RESILIENT HERITAGE
ST AUGUSTINE

RESILIENT HERITAGE IN THE NATION'S OLDEST CITY

CITY OF ST. AUGUSTINE

Project Report, PB2019-02
August 2020

TAYLOR ENGINEERING, INC.

Resilient Heritage in the Nation's Oldest City
St. Augustine, FL

Final Report

Prepared for

City of St. Augustine

PB2019-02

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This project is sponsored in part by the Department of State, Division of Historical Resources and the State of Florida.

RESILIENT HERITAGE BRANDING DEVELOPMENT

Together with the City of St. Augustine, the team worked to develop an identifiable and iconic brand that unites the multitude of efforts comprising the Resilient Heritage initiative. The logo captures the essence of the City's heritage through the abstraction of its characteristic architecture, while emphasizing the factor of the City's coastal location in the project's purpose. The use of a strong and bold type reflects the City's forward-thinking leadership in working to mitigate the impacts of major storms, nuisance flooding, and sea level rise. In addition, the use of a color palette consistent with the City of St. Augustine's existing brand reinforces the relationship of the City's role in the challenges inherent with increased resiliency.

PROJECT TEAM

TAYLOR ENGINEERING, INC.
Delivering Leading-edge Solutions

For over 30 years, Taylor Engineering, Inc. has focused its attention on water-related issues and the effects of water resource activities on the environment. Today, the company is comprised of 50 employees including licensed engineers, scientists, certified land planner, technicians, specialists, interns, and support staff in the fields of finance and accounting, human capital, information technologies, and administration. Collectively, professional staff members hold advanced degrees in civil, coastal, water resources, environmental engineering, and the environmental sciences. Their vision is to be the best in delivering leading-edge solutions to challenges in the water environment.

ACI
ARCHAEOLOGICAL CONSULTANTS, INC.

Established in 1976, Archaeological Consultants, Inc. (ACI), is Florida's oldest full-service cultural resource management company, and a woman-owned business. Over four decades, ACI has become a nationally recognized business leader in the public and private sector, as well as the recipient of awards from the Florida Trust for Historic Preservation, the Florida Department of Transportation, and the National Aeronautics and Space Administration.

THE CRAIG GROUP | PARTNERS IN PRESERVATION, PLANNING & POLICY

The Craig Group is focused on ensuring a viable future for the places of our past through community-based development, design and decision-making. They promote historic places as economic, resilient, dynamic and creative community assets. Their approach to protecting historic communities begins with collaboration, bringing public and private partners together in the shared value of promoting historic places as the preferred place to live, work and visit.

Marquis Latimer + Halback
LANDSCAPE ARCHITECTURE · PLANNING

Marquis Latimer + Halback is a planning, design, and management firm specializing in landscape architecture, planning, urban design, and project management. They create authentic landscapes that are historic or contemporary interpretations for each unique place. Fittingly, they are located in the nation's oldest city—St. Augustine, Florida—where they have added our distinctive touch to many of the most recognizable and significant sites across the Southeast. With small firm values and large firm capabilities, they don't simply interpret history and culture; they carry it into the future with informed, imaginative storytelling from project development to implementation.

PlaceEconomics

PlaceEconomics is a private sector firm with over thirty years of experience in the thorough and robust analysis of the economic impacts of historic preservation. They conduct studies, surveys, and workshops in cities and states across the country that are addressing issues of downtown, neighborhood, and commercial district revitalization and the reuse of historic buildings.

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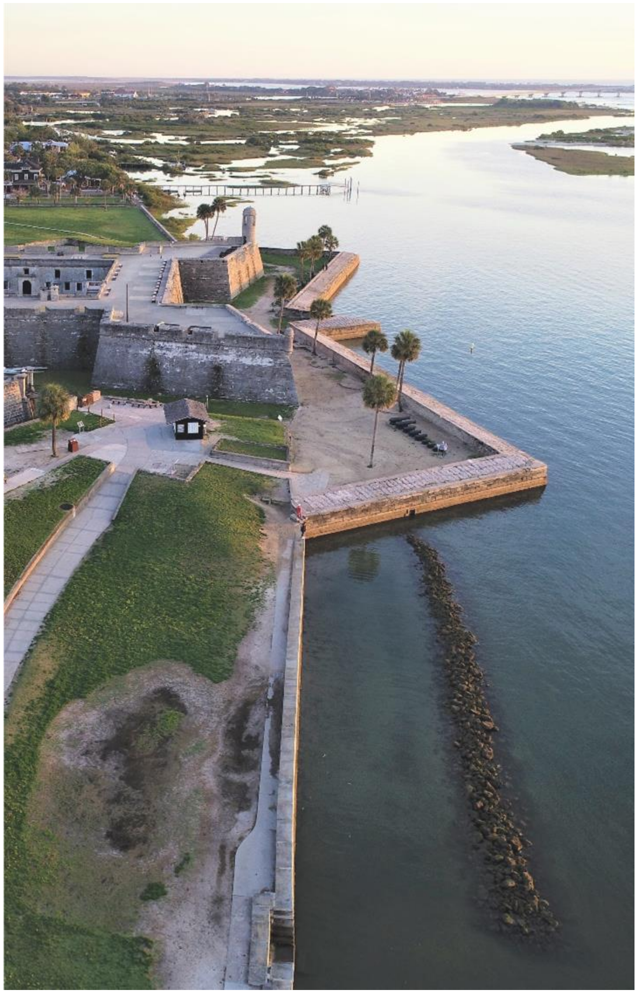

Figure 1.1 Castillo de San Marcos

St. Augustine, founded in 1565, ranks as the nation's oldest continuously occupied settlement of European and African American origin in the continental United States. The ten-square-mile area, with a current population of 14,280, is abundant in cultural heritage (Figure 1.1). Archaeological resources provide evidence of pre-historic and Native American heritage dating back more than 4,000 years. Many properties are listed in the National Register of Historic Places and several are National Historic Landmarks such as those in the St. Augustine Town Plan. Thousands of buildings are more than fifty years old which heightens the city's unique sense of place. These heritage assets attract more than six million visitors annually.

Part of the charm and beauty of St. Augustine is its proximity to meandering waterways and lengthy coastlines (Figure 1.2). Simultaneously, these features put the city at risk to flooding from tides, storms, and sea level rise. Within an eleven-month time span, St. Augustine suffered impacts from Hurricanes Matthew and Irma, and two years later, Hurricane Dorian (Figure 1.3). These storms caused significant physical and economic damage. In addition to major storm events, the city suffers from nuisance flooding and will continue to combat rising waters from the impacts of sea level rise. These hazards threaten the historic assets that define St. Augustine.

Figure 1.2 Historic St. Augustine Waterfront

Integrating historic preservation considerations into hazard mitigation planning is a necessary strategy for the city's continued resilience and high quality of life. City-wide vulnerability assessments, adaptation strategies, and mitigation planning for flooding and sea level rise, continue to evolve and are valuable sources of information for the City's policymakers and the community's property owners. This project, sponsored in part by the Florida Department of State, Division of Historical Resources through a Small Matching Grant, focuses on creating a document that identifies methods for prioritizing archaeological sites threatened by rising seas, outlines the economic impacts of previous and future flooding events, and recommends potential solutions such as mitigation strategies and policy revisions.

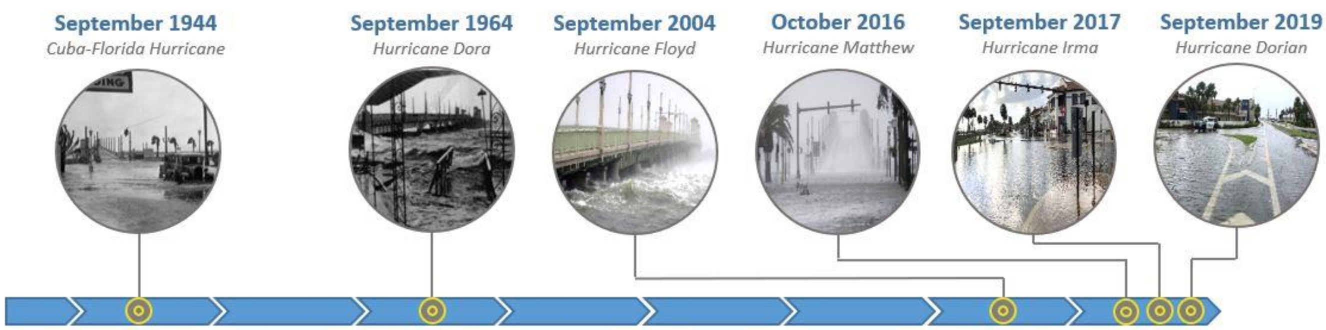

Figure 1.3 Significant Hurricanes Which Affected St. Augustine

2.0 PRESERVING ARCHAEOLOGICAL RESOURCES

In 1986, the City of St. Augustine enacted the Archaeological Preservation Ordinance to protect its buried heritage. The intent of the Ordinance was not to stop or limit development, but to collect information from archaeological sites through documentation when cultural deposits are threatened by destruction. Causes of archaeological site destruction can include development, neglect, erosion, looting, and - the focus of this report – rising seas and elevated water tables.

The City's Archaeological Preservation Ordinance designated 18 archaeological zones; geographical areas that have or may reasonably be expected to yield information on local history or prehistory based upon broad prehistoric or historic settlement patterns and existing archaeological knowledge. The Archaeological Zones, shown in Figure 2.1, are not static entities, rather the boundaries can change based on current knowledge.

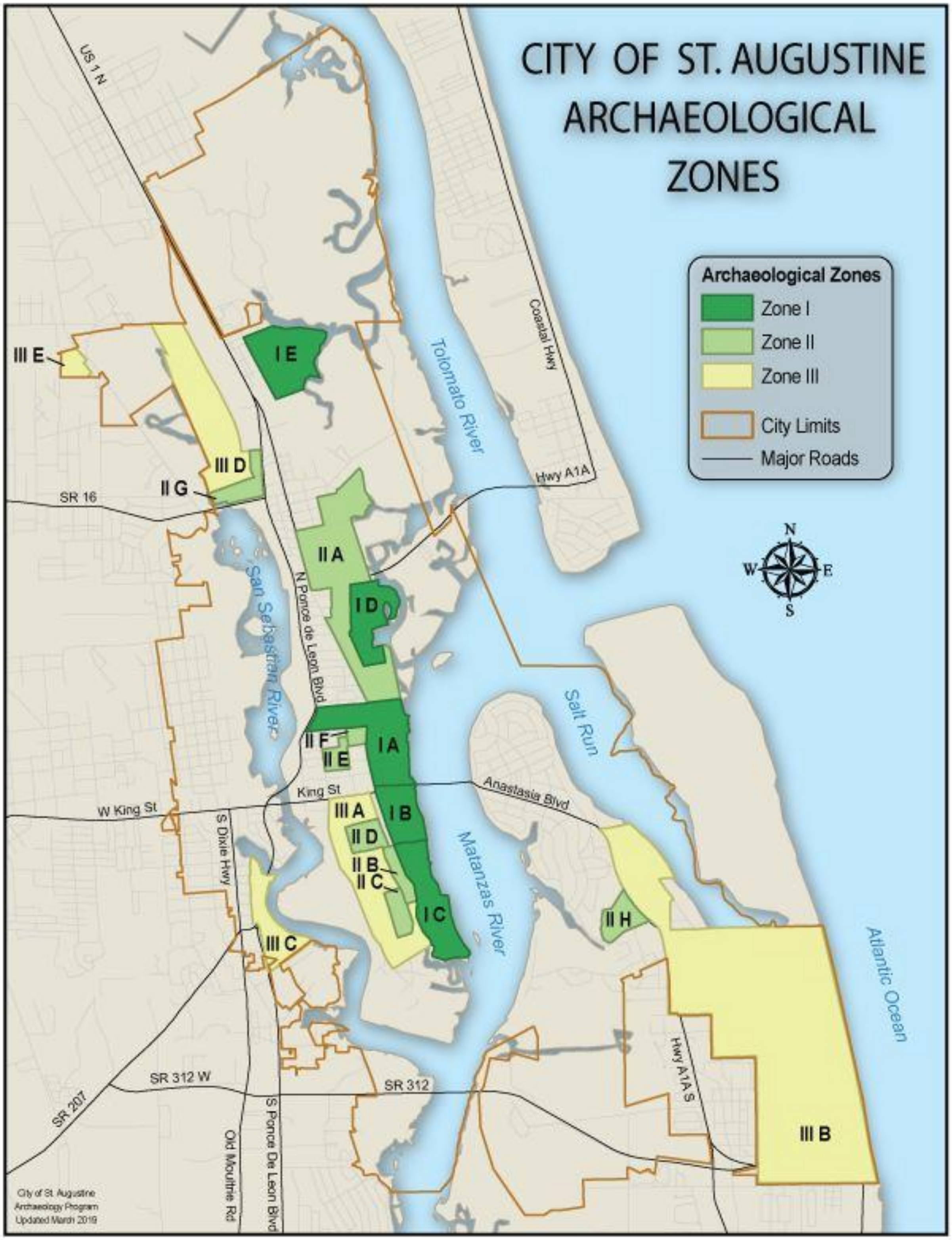

Figure 2.1 City of St. Augustine Archaeological Zones

A previous study for the City found some archaeological zones already impacted by nuisance flooding under baseline conditions and, as sea level rise accelerates, archaeological resources will experience increased flood effects. As water levels and inundation increase, the opportunity to retrieve and document archaeological information will decrease. Some archaeological zones will become completely inundated with minor sea level rise. The study also found that many archaeological zones will experience large, sudden jumps in inundation once a threshold elevation is reached (City of St. Augustine 2016: 36-41). Additionally, the study of inundation effects to archaeological resources does not account for elevated water tables below ground, which could impede excavation and documentation even if the surface of the site is not flooded. As a result of these findings, the City wishes to explore ways to prioritize, document, and/or preserve the valuable archaeological resources that span more than 4,000 years.

2.1 Archaeological Meeting

Many professional archaeologists live and work in St. Augustine. They are familiar with the City's archaeological resources, and care about the protection and preservation of the sites. A meeting to discuss the prioritization of archaeological sites with regard to sea level rise was organized. Several methods used by other municipalities were discussed, as was the possibility that prioritizing sites could privilege one cultural group's heritage over another. The consensus was that that prioritization, at this point, may not be the best approach for St. Augustine.

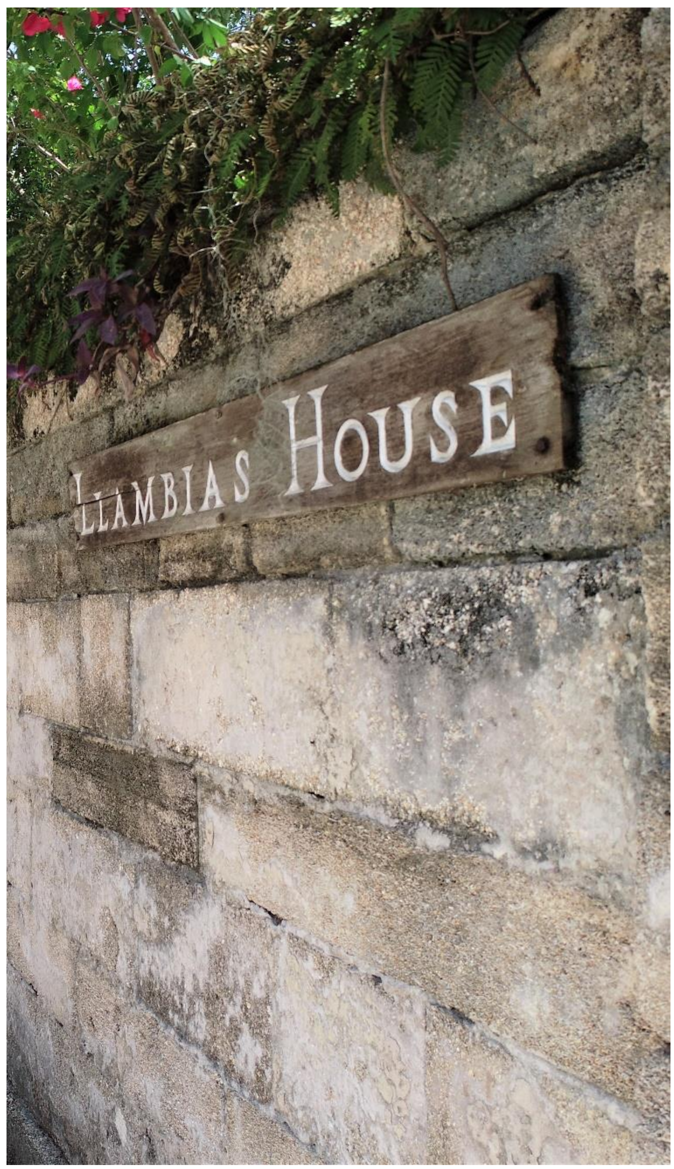

Figure 2.2 Historic Llambias House

More than 60 years of archaeological investigations conducted by various institutions, universities, consultants, and the City of St. Augustine Archaeology Program have demonstrated that the downtown/colonial area of the City of St. Augustine is, in itself, an archaeological site. However, much of the archaeological work has been limited to areas that were to be impacted by development. While this has been positive for gathering data, gaps in knowledge exist. Many areas of the city have not been sufficiently evaluated archaeologically, including sites on city-stewarded properties such as the Llambias House (Figure 2.2). Thus, site prioritization without additional information would be premature. That said, methods of assessing sites were discussed at the meeting and subsequent discussions, and suggested strategies to be used by the city to prepare for sea level rise are included in this report.

2.2 Documented Archaeological Sites

One of the first priorities was to update the list of city-owned properties. Numerous, but not all, city-owned archaeological sites have been recorded in the Florida Master Site File (FMSF). The FMSF is the State's official inventory of historic resources. Each archaeological site has a designated number and an accompanying site form which details important information about the site. A total of 52 archaeological sites located on city-owned or managed property are listed in Table 2.1. These include terrestrial, shoreline, and underwater archaeological sites, since the city holds rights to the submerged bottomlands of Matanzas Bay. Additionally, several resource groups are listed. Resource groups can be a district, a building complex, a linear resource, or a landscape. Those listed below are examples where city-owned properties are included within the FMSF resource group and the archaeological resources are important components. Also included are two city-owned structures that fall within the boundaries of two archaeological sites. Finally, the archaeological collections housed at the Middleton Archaeology Center are included as a resource. The Center contains data extracted from hundreds of archaeological excavation projects conducted under the auspices of the City's Archaeology Program. Not only do they represent a cultural resource as a comprehensive collection, they are considered part of the historic property/archaeological site from which they were extracted.

Table 2.1. Archaeological Sites and Resources on City-Owned/Managed Property

FMSF Number	Name	Site Type
SJ00010	St. Augustine Town Plan Historic District	Resource Group
SJ00010B	St. Augustine Sea Wall	Archaeological
SJ00010C	Dragoon Lot	Archaeological
SJ00013	Coontie Island	Archaeological
SJ00063	Fish Island	Archaeological
SJ00056	The Mud Wreck or 8UW31	Archaeological, Underwater
SJ02492	Railroad Park	Resource Group
SJ03299	Troll	Archaeological
SJ03312	Trolley Station	Archaeological
SJ03313	Billy's Ballast Pine	Archaeological, Underwater
SJ03702	Old St. Augustine Lighthouse	Archaeological
SJ04783	Fish Island Boat	Archaeological
SJ04807	Black Barge site	Archaeological, Underwater
SJ04808	Ledford Site	Archaeological
SJ04841	Fish Island Well 1	Archaeological
SJ04842	Fish Island Well 2	Archaeological
SJ04838	Fish Island Blockhouse	Archaeological
SJ04839	Fish Island Wharf	Archaeological
SJ04874	Conch House Groin	Archaeological, Shoreline, and Underwater
SJ04875	Coquina Groin or Red Barn Groin	Archaeological, Shoreline, and Underwater
SJ04876	Sandspur Groin	Archaeological, Shoreline
SJ04877	Wilton's Groin or Stokely Groin	Archaeological, Underwater
SJ04878	Corps Bulkhead	Archaeological, Shoreline

FMSF Number	Name	Site Type
SJ04888	Maria Sanchez Barges	Archaeological, Shoreline
SJ04965	Mark W. Lance (Davenport Park)	Archaeological
SJ05020	Lincolnville Landing	Archaeological
SJ5298A	King Street Site	Archaeological
SJ05597/SJ5689	Plaza de la Constitución/Plaza East	Resource Group/Archaeological
SJ05400	Bayfront Ballast Pile	Archaeological
SJ05409	Seawall Boat Basin	Archaeological
SJ05510	Shoal 2 Pier or St. Francis Barracks	Archaeological, Shoreline
SJ05511	Vortechnics Vault 3 or Foreshore Scatter Matanzas Bay	Archaeological, Shoreline
SJ05513	Isolated Find-Tank	Archaeological
SJ05515	Malaga Street Site	Archaeological
SJ05656	Parking Lot (Block 8)	Archaeological
SJ05658/SJ00075	Peck House (Block 10)	Archaeological/Historic Structure
SJ05664	Tolomato Parking Lot (Block 16)	Archaeological
SJ05685	St. Francis Bicentennial Park (Block 39A)	Archaeological
SJ05685/SJ00068	Llambias House Garden	Archaeological/ Historic Structure
SJ05691	Aviles Street	Archaeological
SJ05692	Artillery Lane	Archaeological
SJ05693	Cadiz Street	Archaeological
SJ05694	Castillo Drive	Archaeological
SJ05695	Charlotte Street	Archaeological
SJ05696	Seawall and Avenida Menendez	Archaeological
SJ05697	Hypolita Street	Archaeological
SJ05698	Marine Street	Archaeological
SJ05699	San Salvador Street	Archaeological
SJ05700	Spanish Street	Archaeological
SJ05701	St. George Street	Archaeological
SJ05702	Treasury Street	Archaeological
SJ05703	Anderson and Ponce Circles	Archaeological
Various *	Collections at the City Archaeological Center	Archaeological

Yellow color signifies site is listed in the National Register of Historic Places.
*Collections represent data from both recorded and unrecorded archaeological sites. The collections are city-owned or managed, but the sites may be privately or city-owned.

2.3 Non-Documented Archaeological Sites

Not all city-owned properties with archaeological deposits or sites have been recorded in the FMSF. Results of archaeological testing and excavation conducted through the city's archaeological program are not always recorded in the FMSF, rather the documentation lies in the City Archaeology Program files. Table 2.2 lists city-owned properties where a FMSF number has not been assigned, but the property may have archaeological deposits.

Table 2.2. City-Owned Properties with Possibility of Archaeological Deposits

Name	Probability of Archaeological Resource
Oglethorpe Battery Park	Likely
Lighthouse Park	Likely
Hamilton Upchurch Neighborhood Park	Possible
Joe Pomar, Jr. Park	Possible
Eddie Vickers Park	Possible
Twine Park	Possible
Zora Neale Hurston Memorial Park	Possible
Robert B. Hayling Freedom Park	Possible
Numerous Streets and Parking Areas	Likely
Water Treatment Plant	Possible

Other non-documented sites include archaeological deposits associated with historic structures. It is imperative that when planning ground-disturbing alterations of historic structures the potential for archaeological resources be recognized. The City Archaeology Program's archaeologists, through the Planning and Building Department, review permit applications, but are usually restricted to properties that fall within the existing Archaeological Zones. Undocumented sites may fall outside the zones.

2.4 Examples of Factors Used in Ranking Archaeological Sites

Several methodologies have been developed for prioritizing archaeological sites. Most involve assigning a value to an archaeological site based on characteristics such as social value, intrinsic value, economic value, archaeological potential, rarity, economic potential, integrity, threats, exposure, sensitivity, adaptive capacity, and/or the ability to protect the site. Other studies use the site value, combined with the threat to the site, to rank sites. For studies of this type, detailed information about each archaeological site is needed. At this point, it is a general consensus of St. Augustine archaeologists that more site-specific information is needed prior to prioritizing St. Augustine's city-owned archaeological sites.

Another consideration is to use the criteria for National Register eligibility as a guide for archaeological site ranking. However, again, the needed site-specific information is not available for most sites found on city-owned property. The exceptions are those previously listed on the National Register such as the St. Augustine Historic District, Llambias House, Fish Island, and the Peck House.

2.5 Alternative Strategies

Since ranking sites is not feasible at this time, other strategies are suggested that will help in protecting and preserving the archaeological sites on city properties. They can also be applied to sites located on private lands.

- Prioritize the long-term preservation of the City's archaeological collections, which are at risk if not properly managed and curated. These collections represent one of the most comprehensive Spanish-colonial archaeological collections in the United States and embody the data extracted from hundreds of archaeological sites. The collections include the artifacts, field notes, photographs, reports, and associated records. These are valuable resources entrusted to the City's care and require long-term management responsibilities. Care can include creating a comprehensive artifact inventory of the collections and records, conduct a facilities assessment for the Middleton Archaeology Center, expanding curation capabilities and standards, and rehousing older collections according to professional curation standards to insure their long-term protection. These strategies align with the City's Historic Preservation Master Plan (HPMP) goals G.1.1, G.1.6 and A.2.7.

- Implement archaeologically friendly practices when conducting work to protect historic resources. Be aware that a trench alongside an historic house wall can destroy important details about construction techniques or can cause serious harm to the building's stability. A deep storm water retention pond will destroy an archaeological deposit. The use of heavy equipment can easily disturb archaeological resources. Sometimes simply altering construction plans by a few feet will protect an archaeological feature or site.
- Consider developing a testing and/or excavation program for areas most threated by flooding and sea level rise. Areas where no archaeological investigations have been conducted, but site location is suspected, would be tested to determine site presence or absence. Excavation could be carried out in areas where sites have been documented, but limited information is available. Archaeological mitigation, which includes proper excavation, analysis, reporting, and curation in perpetuity, would be an alternative for sites that will be lost due to erosion or rising waters. The program, administered through the City Archaeology Program, could involve funding from sources other than the City. This strategy aligns with the City's HPMP goals E.2.4.
- Provide city personnel, contractors, real estate professionals, homeowners, and others with information pertinent to the protection of archaeological resources. This can be done through presentations, short classes, and handouts. This strategy aligns with the City's HPMP goals H.3, H.8, and H.9.
- Coordination between city departments is especially important; all should be aware of which city-owned properties have archaeological resources.
- Continue to engage the public in helping to preserve and protect the archaeological resources. The St. Augustine Archaeological Association has more than three hundred members; many willing to become actively involved in helping the City's Archaeology Program. Consider coordinating with the Florida Public Archaeology Network's (FPAN) Heritage Monitoring Scouts, a program focused on tracking changes to archaeological sites at risk.
- The Archaeological Zones that were developed in 1986 should be revisited. This will allow new information gathered from more than 30 years of investigations conducted by the City Archaeology Program, St. Johns County, university programs, and private consultants, to be integrated into the Archaeological Ordinance's Zones. This strategy aligns with the City's HPMP goal G.1.2.
- Consider developing a geodatabase using GIS to model the city's growth through time. This will provide a tool that can be used to determine which areas of the city have the greatest potential for multiple occupation levels, as well as research potential for answering specific questions.
- Continue to convert the city's archaeological information into a GIS-based system compatible with the FMSF. This has been done for the downtown/colonial area, but not for other parts of the city. Additionally, continue to update the FMSF with new, and older, information.
- Investing in better archaeological data management and synthesis at a city-wide level is critical to better assess and prioritize resources, in addition to GIS-based strategies and

updating and reporting sites with the FMSF, conduct a synthesis of previous research to understand what gaps in archaeological knowledge exist.

- Coordinate with the St. Augustine Lighthouse Archaeological Maritime Program (LAMP) to monitor and implement protections to at-risk underwater and shoreline archaeological sites. Due to risk of site loss, excavation may be necessary to gather as much information as possible.
- Implement or partner with existing environmental monitoring programs to help understand current impacts of flooding and sea level rise, as well as urban development, on archaeological sites. Variables may include water table fluctuation, salinity, dissolved oxygen, groundwater chemistry, temperature, vibration and/or others. This information would provide baseline data for future studies of impacts over time.
- Continue documentation of previously excavated sites and associated collections. While the prioritizing of sites was not feasible in this study, some threatened sites have already been excavated under the auspices of the City Archaeology Program. However, due to program limitations, some excavation projects still need additional documentation including complete artifact analysis, synthesis, FMSF recording, reporting, and curation. Prioritizing the continued documentation of already excavated sites is a realistic and cost-effective strategy to preserve archaeological data and resources.
- Continue to record and document archaeological resources outside of the colonial downtown area. Many of the mission settlements surrounding St. Augustine have not been documented in the FMSF and may be present, in part, under the city streets. A better understanding of these sites will help in determining future priorities.
- Consult experts in the field of archaeological site stabilization. Additionally, numerous publications with case studies are available for review.
- Ensure that archaeological sites are incorporated into Emergency Operation and Disaster Recovery Plans and are considered during initial responses. Enlist the help of individuals familiar with archaeological resources prior to and during emergencies. This strategy aligns with the City's HPMP goals F.1 and F.2.
- Sea level rise and the rising water table will impact archaeological resources differently depending on site type and geomorphological factors such matrix, nature of deposit, shoreline shape and slope, vegetation, as well as other factors. As attention shifts toward recognition of rising waters, look for guidance from state, federal, and international agencies as to funding sources and innovative ideas for protection and preservation. Meanwhile, continue to document the archaeological resources.

3.0 ECONOMIC ANALYSIS OF PAST FLOOD EVENTS AND FUTURE PROJECTIONS

3.1 Key Findings

- St. Augustine's historic districts[1] represent 41% of the city's total assessed value. 75% of the land area in historic districts fall within a high-risk flood zone.
- Property values have not been affected by storm events in St. Augustine. If there is a differential risk in high risk flood zones, it is not yet recognized by the market.
- Building permit activity is 51% greater in the year following a storm event, representing an expenditure of $16.6 million more, conservatively.
- Heritage tourism visitor parties spend $1,616,780 on average each day. Each day's expenditures generate 29.1 year-round jobs and $970,017 income daily.
- During the two months following a weather event, St. Augustine sees a loss of nearly $20 million in tourist expenditures, translating to over 300 direct and induced jobs lost. This amounts to over $12 million in lost labor income.

3.2 Introduction

The loss of belongings, personal property, and public sites following a disaster is devastating on multiple fronts–economically, socially, spiritually. The loss of heritage resources is uniquely disastrous. Cultural heritage plays a significant role in contributing to one's social and psychological comfort.[2] In many cities, historic resources are integral to local economies, and their loss denies the city a source of new businesses, jobs, and income. Countless studies have shown that historic districts support small and startup businesses, diverse business ownership, and a more active streetlife both day and night.[3] These attributes mean that historic resources can help a city recover faster from a disaster. For this reason, heritage resources must be considered an integral component if any resiliency strategy.

The goal of this analysis is to understand the economic consequences of storm damage to a city's historic resources. This is achieved in three parts: 1) By quantifying the present total value of St. Augustine's historic resources, and those at particular risk; 2) By assessing the economic impact experienced following a storm event and measuring the loss of jobs, income, and visitor expenditures due to decreased tourism visitation, and; 3) Predicting the impact that the loss of historic resources would have as the result of future extreme weather events.

