goode Family Entry Pavilion is designed to float during flood events
- Includes spaces for workshops and events
- An anchor for the planned eco-district
- Restorative landscaping in the form of a "living shoreline" of restored wetlands, oysters, and native plants
- HRSD Research Dock for Higher-Education partners
- Changing research and interpretive displays
- A boardwalk observatory
- Continuous rain gardens

(Elizabeth River Project 2022)



Designed to withstand flooding and promote the health of the Elizabeth River, the Louis & Pru Ryan Resilience Lab will be a community anchor on Knitting Mill Creek in Norfolk. (Source: https://elizabethriver.org/ryan-resilience-lab/)



"Developing on-land solutions to rising tides and rising sea level is not just a case of trying to make it more inhabitable for human beings. It's also a case of making the land more friendly to the river." Louis Ryan, Officer, Board of Directors, The Elizabeth River Project. (Source: https://elizabethriver.org/ryan-resilience-lab/)



The Resilience Park is an intentional green space that connects two neighborhoods, providing outdoor opportunities for the community and also providing critical protection against flooding. Designed to flood while keeping structures and people safe, the park is able to accomplish this because the earthen berm creates a high point that keeps flood waters at bay. (Source: https://www.norfolk.gov/DocumentCenter/View/62713/Ohio-Creek-Project-Resilient-Park-Fall-2020?bidId=)



This pump station located within the Ohio Creek Watershed Project will also function as an educational, interpretive space so that residents and visitors can learn about resilience, sea level rise, and what the community is doing to stay safe.

Ohio Creek Watershed Project [Norfolk, VA]

"Norfolk was awarded a $112 million federal grant from the National Disaster Resilience Competition for the Ohio Creek Watershed Project. The project is exploring various landscape and hardscape options to improve flooding, public access to the waterway and connections to the rest of the city" (City of Norfolk 2022).

The project comes in response to nuisance flooding from major storm events and sea level rise impacting two neighborhoods, the Chesterfield Heights Historic District and Grandy Village. These neighborhoods are located on Ohio Creek, a tributary to the Eastern Branch of the Elizabeth River in Norfolk. It contains three major types of interventions: coastal defenses, stormwater management improvements, and improvements to transportation infrastructure.

- **Coastal defense:** 1,020 linear feet of flood wall, structural flood protection via earthen berm, 4,200 linear feet of living shoreline
- **Stormwater management:** development of a major tide gate, two pump stations, and planted bioswales and permeable parking at 14 locations within the neighborhoods
- **Transportation infrastructure improvements:** raised and/or relocated roads at six locations within the neighborhoods

"The Resilience Park connects the Grandy Village and Chesterfield Heights neighborhoods and includes a flood berm, a restored tidal creek and wetland and other environmental features as well as a multi-use sports field and places for community gatherings, sports and play. Resilience Park strives to be a model for resilient open space that is uniquely Norfolk" (City of Norfolk 2022).



This pump station on the western side of the Ohio Creek Watershed Project acts to pump dangerous stormwater flooding from the community during tidal storm events when stormwater cannot freely discharge into the Elizabeth River.

Section 7

Next Steps Process

Recovery and Maintenance of the Landscape

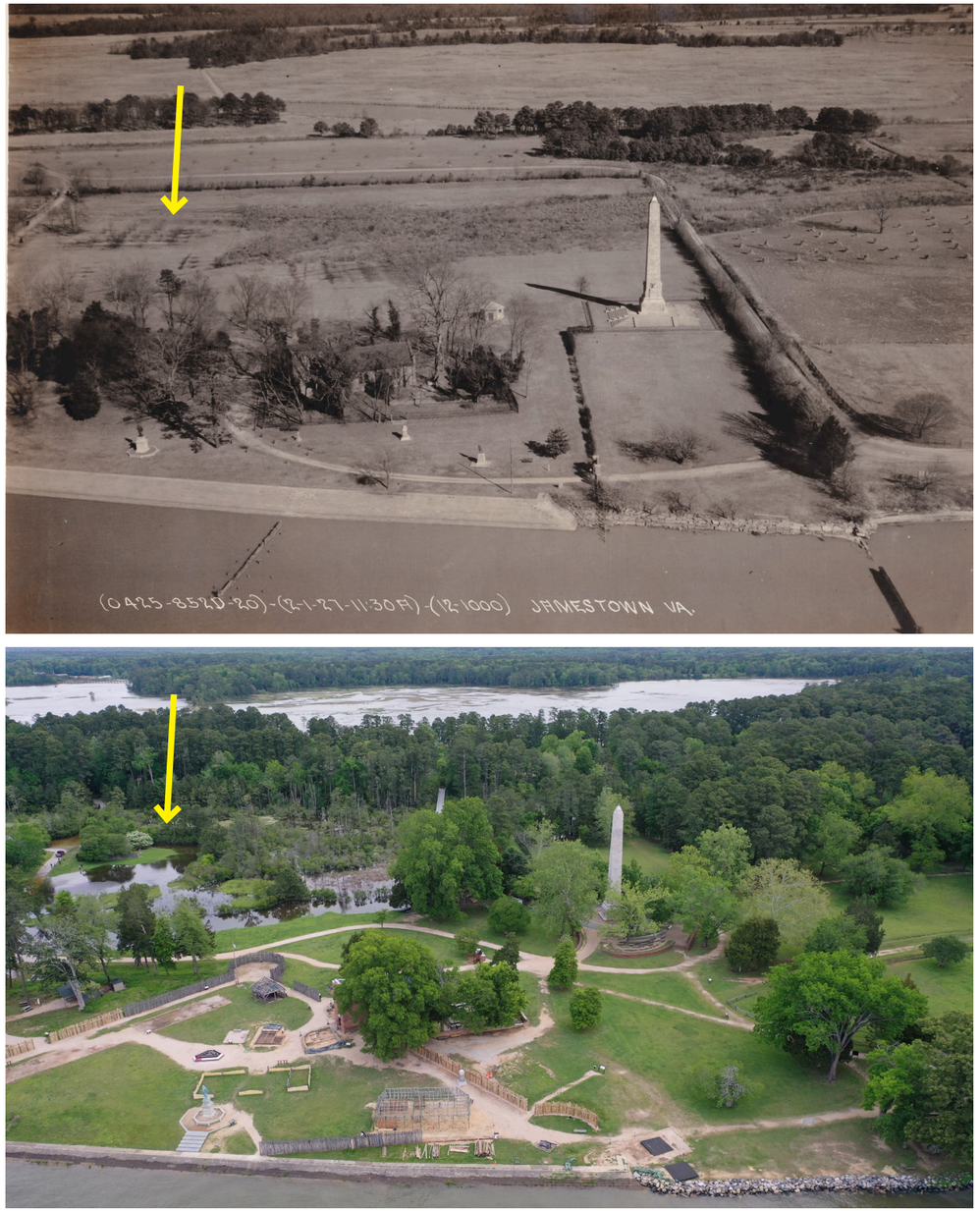
Cultural and historical landscapes are created in the past (Fairclough 2003). These landscapes emerge when a significant event happens there or if the site is associated with a significant person or people. Cultural landscapes become distinct Places when people share collective meaning associated within that context. Archaeologists at Jamestown continue to uncover clues to the culture of Jamestown, evolving the story of the landscape and how it was used over time. Historical landscapes come into being over time, when the shared meaning about events and place mature, retaining integrity as they evolve temporally. The PV property at Jamestown Island is worth saving, not only for its value as the first permanent English settlement, location of the first English representative government, and English race based slavery, but also for millennia of habitation by Indigenous Tribes. After the original fortified settlement at Jamestown Island was discovered in 1994, a more accurate story of our country's origins began to emerge. A broader conversation about the value of archaeological research and exploration in such close proximity to wetlands and critical environmental areas that deal with nuisance flooding and sea level rise is necessary.

The landscape that exists today at Jamestown consists of an overlay of historic structures, interpretive structures and landscapes, and recreated landscapes based on discoveries to date. This landscape is constantly evolving as archaeologists make new discoveries and become more informed about the history and culture of Jamestown.

In the past, PV and the NPS created a partnership to undergo joint research, protection, and public outreach efforts in order to share the resources at Jamestown Island to "enhance educational and research opportunities and connect the visitor more closely with the site, its past inhabitants, and their experiences" (APVA and NPS 2002, 1-1). Although no longer working as a joint venture, PV and the NPS understand that there are many challenges to overcome with respect to implementing best management practices in both ecological and archaeological contexts, even with cooperative collaboration. It is recognized that there is a delicate balance between site interpretation, display, and tourism because none of these matter without site integrity. With the flooding that is happening more frequently, the site itself--much of which has not yet been explored using contemporary archaeological methods, is under threat for loss of integrity without intervention. Although Jamestown Island has multiple opportunities for interpretation in indoor spaces, much of the site's integrity is experienced outdoors. PV is approaching this significant, but ecologically sensitive site with mindfulness toward best management practices for coastal resilience and mitigation of wetland disturbance while also honoring the historic value and site integrity to bring its resources to the public. Interventions at Jamestown Island are proposed to bolster resilience to sea level rise and nuisance flooding while allowing archaeological efforts to continue for the next 50-75 years.

NEPA Process

The National Environmental Policy Act (NEPA) requires federal agencies to fully consider the impacts of proposals that would affect the environment (including natural and cultural resources) prior to deciding to take an action. Although PV is not itself a federal entity, the continuity of resources between the PV site and NPS lands may warrant evaluation of the proposed action under NEPA. Furthermore, NEPA is a procedural law, and as such, the NEPA process serves as an umbrella under which related laws and policies are reviewed and either complied with concurrently or outlined for future compliance. For instance, many elements of the resilience strategy will require coordination with the Virginia Department of Historic Resources, and some elements will require a permit from the U.S. Army Corps of Engineers (Corps). Such structure can be helpful in assisting teams in communicating a proposed project to relevant stakeholders and laying out a road map to implementation.



(Top) *Aerial of Jamestown (c. 1927). Note the land cover is predominantly pasture. The extent of the branch of Pitch and Tar Swamp begins to become detectable.* **(Bottom)** *Aerial of Jamestown (c. 2021). Note that some areas have been maintained as lawn and canopy trees have been allowed to grow up, especially around the wetter, low-lying areas, which are emphasized by the flooding happening in Back River and Pitch and Tar Swamp. The yellow arrows are shown in approximately the same location in both images to draw attention to the impact of even minor flooding at contemporary Jamestown Island.*

Permitting + Compliance Considerations

For the proposed project to be in compliance with local, state, and federal policy, several factors must be considered and responded to. This can be done through: 1. Framing of the site location and significance to identify relevant jurisdictional settings; 2. Understanding the regulatory process with respect to local, state, and federal entities; 3. Creating a thorough purpose and need statement for the project which includes supporting evidence; and 4. Completion of the National Environmental Policy Act (NEPA) of 1970 to enable informed decision-making based on how the proposal may impact the environment. Some portions of the project within Pitch and Tar Swamp are likely within the upper limits of jurisdiction for the James City County (JCC) Wetland Board and require a permit per Section 28.2-1300 (Virginia Tidal Wetlands Act) of the Code of Virginia. The project will also require authorization from the Corps through Section 404/401 of the Clean Water Act that requires a permit for placement of fill into waters of the United States, including wetlands. Depending on the funding source (use of federal money) , documentation per NEPA guidelines may be required. Nonetheless, a rigorous permitting process should be expected and will likely include an analysis of the alternatives considered and the associated impacts.