3.3 Base Statistics

Historic districts make up only 7.3% of the land area in the City of St. Augustine; they cover less than 1 square mile of the city. Yet, nearly 26% of the population lives within the city's historic districts. Historic districts account for 31% of all residential parcels and nearly 36% of all commercial parcels in the city. Overwhelmingly, the properties within historic districts are at risk of flooding–76% of these parcels fall within areas expected to flood during a 100 year flood.

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[1] Historic districts encompass both local and national register districts for this analysis.

[2] Rodney Swink, "The Importance of Memory and Place in Heritage Resilience," 2017.

[3] *Older, Smaller, Better: Measuring How the Character of Buildings and Blocks Influences Urban Vitality*, National Trust for Historic preservation, Preservation Green Lab, 2014.

Table 3.1 FIRM Zones in Historic Districts[4]

FIRM Zone	Description	Land Area within Historic Districts
X	Areas not expected to flood during 100 year flood.	24.0%
AE	Areas subject to flooding during 100-year flood; Base Flood Elevation determined	75.9%
VE	Areas closest to shoreline, subject to wave action, high velocity flow, and erosion during 100 year flood; Base Flood Elevation determined	0.1%

3.4 Part 1: Current Value of all Historic Resources

Historic resources embody a range of values–economic, cultural, social, environmental, etc. The economic values of historic properties are the most easily quantified, such as in the market value of a designated property or the fee an individual is willing to pay to see a heritage site. Therefore, the values assigned to individual properties by a county property appraiser are one reasonable and reliable indicator of the economic value of a heritage property. However, many cultural and heritage goods are public in nature; since they are goods which are offered to everyone, no one may be excluded from using them. For example, St. Augustine's Historic Town Plan Historic District–a National Historic Landmark District–has no market on which it may be exchanged, and it therefore lacks a definitive "price." Yet, that does not mean they are not valued by the "heritage consumer"–between 95% and 99% of all visitors to St. Augustine walk the historic downtown streets.

Heritage properties have a public benefit beyond their utility as private residences or commercial establishments. While all properties are assigned a measurable economic value, heritage properties have additional cultural, social, and historical values that are harder to quantify. One method of arriving at this value is by using the travel cost method. Therefore, this analysis arrives at the total present value of St. Augustine's historic resources in two ways: property value analysis and travel cost method.

3.4.1 Property Values

As noted, one reliable indicator of the economic value of historic resources is the value assigned to them by a county property assessor. The amount designated in assessment records as "Just Value" is a proxy for the market value of the property. The St. Johns County Property Appraiser is constitutionally mandated to assess real and tangible personal property and administer exemptions. Among other things, they consider a home's size, layout, and how well it has been maintained. They also factor in surrounding properties and recent sales of similar homes. The Property Appraiser's Office uses a combination of on-site property inspections, aerial photography, recorded sales, construction cost data, and mapping technologies to determine the just value of a property. On average, a property in a St. Augustine historic district is valued 1.5 times higher than a property in the rest of the city.

[4] In this analysis, AE and VE are combined and analyzed together as "at risk" groups. This is because there are very few parcels in historic districts that fall in the VE zone.

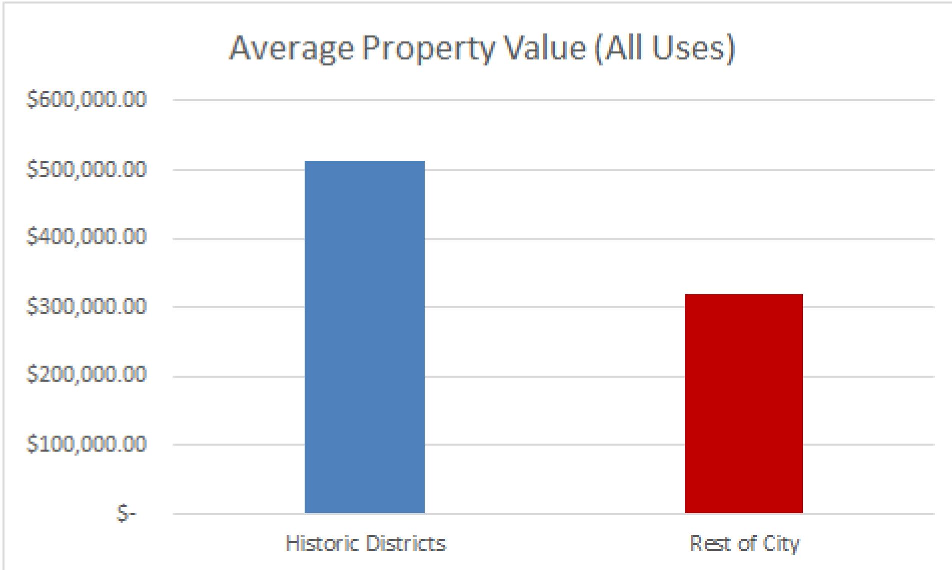


Figure 3.1 Average Property Value (All Uses)

Across all uses, historic districts represent an outsized share of the city's overall value. Despite making up only 7% of the land area, historic districts account for 41% of the city's assessed property value. Alarmingly, historic districts also account for 50% of the value of all properties that fall in the AE or VE flood risk zones. The value of St. Augustine's properties is concentrated in historic districts, and these areas are overwhelmingly at risk of flooding in the next 100 year flood.

Table 3.2 Total Property Value (2019)

	Historic Districts	Total	Share of City's Value in HD[5]
Total	$1,057,523,172[6]	$2,473,784,405	41.0%
By Use			
Residential	$464,606,862	$1,347,361,078	34.5%
Commercial	$198,228,331	$518,266,652	35.7%
By Risk			
AE/VE	$818,362,937	$1,638,384,817	49.9%
X	$239,160,235	$835,399,588	28.6%

[5] The totals in this column are not supposed to add up to 100%, they represent the share of the row total.

[6] This figure includes the property values for City Hall and the Lightner Museum, Flagler College, and the Castillo de San Marcos. These publicly or institutionally owned types of properties are often not included in property assessment data but are necessary for this analysis.

3.4.2 Total Value

The total value of all properties in historic districts in 2019 is $1,057,523,172. Over the last 10 years, the value of properties in St. Augustine has been steadily rising, despite two major storm events in 2016 and 2017.

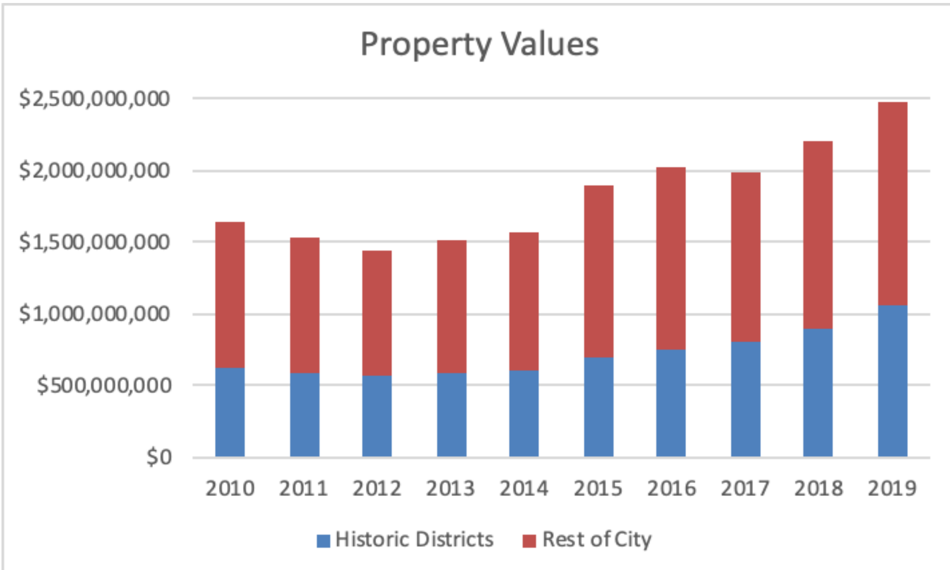


Figure 3.2 Property Values (Historic Districts and City)

In 2019, properties in historic districts made up 41% of the City's total assessed value. Every year since 2016, the historic districts have accounted for a larger share of the City's total assessed value.

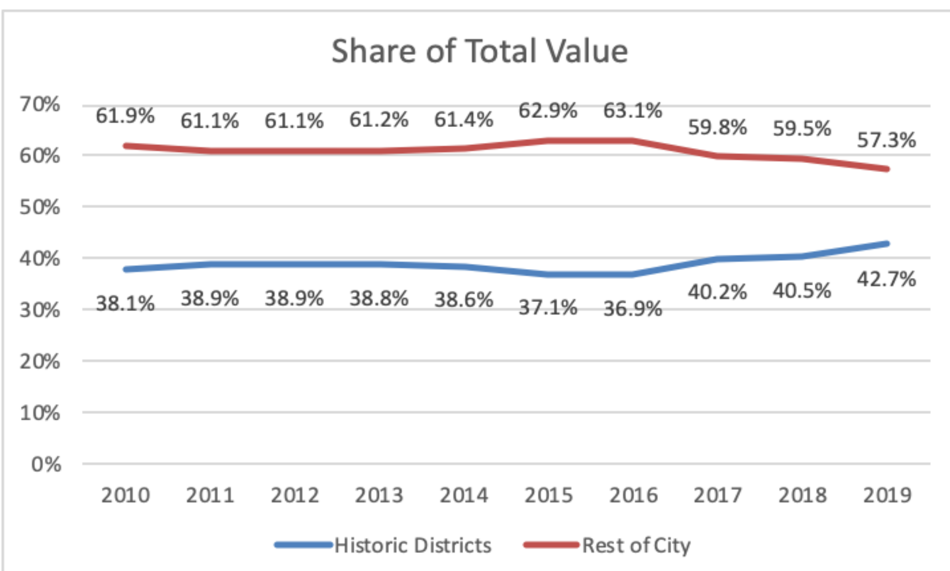


Figure 3.3 Share of Total Value (Historic District and City)

3.4.3 *Property Values in Historic Districts by FIRM Zone*

The total value of properties in historic districts within the high-risk flood zones (AE and VE) is $818,362,937, while properties in Zone X (minimal flood risk) are valued collectively at $239,160,235. This means that in 2019, 77% of the value of properties in historic districts was in a high-risk flood zone.

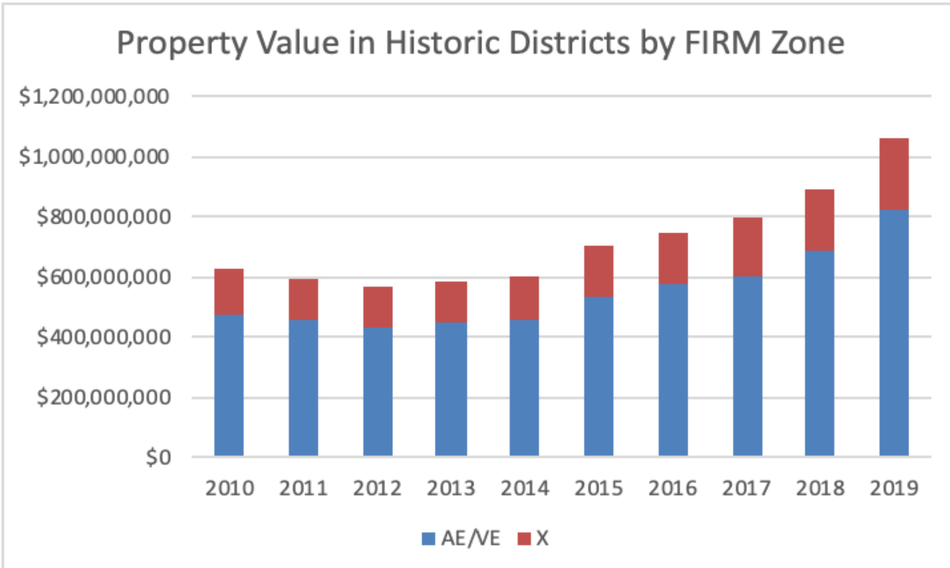


Figure 3.4 Property Value in Historic Districts by FIRM Zone

3.4.4 *Residential Property Values*

Citywide, 79.4% of all parcels in St. Augustine are residential. Historic districts account for 31.1% of those residential parcels and house 26% of the city's population. Both within historic districts and in the rest of the city, the value of residential properties has been rising over the last ten years. In 2019, the total value of residential parcels in historic districts is $464,606,862.

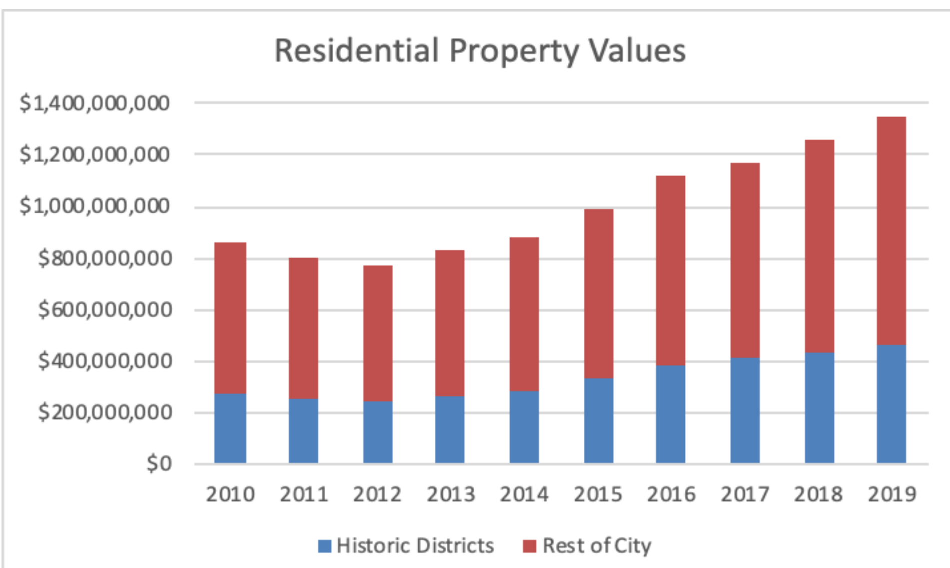


Figure 3.5 Residential Property Values

This nearly $465 million represents 34.5% of the City's overall residential value. Every year since 2016, the historic districts have accounted for a larger share of this value.

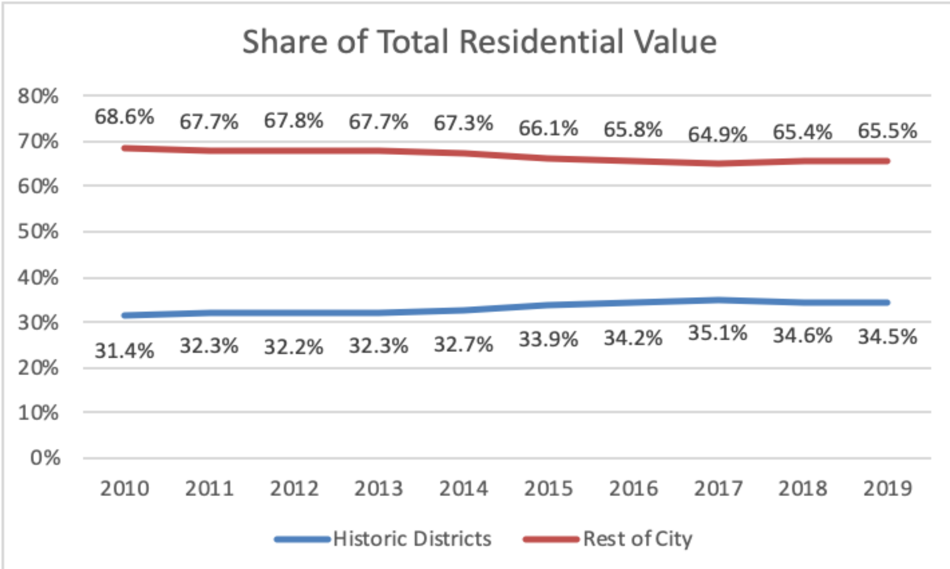


Figure 3.6 Share of Total Residential Value

3.4.5 Residential Property Values in Historic Districts by FIRM Zone

St. Augustine's historic districts are home to just under 30% of the city's population. Almost three-quarters of the residential properties in those historic districts fall within FIRM Zones AE and VE, meaning the majority of historic residential properties are at risk of significant flooding. In 2019, the total value of all residential properties in historic districts was $465 million. Seventy-five percent of that value, or $350 million, is at risk in the next 100-year flood.

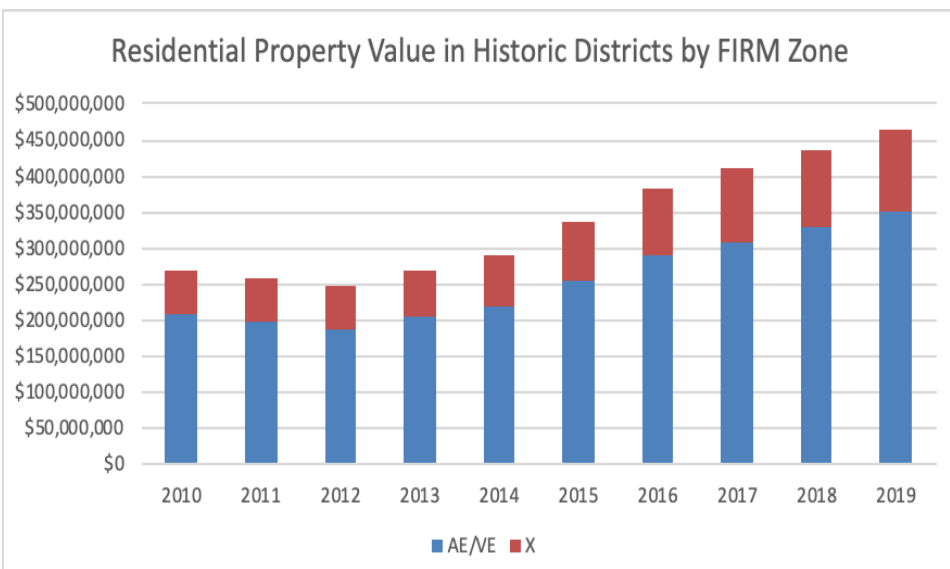


Figure 3.7 Residential Property Value in Historic Districts by FIRM Zone

This is in contrast with the Rest of the City, where 63% of the residential value is captured in Zones AE and VE, and almost 37% is in Zone X.

3.4.6 Commercial Property Values

Overall, 13.7% of all parcels in St. Augustine are commercial. Historic districts account for 35.7% of those commercial parcels. As with residential properties, the collective value has been rising steadily for commercial properties since 2016. In 2019, the total value of commercial parcels in historic districts was $198,228,331.

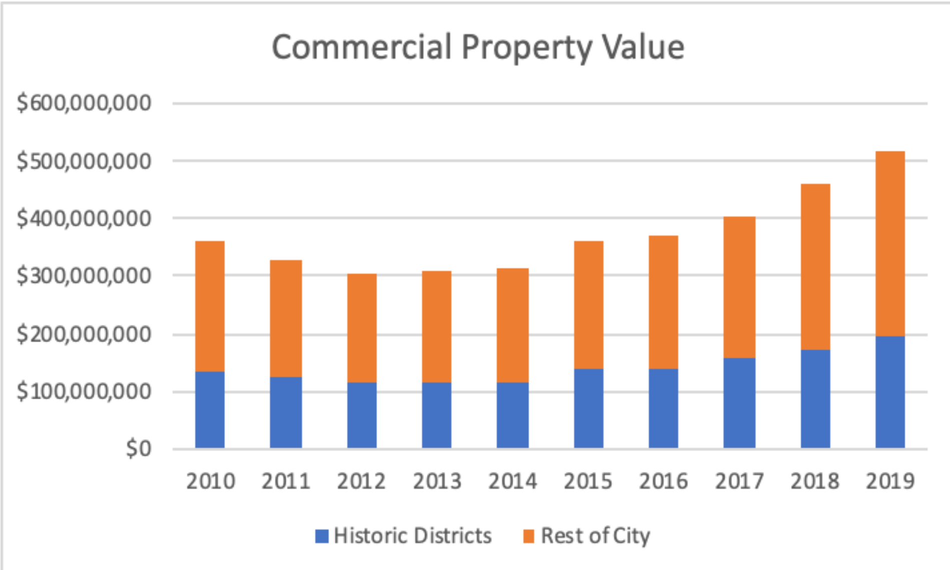


Figure 3.8 Commercial Property Value

This nearly $200 million represents 38.2% of the City's overall commercial assessed value.

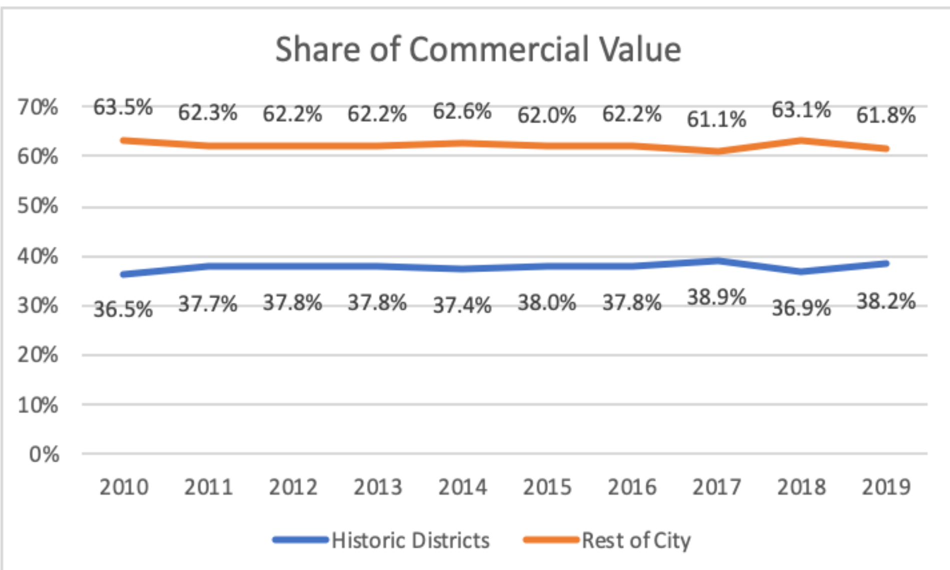


Figure 3.9 Share of Commercial Value

3.4.7 Commercial Property Values in Historic Districts by FIRM Zone

St. Augustine's downtown historic districts are the economic and cultural heart of the city. 31% of the city's jobs are located in historic districts–that includes 71% of all jobs in Arts, Entertainment, and Recreation and 50% of all jobs in Accommodation and Food Services.[7] Just under 80% of the commercial properties in historic districts fall within FIRM Zones AE and VE, meaning the majority of businesses in St. Augustine's commercial historic districts are at risk of significant flooding. In 2019, the total value of all commercial properties in historic districts was $200 million. Seventy-three percent of that value, or $144 million, is at risk in the next 100-year flood.

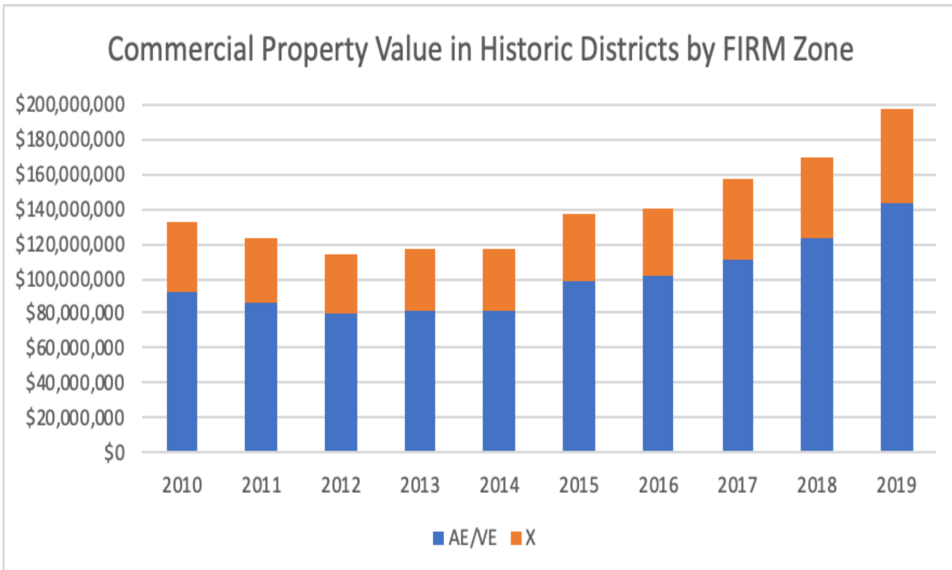


Figure 3.10 Commercial Property Value in Historic Districts by FIRM Zone

In 2019, in the Rest of the City, commercial property is nearly evenly distributed between Zones AE/VE and X–49% and 51% respectively.

3.4.8 Travel Cost Method (TCM)

The travel cost method is "a revealed preference method of economic valuation used to calculate the value of something that cannot be [completely] obtained through market prices. The travel cost method involves collecting data on the costs incurred by each individual in travelling to the recreational site or amenity. This 'price' paid by visitors is unique to each individual, and is calculated by summing the travel costs from each individual's original location to the amenity."[8] The analysis is based on methodological

[7] U.S. Census Bureau. (2020). LEHD Origin-Destination Employment Statistics (2002-2017). Washington, DC: U.S. Census Bureau, Longitudinal-Employer Household Dynamics Program, accessed on Apr 7 2020 at https://onthemap.ces.census.gov. LODES 7.4

[8] http://www.cbabuilder.co.uk/Quant4.html

guidance provided by the World Bank for the use of the Travel Cost Method.[9] The approach used is called the "Zonal Model" where the origin of the visitor trip is a major variable.

The Travel Cost Method has generally been applied to natural environmental resources for which there are few market-based approaches that can fully account for the value of the asset. It was first developed for the National Park Service for such purposes. In more recent times, however, the approach has been used to value heritage resources including by the World Bank, various World Heritage Cities, and other historic locations. It has been accepted as an appropriate approach, particularly when the value of the heritage is a collection of resources rather than just a single significant site. It was, therefore, deemed an effective and defensible approach to consider the overall value of the heritage resources in St. Augustine.

Visitation data provided by the National Park Service, the Peña-Peck House, and the City of St. Augustine, were considered as part of this analysis. The primary data used for this analysis, however, was the tourism data provided by the St. Johns County Visitors & Convention Bureau. Multiple studies conducted over several years were provided.[10] These studies included visitor surveys at various times of the year at several locations over multiple years, hotel occupancy rates, visitor satisfaction responses, and other information.

The following variables were abstracted from the provided data and used to create the TCM model:

- Number of visitors by season.
- Primary reason for coming to St. Augustine.
- Top activities while in St. Augustine.
- Size of visitor party.
- Number of day visitors and overnight visitors and visitor parties.
- Length of stay for overnight visitors.
- Means of travel to St. Augustine.
- Expenditures while in St. Augustine, including lodging, food and beverage, entertainment and amusements, retail purchases, and other.
- Region within the US from which the traveler came.
- Share of international visitors, with Canadian visitors disaggregated.
- Household income of visitor parties.

Based on that data, two categories of "Heritage Visitor" were established. "Core Heritage Visitors" are those whose primary reason to come to St. Augustine was for the "Historical sites and attractions". "Opportunity Heritage Visitors" are those whose primary reason for visiting St. Augustine was something other than historic sites, but identified visiting those sites as a top activity while in St. Augustine.

[9] http://documents.worldbank.org/curated/en/418021468138259656/pdf/357920ENGLISH0EDP011060Env0Degradation.pdf

[10] Special thanks to Richard Goldman. President & Chief Executive Officer, St. Augustine, Ponte Vedra & The Beaches Visitors & Convention Bureau for giving us access to their extensive data.

The visitor base upon which the TCM was applied was:

Table 3.3 Visitor Base with TCM Applied

Visitor Parties	Core Heritage Visitors	Opportunity Heritage Visitors	Total
Day Visitors	131,470	139,809	271,279
Overnight Visitors	355,316	364,306	719,623
TOTAL	486,786	504,115	990,901
Visitor People			
Day Visitors	404,997	426,850	831,847
Overnight Visitors	1,107,937	1,124,701	2,232,639
TOTAL	1,512,934	1,551,552	3,064,486

The sources of the numbers upon which the TCM estimates were obtained were:

- For expenditures while in St. Augustine, the Visitor and Convention Bureau surveys.
- For expenditures while traveling, the General Services Administration allowances for travel, including mileage, meals, hotels, and incidentals.
- For value of time spent in and traveling to St. Augustine, the median household income data from Visitor and Convention Bureau surveys
- For estimates of distances traveled, the mileage from the most common city of origin in each region South, (Atlanta), Northeast (New York City), Midwest (Cincinnati) and a midpoint location for the West (Salt Lake City).

For credibility of the report, it was deemed important to be as conservative as possible in the TCM estimates. Examples of taking the more conservative estimates included:

- Assuming only one hotel room while traveling to St. Augustine each night, in spite of the fact that the average party size ranged from 2.9 to 3.1 depending on season.
- For visitors who arrived by plane, only the price of the estimated plane ticket was included, in spite of the closest airport to St. Augustine being 40 miles away.
- Dividing the median household income over 365 days to establish a time value per day, rather than the likely working days of between 220 and 250.
- As noted above using the standard federal government allowance for travel which is likely less than most travel parties would spend.
- While the full travel costs for "Core Heritage Visitors" was included, only half of the costs incurred by "Opportunity Heritage Visitors" was incorporated into the final value estimate.
- The onsite expenditures of longer-term heritage visitors (6 or more days) was calculated not on their full length of stay, but only for 5.45 days, which was the typical length of stay for all visitors. Therefore, a heritage victor party who stayed in St. Augustine for a month, for example, was only credited with 5.45 days of their expenditures toward the TCM estimated value.

Based on the sources and methodologies above, the estimate of the value of the heritage resources:

Table 3.4 Estimated Value of Heritage Resources

	Core Heritage Visitors	Opportunity Heritage Visitors	TOTAL
Day Visitors	$68,759,941	$36,497,446	$105,257,388
Overnight Visitors	$1,712,942,396	$1,100,361,847	$2,813,304,242
TOTAL	$1,781,702,337	$1,136,859,293	$2,918,561,630

The estimated value of the heritage resources in St. Augustine, based on the Travel Cost Method is:

Two Billion, Nine Hundred Million Dollars ($2,900,000,000)

3.5 Part 2: Economic Impact of Storm Events

Part 2 of this study quantifies the economic impact of storm events over the last 5 years. There are two categories of damages tallied from natural disasters: direct damages, which are caused by harm to physical structures like buildings and the belongings inside of them, and indirect damages, which are caused by individuals losing their incomes and jobs.[11] By assessing property value change, building permit activity, and lost tourism revenues and wages, the following section examines the economic impact that storm events have on St. Augustine's historic resources.

The storms used in this analysis are listed in Table 3.5:

Table 3.5 Storm Events Considered in Analysis

Month	Year	Water Level (NAVD ft)	Event	Date of Highest Water Level
10	2015	5.18	High Water Event	27-Oct
10	2016	6.86	Hurricane Matthew	7-Oct
11	2016	5.22	High Water Event	13-Nov
9	2017	6.32	Hurricane Irma	11-Sep
9	2019	5.27	Hurricane Dorian	4-Sep

In this analysis, the months between October 2015-December 2017 and October-December 2019 are considered "Affected" months based on daily visitation data from the Castillo de San Marcos National Monument (Table 3.6).

[11] https://www.theatlantic.com/business/archive/2017/08/harvey-economic-impacts/538353/

Table 3.6 Visitation Months Affected by Storms at Castillo de San Marcos National Monument

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009												
2010												
2011												
2012												
2013												
2014												
2015										HWE	HWE	HWE
2016	HWE	HWE	HWE	HWE	HWE	HWE	HWE	HWE	HWE	Matthew	HWE	Matt./ HWE
2017	Matt./ HWE	Matt./ HWE	Matt./ HWE	Matt./ HWE	Matt./ HWE	Matt./ HWE	Matt./ HWE	Matt./ HWE	Irma	Irma	Irma	Irma
2018												
2019									Dorian	Dorian	Dorian	Dorian

3.5.1 Property Value Change

In the years following a major storm event, one would expect the value of properties to be affected, especially in flood risk zones. This analysis did not find that to be the case.

3.5.1.1 Historic Districts vs. Rest of City

The values of the properties within historic districts and in the rest of the city moved together until the last five years. Then around 2016, the value of properties in historic districts began to rise faster than the rest of the city. The data suggests that property values outside of historic districts dipped slightly following Hurricane Matthew between 2016 and 2017. However this trend did not last, and the city as a whole continued to rise even after Hurricane Irma in 2017. Property values in historic districts rose faster following the storm events--this is even so considering that the non-designated areas of town would be where new construction is much more likely to take place.

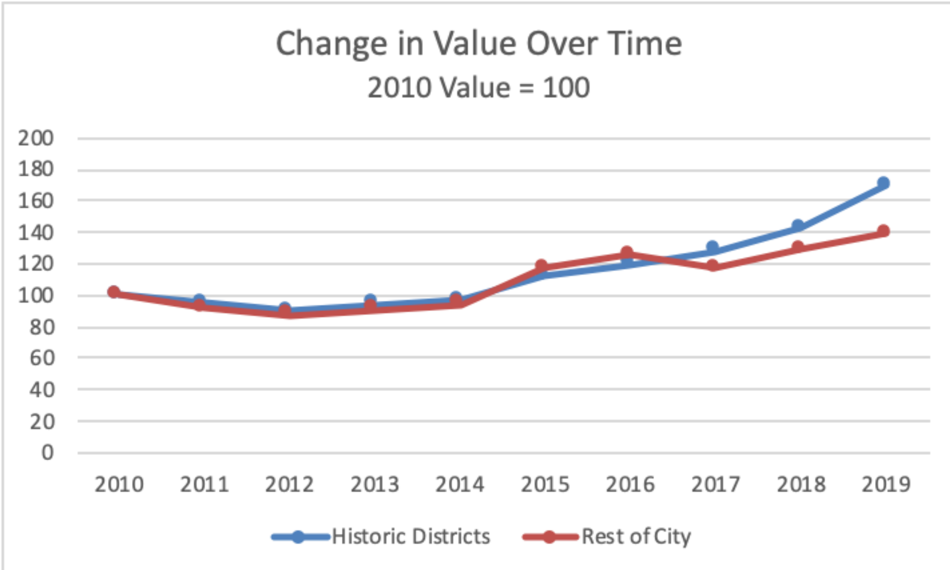


Figure 3.11 Change in Value Over Time

3.5.1.2 Value Change in Historic Districts by FIRM Zone

There is no statistical difference between the AE/VE and the X change in values for the historic properties. If there is a risk difference between these FIRM zones, it is not yet being recognized by the market.

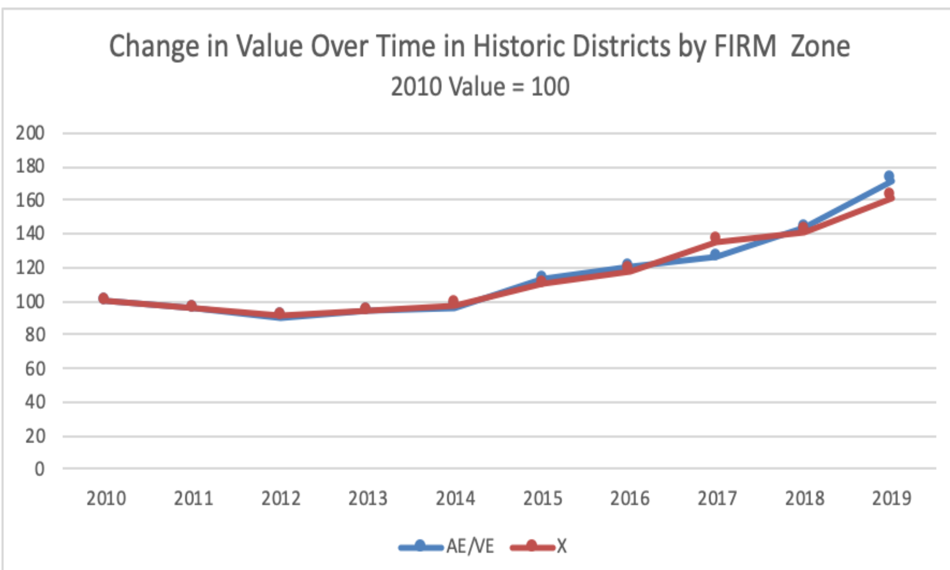


Figure 3.12 Change in Value Over Time in Historic Districts by FIRM Zone

3.5.1.3 Residential

3.5.1.3.1 Historic Districts vs. Rest of City

The value of residential properties in historic districts are increasing at a rate greater than the rest of the city's residential areas. Residential properties in historic districts also started to diverge from the rest of the city earlier than other property types.

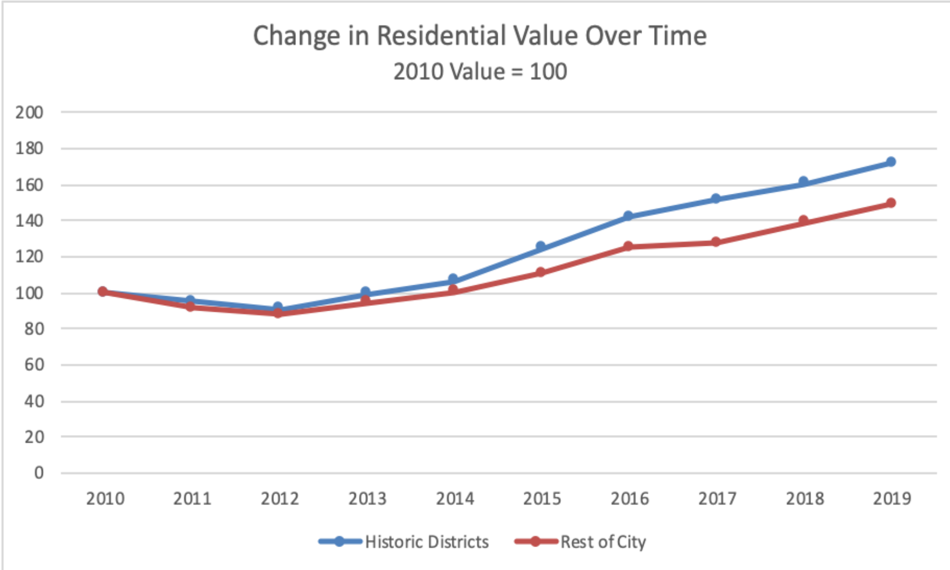


Figure 3.13 Change in Residential Value Over Time

3.5.1.3.2 <u>Residential Value Change in Historic Districts by FIRM Zone</u>

Within historic districts, property values are rising overall, but residential properties within FIRM Zone X–which are not expected to flood in a 100-year flood–are valued slightly higher.

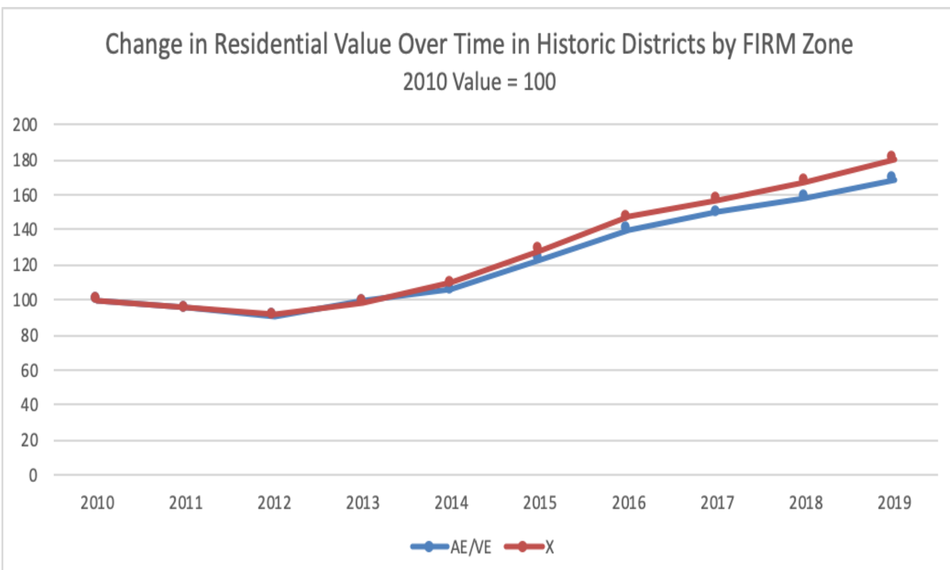


Figure 3.14 Change in Residential Value Over Time in Historic Districts by FIRM Zone

3.5.1.4 <u>Commercial</u>

3.5.1.4.1 <u>Historic Districts vs. Rest of City</u>

There is no statistical difference in the rate of value change for commercial properties in historic districts compared to the rest of the city.

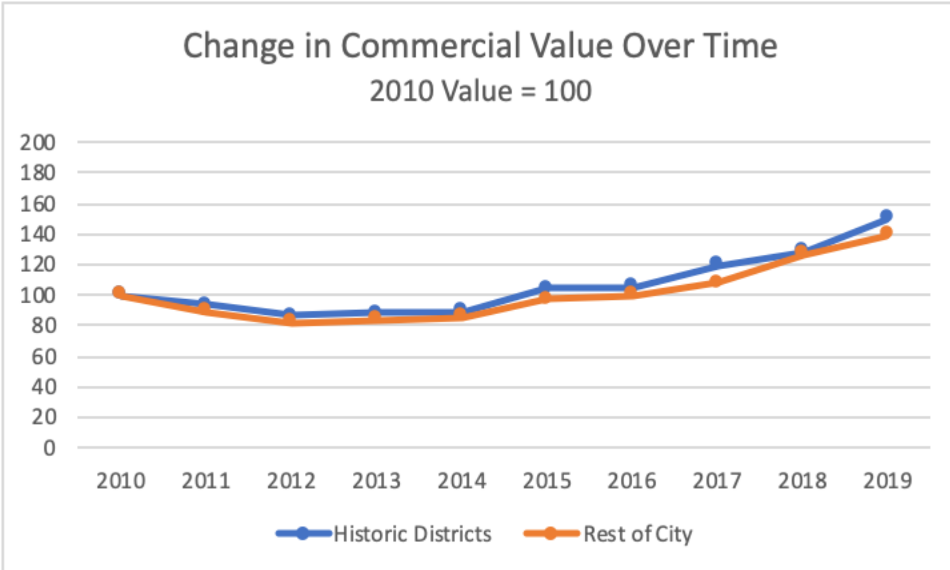


Figure 3.15 Change in Commercial Value Over Time

3.5.1.4.2 *Commercial Value Change in Historic Districts by FIRM Zones*

Unlike in residentially zoned areas, historic commercial property values within high risk flood zones (AE/VE) appear to have performed slightly better than in minimal risk zones.

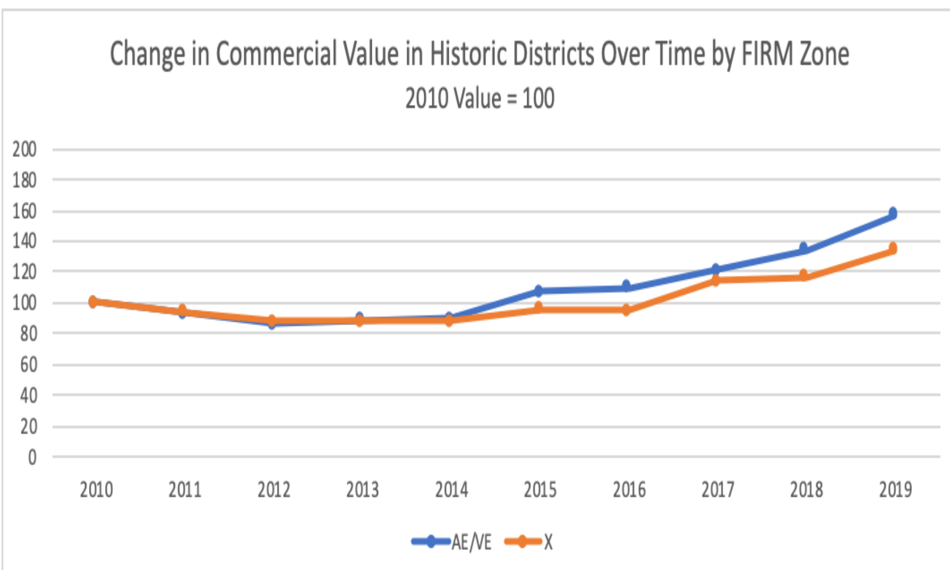


Figure 3.16 Change in Commercial Value In Historic Districts Over Time by FIRM Zone

3.5.2 *Repair to Storm Damaged Properties*

This analysis looked at the difference in building permit activity in normal years compared to years affected by storm events. In affected years,[12] there are two peaks in building permit activity. The first is around the time of the storm and another six months later or so.

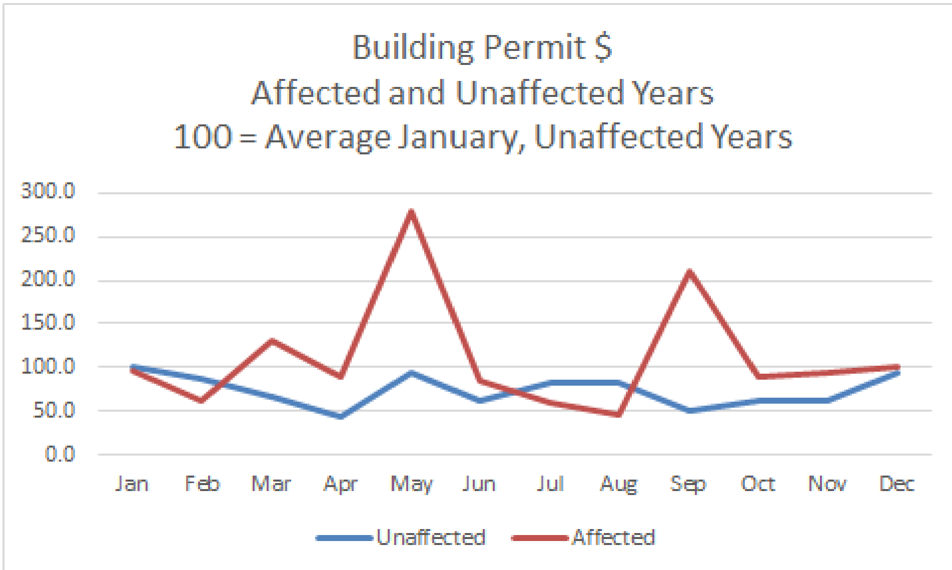


Figure 3.17 Building Permit Activity during Affected and Unaffected Years

During a storm year, overall permit activity is 51.2% greater than would be normally expected. That is an amount of about $16.6 million more.[13]

In historic districts, the trend line is similar. Historic districts are ordinarily intensive in terms of building investment. Over the last ten years, 37% of all building permits were issued to properties in historic districts, representing 29% of the overall investment. This is especially true during storm years. In the year following a storm event, permit activity is 110.9% greater than would be normally expected in historic districts, or on average $11.7 million more.

[12] In this analysis, a storm year is the 12 month period following a storm event.

[13] This likely underrepresents the real cost, as contractors/owners low ball the cost of the work when applying for permits as that reduces the fees they have to pay.

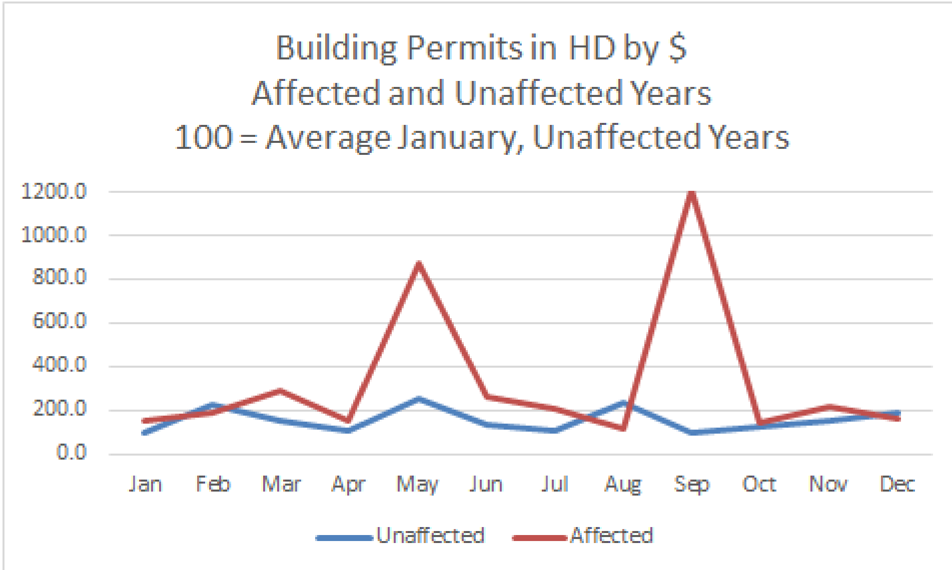


Figure 3.18 Building Permit Activity in Historic Districts during Affected and Unaffected Years

Though there is a difference in scale in historic districts, the pattern is the same in historic districts–there are two spikes in May and September of storm affected years.

3.5.3 Loss of Heritage Tourism

3.5.3.1 <u>Tourism Impact Methodology</u>

Using 10 years of daily visitation data provided by the National Park Service at the Castillo de San Marcos National Monument, it was possible to develop a model for the impact of storm events on tourism visitation. By graphing daily attendance in years not affected by a storm event, a reliable curve of the normalized daily attendance at the Castillo was created, which represents a normal, "expected" pattern of visitation. By graphing this expected curve against the actual attendance at the Castillo before and after a storm event, the graphs below demonstrate the scale of lost visitation during Hurricane Matthew in 2016 and Hurricane Irma 2017. It also illustrates the number of days before and after a storm event that visitation was reduced. The trend line for actual attendance suggests that visitation begins to drop off a week before the event, but lasts for three to four weeks after.[14]

[14] The graphs below would seem to indicate that attendance never fell to zero. That is not the case. The attendance curve stabilizes what otherwise is data points so varied as to not communicate what is actually happening. The curve used was a polynomial trendline, which, "…works well for large data sets with oscillating values that have more than one rise and fall." https://www.ablebits.com/office-addins-blog/2019/01/16/excel-trendline-types-equations-formulas/

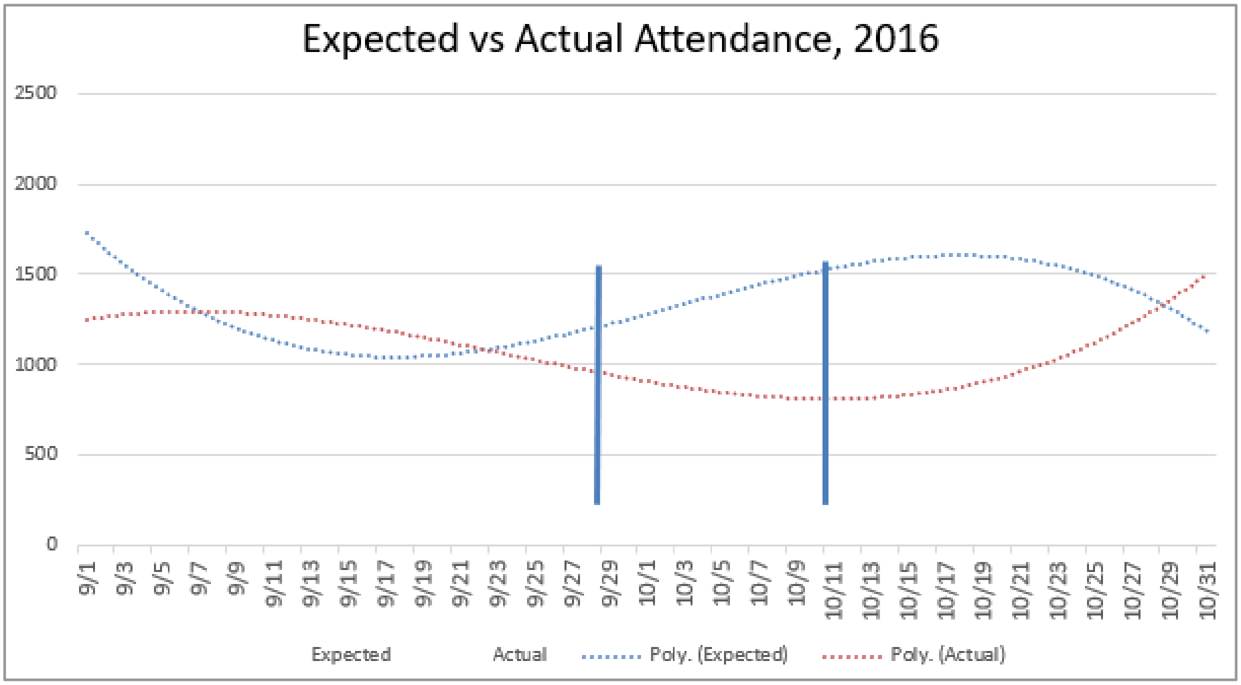


Figure 3.19 Expected vs Actual Attendance 2016

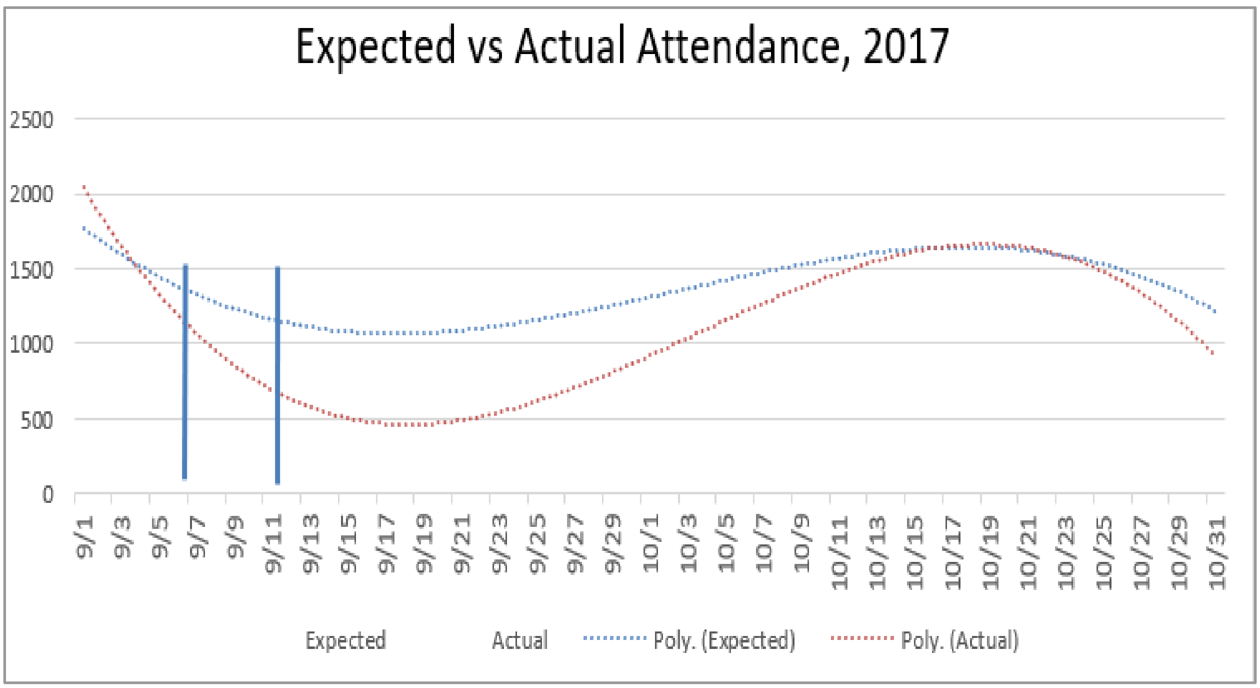


Figure 3.20 Expected vs Actual Attendance 2017

This data represents the lost visitation to the Castillo de San Marcos. While this data set does not perfectly or totally capture all types of visitors to St. Augustine, this data serves as a reasonable proxy for the scale and duration of lost heritage tourism during storm events. Since the data is so granular and consistent over many years, it represents the closest possible estimate of the impact of storm events on tourism and visitation.

This curve is used as a proxy model on which the analysis was based. The model provided approximate figures for the number of lost visitors, the number of days visitation was reduced, and the amount of lost visitor expenditures. This data, along with data provided by the St. Johns County Visitors & Convention Bureau, IMPLAN data, and visitation data provided by the National Park Service, and the Peña-Peck House were used to calculate the impacts below.

3.5.3.2 Heritage Visitors

St. Johns County benefits from just over 5.4 million visitors annually.[15] Twenty-nine percent of those visitors cited heritage as a specific reason for their visit. In this analysis, such visitors are called "Core Heritage Visitors." Another 26% of visitors identified heritage as a "major activity" during their time in St. Augustine, meaning while they did not make the trip with the express purpose of visiting heritage resources, they did so during their time there. These visitors are called "Opportunity Heritage Visitors." Together, 55% of all visitors to St. Augustine are identified as "Heritage Visitors."

On an average day, St. Augustine benefits from 715 day heritage visitor parties and 2,034 overnight heritage visitor parties. The daily expenditures of the two types of heritage visitors are included in Table 3.7.

Table 3.7 Heritage Visitation and Expenditures

Type of Heritage Visitor Party	Average # of Daily Heritage Visitor Parties	Average Daily Expenditures of Heritage Visitor Parties
Day Visitor Parties	715	$318.99
Overnight Visitor Parties	2,034	$687.77

Overnight visitor parties spend more per day because they stay longer, eat more meals, and rent lodging. On average, overnight heritage visitor parties spend over twice as much per day as day heritage visitor parties (Table 3.8).

Table 3.8 Average Daily Expenditures of Heritage Visitor Parties by Category

	Day Visitors	Overnight Visitors
Lodging	N/A	$173.01
Restaurants	$67.01	$123.45
Shopping	$59.81	$100.47
Entertainment/Amusements	$144.42	$221.70
Transportation	$34.53	$48.15
Other	$13.22	$21.09
Total	**$318.99**	**$687.77**

[15] This is a conservative figure. St. Johns County reported 6.3 million visitors in 2017. However a significant share of those visitors have visited 10 or more times within a two year period and another measurable percentage appeared to be season long visitors, so they were removed from this analysis.

The total daily expenditure of all heritage visitors is $1,616,780. The expenditures of overnight heritage visitors account for nearly 87% of that revenue (Table 3.9).

Table 3.9 Total Daily Heritage Visitor Expenditures

	Day Visitor	Overnight Visitors	Total
Lodging		$351,850	$351,850
Restaurants	$47,912	$251,060	$312,678
Shopping	$42,761	$204,325	$263,690
Entertainment/Amusements	$103,261	$450,870	$510,177
Transportation	$24,691	$97,922	$123,472
Other	$9,450	$42,891	$54,914
Total	**$228,076**	**$1,398,918**	**$1,616,780**

These visitor expenditures are important not only because they sustain a tourism industry that employs historic site managers, hotel workers, and food and beverage professionals–those dollars also indirectly impact other industries. Every dollar spent has both a direct impact and an indirect/induced impact. The direct impact consists of labor and material purchases made specifically for the activity. The indirect impact consists of spending on goods and services by industries that produce the items purchased for the activity. Induced impact focuses on the expenditures made by the households of workers involved either directly or indirectly with the activity.[16]

For example, a hypothetical bakery operates in St. Augustine's historic district, servicing heritage visitors downtown. A heritage visitor buys a croissant at the bakery. The bakery owner then uses that money to pay the employees who bake and sell the bread–this is a direct impact. Then, the bakery owner pays its supplier for flour, butter, and spices to bake the bread. When their supplier spends money on goods and services, that is an indirect impact, meaning it indirectly impacts another industry. When the bakery's employees spend their paycheck on groceries, a haircut, etc., this is an induced impact. Similarly, for jobs– the direct job is created for the bakery cashier, the indirect job is the supplier who sells the flour, and the induced job is the hairdresser.

One day of expenditures made by heritage visitors create 21.8 direct jobs and 7.3 indirect/induced jobs ***for an entire year*** (Table 3.10).

Table 3.10 Year-Round Jobs Generated by One Day's Heritage Visitors Expenditures

	Direct	Indirect/Induced	Total
Lodging	3.2	1.2	4.4
Restaurants	4.5	1.2	5.7
Shopping	4.5	1.1	5.6
Entertainment/Amusements	6.2	3	9.2
Transportation	2.6	0.6	3.2
Other	0.8	0.2	1
Total	**21.8**	**7.3**	**29.1**

16 https://www.americansforthearts.org/by-program/reports-and-data/legislation-policy/naappd/economic-impacts-of-historic-preservation

The $1,616,780 spent on average each day by heritage visitors generates $970,017 in labor income daily (Table 3.11).

Table 3.11 Labor Income Generated by One Day's Heritage Visitor Expenditures

	Direct	Indirect/Induced	Total
Lodging	$137,776	$49,777	$187,553
Restaurants	$114,175	$50,368	$164,543
Shopping	$105,234	$42,238	$147,472
Entertainment/Amusements	$266,349	$107,808	$374,157
Transportation	$39,095	$27,187	$66,282
Other	$20,584	$9,427	$30,011
Total	**$683,213**	**$564,184**	**$970,017**

3.5.3.3 Economic Impact of Lost Visitation Following Weather Events

Another way to think about the numbers above: every day that St. Augustine is shut down because of an extreme weather event is a day when these expenditures, jobs, and labor income are *NOT* being generated.

The model developed from the Castillo de San Marcos visitation data demonstrates the scale of deviation from expected visitation seen during a weather event. Those lost visitors also mean a loss of their expenditures, which has a significant negative impact on jobs and income in St. Augustine. The analysis below (Table 3.12-Table 3.14) looks at that impact over a two-month period beginning 5 days before the event and ending when visitation begins to pick up again. Over those two months following a weather event, St. Augustine sees a loss of nearly $20 million in tourist expenditures.