Regulatory Process

The scope of this project lies in all three: local, state, and federal jurisdictions. Local jurisdiction falls within JCC governance, including the JCC Wetlands Board, JCC Chesapeake Bay Board, JCC Planning Department, JCC Environmental Division and Division of Code Compliance and the Chesapeake Bay Preservation Ordinance, which regulates development or construction within the resource protection areas. In the local context, an agreement must be reached between the PV and NPS on the new site boundary and especially where access to site buildings, utilities, and implementing best management practices is an issue. State jurisdiction is carried out through a range of government entities, which includes the Virginia Department of Environmental Quality Water Division, the Virginia Marine Resources Commission, the Virginia Department of Historic Resources, the Virginia Department of Labor, the Virginia Department of Health, the Virginia Department of Transportation, the Virginia Department of Historic Resources and the Advisory Council on Historic Preservation. Federal jurisdiction includes the Environmental Protection Agency, the National Park Service, the U.S. Coast Guard, the U.S. Department of the Interior Fish and Wildlife Service, and the Corps.

Due to the site location and proximity to wetland and other natural resources, its status and recognition as a historic place, and the implications of disturbance, the project must undergo a rigorous and thorough permitting process. The project is proposing a range of landscape interventions that involve specific activities that trigger the need for a permit from issuing agencies in all three jurisdictions. A first step to consider in the regulatory process is to conduct an early coordination meeting with those agencies most involved in the necessary regulatory approvals. The purpose of this meeting would be to introduce the agencies to the flooding issues, resources at risk, alternatives being considered, and the potential range of impacts. The timing of this meeting should align with the environmental investigations and documentation that would likely be progressing as part of the NEPA documentation. The results of this meeting would assist with the final analysis and selection of a preferred alternative that would be progressed into the actual permitting process.

Next Steps

Looking forward beyond the completion of this report, a consulting team with the purpose to assess the environmental and archaeological impact of the proposed project should be established. The composition of the group should reflect a range of interdisciplinary expertise in hydrology and water resources, ecology, natural resources, history, archaeology, engineering, permitting and regulatory compliance, and landscape architecture.

The project will have an impact to the branch of the Pitch and Tar Swamp and upper reaches of wetlands that have migrated further onto PV land, the archaeological resources within the soil, and the experience of the historic landscape. It is beyond the scope of this resilience plan to conduct these studies to quantify landscape impact, but the team can leverage forward momentum generated by this plan to continue into design development and creating a framework for approaching next steps toward permitting and regulatory compliance. Because the site constraints are so closely intertwined, there is considerable overlap of impact within the domains of archaeology, hydrology, ecology, and visitor experience. Some of the issues that require further analysis include, but are not limited to:

- Reclaiming of the historic landscape will need to be further analyzed to understand the impacts to viewsheds and visitor experience.
- The use of cofferdams to conduct archaeology in low-lying areas will temporarily impact Pitch and Tar Swamp, and further coordination and compliance with permitting agencies and regulations will be required for work in archaeology wetland areas.
- Engagement between the consulting design team and archaeologists for permitting discussions to develop a phasing plan that positions PV for swift salvage efforts that have minimal negative impacts to the landscape should occur.
- The filling in of some wetland areas to create the flood control features (berms) will need to be further analyzed to understand the impact the hydrology of and existing plant species present in Pitch and Tar Swamp. Further analysis will be required to understand landscape, hydrology, and ecological impacts after setting thresholds for opening and closing the tide gate on the flood protection berm and the duration of stormwater runoff storage.
- Development of a post-construction monitoring plan can and should be used to evaluate if the resiliency plan did or did not have the anticipated impact on the ecology of Pitch and Tar Swamp.
- The post-construction monitoring plan can and should be leveraged as an interpretive and educational tool.
- The pump system has the potential to have an impact on the landscape's visual resources and should be sited to reduce impact and to maintain integrity of viewsheds.
- The height of the intermediate berm will require further study so that the portion of Pitch and Tar Swamp contained therein floods when it is appropriate, and it is understood at what threshold the pump systems become engaged so that the system is designed and engineered correctly.
- Due to wetland impact, off-site wetland credits will be required to offset the project's design interventions. The type of wetland credits (saltwater or freshwater) and quantity needed to meet regulatory requirements will need to be determined.
- Site grading to establish positive drainage will need to be evaluated to preserve the integrity of existing viewsheds.



The existing Pitch and Tar Swamp will need extensive environmental and hydrology studies completed to determine the full impact of any resiliency improvements. Note the tree die back as a result of increased water levels and salt water intrusion during flood events.



An open archaeology site adjacent to the encroaching Pitch and Tar Swamp. Note the presense of NPS maintenance machinery using the PV site pedestrian paths.

Current policy established by the previous administration enabled a more streamlined design, permitting, and compliance process. For instance, the City of Norfolk Ohio Creek NEPA process was concurrent with the permitting process, which was unique and allowed for a reduced time frame to complete NEPA compliance and permitting. This could happen at Jamestown to expedite next steps for the proposed project while staying in regulatory compliance and also enabling the archaeologists at PV to be able to move forward in conducting the salvage archaeology efforts in low-lying areas.

Order of Magnitude Cost Estimate

The order of magnitude cost provided on the following page is intended to be a high-level estimate of what fees and costs may be encountered and expected at the PV site for the project's next steps based on comparable projects completed by VHB. For each resiliency implementation proposed, there are permitting, design and engineering, and construction costs that must be considered. As the project moves forward, there could be new challenges that arise based on findings during the permitting and design and engineering steps. These figures are meant to help describe the potential costs of next steps. Archaeology costs are estimated by PV staff and include research, field mitigation, and collections management. Construction costs are estimated based on comparable projects in the Mid-Atlantic, but should be interpreted as strictly order of magnitude estimates given the volatility of the current construction market.

Completed and Funded Projects

PV has already committed a significant amount of funding to preserving Jamestown and protecting the island from sea level rise and increased storm events. The seawall repair project and this report are major steps to outlining a resiliency plan, establishing a framework for improvements, and beginning the process of making the property more resilient. In addition, PV has funded improvements to the historic church including drainage and church tower improvements.

Life Cycle Costs

A detailed life cycle cost analysis is strongly recommended to be performed as the project moves forward. Added infrastructure improvements such as pump stations and tide gates will require operations and maintenance that are not accounted for in annual PV budgeting. A life cycle cost analysis will be critical in understanding the full cost of the project and help guide PV and other partners on the appropriate funds to allocate for the project.

Order of Magnitude Cost Estimate Breakdown

Permitting, Compliance, Design + Engineering

- Permitting agency coordination and compliance documentation
- Topographic, wetlands, resource protection areas (RPA), vegetation, and rare, threatened, endangered species surveys
- Wetland mitigation
- Utilities assessment, analysis, and engineering
- Energy/ sustainability analysis
- Easements identification and recordation
- Cultural landscape review
- Hydrological and flood modeling
- Stormwater management engineering
- Geotechnical investigations, analysis, and engineering
- Coordination with stakeholders and public outreach
- Visitor use analysis
- Site facilities and access vulnerability study
- Resiliency and Discovery Center planning, design, and engineering
- James City County Site Plan Approval
- Stormwater Pollution Prevention Plan (SWPPP) and Virginia Pollutant and Discharge Elimination System (VPDES) Application
- Construction Documents
- Bidding Assistance and Pre-Construction Services

Archaeology

Wetlands research for anthropogenic change over time

- Vibracore study of the swamp anthropogenic changes to the land over time
- Geophysical Study of the wetlands and periphery. Both for the past and to monitor dynamic actions of the water table
- Modeling subsurface conditions of the marsh and water table
- Consultation on cultural resources and data recovery related to wetlands

Archaeological Mitigation

- Shovel testing of approximately 6 acres
- Test units associated with the shovel testing
- Mitigation of features (i.e., Great Road, boundary ditches, burials)
- Mitigation of construction areas (stripping and excavation beneath the area of potential effect [APE])
- Permitting (106 compliance, etc.)
- Construction of a geo-spatial data management system clearinghouse (one-stop library for researchers)
- Dissemination of excavations (research, reports, signage, exhibits, and web development)

Collections management & long-term curation

- Processing, cataloging and storage of artifacts
- Conservation of artifacts (water-logged artifacts are costlier)
- Environmental and infrastructural control changes to collections

Construction

- Elevate and/ or flood proof buildings
- Construct flood resiliency infrastructure improvements including pump stations and flood berms
- Elevate roads, pathways, and landscape
- Construct Resiliency and Discovery Center and associated landscape improvements
- Construct and rehabilitate pedestrian and maintenance access pathways and roads
- Construct sitewide visitor interpretive improvements

Completed and Funded Resiliency Projects

Completed Projects	
Seawall Repair Permitting, Design + Engineering	*$160,000.00*
Seawall Repair Construction	*$1,717,000.00*
Jamestown Resiliency Plan	*$130,000.00*
Total	***$2,007,000.00***
Funded Projects	
Historic Church Drainage Improvements Engineering	*$60,000.00*
Historic Church Drainage Improvements Construction	*$190,000.00*
Historic Church Tower Structural Engineering	*$80,000.00*
Historic Chruch Tower Improvements Construction	*$424,000.00*
Boundary Survey	*$15,000.00*
Total	***$769,000.00***

Proposed Resiliency Projects

Permitting, Compliance, Design + Engineering	**Opinion of Cost**
Flood Resiliency Infrastructure Improvements	$1,400,000.00
Resiliency + Discovery Center	$840,000.00
Circulation + Visitor Improvements	$180,000.00
Total	**$2,420,000.00**

Archaeology	**Opinion of Cost**
Wetlands Research for Anthropogenic Change	$2,300,000.00
Archaeological Mitigation	$6,800,000.00
Collections Management & Long-term Curation	$3,200,000.00
Total	**$12,300,000.00**

Construction	**Opinion of Cost**
Flood Resiliency Infrastructure Improvements	$18,000,000.00
Resiliency + Discovery Center	$7,000,000.00
Circulation + Visitor Improvements	$1,800,000.00
Total	**$26,800,000.00**

Grand Total	**$41,520,000.00**

Early Action Projects

Certain projects have already been undertaken at the Preservation Virginia site due to need, readiness, and marginal environmental resource impacts: the Historic Seawall Preservation Project, the Historic Church Tower and Drainage Improvements, and the Boundary Survey. The following sections will discuss each of the projects and their current status.

Historic Church Tower and Drainage Improvements

The project will include water abatement and preventative measures for on-site flooding around the historic church and immediate landscape. Due to the volume and velocity of stormwater runoff from the Church, the landscape has been subject to erosion and ponding on the surface, and threats to archaeological features increases when site conditions are wetter. The new conveyance will carry the water away from the building in carefully planned underground pipes that avoid damaging existing archaeological features. The stormwater system is planning on discharging the stormwater into the James River using best management practices. Further study will be required to understand stormwater runoff from the church, produce complete stormwater calculations in accordance with the Virginia Runoff Reduction Method, and to create a detailed plan for implementation with appropriate specifications for mitigation at an active archaeology site.

Historic Seawall Preservation Project

Due to the erosion of the southwestern riverbank of the island, the need for armoring to protect the historic, prehistoric, and environmental resources of the site was first identified. The first seawall improvement was undertaken "in 1895 with granite breakwaters and wooden jetties; however, a damaging winter storm soon destroyed them. In 1901, construction of a concrete seawall began; it still protects the Island's southwestern shore. The seawall construction was an extremely important milestone in preserving cultural features of recognized importance in the nation's history" (APVA and NPS 2002, 3-23). Over time, the seawall has been impacted by storms, tidal dynamics, and hydrostatic pressure, which has led to erosion of the riverbank below and led to the collapse and subsequent repair of certain sections of the original construction. These contemporary collapses are largely what spurred the need for armoring of the historic seawall to protect it from these forces.

Construction for the Historic Seawall Preservation Project was completed in summer 2022 where the historic seawall was armored with a revetment to protect it from further degradation. Through the use of ground penetrating radar, void spaces under the historic seawall were located. These voids were filled with #57 stone before a layer of filter fabric and VA #2 stone was applied. These serve as bedding and filter for the 150- to 500-pound Class II+ rip rap stones placed on top. The revetment armoring begins at approximately 3 feet above mean high water level on top of the original structure and extends approximately 8' beyond it to a depth of approximately 3 feet below the mean low water level. The revetment is essentially a robust stone blanket spanning the entire original construction. The revetment also extends beyond the original structure's footprint to include an armored toe several feet further out into the James River, protecting the historic structure by dissipating and absorbing wave energy and erosive forces that it encounters.

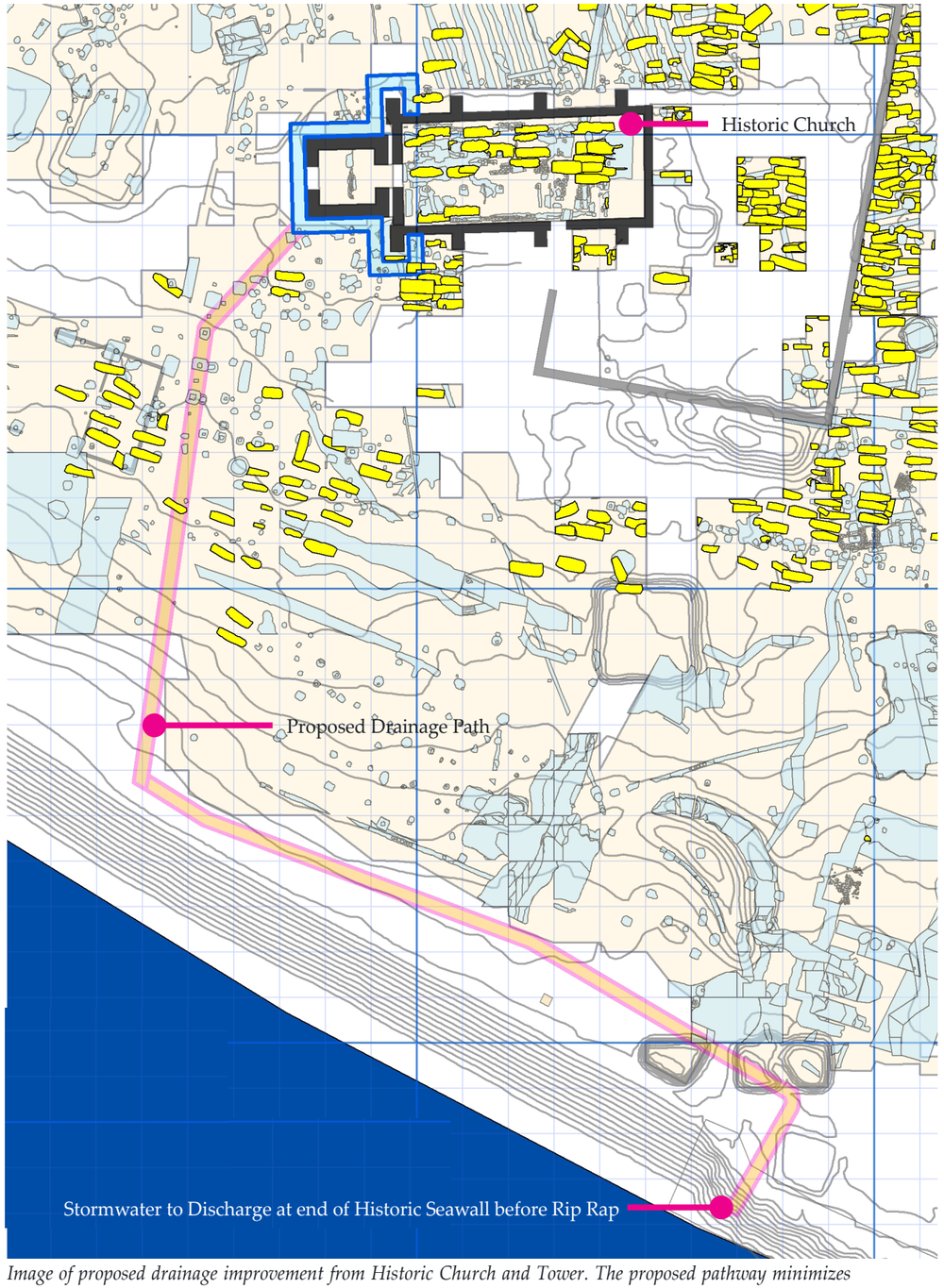


Image of proposed drainage improvement from Historic Church and Tower. The proposed pathway minimizes disturbance to archaeological features and protects the upland areas around the church from water damage.



Image of the seawall shortly after original construction was completed. Photograph courtesy of Preservation Virginia.



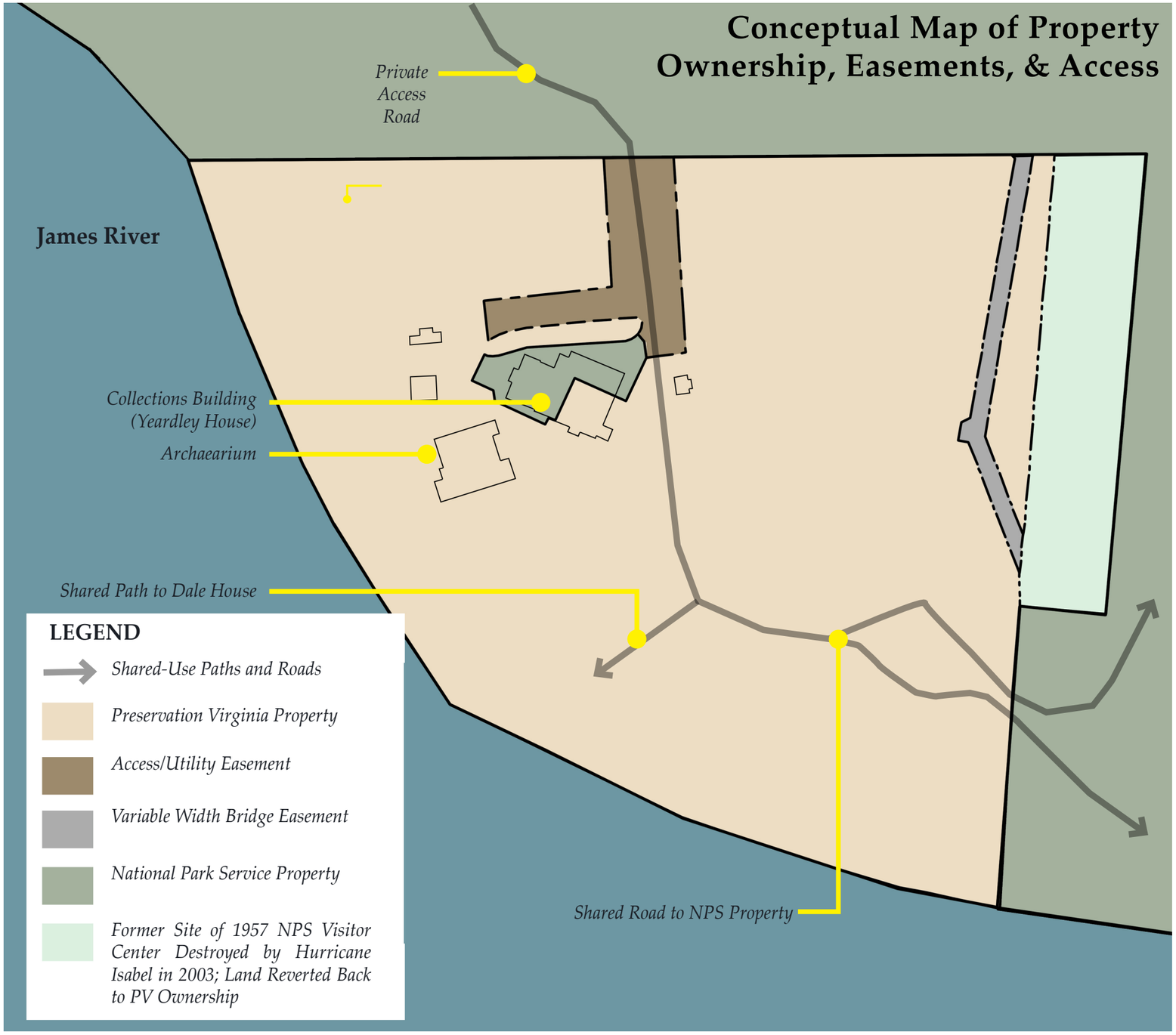
Image of the seawall where concrete blocks have collapsed into void spaces below.







(Top) *Seawall repair utilized equipment and materials on barges to build the revetment from the James River. This enabled the construction crew to keep a light touch on the landscape and avoid damage to the site and prospective archaeological resources.* **(Bottom Left)** *The condition of the seawall prior to armoring; photograph taken in June 2020.* **(Bottom Right)** *The condition of the seawall after repair, photograph taken in July 2022.*



The Boundary Survey was conducted to establish property ownership, especially after the destruction of the NPS Visitor Center and agreements between Preservation Virginia and the National Park Service about what should happen to the sliver of land (light green polygon) to the west of the bridge.



Boundary Survey Crew locating property corners near the 1907 Monument.

Boundary Survey

One of the original project goals was to verify the property boundary and create an official property line that Preservation Virginia (PV) and the National Park Service (NPS) agree upon. When the 1957 Visitor Center was demolished, the land area where it once stood went back into ownership by PV, although the documentation for such a transfer has been difficult to establish in the official record. Since this time, the property boundary between PV and NPS lands has been murky at best.

The boundary survey was accomplished by using available deeds, record drawings, and maps coupled with field staking of the approximate boundary line. Two original property corner pins were located near the 1907 monument. The location of these pins was used to locate the remainder of the property lines where field markers or property pins were not present. One constraint of the survey that was performed, is that the documents of record did not adequately provide for the means by which a boundary survey could be performed. Thus, an agreement between PV and the NPS must be struck based on the results of the survey that was performed by VHB in spring 2022.

PV provided VHB with site access, available as-built and post-construction record drawings, available Ground Penetrating Radar (GPR) Data obtained by PV staff, and archaeological surveys and data for the coordination with topographic survey and base mapping. VHB relied on the accuracy and completeness of PV-furnished information concerning the performance of the boundary survey. The survey was completed under the direct responsible charge of a Virginia Licensed Land Surveyor and in accordance with 18VAC10-20-370. Minimum standards and procedures for land boundary surveying practice, where VHB performed the survey and prepared a plat suitable for recordation by the Williamsburg—James City County Clerk of Courts. The plat is in draft form since the revised property line and associated easements have not yet been agreed upon by the NPS and PV. The draft plat is available in Appendix B of this report.