Table 3.12 Estimated Tourist Expenditures

Expenditures	
Lodging	$4,450,669
Restaurants	$4,617,915
Shopping	$4,138,273
Entertainment/Amusements	$4,328,187
Transportation	$1,603,325
Other	$819,047
Total	**$19,957,415**

The loss of those tourist expenditures results in a negative impact on both jobs and labor income. Over those two months, over 300 year-round direct, indirect and induced jobs are lost. This amounts to over $12 million in forgone labor income.

Table 3.13 Forgone Jobs Due to Lost Visitation Over Two Months

	Direct	Indirect/Induced	Total
Lodging	40.4	15.6	56
Restaurants	56.6	15.2	71.8
Shopping	56.7	13.5	70.2
Entertainment/Amusements	78.6	37.1	115.7
Transportation	32.5	7.9	40.4
Other	10.5	2.9	13.4
Total	**275.3**	**92.2**	**367.5**

Table 3.14 Forgone Income Due to Lost Visitation

	Direct	Indirect/Induced	Total
Lodging	$1,742,773	$629,650	$2,372,423
Restaurants	$1,444,245	$637,127	$2,081,372
Shopping	$1,331,140	$534,283	$1,865,423
Entertainment/Amusements	$3,369,139	$1,363,702	$4,732,841
Transportation	$494,527	$343,894	$838,421
Other	$260,371	$119,247	$379,618
Total	**$8,642,195**	**$3,627,902**	**$12,270,097**

3.6 Part 3: Modeling Future Impacts of Increased Storm Events

3.6.1 Lost Visitation Due to Lost Historic Resources

The graph below demonstrates how heritage tourism would likely decline with the loss of heritage buildings.[17] The decline in heritage tourism visitation is negligible with a minor loss of heritage resources, but it increases geometrically as a greater share of heritage buildings are lost. The graph is for illustrative rather than statistical purposes but represents a pattern likely to be seen.

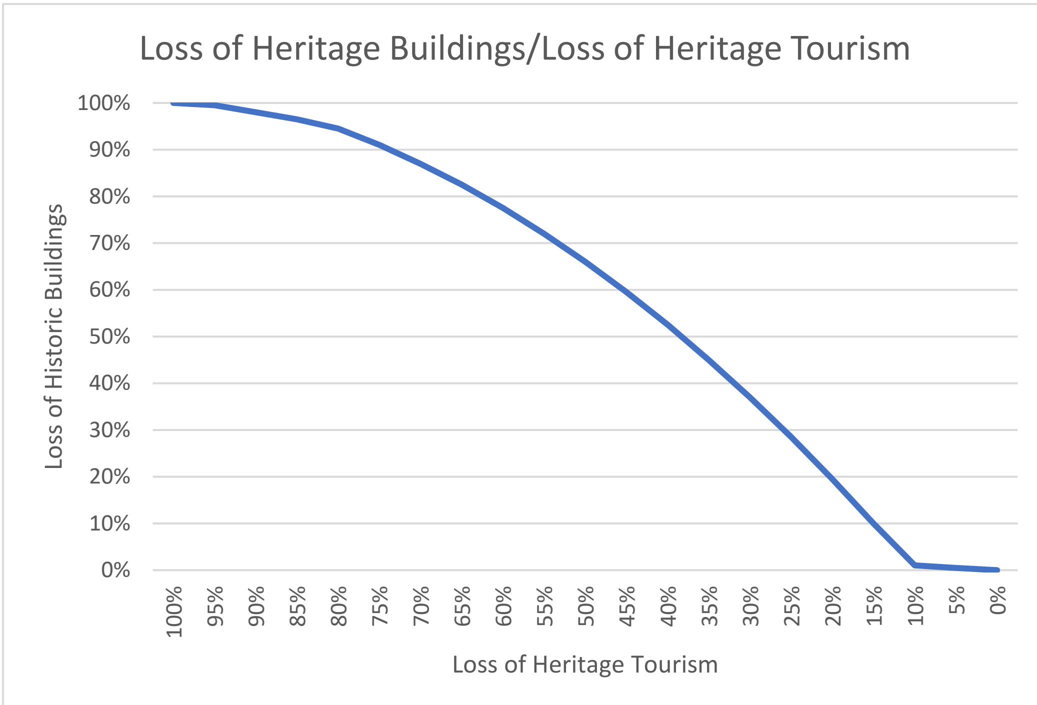


Figure 3.21 Loss of Heritage Buildings/Loss of Heritage Tourism

Based on the hypothetical curve above, an "if/then" scenario emerges:

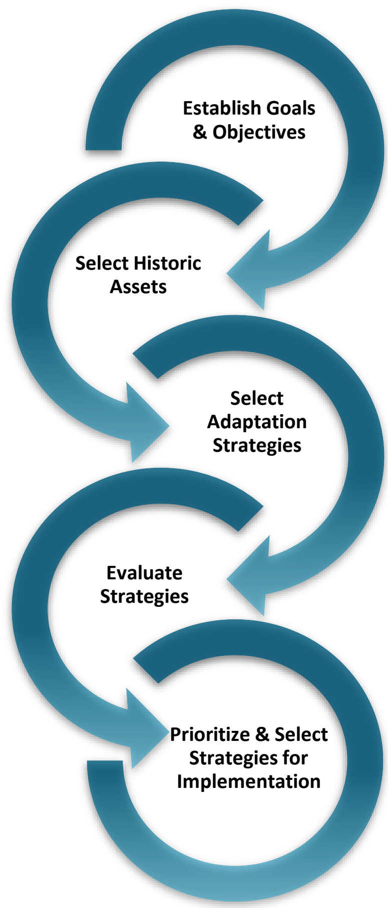
- If only 90% of resources remain, 2% of visitor parties no longer come. This represents a loss of $32,336 in heritage tourism expenditures per day.
- If only 50% of resources remain, 34% of visitor parties no longer come. This represents a loss of $549,705 in heritage tourism expenditures per day.
- If only 10% of resources remain, 99% of visitor parties no longer come. This represents a loss of $1,600,612 in heritage tourism expenditures per day.

[17] Assumption: 100% of heritage buildings still existing = 100% of heritage visitors still come; 0% of heritage buildings still existing = 0% of heritage visitors still come.

4.0 FLOOD MITIGATION DESIGN FOR PRIORITIZED PROPERTIES

Hazard mitigation is the action taken to reduce or eliminate the long-term risk to human life and property as define by the Disaster Mitigation Act of 2000 (The Committee on Appropriations of the House of Representatives 2000). To allow specific and relevant guidance, this document will focus on the process of flood mitigation for historic buildings, structures, objects, or sites. This section offers guidance as to how the responsible entities should establish goals and objectives, select assets, evaluate relevant mitigation strategies, and prioritize selected strategies for future implementation.

4.1 Develop Mitigation Goals and Objectives



Goals and objectives are general guidelines that outline what the City of St. Augustine hopes to achieve by applying a mitigation strategy to a selected historic asset. These intentions can range from new or updated policy guidelines, long term preservation measures, short term emergency measures, and any other actions that mitigate the hazard. The goals should be based on the community's values, identity, and culture. In addition, mitigation goals should be consistent with the state's goals and should not contradict other community goals, such as those expressed in the local comprehensive plan (FEMA 2003).

The need to establish goals that align with the community's values highlights the importance of identifying key team members at the inception of the planning process. Since many projects will depend on community acceptance for implementation, it is also recommended that a Working Group is established. This group should be made up of an interdisciplinary team that can offer expertise in the social, technical, administrative, political, legal, economic, environmental, and community value aspects of the project when possible. The Working Group should also engage stakeholders early in the planning process. The *Guidance for Evaluation Criteria for Mitigation Actions* document found in APPENDIX C offers guidance on potential key team members that may offer valuable input on each of the selection criteria.

4.2 Site Selection Utilizing Multicriteria Decision Matrix

The first step in selecting a historic asset is to determine its level of vulnerability. In this case, vulnerability to flood hazards induced by tidal events, rain events, sea-level rise, or extreme storm events. Vulnerability for this specific resilience project is defined as the susceptibility of the historic building, structure, object, or site to the harmful impacts of a natural hazard, such as flooding. Recent reports such as the *Coastal Vulnerability Assessment: City of St. Augustine, Florida, Florida Community Resiliency Initiative Pilot Project: Adaptation Plan for St. Augustine, Florida* (FDEP 2017), and the *City of St. Augustine Historic Preservation Master Plan* (Preservation Design Partnership, LLC 2018) are valuable documents that can aid in this step. This data can be utilized to create an inventory of historic assets that are situated in areas susceptible to present or future hazards.

Once an inventory of at-risk historic assets is established, the Working Group can prioritize the assets. In order to rank the assets, selection criteria should be established to allow the Working Group to effectively select historic assets based on values that have been voted or agreed upon. This will allow all assets to be evaluated by the same criteria as the City moves forward with implementing mitigation strategies.

During a City of St. Augustine meeting with key team members on January 30, 2020, the project team led the attendees through the process of developing a multicriteria decision matrix for future asset priority ranking and selection. All meeting attendees were given a post-it note and instructed to anonymously write down three criteria they would use to evaluate the priority of city-owned historic assets with the potential for evaluating flood mitigation designs. After the participants were finished, the criteria were recorded, and then distilled into six categories. As the meeting ended and attendees departed, they were asked to choose the two most important criteria. The project team members also voted after the meeting ended. The results are illustrated in Table 4.1.

Table 4.1 Prioritization of Selection Criteria

Selection Criteria	Stakeholder Votes	Project Team Votes
Critical Infrastructure/Public Safety	2	1
Tourism Value	1	0
Damage/Repair Costs	2	1
Vulnerability of Property	6	2
Potential for Pilot Project	5	3
Year Built/National Historic Registry of Historic Places	3	1

Utilizing the criteria established and selected by the attendees of the meeting, the selection criteria were ranked as shown in Table 4.2.

Table 4.2 Final Ranking of Selection Criteria

Rank	Selection Criteria
1	Vulnerability of Property[1]
2	Potential for Pilot Project[1]
3	Year Built/National Historic Registry of Historic Places
4	Damage/Repair Cost[2]
5	Critical Infrastructure[2]
6	Tourism Value

[1] Votes received by meeting attendees were weighted higher than Project Team members in the case of a tie.
[2] Damage/Repair Cost and Critical Infrastructure received equal votes.

As the City of St. Augustine moves forward with mitigation strategies for historic buildings, structures, objects, and sites, they can utilize the stakeholder selection criteria to prioritize assets for protection from potential flood hazards.

4.3 Developing a Priority Ranking of Adaptive Strategies

Once the Working Group has selected a historic asset and established goals and objectives, the next step in planning is to identify, evaluate, and prioritize mitigation actions. The actions should directly address the goals and objectives defined by the Working Group. The U.S. Department of the Interior's Nation Park Service Technical Preservation Service offers guidance specifically on flood mitigation for rehabilitating historic buildings. “The goal of the *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* is to provide information about how to adapt historic buildings to be more resilient to flooding risk in a manner that will preserve their historic character and that will meet *The Secretary of the Interior’s Standards for Rehabilitation*. These guidelines should be used in conjunction with the *Guidelines for Rehabilitating Historic Buildings* that are part of *The Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings,* issued in 2017.” (J. Eggleston 2019) The Secretary of the Interior’s Guidelines are organized by adaptive treatment and include:

- **Planning and Assessment for Flood Risk Reduction:** Actions that include asset maintenance, identification, monitoring, and documentation. These types of actions should be enacted proactively.
- **Temporary Protective Measures:** Actions that include temporary or non-permanent installations of materials or systems that can be deployed when flooding is predicted and removed or stored after the floodwaters have receded.
- **Site and Landscape Adaptations**: Actions that include changes to the site or the surrounding site to promote flood protection and will generally allow the historic asset to remain unaltered.
- **Protect Utilities:** Actions that protect the utilities and mechanical systems of a historic building and can include elevating or relocating the system above the flood risk level.
- **Dry Floodproofing:** Actions that are designed to prevent floodwaters from entering a building. To dry floodproof a property, all openings that extend or are completely below the established flood risk level must be designed to be temporarily or permanently sealed.
- **Wet Floodproofing:** Actions that allow water to enter the historic asset during a flood event and drain out as the waters recede. Since water is moving in, through, and out of the structure it must be able to withstand the hydrostatic force of the floodwaters and all mechanical systems must be elevated above the flood level.
- **Fill the Basement:** Action that includes filling the below ground level basement on all sides of the masonry construction of a historic building with compacted gravel, soil, or sand.
- **Elevate the Building on a New Foundation:** Actions that include raising the height of a building by lifting it from its existing foundation, constructing a new and higher foundation, and resetting the building on the new foundation. Care should be taken to arrive at a foundation height that not only mitigates against flood but is also congruent with the historic character and appearance of the building.
- **Elevate the Interior Structure:** Actions that involve removing the historic building’s first or ground floor level and replacing it with a new floor plate at a level above the flood risk. This treatment allows the exterior of the structure to remain generally unchanged but requires a adequate ceiling height to accommodate the change.
- **Abandon the First Story:** Actions that modify a multi-story building to relocate all living spaces to upper floors above the flood risk level. The abandoned floor will require wet or dry floodproofing. Coordination with the local floodplain ordinance is necessary to determine if the course is allowable.
- **Move the Historic Building**: Actions that include separating a building or structure from its foundation and relocating it to a new site and foundation out of the flood risk area. Generally, relocating a building is not a recommended preservation practice but may be necessary with increased exposure to hazards.

A list of mitigation strategies recommended by the Secretary's Standards of the Interior as well as general mitigation strategies and an in-depth encyclopedia of mitigation strategies are included in APPENDICES G and H**.**

4.3.1 Resilient Historic Asset Planning Worksheet

The *Historic Properties Mitigation Planning Workshee*t (APPENDIX D) was created to serve as a starting point for the Working Group tasked with identifying mitigation strategies for the prioritized historically significant assets. The *Guidance for Evaluation Criteria document* (APPENDIX F) outlines the eight main criteria used to evaluate the feasibility of any strategy with the associated asset and objective(s). This process to evaluate mitigation actions to fulfill specified objectives is commonly used by the Federal Emergency Management Agency (FEMA) and referred to as the STAPLEE Criteria (FEMA 2003). These criteria, and the explanation of the STAPLEE acronym, with the addition of Community Values are:

- **Social:** Will there be community acceptance? What are the effects on certain segments of the population?
- **Technical:** Is the action technically feasible? Is the solution long-term? What are the secondary impacts?
- **Administrative**: Are there available staff and funding for the action? What will be required for operation and maintenance?
- **Political:** Is there political and public support? Is there a local champion?
- **Legal:** What are the potential legal challenges? Who are the existing state and local authorities?
- **Economic:** What are the costs and benefits of the action? Does the project contribute to economic goals? Will it require outside funding?
- **Environmental:** Is the action consistent with local, state, federal laws, and community goals? What are the effects on land, water, and wildlife?
- **Community Values:** What is the historic designation? What is the geographic context of significance and the level of significance? What is the public sentiment, economic importance, and degree of integrity?

These aforementioned criteria are combined to create the STAPLEEC acronym. The Working Group should use the *Planning Worksheet* to evaluate each of the criteria regarding the implementation of the proposed mitigation strategy. This process should be repeated to include several possible strategies that are relevant to the goals and objectives set forth by the group. To fully address each of the criteria, the Working Group should refer to the *Guidance for Evaluation Criteria for Mitigation Strategies* document. This guidance outlines detailed questions that should be evaluated under each criterion, as well as, key persons or agencies that may be crucial in moving forward with the proposed actions.

The Community Values criteria are traditionally not included in the standard STAPLEE criteria for evaluating mitigation strategies but as determined in the work with St. Augustine are monumental when evaluating proposed changes to historic buildings, structure, objects, and sites that make up a city's culture as in the City of St. Augustine. The Community Values aspect encourages the Working Group to make an evaluation based on the following criteria:

- Historic Designation
- Geographic Context of Significance
- Level of Significance
- Public Sentiment

- Economic Importance
- Degree of Integrity

These criteria allow the Working Group to give a quantifiable score to the value that each asset and associate mitigation strategy offers.

4.3.2 STAPLEEC Matrix Worksheet

After several mitigation strategies are selected and evaluated under the STAPLEEC criteria, the Working Group should utilize the *STAPLEEC Matrix Worksheet (*APPENDIX F) to score and prioritize the proposed actions. The group will fill in the historic building, structure, object, or site, the hazard, and the objective (Note: a separate *STAPLEEC Worksheet* should be used for each objective). Next, the mitigation strategies selected and evaluated on the Planning Worksheet will be transferred to the *STAPLEEC Worksheet* (Table 4.3). Using the results from the *Planning Worksheet*, the group will assign a score of plus (+) for favorable, negative (-) for unfavorable, N/A for not applicable, or leave blank if the answer is not known or the evaluation requires the consultation of an outside source. Negative scores indicate gaps or shortcomings in the particular action (which can be noted in the comments section). When the scoring across all criteria is complete, the group should sum the values wherein plus (+) = 1, negative (-) = -1, and not applicable N/A = 0. Each mitigation strategy is then given a priority ranking based on its score.

Table 4.3 Example of Complete STAPLEEC Matrix

STAPLEEC MATRIX

STEP 1 PROPERTY/LOCATION: Llambias House *(eg. building, structure, object, site, etc.)*

STEP 2 HAZARDS: Flooding *(eg. flooding, salt water intrusion, wind, etc.)*

STEP 3 OBJECTIVE: Protect integrity of historic resource *(eg. preserve historic character, protect historic property, etc.)*

*STEP 1-3: Fill in the **PROPERTY/LOCATION**, the existing or future **HAZARD** that will be addressed, and the objective the **MITIGATION STRATEGY** should address. Use a separate worksheet for each **OBJECTIVE**. The **CONSIDERATIONS** under each criteria are suggested and may be edited to reflect specific project priorities.*
*STEP 4: Fill in the **MITIGATION STRATEGIES** that address the specific objective the planning team identified on the Historic Properties Mitigation Planning Worksheet.*
*STEP 5: For each **CONSIDERATION**, indicate a plus (+) for favorable, a negative (-) for unfavorable, or N/A for not applicable. Leave blank if the answer is not known or evaluation requires the consultation of an outside source. Negatives indicate gaps or shortcomings in the particular action (which can be noted in the comments section). When scoring is complete, sum the values wherein plus (+) = 1, negative (-) = -1, and not applicable N/A = 0. Each **MITIGATION STRATEGY** is then given a **PRIORITY RANKING** based on its score.*

STEP 4 | Select STRATEGIES — **STEP 5 | CONSIDERATIONS STAPLEEC ANALYSIS (+ / - / N/A)**

	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Community Value*							
Mitigation Strategy:	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long Term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Community Environmental Goals	Consistent with Federal Laws	*Historic Designation (NR, NHL, etc.)	Geographic Context of Significance (National, State, Local)	Level of Significance (High, Medium, Low)	Public Sentiment (High, Medium, Low)	Economic Importance (High, Medium, Low)	Degree of Integrity (High, Medium, Low)	**SCORE**	**PRIORITY RANKING**
Site Infrastructure *Landscape* Raising Land	+	N/A	+	+	-	+	+	+	+	+	+	N/A	+	-	+	+	+	-	+	N/A	N/A	+	+	NHL	Natl	H	H	M	H	13	2
Temporary Protective Measures *Dry Floodproofing* Temporary Flood Wrap	+	N/A	+	-	+	+	+	-	+	+	+	N/A	+	+	+	+	+	+	N/A	N/A	N/A	+	+	NHL	Natl	H	H	M	H	14	1

4.3.3 Asset Selection for Flood Mitigation Exercise

Utilizing the selection criteria in concert with dialogue from the City of St. Augustine staff, three properties were selected to evaluate their vulnerabilities and propose potential mitigation strategies which protect against flood hazards. This will allow future work to mirror the steps of the process and aid in providing a springboard for implementing mitigation strategies on the properties in focus. The three properties selected are the Llambias House located at 31 Saint Francis Street, Plaza de la Constitución located at 170 Saint George Street, and the Alcazar Hotel – Historic Lightner Museum located at 75 King Street. Each property presents unique opportunities to apply short- and long-term flood mitigation strategies that allow the City to protect the valuable historic resource.

4.3.3.1 Llambias House

Located within the St. Augustine Town Plan Historic District, the Llambias House is designated a National Historic Landmark and is one of the few buildings in the area that dates back to the first Spanish Colonial Period (1565-1763) (National Park Service U.S. Department of the Interior 2020).

Situated between the Matanzas River and Lake Maria Sanchez, the Llambias House experiences high exposure to flood water encroaching from both the east and west along St. Francis Street during extreme weather events. Due to the significant historic value of this asset and the available green space, the project team proposed the following mitigation actions to alleviate the effects of flood hazards:

- **Site and Landscape Adaptations**: Landscape Berm and Additional Trees
- **Temporary Protective Measures**: Temporary Flood Wrap and Removable Flood Gates

The Llambias House allows for a unique opportunity in a cityscape to use green or nature-based site infrastructure since the built infrastructure occupies less than 10% of the total parcel.

This open space allows the addition of trees that naturally offer resilience as they age by intercepting water through their root systems. Table 4.4 outlines the capacity in gallons of specified tree species to intercept water or act as “straws” over their lifetime.

Table 4.4 Resilient Benefits of Selected Trees

Tree Species	Gallons of Water Intercepted in Year 1	Gallons of Water Intercepted in Year 15[1]	Gallons Intercepted Over 15 Years
4” Live Oak	481	7,283	48,375
8” Live Oak	1,491	9,349	71,949
12” Live Oak	2,843	11,507	98,772
4” Yaupon Holly	155	486	5,676
8” Yaupon Holly	548	548	8,226

[1] Values assume an average expected rate of growth for each tree and an associate increase in capacity (USDA Forest Service 2006)

The green space also allows the implementation of landscape berms that can work in conjunction with the existing perimeter walls to offer protection against floodwaters. With all site mitigations, altering the present condition will change how flood waters move through and around the property and require examination of other potential impacts on neighboring properties. It is also to important that the site is surveyed and monitored prior to and during construction to determine potential impacts on important landscape features or archaeological resources and reduce or eliminate losses of historic resources.

Figure 4.1 Conceptual Flood Mitigation Strategies: Llambias House

Figure 4.2 Conceptual Flood Mitigation Strategies: Llambias House

Figure 4.3 Conceptual Flood Mitigation Strategies: Llambias House

Temporary flood wrap is a non-permanent protective measure that can be deployed when flooding is predicted and offers a noninvasive and affordable option for protecting the Llambias House. Flood wraps fabricated from plastic or other synthetic water-proof sheeting material require an anchoring system at the base of the structure such as sandbags. Since the system allows the hydrostatic force of the floodwaters to be applied against the wall in most cases, the existing walls may require strengthening to resist the loads that will be applied. Figure 4.4 illustrates how the temporary flood wrap deflects at doorways and other openings. Figure 4.5 shows a homemade version of flood wrap on a doorway of a historic property in St. Augustine, while Figure 4.6 shows a whole house example.

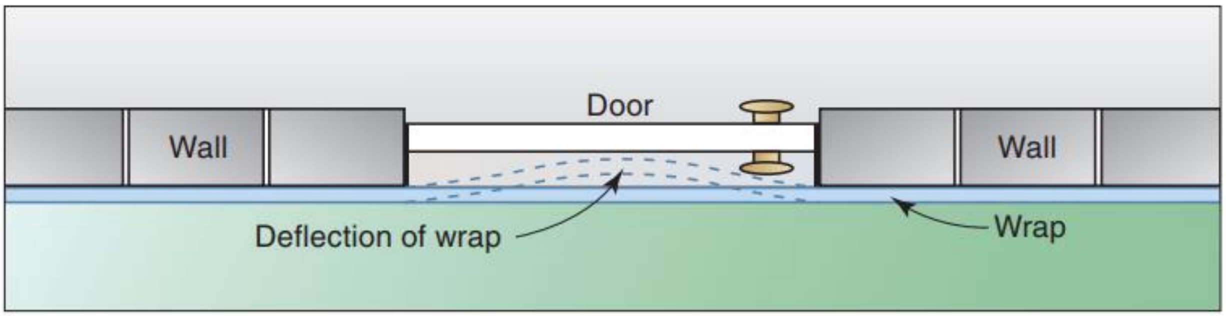


Figure 4.4 Plan View Shows Deflection of Wrap at Doorway (FEMA 2013)

Figure 4.5 Homemade Temporary Flood Wrap Deployed in St. Augustine

Figure 4.6 Temporary Plastic Sheeting Installation **(Aragon 2017)**

Another temporary protective measure to aid in flood mitigation at Llambias House is the installation of flood gates at each of the existing perimeter gates. Like the flood wrap system, these gates would be stored and then installed when floodwaters are predicted.

A "rail" or other mounting system that accepts the temporary flood gates would be installed on the inward-facing section of the perimeter wall to preserve the historic appearance of the property from the street view. Both temporary systems require analysis of the structure that will receive the hydrostatic forces applied by the floodwaters before implementation. In addition, an installation team and maintenance plan are required, as well as storage and periodic monitoring for both systems.

Figure 4.7 U.S. Naval Academy Temporary Stop Logs

Figure 4.8 Masonry Floodwall with Engineered Temporary Flood Gates (FEMA 2013)

Figure 4.9 Conceptual Flood Mitigation Strategies: Llambias House

Figure 4.10 Conceptual Flood Mitigation Strategies: Llambias House

Figure 4.11 Conceptual Flood Mitigation Strategies: Llambias House

4.3.3.2 Plaza de la Constitución

Plaza de la Constitución was platted as the center the St. Augustine in 1573 in accordance with the Spanish Royal Ordinances.[18] The park is on a stretch of land bordered by the Cathedral Basilica of St. Augustine, Trinity Episcopal, and the Government House.[19] The Plaza earned its proper name for the obelisk that was erected to celebrate the Spanish Constitution of 1812 (Visit St. Augustine 2020).

Figure 4.12 Aerial View of Plaza de la Constitución

The Plaza is situated between Cathedral Place and King Street that serve as the main thoroughfares for the City. Its proximity to the Matanzas River to the east and San Sebastian River to the west make it vulnerable to flooding during extreme weather events. The project team proposed the following mitigation actions to alleviate the effects of flood hazards:

- **Site and Landscape Adaptations**: Elevated Park, and Underground Cisterns
- **Temporary Protective Measures**: Temporary Flood Barrier

[18] As referenced by Dr. J. Michael Francis, Hough Family Chair at the University of Southern Florida - St. Petersburg, scholar in 16th century Spanish-Colonial History. Researched by Dr. Leslee Keys, Flagler College.
[19] The State of Florida currently owns the entire parcel that includes Government House and the grounds to the west of it.

Figure 4.13 Conceptual Flood Mitigation Strategies: Plaza de la Constitución + Governor's House

During an extreme weather event, floodwaters rise from Matanzas River, driven by storm surge, winds, and tidal influences. These floodwaters first encounter the Avenida Menendez sea wall that was both extended and elevated during a project completed in 2014. This update included coastal design conditions to withstand a Category 1 hurricane. Once the floodwaters exceed this threshold, a barrier in the form of an elevated park could potentially deflect the water to run parallel to Avenida Menendez. This proposed elevated park, or berm, adds another level of flood protection, creates a “speed table” slowing the traffic, reduces the amount of saltwater intrusion on archaeological resources, and provides space for storing floodwaters underneath. One advantage of raising the street surface and crosswalk islands is the potential for creating an underground stormwater retention system. Rough estimates of the project area with a depth between 3 and 5 feet indicate that approximately 1 million gallons of floodwater could be intercepted with the addition of underground rainwater and stormwater storage, as outlined in Table 4.5. While this elevation seems excessive, the surrounding roadways would be graded accordingly to reduce a large jump in elevation difference.

Cathedral Place and King Street provide two large areas for potential underground stormwater retention systems available to capture and retain floodwaters. This mitigation would require the careful excavation of ground beneath the two streets, including detailed surveys and monitoring to lessen negative effects to the historic viewshed, landscape features, existing infrastructure, archaeological resources, other cultural or religious features, or burial grounds to construct the flood protection. Additional coordination with the State of Florida and the Florida Department of Transportation will likely be required. Consultation with the Florida State Historic Preservation Office and the National Park Service would also likely be required through the Section 106 process. Rough estimates of the project area with a design depth between 3 and 5 ft indicate that this mitigation could intercept approximately 3 million gallons of floodwater, as outlined in Table 4.5. Additionally, the intercepted and stored storm water can function as reclaimed irrigation for the Plaza’s green spaces, after minimal treatment and filtration.

Table 4.5 Estimated Water Storage Capacity for Plaza de la Constitución

Proposed Mitigation	Approximate Area (ft^2)	Approximate Volume (gal) Depth of 3 ft	Approximate Volume (gal) Depth of 5 ft
Elevated Park Berm at King St. & Anderson Cir.	42,000	900,000	1,500,000
Water Retention Basin under Cathedral St.	36,000	800,000	1,300,000
Water Retention Basin under King St.	41,000	900,000	1,500,000

Figure 4.14 Underground Storm Water Detention System (Hydrology Studio 2020)

In the absence of the elevated park berm or in concert with it, a temporary flood barrier is recommended at the east end of Plaza de la Constitución when major floodwaters are expected. These large-scale temporary flood barriers range in types from plastic self-rising and quickly deployable “dams”, rigid plastic flood “fencing”, metal and wood barriers lined in waterproofing, and many other varieties.

Figure 4.15 Quick Deployable Flood Barrier (Fluvial Innovations 2020)

Deployment of these temporary flood barriers requires a team to assemble and disassemble each time there is a threat of flooding. The barriers also require a dedicated area for storage as well as periodic inspection to confirm the performance during a deployment. Any water that is differed by the flood barrier will also be redirected, therefore care must be taken when designing an approach.

Figure 4.16 Gravel Filled Containers that Form a Flood Barrier (FEMA 2013)

4.3.3.3 Alcazar Hotel – Historic Lightner Museum

The former Alcazar Hotel was built in 1888 by Henry Morrison Flagler and closed soon after during the Depression. In 1947, Otto C. Lightner purchased the building, opened the museum two years later, and then handed it over to the City of St. Augustine. The building is on the National Register of Historic Places and currently home to the Lightner Museum and the City of Augustine government offices (Lightner Museum 2020).

Figure 4.17 Aerial View of the Alcazar Hotel – Historic Lightner Museum

The Alcazar Hotel – Historic Lightner Museum building is centrally located within the heart of the city between Granada and Cordova Streets and south of King Street. Like most of the Historic District, its proximity to the Matanzas River to the east and San Sebastian River to the west make it vulnerable to flooding during extreme weather events. The project team proposed the following mitigation actions to alleviate the effects of flood hazards:

- **Site and Landscape Adaptations**: Underground Cisterns
- **Temporary Protective Measures**: Temporary Flood Wrap, Temporary Flood Gates
- **Wet Floodproofing:** Wet Floodproofing Indoor Pool

Figure 4.18 Conceptual Flood Mitigation Strategies: Alcazar Hotel: City Hall & Lightner Museum

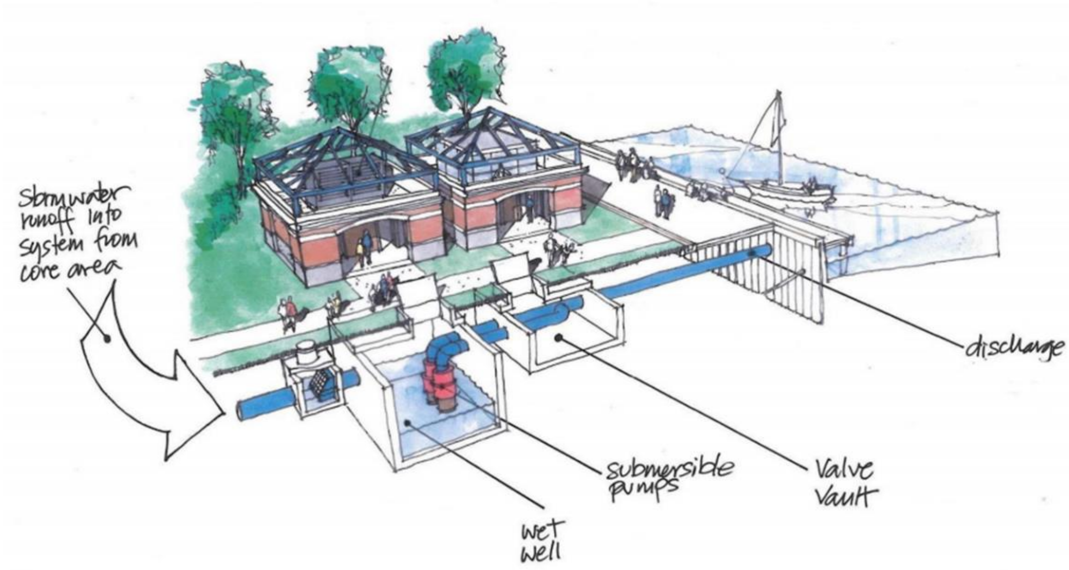


Figure 4.19 Conceptual Pump Station Schematic (Olin Studios 2012)

The gardens which front the Alcazar Hotel along King Street offer the possibility to install an underground stormwater detention system, similar to that proposed in Section 4.3.3.2. This system provides temporary floodwater or rainwater storage, as well as irrigation for the gardens above. Rough estimates indicate that the proposed mitigation could intercept approximately 1.5 million gallons of water. Detailed surveying and monitoring of the excavation site is a requirement prior to and during construction to evaluate any potential archaeological resources which may exist at the site. San Sebastian Creek once flowed underneath this property; therefore, archaeological investigation is critical to this location due to the presence of prehistoric and Flagler-era historic and cultural resources.

Table 4.6 Estimated Water Storage Capacity for Alcazar Garden on King Street

Proposed Mitigation	Approximate Area (ft^2)	Approximate Volume (gal) Depth of 3 ft	Approximate Volume (gal) Depth of 5 ft
Water Retention Basin under Alcazar Front Garden	41,000	900,000	1,500,000

The Alcazar Hotel’s outer walls are constructed from the shell rock formation, coquina shell as an aggregate in formed and poured concrete, the same shell that evolved into coquina stone that is indigenous to the region. Coquina contains very little silt or clay-sized particle and is composed almost entirely of fossil debris, making it an extremely porous construction material. Due to their porosity, the exterior walls of the Alcazar Hotel – Lightner Museum are highly vulnerable to floodwaters that encounter the building’s exterior. For this reason, the project team proposed implementing a temporary flood wrap system on the building in conjunction with temporary flood gates at each opening of the property site walls. The scale of the exterior building would require approximately 1,400 linear feet of flood wrapping but would also demand a team trained and deployable when flooding is predicted. The flood wrapped walls must also be inspected and possibly reinforced to ensure they can withstand the hydrostatic forces applied during a flood event.

At the peak of its popularity during the 1890s, the Alcazar Hotel housed the world’s largest indoor swimming pool (Lightner Museum 2020). The space that once housed the indoor pool is now the location of the restaurant, Café Alcazar. Due to its original construction as a receptacle for water, this facility is ideal for wet floodproofing and possibly overflow water storage for major storm events, if needed. As with other suggested mitigation ideas, this is a conceptual proposal which needs further investigation.

Figure 4.20 Alcazar Pool 1889 (Lightner Museum 2020)

Wet floodproofing is a flood mitigation technique that allows water to enter a building during a flood event and drain or be pumped out as the waters recede. According to the Secretary of the Interior's flood adaptation guidance, wet floodproofing is not recommended where flooding is expected to exceed 24 hours in duration. Additionally, it is best to limit this strategy to buildings where the area of inundation is an unfinished space, such as a basement, if the building is not constructed of flood damage-resistant materials. In wet floodproofing scenarios where the walls and foundations are exposed to floodwaters, building components must be able to withstand hydrostatic forces. As the floodwaters recede the building will also have to dry out and requires adequate ventilation and pumps when the catch basin is lower than the ground elevation. This adaptation requires a lengthy cleaning process and drying time. All utilities and mechanical systems also require either elevation out of the flood risk area or dry floodproofing. Figure 4.21 offers an illustration of wet floodproofing a subgrade basement.

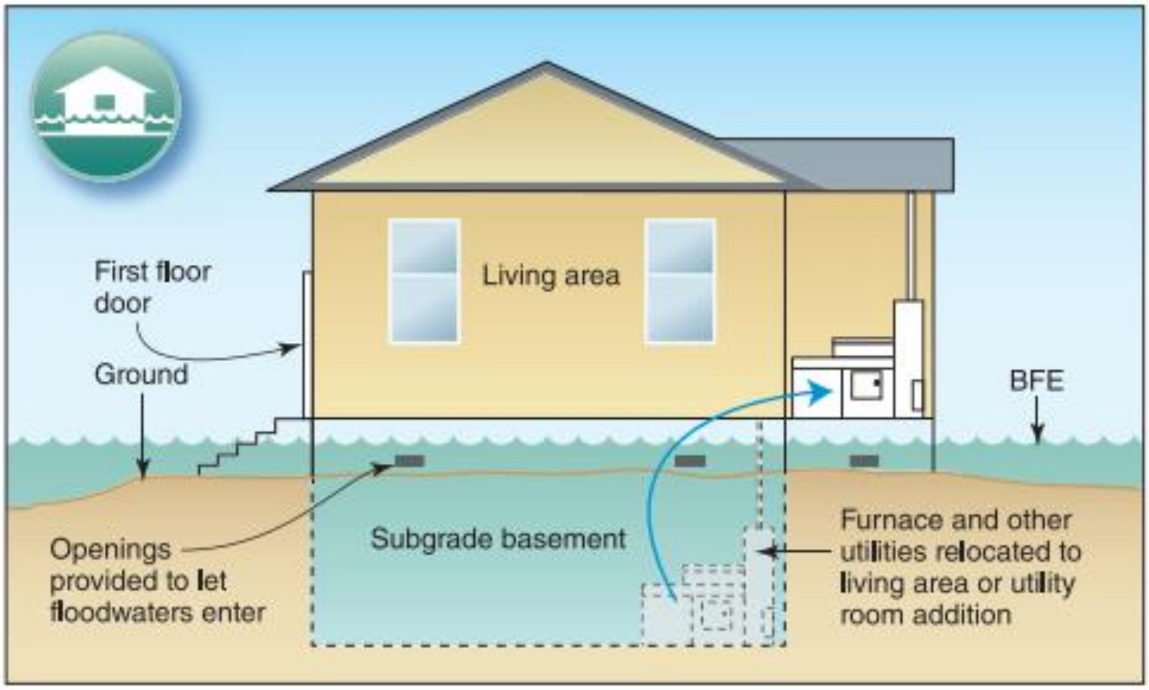


Figure 4.21 Example of a Home with Wet Floodproofed Subgrade Basement (FEMA 2014)

5.0 ADAPTATION ALTERNATIVES – POLICY, REGULATIONS, INCENTIVES

FEMA recognizes changes to local public policies, regulations and incentives as a necessary adaptation alternative when developing local mitigation strategies. The following selected policy alternatives are applicable to local government decision-making in St. Augustine and can benefit the preservation and adaptation of contributing and non-contributing properties in St. Augustine's National Register historic districts. The alternative approaches to public policy addressed below are divided into areas of community development, urban land use, building codes, environmental protection, incentives, and finance and all have potential for benefitting St. Augustine's historic properties and cultural resources.

5.1 Land Use Planning

5.1.1 Comprehensive Planning

St. Augustine's current comprehensive plan is for a period of 20 years. Florida law does not preclude a longer planning horizon should a local government choose to utilize a longer horizon.[20] This is important to St. Augustine as the City continues work on *Comprehensive Plan 2040: Mapping Our Future*. Planning for future conditions in the context of sea level rise may require a planning timeframe far enough out to model for climate impacts. A 20-year planning timeframe allows for informed decision making related to nearer-term flood risk, while a 50-year planning timeframe can better anticipate major infrastructure projects for the less certain timeframe tied to long-term sea level rise.

Noted Florida land use attorneys, Thomas Ruppert and Erin Deady, completed an analysis of provisions within municipal and county comprehensive plans which addressed climate impacts.[21] Ruppert and Deady's analysis evidenced that the most extensive planning for sea level rise in Florida is that undertaken by Miami-Dade County, Broward County, and the City of Fort Lauderdale. Similarities in the planning provisions between these jurisdictions include:

- Coordination of activities between the local government and other governmental units and with educational or non-profit institutions;
- Plans incorporate analyses of climate change and sea level rise impacts for current and future risk;
- Infrastructure decisions include sea level rise in the decision-making process, even if it meant future relocation of infrastructure (Fort Lauderdale and Miami-Dade County);
- Future development and density increases should be focused in the least vulnerable areas; and
- Incorporating criteria for identifying Adaptation Action Areas.

5.1.2 Adaptation Action Areas

The use of Adaptation Action Areas ("AAAs") is recommended for inclusion in a city's comprehensive plan. Florida statute references AAAs as follows: "At the option of the local government, develop an adaptation action area designation for those low-lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level." Local

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[20]Chassignet, E. P., Jones, J. W., Misra, V., & Obeysekera, J. (Eds.). (2017). Florida's Climate: Changes, Variations, & Impacts. Ruppert, Thomas, & Deady, Erin L. *Climate Change Impacts on Law and Policy in Florida*. p. 213 Gainesville, FL: Florida Climate Institute. https://doi.org/10.17125/fci2017

[21]Ibid. p. 216

governments that adopt an adaptation action area may consider policies within the coastal management element to improve resilience to coastal flooding resulting from high-tide events, storm surge, flash floods, stormwater runoff, and related impacts of sea-level rise. The enabling statute contemplates that a local government might designate a AAA "for the purpose of prioritizing funding for infrastructure needs and adaption planning."

The City of St. Augustine has identified the need to design Adaptation Action Areas for inclusion in the 2040 Comprehensive plan. The State of Florida's Model Comprehensive Plan for sea level rise adaptation recommends the following AAA subareas:

- Managed Relocation Zones – Areas where local government will prohibit coastal hard armoring, limit or prohibit rebuilding of damaged structures, and/or require the removal or relocation of structures that become inundated.
- Accommodation Zones – Areas where local governments will allow new development but may limit the intensity and density of new development, limit hard shoreline armoring, and require that structures be designed or retrofitted to be more resilient to flood impacts.
- Protection Zones – Areas with critical infrastructure and dense urban development, where coastal armoring will be allowed; local governments could require soft armoring techniques be employed where feasible.

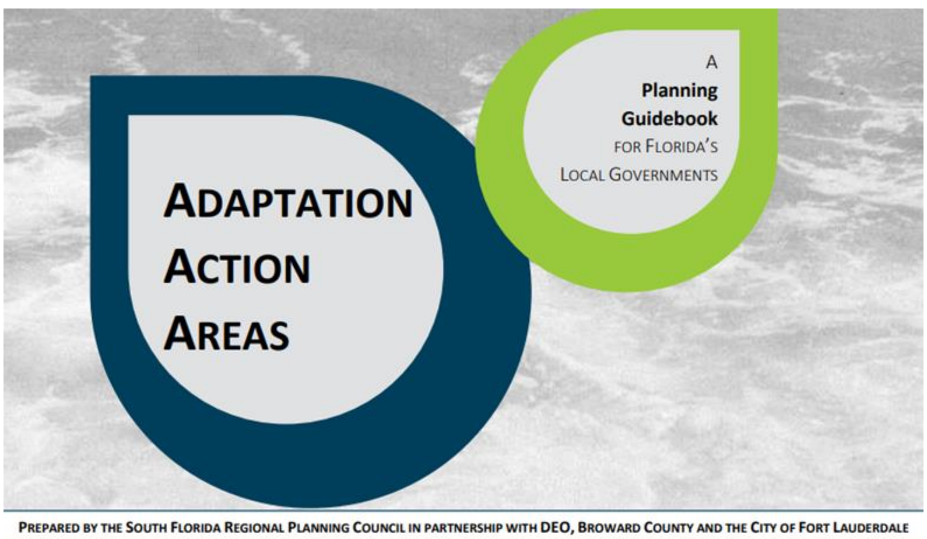

Figure 5.1 The Florida Department of Economic Opportunity (DEO) created this guidance to assist local governments in using AAAs to adapt to coastal flooding.

St. Augustine should also consider how capital investments are prioritized within AAAs. The City of Fort Lauderdale adopted a community investment plan in 2019 identifying 42 projects in their 17 AAAs. Each project was prioritized for funding based on those infrastructure improvements which would best reduce risks to vulnerable assets.[22]

St. Augustine has the flexibility to determine what benefits and regulations apply in a designated Adaptation Action Area and are not bound by the terms of the Florida AAA statute. However, the City is

[22] City of Fort Lauderdale. Adopted Community Investment Plan – Fiscal Years 2020 – 2024. p. 291.

bound by the enabling authority granted by the state of Florida to municipalities, including and specific to property taxing authority which is heavily regulated by the Florida Constitution and statutes.[23]

5.2 Zoning

5.2.1 Zoning Ordinance

In 2018, Norfolk updated its Zoning Ordinance designating a Coastal Resilience Overlay zone, Upland Resilience Overlay zone, and a Resilient Quotient System to implement the goals established by the Vision 2100 plan.

5.2.2 Overlay Zones

Overlay zones superimpose additional regulations on top of existing zones with special characteristics. This is often how historic districts are regulated within a city's planning ordinance. Overlay zones allow greater flexibility because they do not require the locality to disrupt existing zoning classifications. The City of Coral Gables uses overlay zones to protect "natural and cultural resources and environmentally sensitive lands such as wetlands, tideland, mangroves, natural forest communities, marine and wildlife habitats and such other areas or terrain value in its present state as a natural area."[24] AAAs are an overlay district for implementing sea level rise adaptation regulations and initiatives.

5.2.3 Downzoning

Downzoning of a large area due to flooding occurred in St. Tammany Parish, LA, after Hurricane Katrina. Previously zoned for residential or commercial development, flood-prone areas in St. Tammany Parish were down-zoned to lesser densities or rezoned for land uses more compatible with periodic flooding.[25] As a companion to downzoning, a City can increase allowable density in less vulnerable areas either through zoning updates or as part of a transfer of development rights program. It's important to note that such changes to the City's Zoning Code will require updates to other site-specific zoning regulations.

5.2.4 Setbacks and Buffers

In flood zones, setbacks require that development be set back a certain distance from a shoreline feature (high water mark, vegetative line, etc.). Buffers require landowners to leave portions of a property (such as existing wetlands) undeveloped, but they also support effective stormwater management, contribute to protecting adjacent properties from flooding, helping preserve landmark viewsheds, maintain existing ecosystems, and serving as alternatives to coastal hard armoring.[26] The City of St. Augustine should consider revising setbacks and/or buffer areas based on projected shoreline locations as estimated over the life of any new or proposed infrastructure or property improvement.

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[23] Reference email Thomas K. Ruppert, August 25, 2020.

[24] City of Coral Gables. Legal Considerations Surrounding Adaptation to the Threat of Sea Level Rise. (2015) p. 37.

[25] Krystle Macadangdang & Melissa Newomons, Sea Level Rise Ready: Model Comprehensive Plan Goals, Objectives and Policies, to Address Sea-Level Rise Impacts in Florida, (2010) https://www.law.ufl.edu/_pdf/academics/centersclinics/clinics/conservation/sea_level_rise.pdf

[26] Jessica Grannis, Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use (2011) http://www.georgetownclimate.org/adaptation/toolkits/adaptation-tool-kit-sealevel-rise-and-coastal-land-use/introduction.html?full.

5.2.5 Exactions

When enacted, this regulatory tool can require developers or landowners undertaking new development or substantial improvements to either pay a fee or cover costs associated with the following:

- Future emergency response and armoring;
- Mitigating natural resource impacts from armoring;
- Flood-proof infrastructure for proposed new development;
- Moving buildings or structures as they become inundated due to land loss;
- Construction of supporting infrastructure (i.e. sewer lines) above flood protection minimum requirements;
- Dedication of easements to preserve natural buffers or floodways in areas with historic or archaeological resources;[27]
- Restricting coastal hard-armoring and authorizing through permit conditions soft-armoring alternatives to protect against future flood risk.

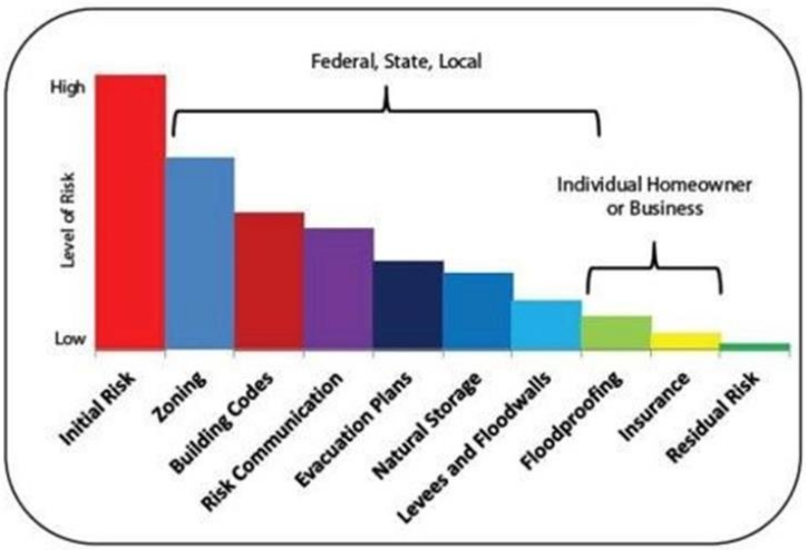

Figure 5.2 As municipalities enact regulations and create incentives to manage future storm events and flooding, the level of flood risk is reduced.

5.3 Resilience Planning

5.3.1 Resilience Planning Team

It is critical to have ongoing engagement between key City agencies and community stakeholders in both the planning and the implementation of adaptation strategies. By assembling City and community leaders and conducting regular meetings, the City can ensure coordination of planning efforts, mitigation projects, capital improvements, and public engagement activities. Participants should include representatives from the City Administration, City Commission, Public Information, Housing & Community Development,

[27] South Florida Regional Planning Council, Adaptation Action Areas: Policy Options for Adaptive Planning for Rising Sea Levels (2013) http://www.southeastfloridaclimatecompact.org/wpcontent/uploads/2014/09/final-report-aaa.pdf

natural and cultural resources, public health, transportation, public works, emergency management, tourism, economic development, business, civic and social equity groups.

5.3.2 Adaptation Plan

St. Augustine can consider crafting a stand-alone adaptation plan or strategy, with designated actions at pre-determined planning benchmarks. This adaptation plan can only be effective if it is developed with cross-sector buy-in with the update of other planning documents (i.e. local mitigation strategy, transportation plan, comprehensive plan, economic development plan). In 2017, St. Augustine undertook with support of the Florida Department of Economic Opportunity's Coastal Resilience Initiative, an adaptation planning process. This resulted not so much into a plan, but as a report with recommendations.[28] There are a number of references in that report to actions that could benefit the long-term adaptation of St. Augustine's historic districts and landmarks to a future of rising seas. Principally, the report recommends modifying the historic preservation comprehensive plan element to better contemplate the changing environmental circumstances that will impact the integrity of historic districts and archaeological resources. The report recommends that the historic preservation element "be revised through an organized decision-making process that will ensure that the allocation of resources toward preservation is consistent with public priorities and good technical practice."[29]

As to how a formal adaptation plan can be adopted by the City of St. Augustine, the City of Santa Cruz, CA adopted their Climate Adaptation Plan as an appendix to the City's 2018-2023 Local Hazard Mitigation Plan. This could be a consideration as St. Johns County updates its Local Mitigation Strategy.

5.3.3 Historic Resource Vulnerability Assessment and Adaptation Strategy

The City of Portsmouth issued a planning document in 2018 entitled "Preparing Portsmouth's Historic District for Sea Level Rise." Four strategy areas were selected for evaluation of the economic impact of flooding and sea-level rise on a variety of land uses and settings. Specific adaptation actions were evaluated for 18 historic sites based on the potential feasibility, effectiveness, cost, and implications to historic character for each action taken. Additionally, specific action items were called out for implementation as follows:

- Projects vulnerable to current or future shoreline flooding should be designed to meet 2050 sea-level projections. Those intended to be in place longer than 2050 should prepare an adaptive management plan to 2100
- Amend the Flood Plain District and/or Historic District overlay(s) to accommodate the elevation of historic structures in keeping with its surrounding neighborhood, *and to the extent possible*, consistent with the Secretary of the Interior's Standards for the Treatment of Historic Structures.
- When a variance is requested for substantial exterior renovations to a historic structure, require that the mechanical, electrical, and plumbing systems be relocated to appropriate elevations if interior renovations are proposed. In addition, require (wet or dry) floodproofing to the extent practicable while preserving the exterior of the historic structure.
- Add new design criteria to the consideration of historic rehabilitation proposals to include:
    - Accommodate (wet floodproofing), fortify (barriers, dry floodproofing), and relocate.

[28] Florida Community Resiliency Initiative Pilot Project Adaptation Plan for St. Augustine, Florida (May 2017)
[29] Ibid. p. ES-6.

    - Add a definition of Flood Risk Reduction Measures to the ordinance.
    - Identify exempted construction activities from the Certificate of Approval that might benefit from flood risk reduction measures.
    - Require flood risk reduction measures with proposed improvements to architectural elements, features, and utilities.
    - Amend the Historic District overlay to addresses the installation of temporary storm protective measures (e.g. temporary floodwalls, storm shutters, and barriers).
    - Amend the Historic District Guidelines Manual to include preferred adaptation strategies for historic buildings.
- Adopt a post-disaster recovery expedited review and permit procedure for historic structures considering the City's disaster recovery process and how any alterations of the structure may affect federal recovery funding (FEMA, HUD). Define work eligible and identify areas within the Historic District where expedited review would apply.
- Treat existing developments in projected high-risk flood areas as non-conforming structures and prohibit expansion or intensification of their use but allow ordinary maintenance and repair of damage up to no more than 50 percent of the building value.
- As new regulations are being developed, assess projects on a case-by-case basis to determine the public benefits, historic preservation opportunities, resilience to flooding, and capacity to adapt to flood projections at 2050 and 2100.
- Encourage identification of "critical facilities" in the Hazard Mitigation Plan to include resources of historical, cultural, and social value impacted by flooding, sea level rise, and coastal storms.

5.3.4 Cultural Resource Hazard Mitigation Plan

In 2019, the City of Annapolis updated its Natural Hazard Mitigation Plan to address various types of natural disasters prevalent to the region. The accelerating rate of sea level rise and the devastation realized in the aftermath of Hurricane Sandy created a sense of urgency in Annapolis for the development of a Cultural Resource Hazard Adaptation and Mitigation Plan (CRHMP). The CRHMP identifies and mitigates potential loss to historic resources associated with natural disasters, primarily threats from sea-level rise, subsidence, and flooding. By assessing the significance of cultural resources within the 100-year flood plain boundary and risk from flooding associated with those resources, planning for their preservation enables the City of Annapolis to better protect the architectural integrity of the Colonial Annapolis Landmark.[30]

5.3.5 Climate Action Plan

The City of Pensacola appointed a Climate Mitigation and Adaptation Task Force to develop recommendations for specific actions to counter the threats and impacts of climate change and extreme weather.[31] The recommendations as follows are all action items for consideration by St. Augustine.

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[30] Weather It Together: A Cultural Resource Hazard Mitigation Plan for the City of Annapolis. (April 2018). **https://www.annapolis.gov/DocumentCenter/View/10064/Consolidated-CRHMP-Report-April-2018**

[31] Climate Action Recommendations A Blueprint for Addressing Climate Change at the Municipal Level. City of Pensacola (2018) https://www.cityofpensacola.com/DocumentCenter/View/15491/Climate-Mitigation-and-Adaptation-Task-Force-Report-PDF

- Develop emergency management plans and Federal Emergency Management Agency (FEMA) all-hazard mitigation plans that include climate change projections and adaptation strategies.
- Utilize local authority to protect open space, wetlands, and riparian buffers to increase resilience to extreme weather events.
- Incorporate Better Site Design, Low Impact Development (LID) and green infrastructure principles into local codes and planning decisions.
- Incentivize restoration of living shorelines instead of hardening (stone, wood, and concrete seawalls).
- Use a watershed-level rather than site level approach to manage stormwater runoff and flooding to reduce impacts of flooding from stormwater downstream and make this a multi-jurisdictional approach.
- Develop permeable surfaces and green incentives for residents and businesses throughout the City.
- Encourage stormwater fee reduction based on beneficial pervious surface area and development incentives during the process of applying for development permits for zoning upgrades.
- Explore grant opportunities to provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices.
- Develop a rebate program or provide installation financing to provide funding, tax credits or reimbursements to property owners who install specific flood reduction practices
- Promote an awards and recognition program that would provide marketing opportunities and public outreach for exemplary projects.
- Identify areas of frequent "nuisance flooding" and create a public database as a disincentive to construct in historically and newly flooded areas.
- Partner with innovative construction projects to showcase the changes they incorporate in new construction to mitigate for flooding and other climate impacts.

5.4 Other Local Government Planning Tools

5.4.1 Capital Improvement Plans

The City of San Francisco adopted guidance for incorporating sea level rise into capital planning processes and design standards. The document presents a framework for considering sea level rise in the context of new construction, capital improvements, and maintenance projects.

5.4.2 Resilience Design Guidelines

New York City's Climate Resiliency Design Guidelines state that the City will design using the best available data for future conditions. This set of guidelines provide step by step instructions on how to utilize historical climate data, supported and enhanced with new regional specific forward-looking data in the design of capital improvements and the design of City facilities.

5.4.3 Disaster Plan

Baltimore's Disaster Preparedness and Planning Project (DP3) recommends using new building code regulations to enhance the resilience of new development and redevelopment to sea-level rise and using green stormwater management practices and urban tree canopy to manage stormwater and reduce urban heat islands.

5.5 Regulatory Compliance

5.5.1 New Construction / Substantial Improvement

5.5.1.1 Green infrastructure (GI) for New Development

Unlike conventional stormwater infrastructure, GI can create benefits beyond flood mitigation, including protecting ecosystems by removing pollutants, beautifying a neighborhood, and, potentially, enabling the capture and use of stormwater for other purposes. Examples of GI include rain gardens, permeable pavement, and cisterns. The City of Berkeley requires applicable private development to include GI in new construction. Voter-approved bond funding enables the City to install GI projects throughout the city and update their comprehensive Stormwater Master Plan.[32]

Figure 5.3 Lake Maria Sanchez provides an opportunity for St. Augustine to incorporate nature-based mitigation strategies into its long-term planning for climate impacts and sea level rise.

5.5.1.2 Building Occupancy Resumption Program (BORP)

The City of St. Augustine can encourage business owners to participate in a program such as San Francisco's BORP which permits owners of buildings to hire qualified structural engineers to create facility-specific post-disaster inspection plans. These engineers are then deputized as City inspectors for the assessment of these buildings in the event of a disaster, allowing rapid reoccupancy of the building. This would be similar to a recovery triage team and could include experts in historic rehabilitation.[33]

[32] City of Berkeley Draft Green Infrastructure Plan. (May 2019) file:///C:/Users/Lisa/Downloads/2019-06-18%20WS%20Item%2001%20City%20of%20Berkeley%20Green%20Infrastructure.pdf

[33] Building Occupancy Resumption Program: Guidelines for Engineers. City of San Francisco. https://sfdbi.org/borp

5.5.1.3 Climate Conditions Checklist

The Boston Planning & Development Agency, the City of Boston's planning and economic development agency, is tasked with overseeing development in Boston. The agency developed a checklist for developers and property owners to complete requiring all new development and major redevelopment projects to consider the impacts of future climate conditions, over the expected life of their project. Applicants must describe planning, design, and / or construction strategies that will be employed to avoid, eliminate, or mitigate any adverse impacts.[34]

5.5.1.4 No-Adverse-Impact Certification

To reduce Brevard, North Carolina's vulnerability to flooding, the City requires developers to secure a no-adverse-impact certification for construction in flood plains to ensure that development projects do not worsen flood risk for other property owners. This regulation has resulted in lower flood insurance premiums for residents.[35]

5.5.1.5 Nature-Based Resilience

Fairfax County, VA Wetlands Board has adopted a living-shorelines first policy. Applicants must consider a design that maintains or creates a living shoreline for shoreline stabilization. A permit for armoring will not be issued unless the landowner can overcome a presumption that a living shoreline will not achieve shoreline stabilization goals.

5.6 Building Codes

Many local governments are revising building codes and requiring increased resiliency for new development and redevelopment. In Florida, the Southeast Florida Regional Planning Council (SERPC) recommends that local governments require the following within a designated AAA:

- Two or more feet of "freeboard" above FEMA's base flood elevation level (BFE) for structures located in tidally influenced floodplains;
- Foundations that are more resilient to erosion and wave impacts;
- Flood-resilient construction materials;
- New development and redevelopment projects maintain the form and function of natural resources, such as incorporating vegetative buffers; and
- Delineation of the minimum technical and safety requirements for design and construction of structures vulnerable to sea level rise.[36]

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[34] Boston Planning & Development Agency: Climate Resiliency Guidance and Checklist. (October 2017) http://www.bostonplans.org/getattachment/5d668310-ffd1-4104-98fa-eef30424a9b3

[35] Mitigation Matters: Policy Solutions to Reduce Local Flood Risk. Pew Charitable Trusts. (November 2019) https://www.pewtrusts.org/-/media/assets/2019/11/north_carolina_brevard_brief_final.pdf

[36] Southeast Florida Regional Climate Change Compact Counties: A Region Responds to a Changing Climate, Regional Climate Action Plan, Appendix B. (Oct. 2012) http://www.southeastfloridaclimatecompact.org/wpcontent/uploads/2014/09/regional-climate-action-plan-final-ada-compliant.pdf

5.6.1 *Elevation*

Freeboard initiatives and elevation requirements generally are a critical part of property owners' efforts to adapt to sea level rise and increased storm surge. Elevation may occur either by elevating buildings or by elevating, through the use of fill, the ground level of entire areas, while also raising roads and other infrastructure.[37] Elevation can save residents money on their flood insurance premiums as both FEMA through the National Flood Insurance Program (NFIP) and private insurance companies look favorably on elevation as a resilient design mitigation strategy. Additionally, FEMA can consider the elevation of buildings to improve a city's Community Rating System ("CRS") score, which benefits all property owners in the city's flood plain area.