Section 8

Appendices

Appendix A. References
Appendix B. Draft Boundary Survey
Appendix C. Seawall Improvements
Appendix D. Media

Appendix A: References

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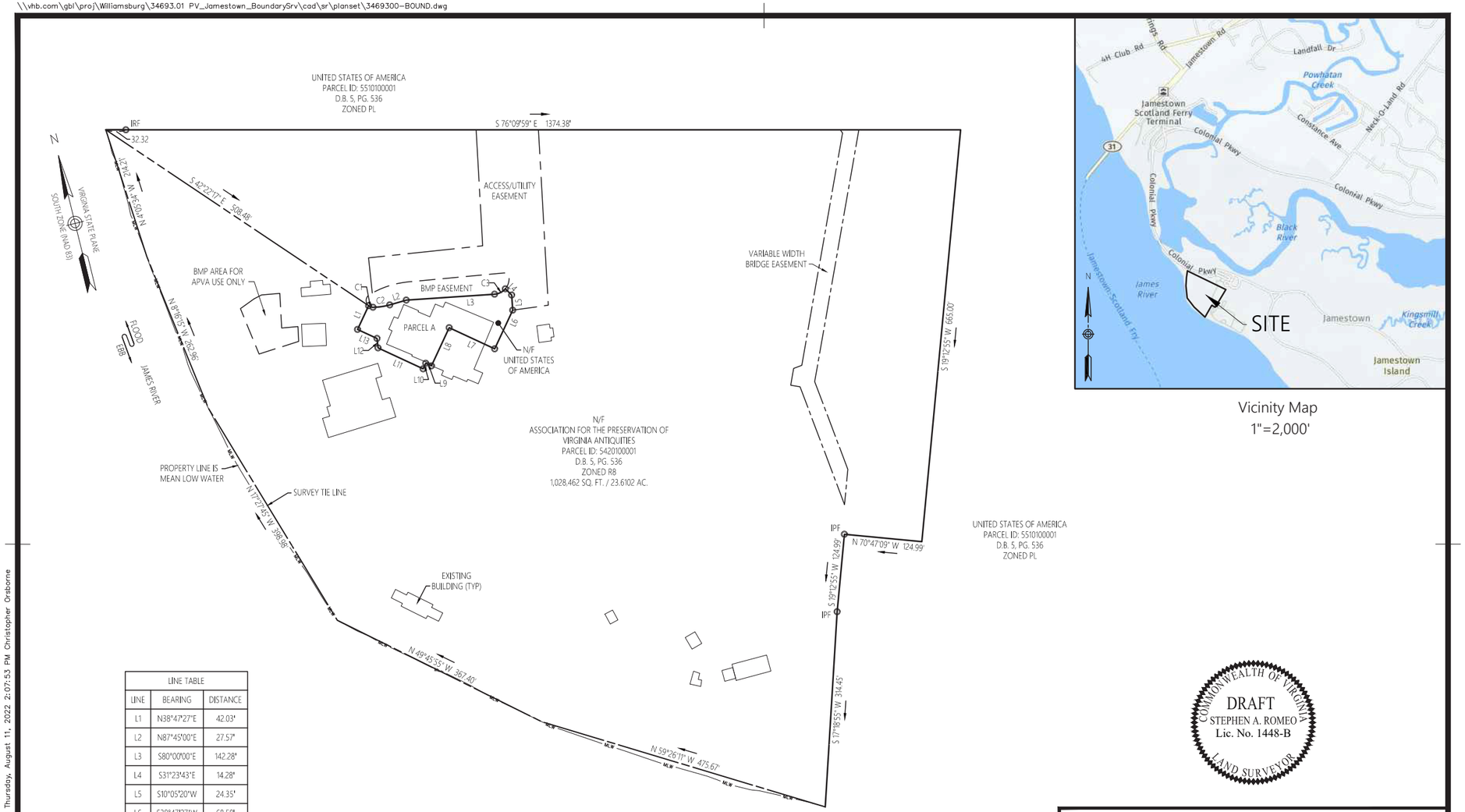
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Appendix B: DRAFT Boundary Survey



Vicinity Map
1"=2,000'

LINE TABLE		
LINE	BEARING	DISTANCE
L1	N38°47'27"E	42.03'
L2	N87°45'00"E	27.57'
L3	S80°00'00"E	142.28'
L4	S31°23'43"E	14.28'
L5	S10°05'20"W	24.35'
L6	S38°47'27"W	68.58'
L7	N51°12'33"W	80.69'
L8	S38°47'27"W	67.75'
L9	N51°12'33"W	10.00'
L10	S38°47'27"W	10.00'
L11	N51°12'33"W	80.00'
L12	N7°48'04"E	15.15'
L13	N51°12'33"W	34.52'

CURVE TABLE						
NUMBER	RADIUS	LENGTH	DELTA	TANGENT	CHORD BEARING	CHORD
C1	11.00'	7.70'	40°05'25"	4.01'	S56°31'25"E	7.54'
C2	100.00'	27.37'	15°40'53"	13.77'	S84°24'34"E	27.28'
C3	25.00'	19.96'	45°45'00"	10.55'	N77°07'30"E	19.44'

General Notes

1. THE PROPERTY LINES SHOWN BASES ON AN ON THE GROUND SURVEY PERFORMED BY VHB DURING FEBRUARY AND MARCH OF 2022 AND DEEDS AND PLATS OF RECORD.
2. MERIDIAN SOURCE: VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD83. DATUM WAS DETERMINED USING TOPNET LIVE RTK NETWORK AND JAMES CITY COUNTY MONUMENT 344.
3. THIS PLAT WAS PREPARED WITHOUT THE BENEFIT OF A CURRENT TITLE REPORT, THEREFORE ALL ENCUMBRANCES UPON THE PROPERTY MAY NOT BE SHOWN.
4. EASEMENTS SHOWN BASED ON PLAT "BOUNDARY SURVEY SHOWING LANDS OF ASSOCIATION FOR THE PRESERVATION OF VIRGINIA ANTIQUITIES ON JAMESTOWN ISLAND" DATED 10/25/02, PREPARED BY VHB.

REFEERENCES
INST. NO. 050001171 (DEED)
P.B. 2, PG. 6 (PLAT)
D.B. 58, PAGE 548 (DEED)
D.B. 10, PAGE 508 (DEED)

COMMONWEALTH OF VIRGINIA
DRAFT
STEPHEN A. ROMEO
Lic. No. 1448-B
LAND SURVEYOR

Boundary Survey
Lands of the
Association for the Preservation of
Virginia Antiquities on Jamestown Island
Parcel Id: 5420100001
James City County, Virginia

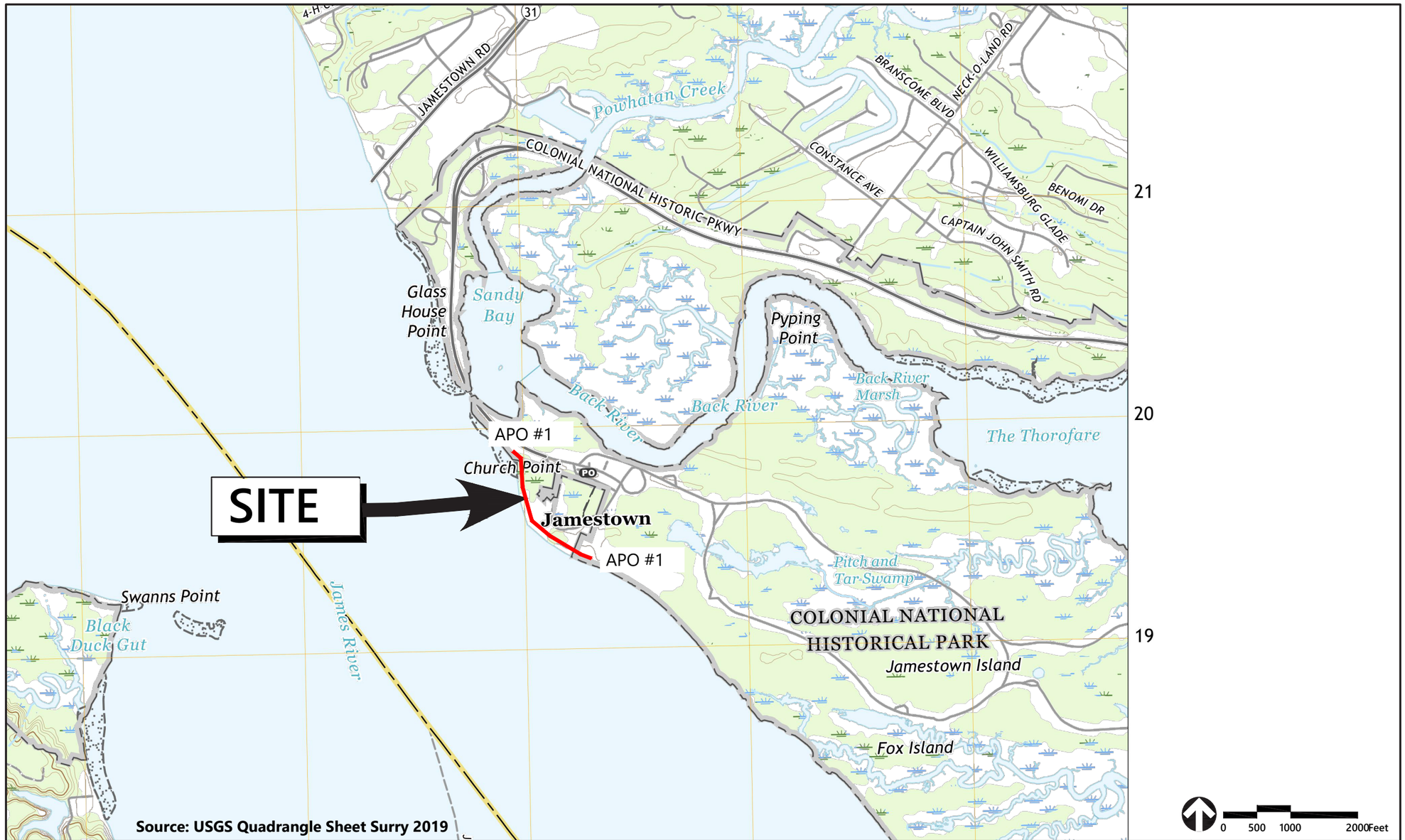
DATE: 8/11/2022	SHEET 1 OF 1	SCALE: 1"=100'
PROJECT NO: 34693.00	DRAWN BY: CRO	CHECKED BY: SAR

vhb Transportation Land Development Environmental Services
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Appendix C: Seawall Improvements





Source: USGS Quadrangle Sheet Surry 2019

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

LOCATION MAP

AT: James River

IN: James City County

PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

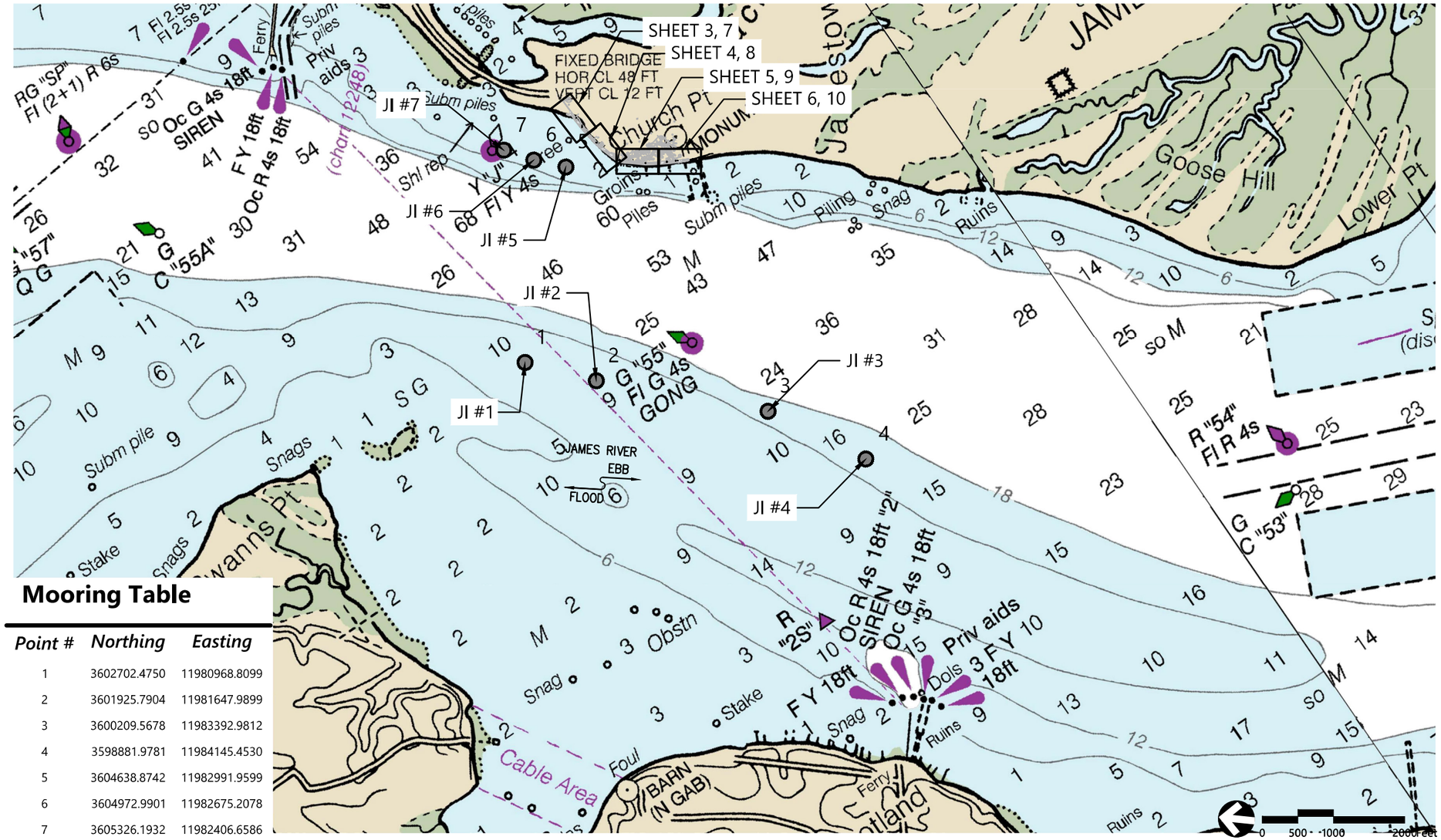
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351 McLaws Circle, Suite 3 Williamsburg, Virginia 23185 (757) 220-0500 • Fax: (757) 903-2794	**ADJACENT PROPERTY OWNERS:** 1. National Park Service **DATUM:** NAVD 88	**JAMESTOWN ISLAND SEAWALL AUGMENTATION** **OVERALL AREA** **AT: James River** **IN: James City County** **PURPOSE: SEAWALL AUGMENTATION**	**APPLICATION BY:** **Preservation Virginia** **DATE: OCTOBER, 2021** **SHEET 2 OF 12**