5.7 Historic Rehabilitation

5.7.1 *Excavation*

In Seaside, CA the City requires a Phase I Archaeological Study be performed by a registered professional archaeologist to determine whether significant archaeological resources may be present when excavation activities are proposed. Mitigations are required as a condition of development where it would adversely impact any archaeological resources. This policy, codified in Seaside's *Local Coastal Program Land Use Plan*, is specific to the Coastal Zone area. In St. Augustine, this same analysis could be required either in an adopted Adaptation Action Area or within flood prone areas of locally designated historic districts. [38]

5.7.2 *Elevation Procedures*

The City of Charleston publishes on the City's website a flow chart to explain the process for consideration of a property for elevation. This process flow chart specifically calls out the variance process for historic buildings and consideration for historic preservation guidelines.[39]

5.7.3 *Elevation Design Guidelines*

The City of Charleston Board of Architectural Review (BAR) played a critical role in the development and adoption in July 2019 of a set of design guidelines for elevating historic buildings. The City concluded the best policy for the long-term preservation of historic structures was to support their need to elevate to the necessary FEMA requirement and to that end the BAR and City staff engaged the public, architects, engineers, contractors, and preservationists to develop a set of guidelines to ensure elevations were done as sensitively and appropriately as possible. The resulting document focuses on four key areas to guide elevation projects for historic buildings: considerations for streetscape/context, site design, foundation design, and architecture/preservation.[40]

Other historic districts which have adopted design guidelines for adaptation include: Boston, (*Resilient, Historic Buildings Design Guide*, 2018), Baltimore (*Fells Point Flood Mitigation Guidelines*, 2018), Somers Point, NJ (*Design Guidelines for the Somers Point Historic Preservation District*, 2014), Schenectady, NY

[37] Thomas Ruppert, Esq., Florida Sea Grant, Elevation. https://www.flseagrant.org/wp-content/uploads/2012/01/Elevation.pdf

[38] City of Seaside Local Coastal Program Land Use Plan. (June 2013) http://seasidecampustown.com/DocumentCenter/View/380/Land-Use-Plan-PDF?bidId=

[39] Elevation Procedures. City of Charleston. https://www.charleston-sc.gov/2333/Elevating-Your-Structure

[40] Design Guidelines for Elevating Historic Buildings. Charleston Architectural Review Board. (July 2019) https://www.charleston-sc.gov/DocumentCenter/View/18518/BAR-Elevation-Design?bidId=

(*Stockade Historic District Flood Mitigation Guidelines*, 2017), Georgetown, NC (*Georgetown Historic District Design Review Standards*, 2017), Newport, RI (*Policy Statement and Design Guidelines for Elevating Historic Buildings,* 2020).[41]

5.8 Public Awareness and Education

5.8.1 StoryMaps

The City of Charleston, SC is using an online communication tool, the ESRI StoryMap to share progress and planning for infrastructure improvement projects in neighborhoods throughout the city. The Department of Stormwater Management coordinates Stormwater related efforts with other City Departments and Local Governments towards the shared goal of improving the drainage system and water quality for residents, businesses, and visitors.[42]

Arlington County, VA is using the StoryMap tool to engage the public by sharing the history of flooding in this historic community and outline steps local government is taking to assess and reduce risk.[43]

Portsmouth, NH produced a Historic Vulnerability Assessment StoryMap with a set of adaptation actions illustrating a range of approaches for consideration by the city. Each approach discusses feasibility, potential effectiveness, cost, and impact on historic character.[44]

Community Resiliency by Design is a dynamic StoryMap for Cape Cod Massachusetts that addresses housing resilience for what the local government termed "missing middle housing." Relevant to historic preservation, the StoryMap discusses the design character of existing neighborhoods, looking at ways the needed housing units can be incorporated while protect and enhancing the community's rich historic character acknowledged as a driver for the region's economy.[45]

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[41] The following design guidelines offer either supplemental or stand alone guidance for consideration by historic preservation boards and commissions in reviewing proposed flood mitigation designs.
Boston, MA. https://www.boston.gov/sites/default/files/imce-uploads/2018-10/resilient_historic_design_guide_updated.pdf
Baltimore, MD. https://chap.baltimorecity.gov/sites/default/files/2018-12_FellsPointFlood_FINAL.PDF
Somers Point, NJ. http://www.somerspointgov.org/documents/DesignStandardsHistoricPreservationDistrict-FinalReport09212014.pdf
Schenectady, NY. http://www.somerspointgov.org/documents/DesignStandardsHistoricPreservationDistrict-FinalReport09212014.pdf
Georgetown, SC. https://www.georgetownsc.gov/download/Georgetown-Design-Standards-2_4_18.pdf
Newport, RI. https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Departments/Planning%20Zoning%20Inspections/Historic%20Preservation/HDC-Design-Guidelines-for-Elevating-Historic-Buildings-Jan-21-2020-APPROVED.pdf

[42] Major Infrastructure Projects: City of Charleston, South Carolina http://charleston-sc.maps.arcgis.com/apps/MapJournal/index.html?appid=ead1e4ba1fba4ba1b260520f654e9710

[43] A Flood Resilient Arlington Story Map: Challenges and the Path Forward. Arlington County, VA. https://storymaps.arcgis.com/stories/d0bb906589d144e5939281b60160b583

[44] Historic Properties Climate Change Vulnerability. City of Portsmouth. https://portsmouthnh.maps.arcgis.com/apps/MapJournal/index.html?appid=302cb9580dfb4dddbd66dbb39055a88e

[45]Community Resiliency by Design. Cape Cod Commission & Union Studio (January 2020) https://storymaps.arcgis.com/stories/75d9538dced244fca275db7dc4add9d4

The City of Annapolis's *Weather It Together* StoryMap*, Landmark at Risk*, was created in collaboration with a private planning and engineering firm Michael Baker International to develop an interactive resource highlighting city efforts to address local climate-change impacts through cultural resource hazard mitigation planning. It was designed as a go-to resource, not only for the citizens of Annapolis, but for other communities facing the challenges of climate change.[46]

5.8.2 Public Tours

The City of Milwaukee provides tours of their sewerage district building, which includes innovative stormwater flood management tools such as a recreated buffer, pervious pavement, a green roof, and new drainage systems, so that property owners can learn the benefits of adapting buildings for flood resilience.

5.9 Buyouts / Relocation

In 2014 the Lincoln Institute of Land Policy addressed a series of public policy issues relating to land use, land markets, and property taxation. In an in-depth study on buyouts in the New York metropolitan region following Hurricanes Irene and Sandy, the research team completed a detailed study of buyout programs and developed a quantitative analysis looking specifically at five case studies of the fiscal impact of buyouts. The below recommendations were authored to improve the effectiveness of and participation in buyout programs and are applicable to communities across the country.[47]

5.9.1 Lincoln Institute Tips for Local Buyout Programs

- Design the buyout program as a long-term adaptation strategy for flood risk, not as short-term recovery. Have long-term goals and strategies, and viable time frames for implementation.
- Consider the long-term interest of buyout participants, particularly those with limited resources.
- Ensure that what follows supports the shared desire of the local government and the community to maintain the tax base while protecting economic and social stability.
- Test pilot buyout strategies than can be executed incrementally, over time, and outside the context of the disaster.
- Consider establishing land trusts to reduce flood risk and creating regulator mechanisms to refuse sales of at-risk properties.
- Set aside taxes in a dedicated open-space fund to acquire high-risk properties.
- Identify priority acquisition zones based on high levels of physical and social vulnerability, paired with input from community residents. Codify these acquisition areas into local mitigation strategy.
- Develop long-term adaptation plans that integrate hazard mitigation with social resiliency, physical adaptation and preservation, economic development, and environmental conservation.

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[46] Landmark at Risk: Protecting the Historic Seaport of Annapolis, MD. https://annapolis.maps.arcgis.com/apps/MapSeries/index.html?appid=a8e43f5101d14748a037603e2a120520&folderid=70b9f5d6e4f54a2bae08ad3becbce954

[47] Buy-In for Buyouts: The Case for Managed Retreat from Flood Zones. Lincoln Institute. (2016) https://www.lincolninst.edu/sites/default/files/pubfiles/buy-in-for-buyouts-full.pdf

- Provide information to homeowners so they understand the full range of available financial assistance and compensation.
- Provide incentives for entire neighborhood blocks to participate encouraging relocation to a new neighborhood to foster long-term stability for the residents and community.

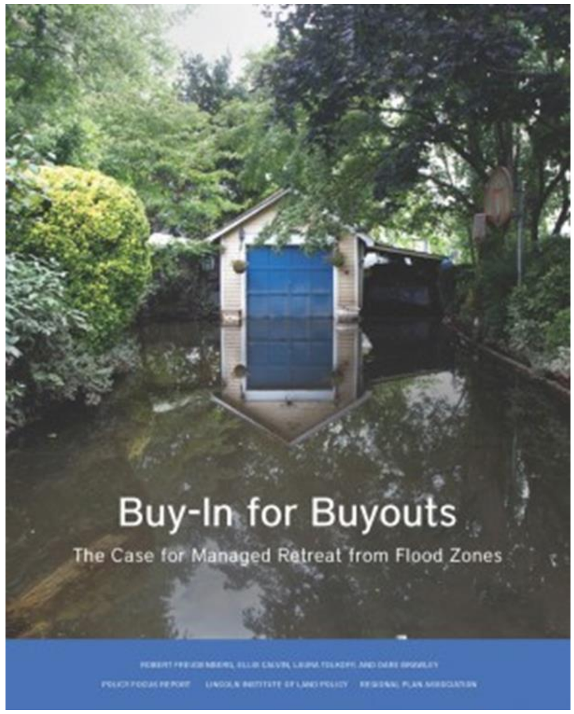

Figure 5.4 Buy-In for Buyouts: The Case for Managed Retreat from Flood Zones, by Robert Freudenberg, Ellis Calvin, Laura Tolkoff, Dare Brawley

5.9.2 Community-Driven Buyout Program

In Oakwood Beach, NY post-disaster response activity included hosting a disaster response and aid community meeting with review of alternatives for assistance, one of which was a buyout program. Community members established the Oakwood Beach Buyout Committee and used that entity to conduct outreach and provided details about a buyout program, then collected signatures regarding interest in the program. The Committee surveyed residents about where they would feel save living to generate maps of priority acquisition areas. Green dot maps were created to show areas targeted for buyouts and no future redevelopment. A fiscal impact analysis was completed for the buyout area to determine avoided damages and dislocation costs, avoided flood insurance premiums, cost of removing properties, losses in property taxes and lost taxes as percentage of the city budget. The result was 170 of 184 property owners applied for this community-driven buyout program.[48]

5.9.3 Deed Restrictions

The Mastic Beach and Smith Point of Shirley communities in New York responded to the devastation of Hurricane Sandy by developing a vision to drive their recovery efforts. Included in that vision is the desire to "develop a sustainable local economy that is built on our natural and cultural resources. We will utilize

[48] Anna A. McGinty. Home Buyouts: One Adaptation Approach to Rising Sea Levels. (May 2017)

our natural and cultural resources as economic assets to retain and attract young people, visitors, and appropriate businesses [AND] protect our housing stock, infrastructure, and other critical assets from future storms and the effects of climate change." Within this vision was the establishment of a program whereby property owners redeveloped with deed restrictions to allow for future acquisition of properties for repurposing as wetlands and open space in perpetuity. This allows the area's future return to its natural floodplain functions and protects a densely developed residential area to the north. The Mastic/Shirley area is adjacent to the natural shoreline of the William Floyd Estate, a National Register of Historic Places 600-acre site owned by the U.S. National Park Service, and part of the Fire Island National Seashore.[49]

5.9.4 Bluebelt Program

Bluebelt is a Floodplain Management initiative developed in Charleston, SC to guide strategic flood mitigation decisions to reduce the risk of flood hazards to life and property by promoting and restoring natural floodplain functions. These projects can provide additional community benefits such as recreation, habitat restoration, and improved water quality. Projects include property acquisition and demolition, relocation, and easement acquisition.[50]

5.9.5 Relocating within the City

In Cherokee and Ames County, Iowa, property owners were offered pre-flood market value of their homes and additional incentives if they chose to relocate within the city. The jurisdictions worked to secure relocation areas within the municipal boundaries and created buffers of green space.

5.10 Market-Based Incentives

To incentivize property owners in flood prone communities to adapt their properties to future flooding conditions, many local and state governments provide financial incentives for private investment. While grant funding is certainly one form of financial assistance, market-based incentives for flood-risk management can offer a carrot along with the regulatory stick that often is the result of floodplain management ordinances. Included in these market-based incentives are tax relief, subsidies, flood insurance, and transferable development rights, among others. When combined with regulatory requirements, these incentives can help local officials with guiding adaptation in flood-prone areas.

5.10.1 Mitigation Rebates

South Holland, IL offers rebates to help residents afford mitigation projects that reduce risk to their properties. The most common types of flood control projects include preventive maintenance to keep water out of residences. Foundation repairs and drain-tile systems, the addition of downspouts and diversion of downspout water, flood walls and disconnection of sump pumps from sanitary sewers are all qualified projects. As well, local officials recommend property owners allow some portion of their properties to become vegetated swales to absorb more rainwater and slow the rate of runoff. With a population of just 8,200, over 1,170 households have used the rebates to install $2.9 million in flood-proofing projects, with more than $800,000 rebated to residents.[51]

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[49] USDA Continues Commitment to Hurricane Sandy Recovery. https://www.usda.gov/media/press-releases/2014/08/25/usda-continues-commitment-hurricane-sandy-recovery

[50] Flood Mitgation Resources: *Bluebelt* Program. Charleston, SC. https://charleston-sc.gov/2386/Flood-Mitigation-Resources

[51] How South Holland, Illinois is helping residents protect their properties against flooding. (May 2020)

5.10.2 Tax Incentives

New Hampshire established a coastal resilience incentive zone (CRIZ) specifically for historic municipalities to use to assist vulnerable property owners address storm surge, sea-level rise, and extreme precipitation. Portsmouth, NH allows tax relief for resilience measures such as elevation and free-board renovations, elevation of mechanicals, construction of resilient natural features, enhancement or creation of tidal marshes, elevation of private driveways and sidewalks, construction or enlargement of private culverts and movement of property to higher elevation. Other relief allowed by the State includes acquisition of preservation or water control easements and tax increment financing districts. Funding is supported through a capital reserve fund or a town-created trust fund.[52]

5.10.3 Public-Private Partnerships ("P3s")

P3s are contractual arrangements between governmental and private entities under which the private entities assume financing and delivery of capital improvement projects in exchange for revenue-sharing opportunities and/or completion bonuses. In 2013, a new Florida statute created the opportunity for local governments to utilize public-private partnerships to finance projects that "predominantly [serve] public purposes." For example, the private entity could pay for the design, construction, and/or operation of a flood adaptation project and, in return, receive revenues that might be generated to realize a return on its investment. In this regard, the statute authorizes private entities to impose fees on the public for use of projects or facilities funded in this way.[53]

5.10.4 Reduced permit fees

Some communities reduce permit application fees for new development and redevelopment within vulnerable areas that incorporate conservation features and flood protection measures above and beyond the minimum requirements in the building code.[54]

5.10.5 Business tax credits

Providing business tax credits to businesses for relocating from the coastal areas to infill development areas upland is another market-based incentive.

5.10.6 Purchase of Development Rights and Transferrable Development Rights

Virginia Beach is using a Purchase of Development Rights (PDR) and Transferrable Development Rights program to allow landowners in high-risk areas to transfer their development rights to protected or higher ground areas.

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https://www.efficientgov.com/emergency-management/articles/how-south-holland-illinois-is-helping-residents-protect-their-properties-against-flooding-R33m8FZtequy72VC/

[52]Chapter 79-E. Community Revitalization Tax Relief Incentive. 79-E:4-a Coastal Resilience Incentive Zone. http://www.gencourt.state.nh.us/rsa/html/v/79-e/79-e-mrg.htm

[53] Brian M. Rowlson, Public Private Partnerships: The Future of Public Construction in Florida?, 86 FLA. B.J. 36 (July/August 2012).

[54] *Adaptation Action Areas: Policy Options for Adaptive Planning for Rising Sea Levels*. South Florida Regional Planning Council (2013). p. 18

5.11 Public Funding Sources

5.11.1 FEMA Pre-Disaster Mitigation Program

This program aids states and local governments in implementing sustained pre-disaster natural hazard mitigation programs to reduce the overall risk to people and structures from future hazardous events, while also reducing the likelihood of reliance on federal funding in future disaster scenarios. These funds can be used for cultural resource vulnerability assessments, adaptation and recovery planning, hazard mitigation planning and other preparedness activities. It is highly recommended that local and state emergency management agencies serve as collaborators in these efforts.[55]

Figure 5.5 Local Mitigation Projects Funded in 2019 by FEMA through the Pre-Disaster Mitigation Program

5.12 Florida's Public Financing Authority for Local Government

5.12.1 Ad Valorem Taxes and Municipal Service Taxing Units

Florida statute provides a local government the power to "[e]stablish, and subsequently merge or abolish . . . municipal service taxing . . . units for any part or all of the unincorporated area of the county." The governing body may also "[l]evy and collect taxes, both for county purposes and for the providing of municipal services within any municipal service taxing unit . . . ; borrow and expend money; and issue bonds, revenue certificates, and other obligations of indebtedness."

The legislature has determined that protecting Florida beaches is in the public interest and allows county and state funds to be used "since local beach communities derive the primary benefits from the presence of adequate beaches," thus making MSTUs a plausible source for local SLR adaptation. This court-tested authority has allowed the creation of MSTUs as a taxing tool to provide municipal services for municipal purposes without voter approval. This allows the county government to use taxes for any government function meant to benefit the citizenry, including sea-level rise adaptation.[56]

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[55] FEMA Pre-Disaster Mitigation Program. https://www.fema.gov/pre-disaster-mitigation-grant-program

[56] See FLA. CONST. art. VII, § 9; Gilreath v. Gen. Elec. Co., 751 So. 2d 705, 707 (Fla. 5th Dist. App. 2000). Sarasota Cnty. v. Sarasota Church of Christ, Inc., 667 So. 2d 180, 183 (Fla. 1995).

Another benefit of ad valorem taxes and MSTUs is there is no requirement for any direct, special benefit to the real property from which the tax is levied, meaning that a local government may justify the levy in much broader applications by tying it to benefits to real property, citizens, or the county as a whole.

However, MSTUs can only be established by county government, hence an alternative option for St. Augustine is the establishment of a Municipal Service Benefit Unit.

Figure 5.6 Special assessments applied citywide benefit not just property owners in the most vulnerable flood hazard areas, but also those who benefit from St. Augustine's heritage tourist-based economy.

5.12.2 Special Assessments & Municipal Service Benefit Units (MSBU)

Municipalities and counties have statutory authority to levy special assessments and are given discretion when determining improvement projects and their costs. Florida statute allows for a municipality to levy and collect special assessments to fund capital improvements and municipal services, including, but not limited to, fire protection, emergency medical services, garbage disposal, sewer improvement, street improvement, and parking facilities so long as the assessed property derives a direct benefit from the service provide and the assessment is fairly apportioned among properties that receive the benefit.
In planning for sea-level rise special benefits could be realized for installation of a new drainage system for an entire area, but the system would offer the greatest benefit to low-lying properties, hence the assessment could be based on the elevation of any given property.

5.12.3 Local Option Tourist Development Tax

The "Local Option Tourist Development Act" authorizes a county to impose a tax on short-term rentals or accommodations within the county with tax proceeds to be used only for the purposes identified in the statute. Specifically, the funds are to be used "[t]o finance beach park facilities or beach improvement, maintenance, renourishment, restoration, and erosion control." It appears the use is narrowly defined and may not serve as a relevant revenue source for adapting St. Augustine's historic neighborhoods to a future of sea-level rise.

5.12.4 Stormwater & Drainage Fees

Local governments can create a stormwater utility and adopt stormwater utility fees to plan, construct, operate, and maintain stormwater systems or create one or more stormwater management system benefit areas. If a municipality decides to create a fee-based stormwater utility, the fee should be based on the square footage of impervious cover on a developed parcel of land within the utility area. The fees raised by stormwater utilities can be set high, as the bar is "enough to meet the system's capital requirements, as well as to defray operating expenses." St. Augustine should consider if the stormwater fee is sufficient to address future capital needs. Funds raised now will be needed when adaptation strategies for stormwater and drainage are scaled to future conditions.

5.12.5 Special Districts

Dependent special districts are those that are governed by a single governing body (i.e. city or county) while an independent special district is defined as including more than one county unless the district lies wholly within the boundaries of a single municipality." This special purpose district designation allows for assessments up to the millage cap allotted by the legislature. Exceeding that cap requires a referendum.

5.12.6 Local Government Infrastructure Surtax

This option allows for a county to levy a 0.5 or 1.0 percent tax pursuant to an ordinance if there is a majority vote of the electors in a referendum. The ballot of this referendum must include a general description of the project to be funded by the surtax. The funds levied by this tax may be used to "finance, plan, and construct infrastructure" and to "acquire land for . . . protection of natural resources."[57]

5.12.7 Developmental Impact Fees

Local government can impose conditions when issuing permits for new development or substantial redevelopment of existing structures. These "impact fees" offset costs associated with the development, such as infrastructure. These fees can serve as funding for City infrastructure projects relating to sea level rise. For example, the City might require a developer to pay a fee to cover the cost of flood-proofing infrastructure that services a new or redeveloped property.[58]

5.12.8 Endowment

A municipality may establish an endowed fund for the acceptance of private donations and voluntary proffers from developers. The funds are placed into an interest-bearing trust fund to be used for sea level rise adaptation efforts (and perhaps for helping residents in need of adaptation assistance), similar to a municipal workforce housing trust fund program.

5.12.9 Municipal Bonds

Issuing bonds can be another option to finance capital improvement projects that address sea level rise. Municipal bond types include: (1) general obligation bonds secured by the credit and taxing power of the municipality; (2) ad valorem bonds secured by the proceeds of taxes levied on real and tangible personal property; (3) revenue bonds payable from revenues derived from sources other than ad valorem taxes;

[57] Thomas Ruppert & Alex Stewart, Sea-Level Rise Adaptation Financing at the Local Level in Florida (Sept. 2015)
[58] Ibid. p. 24

and (4) improvement bonds payable solely from the proceeds of special assessments levied for an assessable project.[59]

5.12.10 Municipal Risk Financing

The City may also consider whether insurance or other risk management tools could help in planning to adapt to future conditions. These tools include reserve funds, catastrophe bonds, or reinsurance as part of a local government's overall risk financing strategy. This financing package could help manage financial exposure to major storm events exacerbated by the effects of sea level rise and climate change.

6.0 DEVELOPMENT OF STORYMAP WEBSITE

City-wide vulnerability assessments, adaptation strategies, and mitigation planning for flooding and sea level rise continue to evolve and are a valuable source of information for the City's policymakers and property owners. A major component of this project includes an educational website studying the impacts from the previous flooding events and the future perils of sea level rise on the City's historic resources. The website delivers the information from the previous sections of this report, distilled into four sections (Economic, Flood Mitigation, Policies, and Resources) dedicated to the most significant findings. The educational tool is designed to be adaptable to changing conditions as well as updates in policy recommendations and will be publicly available at this link: *https://arcg.is/1abKiO*.

This website is published via Esri StoryMap, an online platform that allows the integration of maps as a piece of the overall storytelling narrative. This tool will allow the City to create awareness and communicate the economic importance of its cultural resources while demonstrating the hazards they currently face or will come against in the future.

[59] Ibid. p. 18

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Appendix A
Glossary of Terms

Glossary of Terms

The following are provided for reference to aid in the general comprehension of terms, phrases, entities, and resources used in this publication. They do not necessarily constitute legal definitions that are adopted by the City of St. Augustine.

1-percent annual chance floodplain: This is the boundary of the flood that has a 1-percent chance of being equaled or exceeded in any given year. Also known as the 100-year floodplain.

1-percent annual chance water-surface elevation: The height, in relation to the National Geodetic Vertical Datum of 1929 (or other datum, where specified), of the flood having a 1-percent chance of being equaled or exceeded in any given flood year (also known as the 100-year flood or the base flood).

100-year flood: The flood having a 1-percent chance of being equaled or exceeded in any given year; also known as the base flood. The 1-percent annual chance flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on an NFIP map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

100-year floodplain: This is the boundary of the flood that has a 1-percent chance of being equaled or exceeded in any given year. Officially termed the 1-percent annual chance floodplain.

500-year floodplain: This is the boundary of the flood that has a 0.2-percent chance of being equaled or exceeded in any given year. Officially termed the 0.2-percent annual chance floodplain.

Adaptation Treatments: As defined by the National Park Service *Guidelines on Flood Adaptation for Rehabilitation Historic Buildings,* these measures include: planning and assessment for flood risk reduction, temporary protective measures, site and landscape adaptations, protect utilities, dry floodproofing, wet floodproofing, fill the basement, elevate the building on a new foundation, elevate the interior structure, abandon the first story, move the historic building.

Alternative Use/Adaptive Use or Reuse: The process of adapting old structures and sites for new purposes.

Archaeology: The study of the ancient and recent human past through material remains. It is a subfield of anthropology, the study of all human culture. Archaeology analyzes the physical remains of the past in pursuit of a broad and comprehensive understanding of human culture.

Architectural Guidelines for Historic Preservation (AGHP): Document used to review, direct and regulate rehabilitation and maintenance, new construction and demolitions in the locally designated historic preservation zoning districts. The purpose of historic preservation in general, and of the architectural guidelines in particular is to protect and preserve the rich architectural heritage and the visual public character of St. Augustine.

Base Flood Elevation (BFE): The height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the Flood Insurance Study report, or depth of the base flood, usually in feet, above the ground surface.

Base Flood: The flood having a 1-percent chance of being equaled or exceeded in any given year; also known as the 100-year flood. The base flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on an NFIP map has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage.

Contributing Property: A building, site, structure or object which adds to the historical architectural qualities, historic associations or archaeological values for which a district is significant because (a) it was present during the period of significance of the district and possesses historic integrity reflecting its character at that time; (b) is capable of yielding important information about the period; or (c) it independently meets the National Register of Historic Places criteria for evaluation.

Critical Infrastructure: Systems and assets, whether physical or virtual, so vital that the incapacity or destruction of such may have a debilitating impact on the security, economy, public health or safety, environment, or any combination of these matters, across any local, State, Tribal and Federal jurisdiction.

Cultural or Historic Resource: Any prehistoric or historic district, site, building, object or other real or personal property of historical, architectural or archaeological value. The properties may include, but are not limited to, monuments, memorials, Indian habitations, ceremonial sites, abandoned settlements, sunken or abandoned ships, engineering works, treasure troves, artifacts or other objects with intrinsic historical or archaeological value, or any part thereof relating to the history, government and culture of the city, the state or the United States of America.

Design Flood Elevation (DFE): The elevation of the design flood relative to the datum specified on the community's FIRM. The design flood is associated with the greater of the area subject to the base flood or the area designated as a flood hazard area on a community flood hazard map. Communities may designate a design flood (or DFE) in order to regulate based on a flood of record, to account for future increases in flood levels based on upland development, or to incorporate freeboard.

Design Standards for Entry Corridors: Document(s) used to review, direct and regulate site improvements, rehabilitation, maintenance, new construction and demolition in the architectural review districts of Anastasia Boulevard, San Marco Avenue, and King Street. Their purpose is to protect and preserve the continuum of architectural heritage and in turn enhance the overall visual character of the corridors.

Disturbance, Archaeological: The cumulative digging, excavating, site preparation work or other such construction activities, regardless of the number of individual excavation or construction areas, related to an archaeological site.

Dry Floodproofing: Protecting a building through a combination of measures in order to prevent the entrance of floodwaters. Structural components of the building must have the capacity to resist the resulting flood loads.

Elevation: In retrofitting, the process of physically raising an existing building so that it is above the height of a given flood.

Enclosure: That portion of an elevated building below the lowest elevated floor that is either partially or fully shut in by rigid walls.

Flood (also Flooding): A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land areas. For flood insurance claim purposes, two or more properties must be inundated before flood damage will be covered.

Flood damage-resistant material: Any building product (material, component, or system) capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage.

Floodwall: Flood barrier constructed of manmade materials, such as concrete or masonry, to keep water away from or out of a specified area.

Floodplain Management: The operation of a program of corrective and preventative measures for mitigating flood damage, including, but not limited to, emergency preparedness plans, flood-control works, and floodplain management regulations.

Florida Master Site File (FMSF): State of Florida's official inventory of historical and cultural resources including buildings, structures, bridges, cemeteries, archaeological sites and historic districts, landscapes and linear features. The Site File also maintains copies of archaeological and historical survey reports and other manuscripts relevant to history and historic preservation in Florida.

Freeboard: An added margin of safety, expressed in feet above a specific flood elevation, usually the BFE. In States and communities that require freeboard, buildings are required to be elevated or floodproofed to the higher elevation. For example, if a community adopts a 2-foot freeboard, buildings are required to be elevated or floodproofed to 2 feet above the BFE.

Geographic Information System (GIS): Computer system capable of assembling, storing, manipulating, and displaying geographically referenced information (data identified according to its location). Typically, a GIS is used for handling maps of one kind or another. GIS is becoming an important tool in promoting coordinated efforts between emergency management and historic preservation.

Hazard Mitigation: Sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

Hazard Mitigation Plan or Local Mitigation Strategy: A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the planning area and includes a description of actions to minimize future vulnerability to hazards.

Historic Preservation: An approach to conserving buildings, structures, sites, objects and districts that represent a physical connection with people and events from our past. Historic preservation utilizes various land use planning strategies, governmental programs, and financial incentive to protect historic resources.

Historic Architectural Review Board: The board which is responsible for determining the historical significance of the property and the appropriateness of the proposed work as submitted by an applicant in the City of St. Augustine.

Historic Character: Refers to all visual aspects and physical features that comprise the appearance of historic properties. Extends to the setting of historic properties to include a building's relationship to the environment and adjacent streets and buildings, landscape plantings, views, and the presence of accessory features.

Historic District (local): The portion of the City of St. Augustine that is designated on the official zoning map of the city as a Historic Preservation District.

Historic District (National Register): A significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development with associated documentation of integrity and significance.

Historic Landmark: A building, object, site or structure of the highest historical, architectural, cultural or archaeological importance as measured by the designating authority.

Historic Significance: The importance of a property to the history, architecture, archaeology, engineering, or culture of a community, state, or the nation. There are 4 criteria to measure significance established by the National Register: association with events/activities/patterns; association with important persons; embodying distinctive physical characteristics of design/construction/form; and/or the potential to yield important information.

Hydrodynamic force: Force exerted by moving water.

Hydrostatic force: Force exerted by water at rest, including lateral pressure on walls and uplift (buoyancy) on floors.

Integrity: The authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric period. An overall sense of past time and place are evident in the composite of seven qualities: location, design, setting, materials, workmanship, feeling, and association.

Inventory: One of the basic products of a survey. An inventory is an organized compilation of information on those properties that are evaluated as significant.