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Mooring Table

Point #	Northing	Easting
1	3602702.4750	11980968.8099
2	3601925.7904	11981647.9899
3	3600209.5678	11983392.9812
4	3598881.9781	11984145.4530
5	3604638.8742	11982991.9599
6	3604972.9901	11982675.2078
7	3605326.1932	11982406.6586

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ADJACENT PROPERTY OWNERS:
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DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

MOORING LOCATIONS

AT: James River

IN: James City County

PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 3 OF 12

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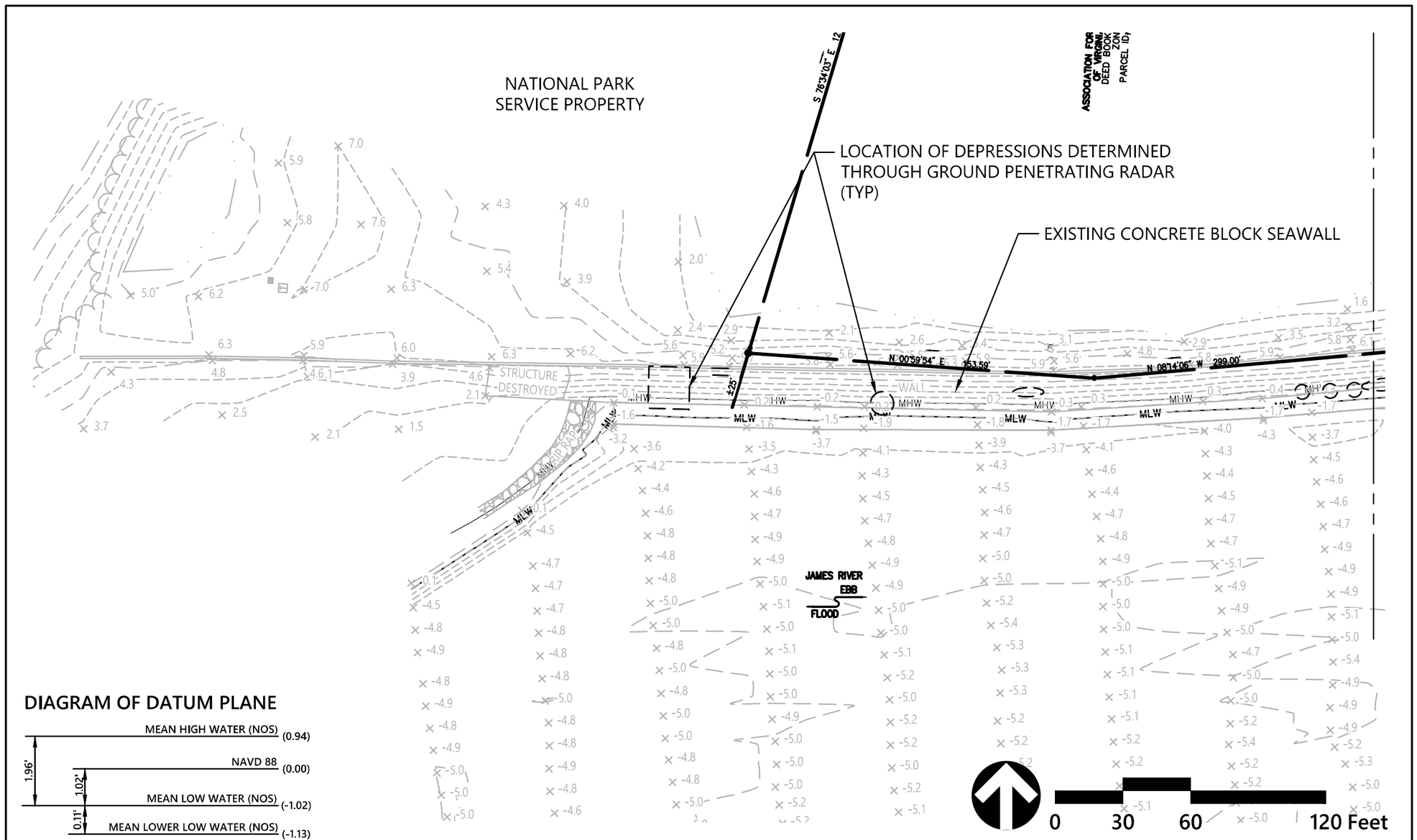


DIAGRAM OF DATUM PLANE

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DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

EXISTING CONDITIONS

AT: James River

IN: James City County

PURPOSE: SEAWALL AUGMENTATION

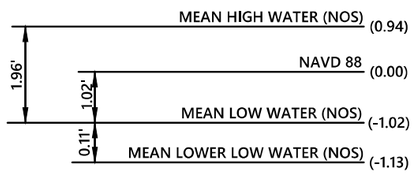
APPLICATION BY:
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DATE: OCTOBER, 2021

SHEET 4 OF 12

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DIAGRAM OF DATUM PLANE



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JAMESTOWN ISLAND SEAWALL AUGMENTATION

EXISTING CONDITIONS

AT: James River

IN: James City County

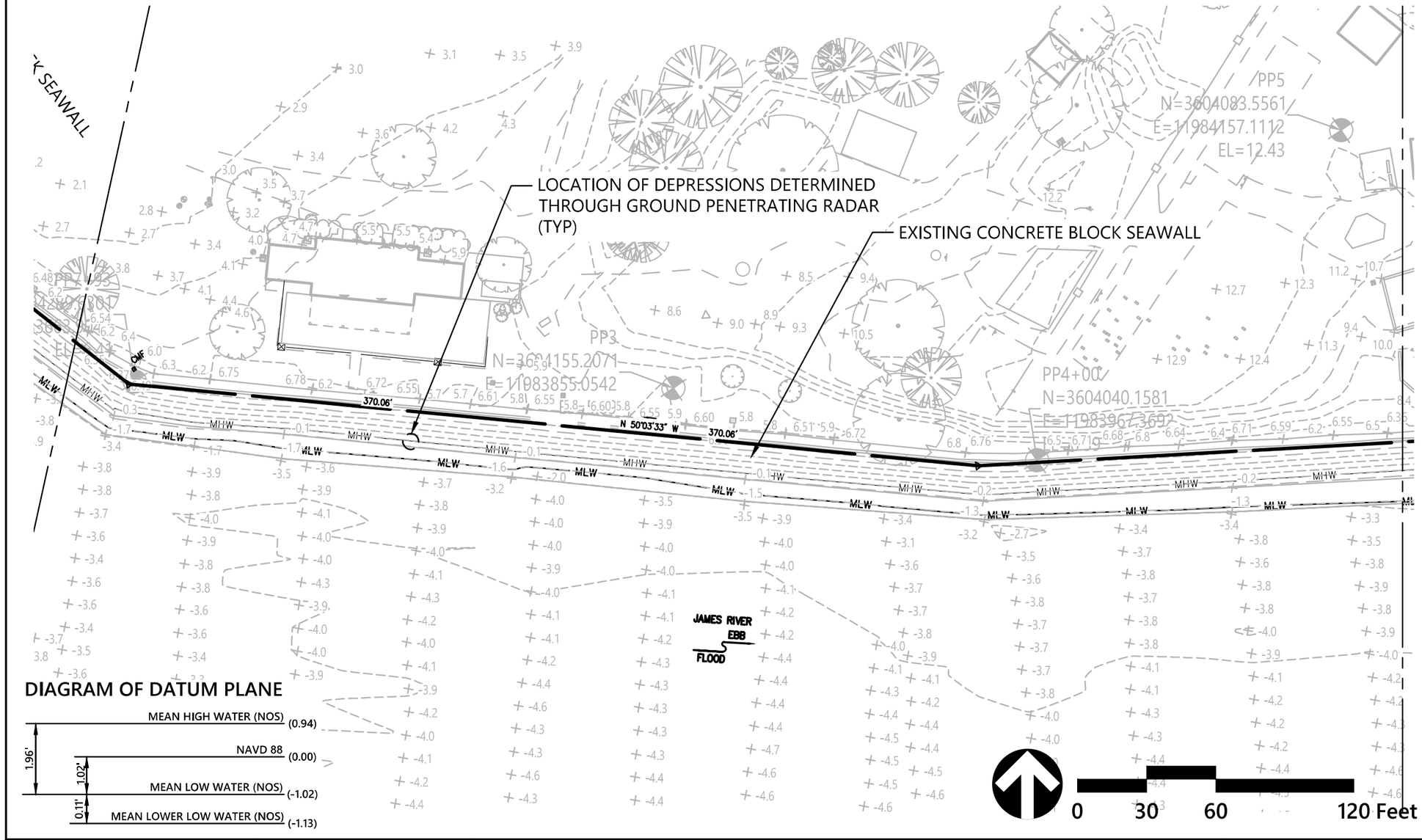
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 5 OF 12

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

EXISTING CONDITIONS

AT: James River

IN: James City County

PURPOSE: SEAWALL AUGMENTATION

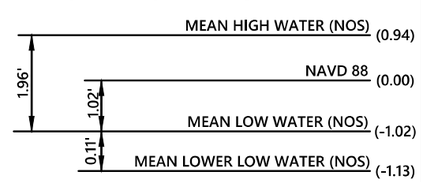
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SHEET 6 OF 12

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DIAGRAM OF DATUM PLANE



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1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