Long-Term Recovery: Phase of recovery that may continue for months or years and addresses complete redevelopment and revitalization of the impacted area, rebuilding or relocating damaged or destroyed social, economic, natural and built environments and a move to self-sufficiency, sustainability and resilience.

Major Disaster: Any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought) or, regardless of cause, any fire, flood or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this act to supplement the efforts and available resources of local, State governments and disaster relief organizations in alleviating the damage, loss, hardship or suffering caused thereby.

Mitigation reconstruction: The construction of an improved, elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed.

Monitoring, Archaeological: The observation after commencement of a disturbance to determine if archaeological resources exist in an area or, when such resources are known to exist, the observation, recording and incidental recovery of site features and materials to preserve a record of the affected portion of the site. Monitoring is applicable in locations where sites or features may occur but are generally not expected to be of such importance, size or complexity as to require lengthy work or project delays for salvage archaeology.

National Historic Landmark: Nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States.

National Register of Historic Places: The list of historic properties significant in American history, architecture, archaeology, engineering and culture, maintained by the Secretary of the Interior, as established by the National Historic Preservation Act of 1966, as amended. Evaluated by age, integrity, and significance. Properties must meet eligibility criteria, criteria consideration categories, or demonstrate exceptional importance.

National Flood Insurance Program (NFIP): Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations.

National Park Service (NPS): Responsible for performing many of the responsibilities specifically vested in the Secretary of the Interior under the National Historic Preservation Act (NHPA). NPS maintains a large cultural resources professional staff with expertise in the broad range of historic preservation activities authorized under the NHPA.

Non-Contributing Property: A building, site, structure or object which does not add to the historic architectural qualities, historic associations or archaeological values for which a district is significant because (a) it was not present during the period of significance of the district; (b) due to alterations, disturbances, additions or other changes, it no longer possesses historic integrity reflecting its character at that time or is incapable of yielding important information about the period; or (c) it does not independently meet the National Register of Historic Places criteria for evaluation.

Preservation: The act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.

Reconstruction: The act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.

Rehabilitation: The act or process of returning a property to a state of utility through repair or alteration which makes possible an efficient contemporary use while preserving those portions or features of the property which are significant to its historical, architectural, cultural and archaeological values.

Relocation: The act of moving a building from its original location to another site, either on the same property or to another location entirely.

Resilience: Ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies.

Resource type: Building (created principally to shelter any human activity), site (location of a significant event, occupation or activity, or location of a building/structure where the location itself possesses historic value), structure (functional construction created for purpose other than sheltering human activity), object (construction that is artistic, small in scale, and/or of simple construction), or district (properties with a number of resources that are relatively equal in importance or property with a variety of types of resources).

Restoration: The act or process of accurately recovering the form and details of a property and its setting as it appeared at a particular period of time by means of removal of later work or by the replacement of missing earlier work.

Retrofitting: Making changes to an existing home or other building to protect it from flooding or other hazards.

Riprap: Pieces of rock or crushed stone added to the surface of a fill slope, such as the side of a levee, to prevent erosion.

Secretary of Interior's Standards and Guidelines for the Treatment of Historic Properties (SOIS): Professional standards and guidelines established by the Secretary of the Interior under the authority of the NHPA for the preservation of the nation's historic properties. They are intended to be applied to a wide variety of resource types, including buildings, sites, structures, objects, and districts. The Standards address four treatments preservation, rehabilitation, restoration, and reconstruction.

Social Resilience: Social Resilience is the ability of a community to cope with and adapt to stresses such as social, political, environmental, or economic change.

Special Flood Hazard Areas: Represents the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

Storm surge: Water pushed toward the shore by the force of the winds swirling around a storm. It is the greatest cause of loss of life due to hurricanes.

Substantial Damage: Damage to a building, regardless of the cause, is considered Substantial damage if the cost of restoring the building to its before-damage condition would equal or exceed 50 percent of the market value of the building before the damage occurred.

Substantial Improvement: Under the NFIP, an improvement of a building (such as reconstruction, rehabilitation, or an addition) is considered a Substantial Improvement if its cost equals or exceeds 50 percent of the market value of the building before the start of construction of the improvement.

Survey: A process of identifying and gathering data on a community's historic resources. It includes field survey- the physical search for and recording of historic resources on the ground-but it also includes planning and background research before field survey begins, organization and presentation of survey data as the survey proceeds, and the development of inventories.

Testing, Archaeological: The limited subsurface excavation or remote sensing of a proposed disturbance (or a portion thereof) to determine the potential, type or extent of the archaeological site. Testing may include augering and establishing archaeological excavation units and will include the screening of excavated material for artifact recovery.

Wet floodproofing: The use of flood-damage-resistant materials and construction techniques to minimize flood damage to areas below the flood protection level of a building, which is intentionally allowed to flood. Usually, only enclosed areas used for parking, building access, or storage are wet floodproofed.

APPENDIX B

Directions for Selecting & Prioritizing Mitigation Strategies

DIRECTIONS FOR SELECTING & PRIORITIZING MITIGATION STRATEGIES FOR HISTORIC BUILDINGS, STRUCTURES, OBJECTS, & SITES

RESILIENT HERITAGE
ST AUGUSTINE

Guidance for using the tools in this workbook to select and prioritize future mitigation strategies for historic properties.

STEP 1: The PLANNING WORKSHEET can be should be utilized by the working group and printed at a large scale (if possible) to allow for a collaborative working environment. The group should choose a historic property or location, a specific hazard, and objective. The CRITERIA GUIDANCE, COMMUNITY VALUES, and HP FLOOD ADAPTATIONS should also be printed.

STEP 2: Once the initial parameters (location, hazard, objective) are selected and added to the top of the PLANNING WORKSHEET, the group shall use the HP FLOOD ADAPTATIONS, MITIGATION STRATEGY ENCYCLOPEDIA, or other resources for selecting possible flood mitigation strategies. The working group should then select at least three mitigation strategies to evaluate for each location/structure, and record these on the left hand side of the PLANNING WORKSHEET.

STEP 3: The working group should refer to the CRITERIA GUIDANCE and COMMUNITY VALUES sheet to evaluate each mitigation strategy for the selected location/structure, given the objective and hazard. The questions on the CRITERIA GUIDANCE and COMMUNITY VALUES worksheets should be answered qualitatively, with comments recorded on the PLANNING WORKSHEET.

STEP 4: Once all of the STAPLEEC CRITERIA have been addressed on the PLANNING WORKSHEET, the working group can record the results in the STAPLEEC Matrix on the computer.
-Fill in the property/location, the existing or future hazard that will be addressed, and the objective the mitigation strategy plans to address. Use a separate worksheet for each property/location.
-Fill in the mitigation strategies that address the specific objective the planning team identified on the historic properties mitigation PLANNING WORKSHEET.
-For each consideration, indicate a plus (+) for favorable, a negative (-) for unfavorable, or N/A for not applicable. Leave blank if the answer is not known or evaluation requires the consultation of an outside source. Negatives indicate gaps or shortcomings in the particular action (which can be noted in the comments section). When scoring is complete, the values should automatically sum in the column to the right, with positive (+)= 1, negative (-) = -1, and not applicable N/A = 0. Each mitigation strategy is then given a priority ranking based on its score.

STEP 5: Develop schedules and budgets for highest priority mitigation strategies.

APPENDIX C

Guidance for Evaluation Criteria

GUIDANCE FOR EVALUATION CRITERIA FOR MITIGATION STRATEGIES
(STAPLEEC CRITERIA GUIDANCE)

The following explain each of the STAPLEEC evaluation criteria. It includes questions the planning team should consider, as well as who may be the appropriate person or agency to answer these questions as the team works through the list of alternative mitigation actions.

Adapted from FEMA Developing the Mitigation Plan: Identifying Mitigation Actions and Implementation Strategies, 2003.

SOCIAL

The public must support the overall implementation strategy and specific mitigation actions. Therefore, the projects will have to be evaluated in terms of community acceptance by asking questions such as:

-Will the proposed action adversely affect one segment of the population?

-Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

-Is the action compatible with present and future community values?

If the community is a tribal will the actions adversely affect cultural values or resources?

Your local elected officials, community development staff, and planning board are key team members who can help answer these questions.

TECHNICAL

It is important to determine if the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Here, you will determine whether the alternative action is a whole or partial solution, or not a solution at all, by considering the following types of issues:

-How effective is the action in avoiding or reducing future losses?

-If the proposed action involves upgrading culverts and storm drains to handle a 10-year storm event, and the objective is to reduce the potential impacts of a catastrophic flood, the proposed mitigation cannot be considered effective.

Conversely, if the objective were to reduce the adverse impacts of frequent flooding events, the same action would certainly meet the technical feasibility criterion.

-Will it create more problems than it solves?

-Does it solve the problem or only a symptom?

Key team members who can help answer these questions include the town engineer, public works staff, and building department staff.

ADMINISTRATIVE

Under this part of the evaluation criteria, you will examine the anticipated staffing, funding, and maintenance requirements for the mitigation action to determine if the jurisdiction has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.

-Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?

-Can the community provide the necessary maintenance?

-Can it be accomplished in a timely manner?

POLITICAL

Understanding how your current community and state political leadership feels about issues related to the environment, economic development, safety, and emergency management will provide valuable insight into the level of political support you will have for mitigation activities and programs. Proposed mitigation objectives sometimes fail because of a lack of political acceptability. This can be avoided by determining:

-Is there political support to implement and maintain this action?

-Have political leaders participated in the planning process so far?

-Is there a local champion willing to help see the action to completion?

-Who are the stakeholders in this proposed action?

-Is there enough public support to ensure the success of the action?

-Have all of the stakeholders been offered an opportunity to participate in the planning process?

-How can the mitigation objectives be accomplished at the lowest "cost" to the public?

Ensure that a designated member of the planning team consults with the board of supervisors, mayor, city council, administrator, or manager.

LEGAL

Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, you will determine whether your jurisdiction has the legal authority at the state, tribal, or local level to implement the action, or whether the jurisdiction must pass new laws or regulations. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. You should identify the unit of government undertaking the mitigation action, and include an analysis of the interrelationships between local, regional, state, and federal governments. Legal authority is likely to have a significant role later in the process when your state, tribe, or community will have to determine how mitigation activities can best be carried out, and to what extent mitigation policies and programs can be enforced.

-Does the state, tribe, or community have the authority to implement the proposed action?

-Is there a technical, scientific, or legal basis for the mitigation action (i.e., does the mitigation action "fit" the hazard setting)?

-Are the proper laws, ordinances, and resolutions in place to implement the action?

-Are there any potential legal consequences?

-Will the community be liable for the actions or support of actions, or lack of action?

-Is the action likely to be challenged by stakeholders who may be negatively affected?

Your community's legal counsel is a key team member to include in this discussion.

ECONOMIC
Every local, state, and tribal government experiences budget constraints at one time or another. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles are much more likely to be implemented than mitigation actions requiring general obligation bonds or other instruments that would incur long-term debt to a community. States and local communities with tight budgets or budget shortfalls may be more willing to undertake a mitigation initiative if it can be funded, at least in part, by outside sources. "Big ticket" mitigation actions, such as large-scale acquisition and relocation, are often considered for implementation in a post-disaster scenario when additional federal and state funding for mitigation is available. Economic considerations must include the present economic base and projected growth and should be based on answers to questions such as: -Are there currently sources of funds that can be used to implement the action? -What benefits will the action provide? -Does the cost seem reasonable for the size of the problem and likely benefits? -What burden will be placed on the tax base or local economy to implement this action? -Does the action contribute to other community economic goals, such as capital improvements or economic development? -What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available? Key team members for this discussion include community managers, economic development staff, and the assessor's office.
ENVIRONMENTAL
Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities and the many statutory considerations, such as the National Environmental Policy Act (NEPA), to keep in mind when using federal funds. You will need to evaluate whether, when implementing mitigation actions, there would be negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources. -How will this action affect the environment (land, water, endangered species)? -Will this action comply with local, state, and federal environmental laws or regulations? -Is the action consistent with community environmental goals? Numerous mitigation actions may well have beneficial impacts on the environment. For instance, acquisition and relocation of structures out of the floodplain, sediment and erosion control actions, and stream corridor and wetland restoration projects all help restore the natural function of the floodplain. Also, vegetation management in areas susceptible to wildfires can greatly reduce the potential for large wildfires that would be damaging to the community and the environment. Such mitigation actions benefit the environment while creating sustainable communities that are more resilient to disasters. Key team members include the local health department, conservation commissions, environmental or water resources agency.
COMMUNITY VALUES
Integrating the "Community Values" for the designated historic building, structure, object, or site is a vital step in addressing the future mitigation strategies applied to the asset. You will need to evaluate how the implemented strategies may affect the integrity of the historical asset as well as the consequences of not applying any strategies to the asset. -How will this action affect the economic drivers of this asset? -What is the public sentiment to minor and major changes to the historic asset? -Is the action consistent with the community values surrounding historic assets? Key team members include the local Historic Architectural Review Board, local experts on archeological sites, the City's Historic Preservation Officer, the State Historic Preservation Office, property owners and business owners associated with the historic asset.

APPENDIX D

Historic Properties Mitigation Planning Worksheet

HISTORIC BUILDING, STRUCTURE, OBJECT & SITE MITIGATION PLANNING WORKSHEET

Instructions: Print one copy for each Working Group planning team (2-6 people per team).

Historic Building, Structure, Object, or Site: **Hazard:** **Objective:** **Planning Team:**

Historic Properties Mitigation Strategy One:

SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	COMMUNITY VALUE
Community Acceptance: **Effect on Segment of Population:**	**Technical Feasibility:** **Long-term Solution:** **Secondary Impacts:**	**Staffing:** **Funding Allocated:** **Maintenance/Operations:**	**Political Support:** **Local Champion:** **Public Support:**	**State Authority:** **Existing Local Authority:** **Potential Legal Challenge:**	**Benefit of Action:** **Cost of Action:** **Contributes to Economic Goals:** **Outside Funding Required:**	**Effect on Land/Water:** **Effect on Endangered Species:** **Effect on HAZMAT/Waste Sites:** **Consistent with Community Environmental Goals:** **Consistent with Federal Laws:**	**Effect on Historic Designation:** **Geographic Context of Significance:** **Level of Significance:** **Degree of Integrity:** **Economic Importance:** **Public Sentiment:**

Historic Properties Mitigation Strategy Two:

SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	COMMUNITY VALUE
Community Acceptance: **Effect on Segment of Population:**	**Technical Feasibility:** **Long-term Solution:** **Secondary Impacts:**	**Staffing:** **Funding Allocated:** **Maintenance/Operations:**	**Political Support:** **Local Champion:** **Public Support:**	**State Authority:** **Existing Local Authority:** **Potential Legal Challenge:**	**Benefit of Action:** **Cost of Action:** **Contributes to Economic Goals:** **Outside Funding Required:**	**Effect on Land/Water:** **Effect on Endangered Species:** **Effect on HAZMAT/Waste Sites:** **Consistent with Community Environmental Goals:** **Consistent with Federal Laws:**	**Effect on Historic Designation:** **Geographic Context of Significance:** **Level of Significance:** **Degree of Integrity:** **Economic Importance:** **Public Sentiment:**

Historic Properties Mitigation Strategy Three:

SOCIAL	TECHNICAL	ADMINISTRATIVE	POLITICAL	LEGAL	ECONOMIC	ENVIRONMENTAL	COMMUNITY VALUE
Community Acceptance: **Effect on Segment of Population:**	**Technical Feasibility:** **Long-term Solution:** **Secondary Impacts:**	**Staffing:** **Funding Allocated:** **Maintenance/Operations:**	**Political Support:** **Local Champion:** **Public Support:**	**State Authority:** **Existing Local Authority:** **Potential Legal Challenge:**	**Benefit of Action:** **Cost of Action:** **Contributes to Economic Goals:** **Outside Funding Required:**	**Effect on Land/Water:** **Effect on Endangered Species:** **Effect on HAZMAT/Waste Sites:** **Consistent with Community Environmental Goals:** **Consistent with Federal Laws:**	**Effect on Historic Designation:** **Geographic Context of Significance:** **Level of Significance:** **Degree of Integrity:** **Economic Importance:** **Public Sentiment:**

APPENDIX E

Community Values Rating Worksheet

COMMUNITY VALUES RATING

PROPERTY/LOCATION:

**Note: The historic designation and geographic context do not automatically correlate to the level of community value for ranking purposes.*

To determine total community value add qualitatively Columns 3, 4, 5, & 6 and place total in Column 7. Use 1 for Low, 3 for Medium, and 5 for High.
High or high to medium value in Column 7 rates as a + in STAPLEEC consideration. Low or Medium to Low rates as a - in STAPLEEC.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Historic Designation* (NR, NHL, etc.)	Geographic Context of Significance* (National, State, Local)	Level of Significance (High, Medium, Low)	Public Sentiment (High, Medium, Low)	Economic Importance (High, Medium, Low)	Degree of Integrity (High, Medium, Low)	**SCORE**

APPENDIX F

STAPLEEC Matrix & Comments Worksheets

STAPLEEC MATRIX

STEP 1 **PROPERTY/LOCATION:** ______________________ *(eg. building, structure, object, site, etc.)*

HAZARDS: ______________________ *(eg. flooding, salt water intrusion, wind, etc.)*

OBJECTIVE: ______________________ *(eg. preserve historic character, protect historic*

STEP 1: Fill in the PROPERTY/LOCATION, the existing or future HAZARD that will be addressed, and the objective the MITIGATION STRATEGY should address. Use a separate worksheet for each OBJECTIVE. The CONSIDERATIONS under each criteria are suggested and may be edited to reflect specific project priorities.

STEP 2: Fill in the MITIGATION STRATEGIES that address the specific objective the planning team identified on the Planning Worksheet.

STEP 3: The working group should refer to the CRITERIA GUIDANCE and COMMUNITY VALUES sheet to evaluate each mitigation strategy for the selected location/structure, given the objective and hazard. The questions on the CRITERIA GUIDANCE and COMMUNITY VALUES worksheets should be answered qualitatively, with comments recorded on the PLANNING WORKSHEET.

STEP 4: For each STAPLEEC column, indicate a plus (+) for favorable, a negative (-) for unfavorable, or N/A for not applicable. Leave blank if the answer is not known or evaluation requires the consultation of an outside source. Negatives indicate gaps or shortcomings in the particular action (which can be noted in the comments section). When scoring is complete, the values should automatically sum, wherein plus (+) = 1, negative (-) = -1, and not applicable N/A = 0. Each MITIGATION STRATEGY is then given a PRIORITY RANKING based on its score.

↓ STEP 2 | Select STRATEGIES

↓ STEP 3 | CONSIDERATIONS STAPLEEC ANALYSIS (+ / - / N/A)

↓ STEP 4 | CALCS & PRIORITY RANKING

	Social		Technical			Administrative			Political			Legal			Economic				Environmental					Community Value		
Mitigation Strategy:	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long Term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/ Operations	Political Support	Local Champion	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Community Environmental Goals	Consistent with Federal Laws	+ or - from Community Values worksheet	**SCORE**	**PRIORITY RANKING**

Comments

APPENDIX G

Mitigation Strategies

Summary of Guidelines on Flood Mitigation for Rehabilitating Historic Buildings

Planning and Assessment for Flood Risk Reduction is a step that should be completed for all project prior to selecting a mitigation strategy.
The U.S. Department of the Interior, National Park Service publication: Guidelines on Flood Adaptation for Rehabilitating Historic Buildings, 2019 offers guidance for appropriate mitigation strategies for historic buildings and offers the recommended and not recommended modes of action.

Planning and Assessment for Flood Risk Reduction

Planning and Assessment for Flood Risk Reduction

- Identify Important Historic Features
- Develop an Implementation Plan
- Identify and Evaluate Vulnerabilities
- Document Property and Defining Characteristics
- Monitor Character Defining Features
- Utilizing and Maintaining Existing Flood Impact Characteristics
- Consider All Feasible Alternatives & Prioritize Actions that Require the Least Alteration
- Utilize Local & Regional Traditions
- Replace Damaged or Deteriorated Historic Materials
- Utilize Special Exemptions & Variances

Temporary Protective Measures

Temporary Protective Measures

- Temporary Barrier, System, or Equipment
- Evaluate Walls and Flood Barriers Against Forces of Flooding
- Install Fastening Devices or Stanchions for Temporary Barriers
- Develop Procedures, Responsibilities, & Training for Temporary Deployment of Flood Systems
- Install a Generator
- Relocate valuable collections to higher floors, upper shelves, or off-site

Site Landscape & Adaptations

Site & Landscape Adaptation

- Alter Locations Unimportant to Historic Character
- Retain Historically Relevant Topography
- Provide Proper Drainage
- Survey & Document Areas that will be Altered
- Protect Important Features
- Plan & Implement Site Investigation
- Improve, Restore, or Implement Natural Systems
- Improve or Design New Stormwater Management System
- Construct a Levee, Berm, or Embankment

Protect Utilities

Protect Utilities

- Relocate all Utilities Above the Flood Risk Level
- Protect Utilities in a Watertight Impermeable Enclosure
- Elevate & Anchor Exterior Mechanical Equipment Compatible with Historic Character
- Utilize Fencing & Landscaping to Screen Exterior Mechanical Equipment
- Relocate Interior Mechanical Equipment

- Relocate Ducts, Pipes, & Conduits
- Utilize Duct Insulation that can be Removed After Flood
- Install an Electrical Disconnect Above Flood Risk Level
- Eliminate Electric Service from Flood Prone Areas
- Install Backflow Prevention Devices
- Install Sump Pumps

Dry Floodproofing

Structural Considerations

- Evaluate Strength of Masonry Walls & Footings Against Flood
- Anchor the Structure to the Foundation

Site Drainage

- Prepare to Manage Floodwaters
- Plan for Removing Water Post Flooding
- Install Drainage System Around Foundation & Footings
- Install Backflow Prevention Devices
- Install Sump Pumps

Coverings & Coatings

- Design Temporary or Permanent Closures
- Install Stanchions, Fasteners, or Tracks for Flood Shields
- Install a Low Wall Around Basement Windows
- Install Vents in Foundations Walls that Can be Sealed
- Coasting or Covering the Exterior of Foundation Wall Surfaces
- Wrap the Foundation with Temporary Removable Waterproof Membrane
- Inspect Permanent Coating or Membranes Regularly

Wet Floodproofing

Structural Needs

- Evaluate Strength of Masonry Walls & Footings Against Flood
- Anchor the Structure

Utilities

- Relocate Utilities
- Install a Ground Fault Circuit Interrupters

Site Drainage & Venting

- Follow Engineering Guidance for Hydrostatic Flood Vents
- Retain Historic Foundation Vents Where Feasible
- Install Pumping System

Interior Alterations

- Retain Historic Materials, Feature, & Finishes that are Flood Resistant
- Remove Non-Historic Finishes and Furnishings that Absorb & Trap Moisture
- Utilize Substitute Flood Resistant Materials When Repairing or Replacing
- Relocate Electrical Outlets & Panels Above Flood Risk Level

Interior Alterations for Spaces That Have Been Significantly Altered

- Install Interior Flood-Damage Resistant Materials
- Utilize Flood-Damage Resistant Substitute Materials
- Install Impervious Materials
- Install a horizontal Water stop Joint

Property Clean-Up Post-Flooding

- Utilize the Gentlest Means Possible to Remove Surface Grime & Kill Flood-Borne Bacteria
- Identify & Assess the Flood-Damage
- Utilize Dehumidifiers and Fans Before Repairs are Made

Fill the Basement

Structural Considerations

- Assess Strength of Basement Walls & Footings
- Modify & Anchor Basement Walls & Footings

Drainage

- Remove or Breakup Non-Porous or Concrete Basement Floor Slabs
- Install Pumping System

System Relocation

- Relocate All Systems & Utilities

Filling the Basement

- Fill Basement Using Removable Fill Material (Gravel, Soil, or Sand)
- Compact Basement Fill
- Monitor & Supplement In place Fill

Elevate the Building on a New Foundation

Planning & Preparation

- Identify Materials & Features that are Historically Significant
- Retain & Preserve Materials & Features that are Historically Significant
- Assess Potential Impacts of Elevation
- Document the Property with Photographs and/or Drawings
- Elevate Later Additions to the Property that Contribute to the Historical Significance
- Repair Any Structural Deficiencies Prior to Elevation
- Protect Fragile Features & Materials

Height of Elevation

- Identify the Historic Massing, Scale, Size, Form, & Proportional Relationships
- Design a New Foundation that Preserves the Historic Character
- Use Existing Features to Minimize the Impact of Height Alterations
- Utilize Local & Regional Traditions
- Elevate on an Already Visible Historic Foundation

New Foundation

- Construct a New Foundation that is Compatible with the Historic Character
- Salvage & Reuse Historic Materials to Construct New Foundation
- Match New Foundation Materials with Characteristics of the Historic Foundation
- Maintain Visual Appearance of Piers/Posts
- Use Design Techniques to Minimize the Perception of Height & Appearance Changes
- Install Flood Vents in Solid Foundations Walls
- Retain Visual Connection of the Structure to the Ground
- Relocate All Utilities or Protect in Place with Watertight or Impermeable Enclosure
- Conceal, Insulate, & Protect Utility Connections, Ducts, & Pipes

Access

- Retain Historical Assess, Approach, & Orientation
- Match New Stairs, Railings, & Ramps with Historic Design

- Use Salvaged Historic Materials to Construct Stairs, Railings, & Ramps
- Construct Railings with Traditional Proportions when Possible
- Retain a Horizontal Rail at Traditional Height if a Taller Rail is Necessary to Comply with Code
- Break Up the Run of Stairs with a Landing
- Change the Stair Design or Materials
- Provide Access Via an Exterior Elevator, Lift, or Ramp
- Install Ramps on Secondary Elevations to Minimize Impact
- Screen Ramps with Planting to Make Less Visible

Associated Site Alterations

- Add Fill or Raised Planters to Reduce Visibility of New Foundation
- Design Driveways, Parking Areas, & Patios that are Unobtrusive & Compatible with Historic Character

In Historic Districts

- Elevate Buildings Similar in Size & Style to Consistent Heights While Maintaining Spatial & Architectural Relationships
- Elevate Buildings in Districts with a Tradition or History of Elevating Buildings

Elevate the Interior Structure

Planning & Preparation

- Identify Materials & Features that are Historically Significant
- Retain & Preserve Materials & Features that are Historically Significant
- Document the Property with Photographs and/or Drawings

Structural Considerations

- Assess Walls, Columns, & Footings
- Assess Building Anchoring System
- Assess Building's Ability to Support Filled Basement, Moving Water Beneath It, or Keep Water Out

Exterior Impacts

- Maintain Original Entrances & Fenestration Patterns
- Preserve Historic Character When Creating Access to Usable Space Underneath the New Floor
- Maintain Storefront Glass & Bulkhead Heights at Their Original Locations
- Retain Original Windows on Primary or Highly Visible Facades
- Installing a New Floor At a Level Below the Sills of First-Floor Windows or Storefronts
- Hold Back the New Floor From Exterior Openings Sufficient to Minimize the Visibility of the Alteration

Interior Considerations

- Preserve Character-Defining Spaces, Features, & Finishes
- Maintain the Historic Character of Entrances
- Add Interior Ramps or Stairs that are Compatible with the Historical Character
- Retain Historic Materials & Features

Abandon the First Story

Planning & Preparation

- Evaluate the Strength of Walls, Columns, & Footings
- Document Interior Materials, Features, Finishes, & Spaces

Structural Considerations

- Identify Materials & Features that are Historically Significant
- Retain & Preserve Materials & Features that are Historically Significant
- Assess Walls, Columns, & Footings
- Assess Building Anchoring System
- Assess Building's Ability to Support Filled Basement, Moving Water Beneath It, or Keep Water Out

Exterior & Interior Considerations

- Retain Historic Materials, Features, & Finishes that are Flood-Damage Resistant
- Remove Non-Historic Finishes and Furnishings that Absorb & Trap Moisture
- Maintain & Use Existing Access Points to Gain Access to Upper Floors
- Add Interior Stairs, Elevators, or Lifts Within the First-Story Space Away from Windows or Storefronts
- Design Secondary Egress that is Compatible with Historic Character
- Create Compatible New Openings or Alter Existing Openings for New Parking or Storage Areas

Move the Historic Building

Planning & Preparation

- Find an Available Site with as Similar Setting as Possible While Also Eliminating Flood Risk
- Document the Historic Building with Photographs
- Hire & Insure a Professional Building Mover
- Move the Historic Building in One Piece
- Conduct Archeological Investigations at the New Site

Moving Considerations

- Provide Protection by Bracing or Covering Fragile Features
- Retain Later Features & Additions
- Move Outbuildings Important to Historic Character
- Ensure No Negative Effects in New Location

Relocation

- Construct an Adequate Foundation
- Reestablish the Original Placement as Closely as Possible
- Make Appropriate Repairs
- Allow Adequate Time for Foundation to Settle
- Place Historic Outbuildings in the Proper Location

APPENDIX H

Mitigation & Preparation Strategy Encyclopedia

MITIGATION & PREPARATION STRATEGY ENCYCLOPEDIA

The following is a full "encyclopedia" of mitigation strategies. These include economic, emergency, identification and monitoring, information and education, infrastructure, as well as, policies and planning.

Note: Proposed mitigations may not apply to all properties.