EXISTING CONDITIONS

AT: James River

IN: James City County

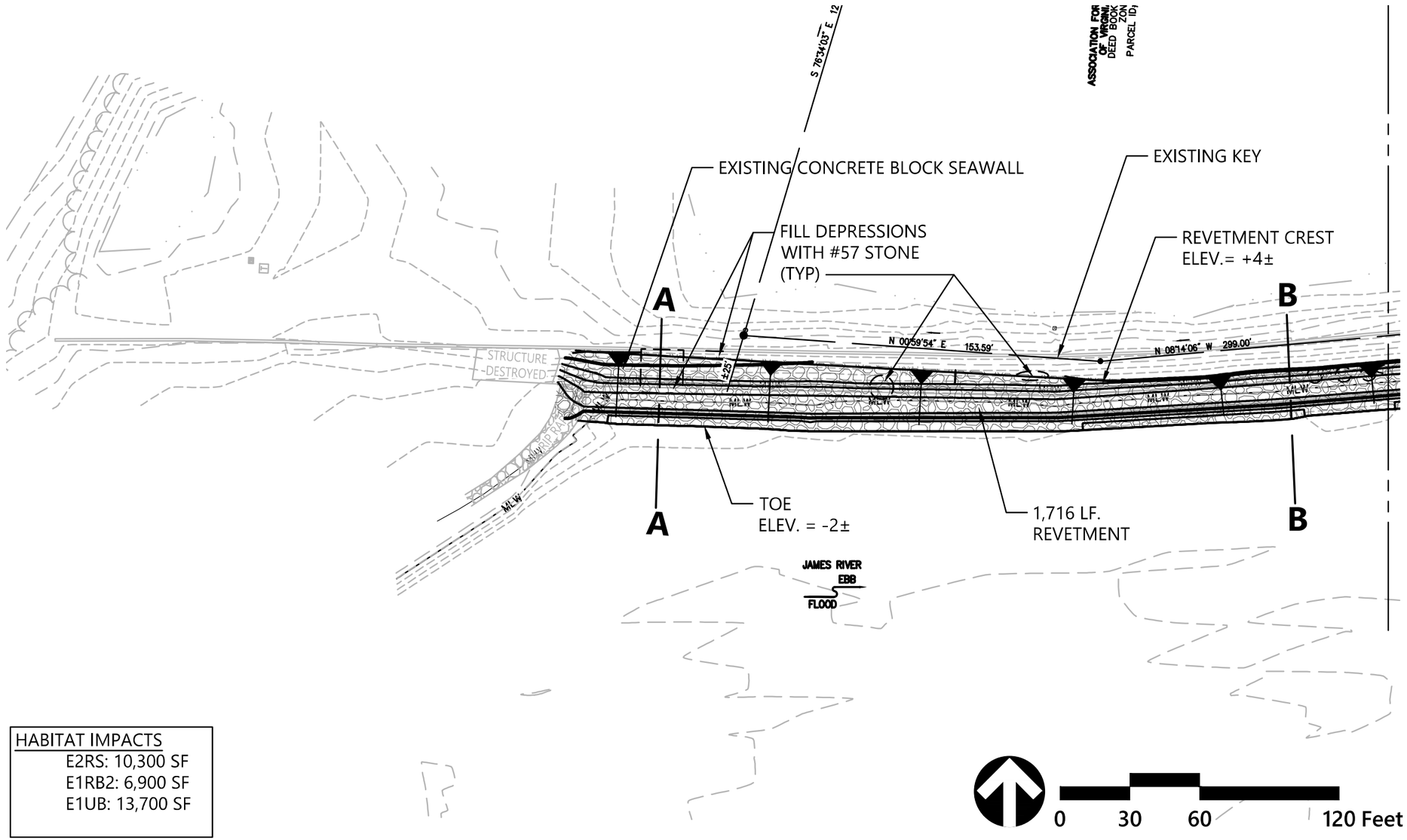
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
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DATE: OCTOBER, 2021

SHEET 7 OF 12

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

PROPOSED LAYOUT

AT: James River

IN: James City County

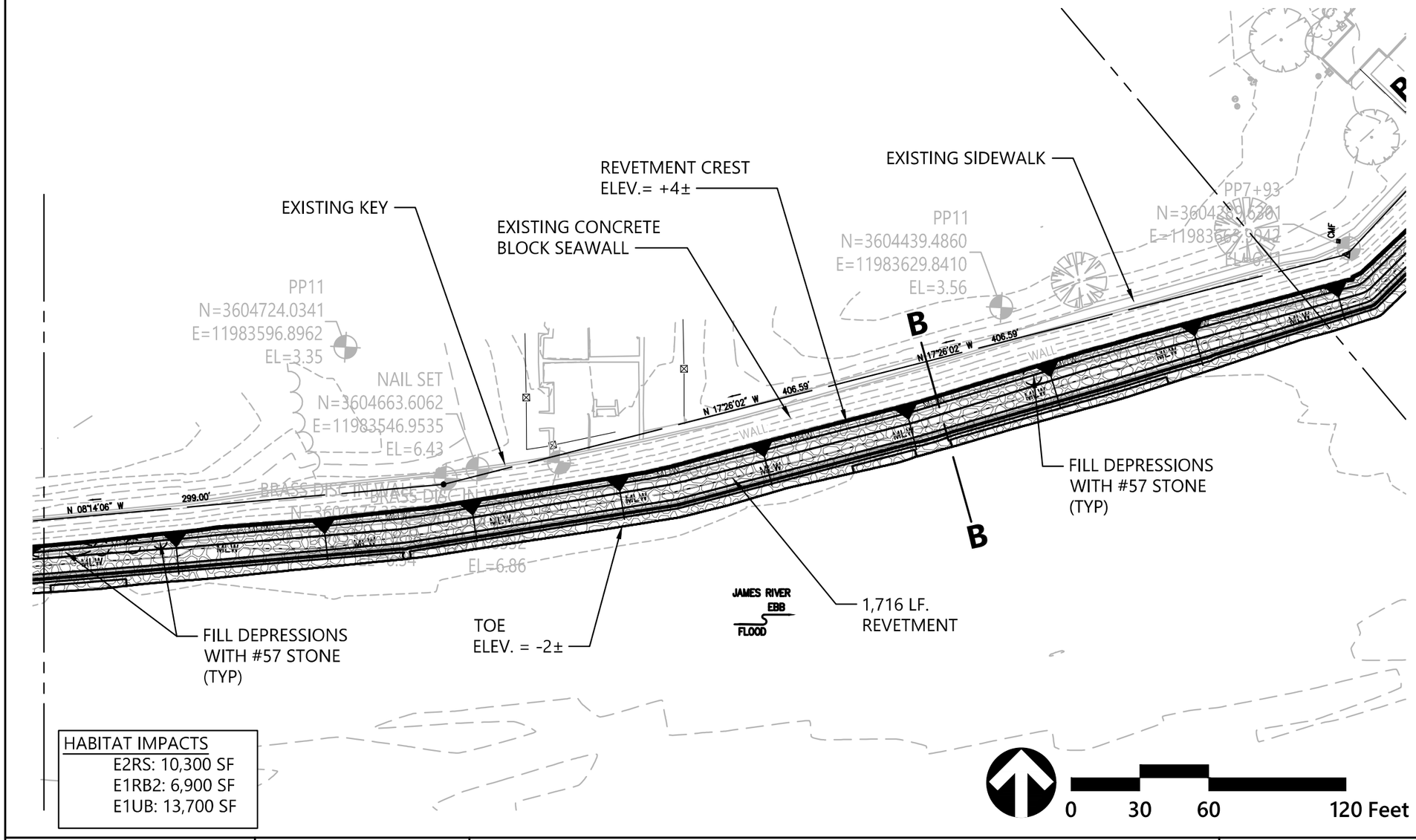
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 8 OF 12

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

PROPOSED LAYOUT

AT: James River

IN: James City County

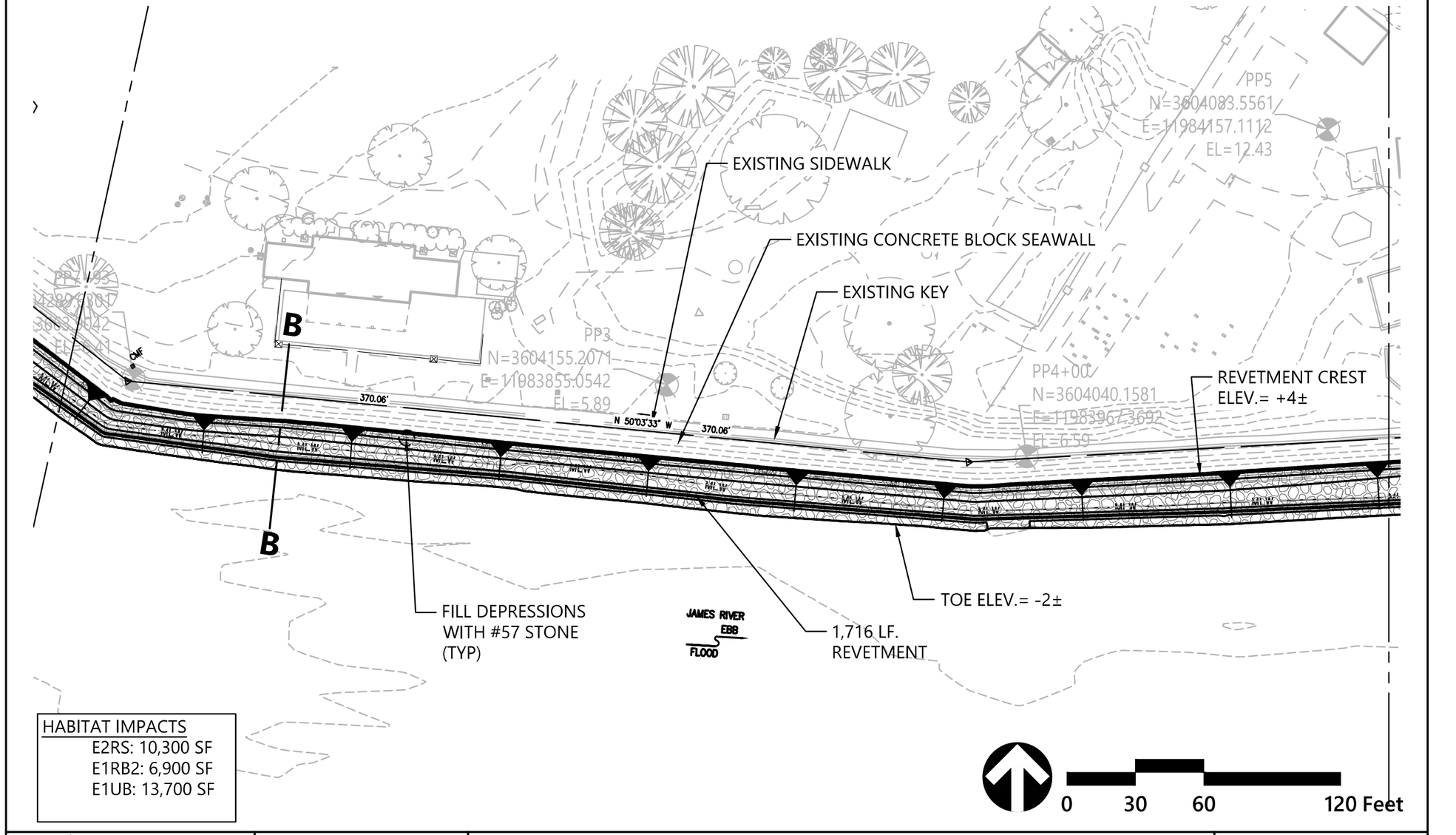
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

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ADJACENT PROPERTY OWNERS:
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JAMESTOWN ISLAND SEAWALL AUGMENTATION