RESILIENT HERITAGE ST AUGUSTINE

ADAPTATION TYPE	ADAPTATION TITLE	DESCRIPTION	SHORT, INTERMEDIATE, OR LONG TERM	MICRO / MACRO	GRAY, GREEN, OR HYBRID	DEGREE OF PROTECTION (LOW, MED, HIGH)	COST ($,$$,$$$)
Economic Assessment and Planning	Taxation and Budgets	Add climate change considerations to taxation and budget reform	LONG TERM	MACRO	GREEN	MEDIUM	$
Economic Assessment and Planning	Building Code Incentives	Create incentives for individuals and businesses to reduce risk of losses due to climate through building design codes	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Economic Assessment and Planning	Funding Support for Relocation	Identify financial and economic support mechanisms in response to relocation	INTERMEDIATE	MACRO	GREEN	LOW	$
Economic Assessment and Planning	Financial Impact Assessment	Assess financial impact of property value changes	SHORT	MACRO	GRAY	LOW	$
Economic Assessment and Planning	Funding for Adaptation Strategies	Provide funding for local communities to develop and implement location appropriate adaptation strategies	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Economic Assessment and Planning	Social Impacts Vulnerable Communities	Assess potential social impacts of climate change on incomes, and other measures of well-being in vulnerable communities	INTERMEDIATE	MACRO	HYBRID	LOW	$
Economic Assessment and Planning	Insurance Costs	Address increased insurance costs, especially in disaster sensitive, remote and/or economically challenged areas	INTERMEDIATE	MACRO	HYBRID	LOW	$
Economic Assessment and Planning	Economic Incentives	Provide economic incentives for building in non-risk zones	LONG TERM	MACRO	GREEN	MEDIUM	$$
Economic Assessment and Planning	Short, Mid, and Long Term Budgets	Establish short-, mid- and long-term budgets that include adaptation strategies and capital investments over time	LONG TERM	MACRO	HYBRID	MEDIUM	$
Emergency Strategies	Flood Shelters	Flood shelters are created in areas which experience severe flash flooding. Elevated flood shelters should be constructed above the highest expected flood levels. They should be easily accessible and should be able to accommodate all people in the vicinity.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Emergency Strategies	Protection of Life Support Facilities / Dangerous Goods	Life support facilities and dangerous goods like nuclear plants should be well defended against climate extremes. This vital infrastructure should be up and running even during extreme conditions.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Emergency Strategies	Emergency Evacuation	Coordinate emergency evacuation and supply transportation routes with emergency preparedness systems to ensure capacity and resilience of escape routes compromised by natural disasters related to climate change	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Identification and Monitoring	Online Mapping	Include online mapping capability in planning information for multiple audiences including local governments	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Identification and Monitoring	Seal Level Rise Visualization	Create visualization tool for sea level rise and associated hazards	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Identification and Monitoring	Assessment of Trends	Conduct assessment of trends in change in land use and stability of natural landscapes	INTERMEDIATE	MACRO	GREEN	LOW	$
Identification and Monitoring	Data Collection	Support ongoing collection and analysis of sea level rise, storm surge, and tidal data by existing institutions	LONG TERM	MACRO	GREEN	MEDIUM	$
Identification and Monitoring	Transportation Routes Effected	Identify and revaluate use of transportation routes in floodplains and coastal hazard zones	INTERMEDIATE	MACRO	GRAY	MEDIUM	$
Identification and Monitoring	Vulnerability Assessment	Conduct a vulnerability assessment for cultural resources such as museums and historical sites	INTERMEDIATE	MACRO	GRAY	LOW	$
Identification and Monitoring	Evaluate Water Supply	Evaluate the vulnerability of the water supply systems and networks to climate change related impacts. Develop strategies to add resilience to these systems.	LONG TERM	MACRO	HYBRID	MEDIUM	$
Identification and Monitoring	Identify Vulnerable Species	Map vulnerability of full spectrum of biodiversity (terrestrial, aquatic and marine)	INTERMEDIATE	MACRO	GREEN	LOW	$
Identification and Monitoring	Map Land Changes	Map vulnerability of areas subject to salinification and erosion under different climate scenarios	SHORT	MACRO	GREEN	LOW	$
Identification and Monitoring	Consolidate Ecological Monitoring	Consolidate and cross-reference ecological monitoring networks	SHORT	MACRO	GREEN	LOW	$

Identification and Monitoring	Develop Biological Indicators	Develop a system of biological indicators for impact assessment	INTERMEDIATE	MACRO	GREEN	LOW	$
Identification and Monitoring	Vulnerability of Flora and Fauna	Assess the vulnerability of special designation areas, areas of unique flora and fauna and areas of essential ecosystem goods and services	SHORT	MACRO	GREEN	LOW	$
Identification and Monitoring	Mapping of Impacts on Watersheds	Improve mapping and characterization of likely storm and precipitation impacts to watersheds and riverine flood zones.	SHORT	MACRO	GREEN	LOW	$
Identification and Monitoring	Coastal Models	Develop morphodynamic and ecological response models of primary coastal zones according to different climate scenarios	INTERMEDIATE	MACRO	HYBRID	LOW	$$
Identification and Monitoring	Coastal Vulnerability	Inventory and map the estuarine and ocean shoreline and its bathymetry, sediments, and vegetation. Assess vulnerability.	INTERMEDIATE	MACRO	HYBRID	LOW	$$
Identification and Monitoring	Shoreline Assessment	Conduct a shoreline impact assessment to establish baseline of data on the existing coastal resources and the projected impacts of sea level rise, include tides, weather	SHORT	MACRO	GREEN	LOW	$
Identification and Monitoring	Vulnerable Populations	Identify health-related vulnerabilities of people, region, infrastructure and the economy	INTERMEDIATE	MACRO	HYBRID	LOW	$
Identification and Monitoring	Identify Vulnerable Cultural Resources	Complete a vulnerability assessment to identify specific cultural resources that may be most sensitive to climate change.	INTERMEDIATE	MACRO	HYBRID	LOW	$
Identification and Monitoring	Assess Disruptions	Assess potential disruption to states major economic sectors due to climate change	INTERMEDIATE	MACRO	HYBRID	LOW	$
Identification and Monitoring	Assess Value of Beach Services	Assess full value of beach services including habitat, tourism, storm buffer, etc.	INTERMEDIATE	MACRO	HYBRID	LOW	$
Information and Education	Healthy Waterways	Support healthy rivers, streams and riparian vegetation to maintain water quality	LONG TERM	MACRO	GREEN	MEDIUM	$
Information and Education	Public Education	Provide outreach to the public and others to plan and prepare for climate change	INTERMEDIATE	MACRO	GREEN	LOW	$
Infrastructure Management	Promote Wetland Accretion by Introducing Sediment	Maintains sediment transport to wetlands, which protects coastal land from storms	LONG TERM	MACRO	GREEN	HIGH	$$
Infrastructure Management	Dams (To Redirect Water)	An artificially raised dam at a strategic location in a river or stream can redirect a part of the water flow into another direction. Most dams have a section called a spillway or weir over which, or through which, water flows, either sometimes or always. Dams generally serve the primary purpose of retaining water.	LONG TERM	MACRO	GRAY	HIGH	$$$
Infrastructure Management	Elevated Flood Wall / Flood Gate	A flood wall can be constructed to protect individual vital buildings/facilities against flooding. They can be either permanent or dismountable. Sometimes gates are built in a flood wall to create space for roads. These gates are only closed during flood events.	LONG TERM	MACRO	GRAY	HIGH	$$$
Infrastructure Management	By-Pass Creation	Creating a bypass for a river or canal can reduce flood levels in a specific location. A bypass provides extra discharge capacity for the river or canal. Thereby known bottlenecks can be solved.	LONG TERM	MACRO	GRAY	MEDIUM	$$$
Infrastructure Management	Amphibious (Floatable) Constructions / Buildings	Amphibious buildings rest on the ground level and only start to float during a flood period. The structure is built on a float. Like in floating buildings, these floats are guided by vertical posts to avoid drift of the amphibious building.	LONG TERM	MACRO	HYBRID	MEDIUM	$$$
Infrastructure Management	Artificial Islands	An artificial island is a man-made island is an island, which can be integrated with flood protection. The island can be created by land reclamation, expanding existing islets, construction on existing reefs, or merging several natural islets into a bigger island. Artificial islands may vary in scale from small islets for a single structure, to islands that support entire communities and cities.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Check Valve / Non-Return Valves	A check valve or non-return valve is installed in pipes which are vulnerable for backflow in flood conditions. Backflow is known to take place in toilets and sewer systems. The valve will block flow if water flows in the wrong direction.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$$
Infrastructure Management	Compartments in Dike Rings	A compartment in a dike ring is a smaller area enclosed by secondary flood protection within a main dike ring. The main reason for dividing a dike ring in smaller compartments is to reduce damage in case of a dike failure / breach. Compartments in dike rings will also slow down a flood in case of a major dike breach to create more time for evacuation protocols.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Compartments in Inflowing Large Waters	The compartments will divide large water surfaces into smaller and better controllable segments. These segments are connected with each other through a system of interacting locks or dams. A smaller amount of water can cause damage to low level terrain in case of a dike breach.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Dikes	A dike is an elongated artificially constructed embankment or levee, which protects low-lying areas against higher water levels. It is usually made of clay and sand. Rock or concrete are used to protect the water facing outer slope against waves. Most dikes are constructed parallel to the course of a river in its floodplain or along low lying coastlines.	LONG TERM	MACRO	HYBRID	HIGH	$$$

Infrastructure Management	Dismountable and Temporary Buildings	Dismountable and temporary buildings can be an option for flood prone locations. For instance temporary beach pavilions can be built along beaches to be used during summer time. During the stormy winter season the buildings are dismounted.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$$
Infrastructure Management	Evacuation Routes at Elevated Level	Evacuation routes at an elevated level are necessary to as a route for safe evacuation in flood events. They should be constructed above the highest expected flood level. People affected by the floods can use the routes to reach safe (higher) ground.	LONG TERM	MACRO	GRAY	HIGH	$$$
Infrastructure Management	Floodable Dike	A floodable dike is designed to protect a floodplain against frequent high water levels. The dikes crest level is designed relatively low, so it is flooded in extreme high water levels. This way the flood plain can be used for instance agriculture in normal conditions and for water storage in extremely wet conditions. A secondary dike further inland is frequently used to protect the vulnerable hinterland against extreme high water levels.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Floodplain Evacuation or Enlargement	The floodplain can be enlarged by lowering the level or increasing the width of the floodplain. Enlarging the floodplain will create more room for the river thereby increasing the discharge capacity and provide upstream retention. The risk of flooding is decreased as the capacity of the river to convey water is increased.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Overtopping Proof Dike	An overtopping-proof dike is designed to withstand one of the most common failure mechanisms: overtopping of a dikes by waves. Prolonged overtopping could cause collapse of the landward slope. For better resistance against overtopping the dikes crest must be raised and the landward slope should contain a gentle slope.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$$
Infrastructure Management	Polder	A polder is a low-lying area enclosed by dikes or levees and forms an artificial hydrological entity. There is no connection with surface water outside the polder other than through manually operated pumps or inlets. There are three types of polders: Land reclaimed from a body of water, flood plains separated from the sea or river by a dike, marshes separated from the surrounding water by a dike and subsequently drained. A polder usually has an excess of water as its ground level is often lower than surrounding water levels. Pumping or opening sluices at low tide is necessary.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Quay / Wharf	A Quay or wharf is a structure on the shore of a harbor or on the bank of a river or canal. I can be a good flood protection in locations where available space is limited. Quays are mostly reinforced concrete structures.	LONG TERM	MACRO	GRAY	MEDIUM	$$$
Infrastructure Management	Raising Land	Raising land is often used to increase the difference between water levels and construction levels. Usually sand is used to raise new roads above the existing ground level. This measure reduces the flood risk. Ground water and surface water levels can rise	LONG TERM	MACRO	HYBRID	MEDIUM	$$$
Infrastructure Management	Relocation of Buildings, Utility, Facilities, and Infrastructure	Some public utilities or vital infrastructure could be located in vulnerable flood prone locations. Relocation to higher ground is an option to minimize flood risk.	LONG TERM	MACRO	GREEN	HIGH	$$$
Infrastructure Management	Seepage Barrier	The main purpose of a seepage barrier is to reduce the rate of seepage: for instance to reduce the loss of water from a reservoir or to reduce the water pressure on the structure. The seepage barrier can also be used as a vertical levee enforcement.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Super Dike	A super dike is much higher and wider than an a traditional dike. It is designed to be unbreakable and to reserve space for urban developments on top of the dike.	LONG TERM	MACRO	GRAY	HIGH	$$$
Infrastructure Management	Unbreakable Dikes	An unbreakable dike is an over-dimensioned dike which will protect low lying land for a longer time span than a traditional dike. Most likely the dike is higher and wider than required by design standards. An unbreakable dike requires less maintenance during its lifetime.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Use of Buildings as Flood Defense	New and existing buildings in flood risk areas can be used as flood defense. The buildings should be completely integrated in the flood defense to create a reliable flood defense.	INTERMEDIATE	MACRO	GRAY	LOW	$$$
Infrastructure Management	Deepen Water Bodies	To mitigate droughts it is necessary that sufficient water can be stored during the wet period, so it becomes available during a drier period. To maximize storage capacity the volume of water bodies can be increased. One way to increase the storage volume is by increasing the depth of rivers, canals and ponds. The amount of water which can be stored in this way can become available when water is scarce. The water bodies are refilled when water is abundant during wet periods. Increased helps reducing flood risk as rivers are able to transport a larger amount of water and ponds and lakes have a larger retention capacity.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$$
Infrastructure Management	Increase Height Difference Between Street Level and Ground Floor Level	Rain water is usually collected in streets. To reduce probability for flood water to enter buildings the difference between street level and ground floor level can be increased. This way more water can be stored in the street profile without flooding the buildings	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$

Infrastructure Management	Increased Pump Capacity	By increasing the pump capacity water tables can be controlled better. Responding to heavy rains becomes easier, and the chance of flooding is reduced. The need for buffer capacity, translated into low water tables in rivers and channels, is also reduced as the managers have more pumping capacity. Water levels can remain at higher levels which increases the retention capacity of the system in case of droughts.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Increased Storage or Discharge Capacity of Surface Water	Increasing the size of a channel or pond, the discharge and storage capacity of surface water can be improved. The discharge of a river can be improved by, removing obstacles and lowering groins. Excavating floodplains, increasing the area of the water body or depoldering large areas along the river, improves the storage capacity of the water bodies. Both measures have the ability to reduce flood risk and improve the ability to manage the water.	INTERMEDIATE	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Raised Curbs / Hollow Roads	Raised curbs and hollow roads are used to increase the storage and transport capacity of a road. In extreme rainfall events excess water is stored in between the curbs instead of flowing into buildings directly.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Storage / Settling Tank and Storage Basins	Storage/settling tanks are designed to store excess runoff in urban drainage systems during wet periods, primarily if runoff exceeds the discharge capacity of the urban drainage system some. The settling tank is designed to prevent polluted runoff to be discharge in surface water.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Increased Capacity of Sewer System	Increasing the capacity of the sewer system increases the ability of the system to drain excess surface water during heavy rains and prevent flooding.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Reconstruct Combined Sewer Systems to Separate Sewer Systems	Old sewer systems were often constructed as combined sewers systems, collecting rainwater and waste water in one system. A separate sewer system is designed to collect sanitary and storm water runoff separately. Rainwater can be stored and/or treated, therewith creating an additional water resource. The sanitary water is in a separate sewer system is more concentrated and waste water runoff is more steady.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Smart-Drain (Ground Water)	A smart drain is used to control groundwater levels. The drain operation is based on the actual groundwater levels. If the groundwater level is too high, more water is drained. If the groundwater level is too low, drainage is limited.	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Infiltration and Transport Sewer	An infiltration and transport-sewer (IT) can function as a underground storage and infiltration mechanism, or a storm water drain. The IT sewer is a permeable pipeline which buffers the water until it is able to infiltrates back into the soil. During heavy rain, when soils are fully saturated and water can no longer infiltrate, the IT sewer functions as a storm water drain. excess water is diverted to the ends of the pipeline where it is discharged into another water body. With this buffering capacity the IT sewer is able to reduce flooding and improve water availability during periods of droughts.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Ditches	A ditch is usually defined as a small to moderate depression created to channel water. A ditch can be used for drainage, to drain water from low-lying areas, alongside roadways or fields, or to channel water from a more distant source for plant irrigation. A trench is a long narrow ditch. Ditches are commonly seen around farmland especially in areas that have required drainage such as low land areas.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Use of Groundcover and Shrubbery	Using groundcover and shrubbery has a few benefits compared to unplanted surfaces. By reducing the velocity of the water on the surface, trees and shrubs improve the infiltration of the water. In addition, plants improve the infiltration rate of the soil. In short, planted surfaces improve the infiltration capacity of the surface and thereby reduce the chance of flooding. Planted surfaces also cool the environment through evapotranspiration and by providing shade. Planted surfaces thereby have the ability to reduce the heat island effect and reduce peak summer temperatures by 1 to 5 degrees Celsius. As it provides shade reduce surface runoff as their features reduce the velocity of the water on the surface. This ability is especially interesting in urban areas where heat reduces the livability of the city.	LONG TERM	MACRO	GREEN	LOW	$
Infrastructure Management	Porous Pavements	Permeable paving is a range of sustainable materials and techniques for permeable pavements with a base and sub base that allow the movement of water through the surface. In addition to reducing runoff, this effectively traps suspended solids and filters pollutants in the soil. Besides pavements examples include roads, lawns and lots that are subject to light vehicular traffic, such as parking lots.	LONG TERM	MACRO	HYBRID	MEDIUM	$
Infrastructure Management	Improve Soil Infiltration Capacity	Improving the soil infiltration capacity means improving the permeability of the soil. If the infiltration capacity of the soil is increased, more water will percolate into the soil and less water will runoff directly. This will reduce peak runoff and promoted groundwater recharge.	LONG TERM	MACRO	GREEN	LOW	$
Infrastructure Management	Infiltration Fields and Strips with Above-Ground Storage	Infiltration fields and strips with above-ground storage combine infiltration and water storage. This way peak runoff is reduced.	INTERMEDIATE	MACRO	HYBRID	LOW	$$

Infrastructure Management	Rainwater Retention Ponds With or Without Infiltration Possibilities	Increasing the storage can be applied on different scales. Capturing runoff from the roof of the house is seen as the smallest scale. This is followed by the retention of runoff of an agricultural field by creating small dams within small channels or depressions in the field. And ultimately large areas can be designated as a flood area to temporarily store excess discharges of the river.	INTERMEDIATE	MACRO	HYBRID	LOW	$$
Infrastructure Management	Wadi (Bioswales / Infiltrating Filter Swales)	A wadi is a naturally designed buffer and infiltration filter. A wadi can be a shallow ditch or depression in the field. The wadi detaches rainwater runoff from streets and rooftops from the traditional sewer system. For the larger part of the year, the wadi remains dry. Only during heavier rain events will the wadi be filled with water. This way clean water is infiltrated into the soil it can be used during drier periods.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Shallow Infiltration Measures	Shallow infiltration measures are focused on increasing infiltration in the shallow unsaturated zone. By increasing infiltration run off peaks are lowered, reducing pluvial flood risk. Also groundwater is recharged, reducing the impact of droughts. Examples of shallow infiltration measures are infiltration crates and soakaways.	INTERMEDIATE	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Flexible Water Level Management	By using flexible natural fluctuations in the water level can improve rainfall runoff characteristics. In wet periods water levels are allowed to rise, in dry periods water levels are allowed to lower. This reduces the use of pumping stations or water inlet systems.	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Infrastructure Management	Water Squares	This type of square can combine water storage with the improvement of the quality of urban public space. The water square can be understood as a twofold strategy. It makes money invested in water storage facilities visible and enjoyable. It also generates opportunities to create environmental quality and identity to central spaces in neighborhoods. Most of the time the square can be used as a recreational space. When heavy rains occur, rainwater that is collected from the neighborhood will flow into the water square for a short times pan. After it has been in use as buffering space, the filtered water is returned to the water system.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Artificial Urban Wetlands	Natural wetlands function as water retention basins, sediment traps and wastewater treatment areas by filtration and the immobilizing harmful microorganisms. The wetlands can be implemented with or without additions which improve the treatment capacity. Would extra treatment capacity is needed due to regular overtopping of the sewage system, mining or heavy industry, additional techniques can be implemented. Aeration, alteration soil composition or the introduction of a particular plant species in the area can all improve the treatment capacity.	LONG TERM	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Reduced Paved Surfaces	Paved surfaces like roofs, roads and parking lots, reduce the infiltration capacity of the soil and increase the surface water runoff. As a consequence, flood risk and the need for additional water retention capacity is increased. By decreasing the total area of paved surfaces, more water is can infiltrate the soil and extra green space is created. The increase in green space also has a positive effect on the heating of a city. Green areas help cooling the area by providing shade and the possibility of evapotranspiration.	LONG TERM	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Gutter	A gutter is a non-permeable open drain to collect transport rainwater. Usually a gutter runs along a road. It is connected to either a manhole or a surface water body.	LONG TERM	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Public Infrastructure Design	Build to last: build resiliency into public infrastructure	LONG TERM	MACRO	HYBRID	MEDIUM	$
Infrastructure Management	Sewage and Solid Waste Management	Improve sewage and solid-waste management infrastructure to reduce vulnerabilities to climate change (i.e. storm surge, flooding, inundation)	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Evaluate Stormwater Infrastructure	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events	INTERMEDIATE	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Beach Nourishment	Use beach nourishment to protect infrastructure in coastal areas	INTERMEDIATE	MACRO	GREEN	MEDIUM	$$$
Infrastructure Management	Management of Possible Submerged Structures	Develop retreat strategies for the management of existing structures or conditions that may become submerged hazards to navigation or public health (e.g. effluent outfalls, water intakes, septic fields, rock walls, docks and piers)	INTERMEDIATE	MACRO	GREEN	LOW	$
Infrastructure Management	Industrial Systems	Site industrial systems away from areas vulnerable to extreme changes in weather conditions	LONG TERM	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Relocation of Structures	Consider relocation of threatened structures	LONG TERM	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Strengthen Building Codes	Strengthen building codes and increase building inspection frequency	LONG TERM	MACRO	GRAY	MEDIUM	$$
Infrastructure Management	Research Potential Gray Structures	Investigate consequences of installation of hard structural options (such as dikes, levees, floodwalls, and saltwater intrusion barriers) and soft structural options (such as dune restoration and creation wetland restoration, periodic beach nourishment temporary barriers) to ensure comprehensive and effective response	SHORT	MACRO	GRAY	LOW	$

Infrastructure Management	Storm Water Capacity	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events	LONG TERM	MACRO	GRAY	MEDIUM	$$$
Infrastructure Management	Storm Water Capacity	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events.	LONG TERM	MACRO	HYBRID	HIGH	$$$
Infrastructure Management	Modify Communication Infrastructure	Incorporate modifications to communications infrastructure to increase resiliency during routine maintenance and upgrades	INTERMEDIATE	MACRO	GRAY	LOW	$$
Infrastructure Management	Modify Energy Infrastructure	Incorporate modifications to energy infrastructure to increase resiliency during routine maintenance and upgrades	INTERMEDIATE	MACRO	GRAY	LOW	$$
Infrastructure Management	Hydrology Models	Develop complete climate-hydrology models to create reliable scenarios of all aspects of the hydrological cycle, including extreme events	SHORT	MACRO	GRAY	LOW	$
Infrastructure Management	Modify Topography	Modify land topography to reduce runoff, improve water uptake, reduce erosion and sedimentation in streams	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Infrastructure Management	Living Shoreline	Reduce loss of wetlands due to hardening of estuarine shoreline	LONG TERM	MACRO	GREEN	MEDIUM	$$
Infrastructure Management	Pedestrian Friendly Planning	Adapt the built environment to make communities more walkable and pedestrian friendly, and ensure consideration of climate change planning	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Special Area Management Plan (SAMP)	Plans which provide for increased specificity in protecting significant natural resources, reasonable coastal dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making”	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$$
Policies & Strategic Planning	Allow Coastal Wetlands to Migrate Inland	Through the use of setbacks, density restrictions, or land purchases a city can mitigate the effects of sea level rise. This adaptation preserves habitat for venerable species and preserves coastal land from developments.	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Prohibit Hard Shore Protection	Create policies that restrict the implementation of hard structures along coastal properties	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Develop Planning Laws	Review planning laws, maps, plans, and development guidelines for Effective Response to Climate Impacts such as sea level rise, salt water intrusion, drought, more frequent and intense storms, storm surges and flooding, erosion, heat waves.	INTERMEDIATE	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Review Land Use Plans	Review land use plans in anticipation of change development pressures and shifts in development patterns due to climate change	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Adaptations in Land Use Planning	Support/Conduct Comprehensive Land Use Planning that incorporates adaptation strategies	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Regional Planning with Climate Change	Engage in regional planning processes in relationship to climate change	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Adaptative Land Use Planning	Develop a series of models for adaptive land use planning for decision-makers at all jurisdiction levels	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Climate Change Projection in Urban Planning	Require consideration of climate change projections in urban planning	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Critical Area Planning	Integrate critical area planning requirements with comprehensive planning laws, including emergency planning and infrastructure planning requirements	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Require Comprehensive Planning	Require that counties act on comprehensive planning requirements	INTERMEDIATE	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Critical Area Planning	Strengthen existing critical area planning and implement requirements to address sea level rise and associated coastal hazards	INTERMEDIATE	MACRO	HYBRID	MEDIUM	$
Policies & Strategic Planning	Deter Development in Vulnerable Areas	Guide future development out of areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	End Permitting in Vulnerable Areas	End permitting of new home construction in areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Update Floodplain Maps	Develop a strategy to regularly update floodplain maps	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Identify High Hazard Areas	Identify high hazard areas (at risk for flooding, sea water inundation, etc.)	SHORT	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Sheltered Coastlines	Increase erosion and hazard planning focused on sheltered coastlines	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Transportation and Land Use	Integrate transportation and land use planning	INTERMEDIATE	MACRO	GRAY	MEDIUM	$
Policies & Strategic Planning	State Transportation Plan	Ensure climate change is considered in reviews of state transportation plan	INTERMEDIATE	MACRO	GRAY	MEDIUM	$
Policies & Strategic Planning	Metropolitan Planning	Require/enable metropolitan planning organizations to take climate change into account	LONG TERM	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Existing Programs in Transportation	Review existing coastal programs for coverage of sea level rise & other climate impacts on transportation	INTERMEDIATE	MACRO	GREEN	MEDIUM	$

Policies & Strategic Planning	Transportation Planning	Develop joint transportation strategies with adjacent communities, regions and states to accommodate changing conditions and transportation system use	INTERMEDIATE	MACRO	GRAY	MEDIUM	$
Policies & Strategic Planning	Task Force	Establish Climate Change and Public Infrastructure Task Force	LONG TERM	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Local and State Coordination	Establish a coordinating mechanism to assure that local governments act in concert with the state to reduce future impacts from climate change SLR and associated hazards	LONG TERM	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	State Building Codes	Review State Building and Design Codes to promote resiliency of communities, to mitigate storm and flood damage.	LONG TERM	MACRO	HYBRID	MEDIUM	$
Policies & Strategic Planning	Evaluation of Mechanical and Electrical	Establish a mechanism to evaluate and recommend new design standards for structures (and placement of mechanical and electrical equipment) that may be vulnerable to SLR and associated hazards	LONG TERM	MACRO	HYBRID	MEDIUM	$
Policies & Strategic Planning	Limit Infrastructure	Limit infrastructure investments in hazard-affected coastal areas	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Institute Design Standards	Institute new hazard-resistant building codes and design standards to reduce vulnerability of structures to future sea level rise and associated hazards	LONG TERM	MACRO	GRAY	MEDIUM	$$
Policies & Strategic Planning	Increased Design Standards	Increase infrastructure design standards to address lower probability events	LONG TERM	MACRO	GREEN	MEDIUM	$$
Policies & Strategic Planning	Building Regulations to Include Climate Change	Require consideration of climate change projections in building guidelines	LONG TERM	MACRO	HYBRID	MEDIUM	$$
Policies & Strategic Planning	Building Regulations to Include Adaptation	Support/Conduct Comprehensive Building Regulation that incorporates adaptation strategies and requirements	LONG TERM	MACRO	HYBRID	MEDIUM	$$
Policies & Strategic Planning	Review Building Codes	Review existing building and plumbing codes that are likely to be effected by climate change	INTERMEDIATE	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Update Building Codes	Update building codes, design standards to include setback zones and phased-out or no development in exposed areas	INTERMEDIATE	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Limit Construction in Flood Plains	Limit construction in 100-year floodplain	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Address Ingress and Egress	Develop strategies to address situations of changing ingress/egress to structures as support for access roads in areas vulnerable to sea level rise and associated hazards is withdrawn	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Limitations of Existing Policies	Investigate potential and limitations of eminent domain, vesting, grandfathering, and amortizing strategies to support relocation activities	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Analysis of Migration Strategies	Analyze incentivized / forced, subsidized migration	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	High Hazard Buyouts	Buyout unused properties in areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	$$$
Policies & Strategic Planning	Relocate from Vulnerable Areas	Relocate from highest risk barrier islands and low-lying lands, removing infrastructure that may exacerbate flooding and natural processes	LONG TERM	MACRO	GREEN	HIGH	$$$
Policies & Strategic Planning	Rolling Easements	Enact law that authorizes the state to secure a rolling property easement as sea level rises	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Strategic Plans	Require that local government coastal land use plans include a strategic plan for responding to sea level rise, and other climate risks.	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Climate Safe Communities	Develop new criteria for 'climate safe' communities and developments	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Real Estate Disclosures	Update real estate transaction disclosure requirements for hazards related to climate change	INTERMEDIATE	MACRO	GRAY	LOW	$
Policies & Strategic Planning	Require Disclosure of Hazards	Enact legislation to require sellers of coastal properties to disclose potential hazards to buyers. Coastal hazards disclosure should accompany all real estate transfers of properties in coastal counties	INTERMEDIATE	MACRO	GRAY	LOW	$
Policies & Strategic Planning	Environmental Standards	Increase environmental quality standards to enhance resilience of natural water systems	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Flood Plain Mapping	Improve flood plain mapping given increasing frequency of major flood events	INTERMEDIATE	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Coastal Zone Management Plan	Create integrated coastal zone management (ICZM) plans and support Coastal Zone Management program	INTERMEDIATE	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Implement Living Shorelines	Conduct coastal re-alignment planning including conversion of land to salt marsh and grassland to provide sustainable sea defenses (IPCC)	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Coastal Resource Action Policies	Develop coastal resource action policies for adapting to more frequent severe storms, sea level rise, drought, erosion, and acute flooding events	INTERMEDIATE	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Coastal Adaptation Program	Create a Coastal Adaptation Program	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Beach Nourishment	Create or update State Beach Nourishment Program	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Beach Management Plan	Create or update Strategic Beach Management Plan with climate impacts	INTERMEDIATE	MACRO	GREEN	LOW	$

Policies & Strategic Planning	Climate Driven Immigration	Anticipate and prepare for potential climate-driven immigration from neighboring countries, especially along border states	LONG TERM	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Assistance Programs	Design assistance programs to respond to potential economic impacts, housing needs, dislocation and chronic deficiencies impacting health and quality of life in communities	INTERMEDIATE	MACRO	HYBRID	LOW	$
Policies & Strategic Planning	Adaption Action Area (AAA) Zoning	Enact planning laws that prevent new-construction in vulnerable zones, Coastal High Hazard Area (CHHA) / Adaptation Action Areas(AAA)	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Establish Leadership	Establish leadership in climate adaptation technology and career fields: engineering and design services, climate-sensitive infrastructure systems, ecosystem and beach management, economic security and services related to human health and safety.	INTERMEDIATE	MACRO	GREEN	LOW	$
Policies & Strategic Planning	Adapt Industries	Adapting state industries to more frequent severe weather events and disruption of once predictable patterns	INTERMEDIATE	MACRO	GRAY	MEDIUM	$$
Policies & Strategic Planning	Restructure Permitting	Refining permitting programs to account for climate change	INTERMEDIATE	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Restructure Zoning	Zoning Development away from sensitive and hazard prone areas	LONG TERM	MACRO	GREEN	HIGH	$$
Policies & Strategic Planning	Setbacks and Easements	Creating setback or rolling easements	LONG TERM	MACRO	GREEN	HIGH	$
Policies & Strategic Planning	Restrict Hard Structures	Restricting the use of shore protection structures	LONG TERM	MACRO	GREEN	MEDIUM	$
Policies & Strategic Planning	Impervious Surfaces	Minimizing extent of impervious surfaces	LONG TERM	MACRO	HYBRID	MEDIUM	$
Policies & Strategic Planning	Buffers	Establishing buffers around natural features	LONG TERM	MACRO	GREEN	MEDIUM	$$
Policies & Strategic Planning	Restructure Building Codes	Instituting or strengthening building codes in flood- and erosion-prone areas	INTERMEDIATE	MACRO	GRAY	MEDIUM	$

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