PROPOSED LAYOUT

AT: James River

IN: James City County

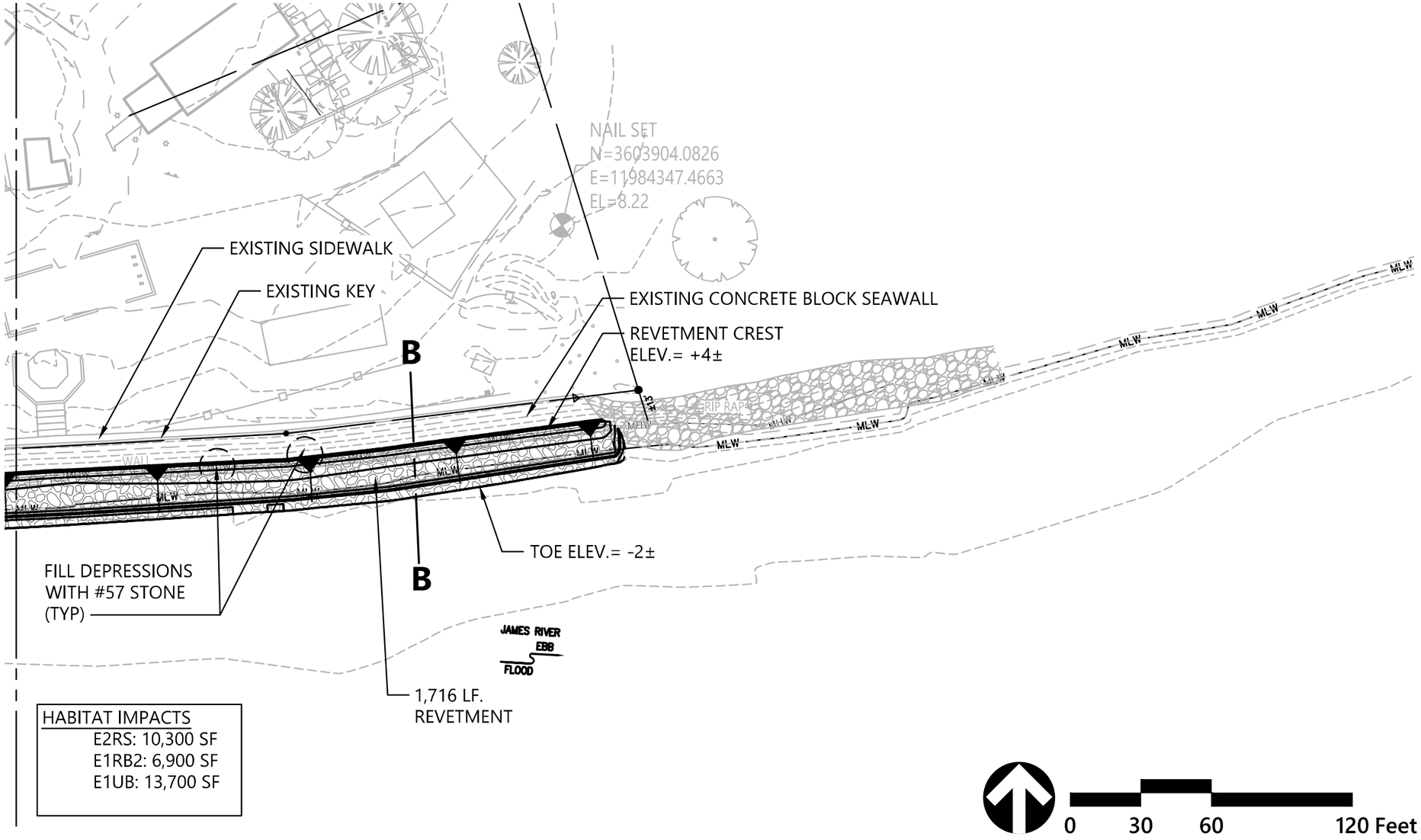
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 10 OF 12

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

PROPOSED LAYOUT

AT: James River

IN: James City County

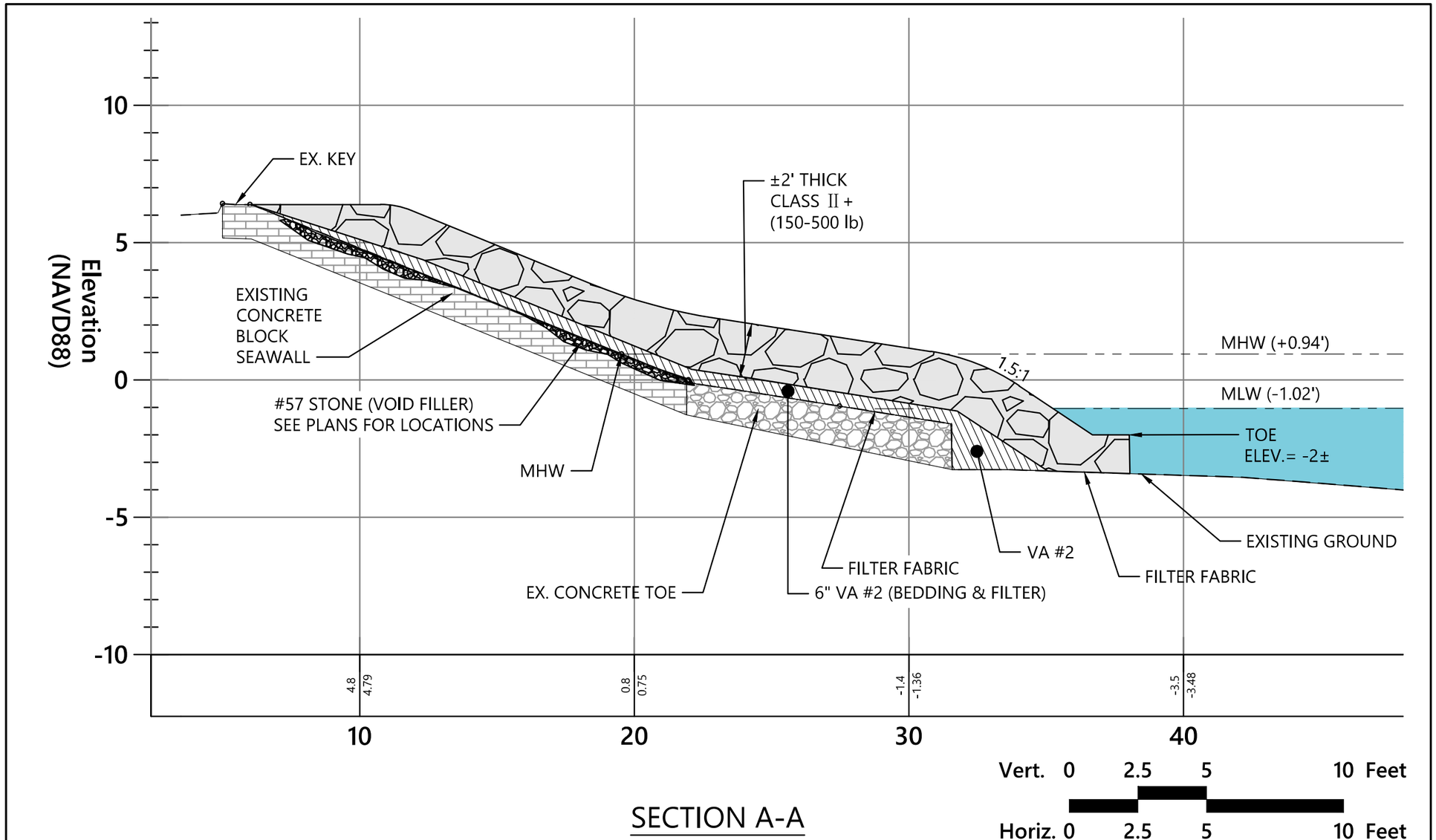
PURPOSE: SEAWALL AUGMENTATION

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Preservation Virginia

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SECTION A-A

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ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

TYPICAL SECTION

AT: James River

IN: James City County

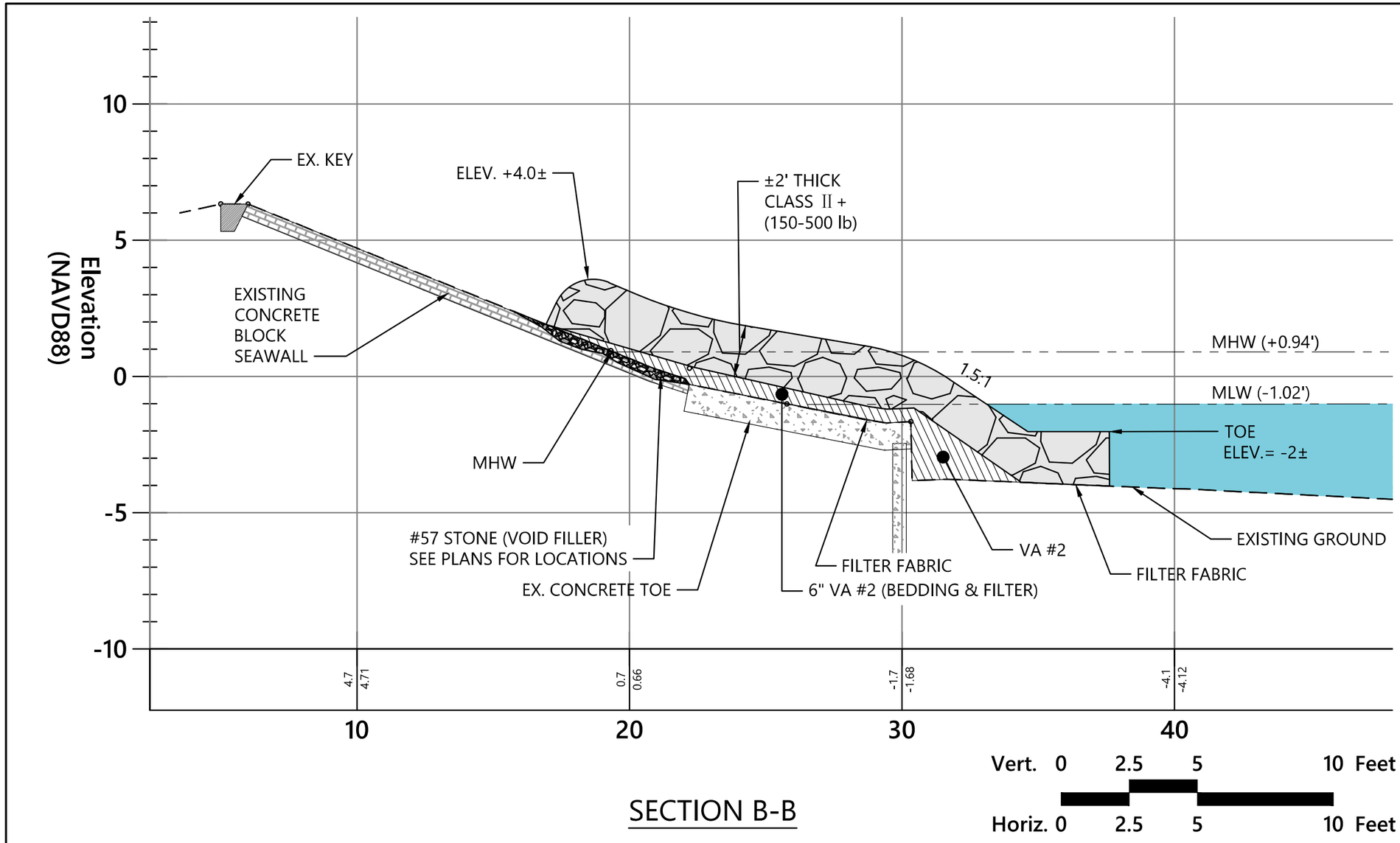
PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 12 OF 12

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SECTION B-B

vhb
351 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
(757) 220-0500 • Fax: (757) 903-2794

ADJACENT PROPERTY OWNERS:
1. National Park Service

DATUM: NAVD 88

JAMESTOWN ISLAND SEAWALL AUGMENTATION

TYPICAL SECTION

AT: James River

IN: James City County

PURPOSE: SEAWALL AUGMENTATION

APPLICATION BY:
Preservation Virginia

DATE: OCTOBER, 2021

SHEET 12 OF 12

\\vhb\gbl\proj\Williamsburg\34693.00 Preservation_Jamestownls\cad\ev\planset\JPA\3469300-JPA-SECTIONS.dw

Appendix D: Media



The Washington Post

Prices may vary in areas outside metropolitan Washington. RE V2

T-storm 80/58 • Tomorrow: Partly sunny 71/58 B8 | *Democracy Dies in Darkness* | WEDNESDAY, MAY 4, 2022 · $2

The Washington Post

METRO

WEDNESDAY, MAY 4, 2022 · WASHINGTONPOST.COM/LOCAL EZ RE B

8 a.m. 62° | Noon 72° | 4 p.m. 73° | 8 p.m. 74° | High today at approx. 6 p.m. 80° Precip: 70% Wind: SW 6-12 mph

JOHN KELLY'S WASHINGTON
Artists and attendees see the Birchmere's sound — honed for over 40 years — as something special. B3

THE DISTRICT
D.C. Circulator bus operators began a strike to protest wages and working conditions. B3

Colonial Jamestown, assailed by climate change, is facing disaster

400-year-old Virginia site, battered by flooding and other effects, is listed as endangered

BY MICHAEL E. RUANE

JAMESTOWN, VA. — The dig site where archaeologist Sean Romo has just found the ancient fragment of armor is surrounded by a double layer of green sandbags to keep out water.

A dig site nearby is covered by a grate where a tarp can be quickly spread if it starts to rain.

And out in the James River, barges filled with stone are waiting to bolster the century-old concrete sea wall that is failing under the relentless pressure of the river.

The 400-year-old colonial site here is losing its battle with climate change, experts say, and Wednesday the National Trust for Historic Preservation placed it on a list of the country's most endangered historical places.

"Jamestown is a world-class archaeological site and a place of national and international significance,"

SEE RETROPOLIS ON B2

TOP: Jamestown, site of the first permanent English settlement in what would become the United States, is seen from above, sandwiched between the James River and a swamp. ABOVE: Archaeologists Caitlin Delmas, left, and Anna Shackelford work Friday at the site of a former cellar turned trash pit in Jamestown.



RETROPOLIS

PHOTOS BY JULIA RENDLEMAN FOR THE WASHINGTON POST

Scan here to view the Washington Post Story

RETROPOLIS

'Subtleties of the past can easily be washed away'

RETROPOLIS FROM B1

said James Horn, president of the Jamestown Rediscovery Foundation, the nonprofit group that conducts archaeology and cares for the original settlement site. (The trust listing does not include the adjacent National Park Service Jamestown location.)

The threat to the site of one of the nation's "very first cultural hubs ... brings home the challenges that climate change pose to our entire society," he said.

Katherine Malone-France, chief preservation officer for the trust, said, "You've got resources there underwater that are staying underwater."

"Jamestown demonstrates that the threats to our cultural resources from a changing climate are incredibly urgent," she said. "We have a five-year window to make an impact. ... This isn't something that can wait 10 or 15 years."

"This is our collective heritage," she said Monday.

The trust was chartered by Congress in 1949, and for the past 35 years it has issued a list of 11 historical sites endangered by things such as development, neglect, decay and exposure to weather.

Another spot struggling with climate change on this year's list is Houston's Olivewood Cemetery, Malone-France said.

It is a 140-year-old African American burial ground with more than 4,000 graves. It suffers from chronic erosion, and after a 2017 hurricane, it was under 10 feet of water.

Jamestown, in 1607, became the place of the first permanent English settlement in what would become the United States. The earth here holds the bones of hundreds of the early colonists and the artifacts that are clues to their lives.

It is also the place where, in 1619, the first enslaved Africans arrived, and where generations of Native Americans had already lived for centuries.

It is an archaeological "trifecta," as one expert put it.

Queen Elizabeth II of Britain has visited. So have Presidents Franklin D. Roosevelt and George W. Bush, Supreme Court Chief Justice John G. Roberts Jr., and an array of political and public figures.

In recent years there have been spectacular discoveries, including the location of the colony's "lost" fort, the remains of colonial VIPs and evidence that the first settlers, facing starvation, may have resorted to cannibalism.

But the location is on a low-lying tidewater island menaced by the river on one side, a swamp on the other and what the archaeologists believe are increasingly frequent deluges of rain caused by climate change.

Drainage systems date back to the 1950s, said Michael Lavin, director of collections and conservation for Jamestown Rediscovery. And archaeologists have had to use sump pumps to empty water-filled excavations.

Part of the problem "is, of course, sea level rise," archaeologist Mary Anna R. Hartley said one day last week as she stood by a sandbagged excavation site that probably dates to about 1608.

"Some of it is groundwater coming up," she said. "The other thing is these tremendous rain events we're getting, I'd say, in the last 12 to 15 years. We'll get between 4 and 10 inches of rain all at once. And there are multiple instances and events like that."

She said the archaeologists keep their smartphones tuned to weather reports and one eye on the sky over the mile-wide river. "When you see a storm directly across, it's almost too late," she said. "You better hurry up and close what you can."

"Our defenses are always the sandbags," she said.

"And then we have this really high-quality plastic that we lay down ... to catch the water and pump it off or bail it off the sites," she said.

"If you get that much rain that fast, it's pretty much like a hurricane or a nor'easter," she said. "And almost on a weekly basis, we'll get one of those rain events. ... The inundation is outpacing us."

Already the small excavation has yielded pieces of "brigandine" armor and Native American projectile points that date back centuries. Both can be destroyed or altered by water.

Fragile layers of sediment that archaeologists use to read a site can be washed away. And human bones exposed to water can become like cardboard, one expert said.

None of Jamestown's high-status burials seem threatened so far because they are on higher ground in or around the main church site.

But at least one burial, and perhaps many more, are on lower ground and in the path of an encroaching swamp, said Romo, one of the archaeologists.

He said some areas where there may be artifacts already have been engulfed by the swamp, and others are in danger of that.

"The subtleties of the past can easily be washed away," he said.

Last week, as archaeologists scraped away dirt in the sandbagged pit, several construction barges were anchored in the river awaiting government permission to start shoring up the sea wall that has protected Jamestown for over 100 years.

Although the sea wall is made of huge blocks of concrete, it has been battered by the river for decades and now is being undermined by water seepage from the land.

"If the blocks start falling out ... at some point the whole thing is going to drop out, and you're going to lose the integrity of the sea wall," Lavin, the collections director, said last week.

Jamestown Rediscovery and its nonprofit affiliate Preservation Virginia have raised more than $2 million for the project to bolster the sea wall with tons of granite "armor" stone, he said.

Each stone weighs between 500 and 1,500 pounds, and they will be placed against the existing concrete blocks of the wall.

R. Neville Reynolds, managing director of VHB, the Williamsburg engineering firm doing the work, said the project could begin in a week and would take about two months to finish.

But Jamestown needs more than just a reinforced sea wall, Lavin said. The landscape needs to be adjusted to cope with the continuing impact of climate change.

Roads should be raised. A modern drainage system needs to be created. And a special flood berm needs to built on the site.

Lavin said the cost will be in the "tens of millions" of dollars. And time is critical.

"We want to raise this flag of awareness and urgency that one of America's premier historic, and prehistoric, sites is at risk," he said.

Ruane, M. 2022. "Colonial Jamestown, assailed by climate change, is facing disaster." Washington Post. May 4, 2022. View online at: https://www.washingtonpost.com/history/2022/05/04/jamestown-climate-change-floods-endangered/.

“Jamestown will be lost”: Climate Change threatens to sink historic colony

Jamestown, Virginia — More than 400 years after the first European settlers arrived, Jamestown, Virginia, is struggling to survive the ravages of climate change.

“We are concerned that if we don’t take action, Jamestown will be lost,” said Elizabeth Kostelny, who runs Preservation Virginia, the nonprofit overseeing the colony’s original 22 acres along the James River.

Kostelny, who is racing to save it from rising water, said America will lose “part of its soul” if the site sinks.

“Jamestown’s incredibly important,” she told CBS News. “It tells a national story about our persistence, our democracy and the beginnings of our race relations.”

The Jamestown colony marked the start of representative government in the new world. It’s also where Pocahontas married John Rolfe. And it remains the site of archaeological history, hidden and waiting to be unearthed. Kostelny said she finds things of significance at the site “every single day.”

“Jamestown holds supreme in terms of world heritage. This place is in our minds where you draw a line in the sand about sea level rise, climate change and cultural heritage,” David Givens, director of archeology at Jamestown Rediscovery, told CBS News.

That line in the sand starts with shoring up the 1904 seawall along the river bank with 96,000 tons of granite to help deflect the force of ever-strengthening storms.

The river has risen more than 18 inches in the last century. So-called 100-year storms now hit every five years. But the biggest threat to Jamestown isn’t the rising river. It’s a swamp that’s literally devouring history as it grows.

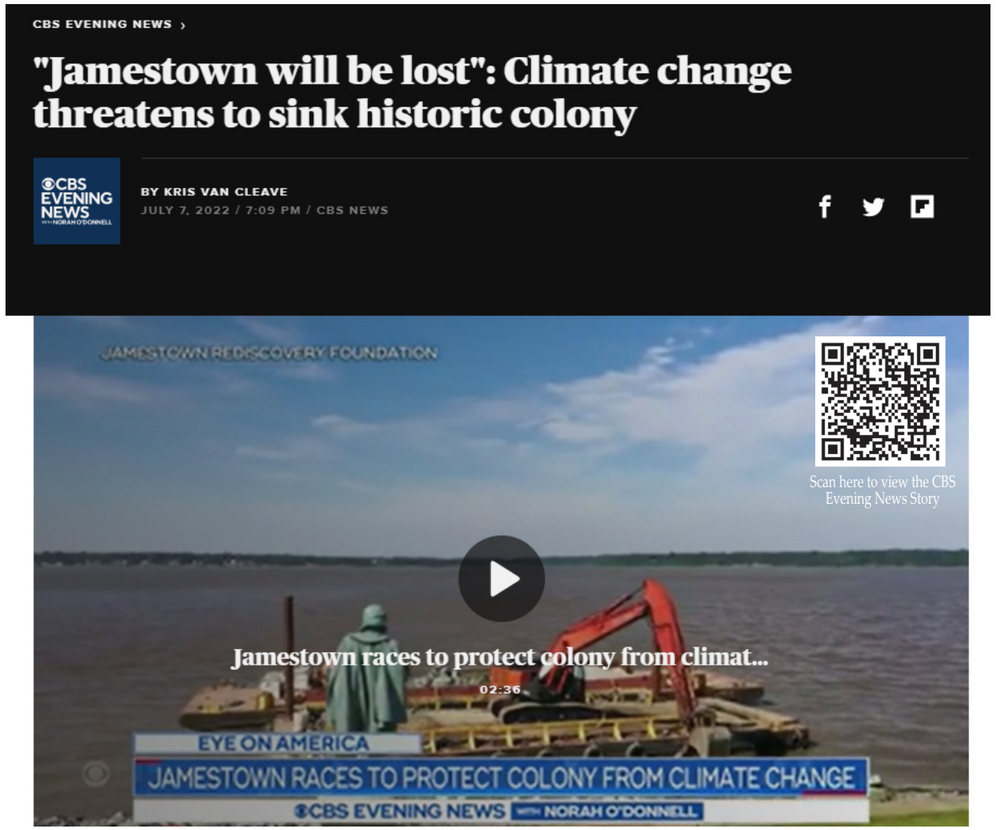
“We have [water] from both sides, below, above. We’re getting attacked from all sides,” Michael Lavin, who is leading Jamestown’s fight against climate change, told CBS News. “We’re going to have to raise buildings, raise roads, do salvage archaeology, put in berms, pump systems to truly save Jamestown.”

Saving the site will likely require raising tens of millions of dollars over the next five years to keep this American treasure from being washed away.

Kris Van Cleave

Kris Van Cleave is a congressional correspondent for CBS News based in Washington, D.C.
First published on July 7, 2022 / 7:09 PM

View online at: https://www.cbsnews.com/news/jamestown-virginia-climate-change/




The cost to save America's Birthplace is estimated to be
in the tens of millions. The time for action is now.
SCAN HERE
to Save Jamestown!
For information please contact:
Denise Kellogg, JRF Director of Development
(804) 698-9808
Photo: Captain John Smith statue amongst an
impending storm over the James River