Flood Barriers: Evaluating Flood Preparedness Guidance for Historic Structures at Cultural Heritage Sites in the United States

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Abstract
More cultural heritage sites across the United States are at risk of flooding than previously recognized due to the escalating effects of climate change. The National Flood Insurance Program, which is responsible for mapping and communicating flood risk to citizens, has had little impact on the cultural heritage stewardship community. As a result, there is generally low flood risk awareness, low flood insurance take-up rates, and minimal investment in long-term adaptation among site stewards. More sophisticated, accessible tools for understanding flood risk are now available and should be leveraged to promote a culture of flood preparedness within the field. Disaster planning is becoming increasingly integrated into cultural heritage site management, but most preparedness resources focus exclusively on collections, largely omitting consideration for the historic structures which are the backbone of many sites. This may be because strategies for preparing historic structures for flooding require specialized knowledge of historic architectural systems, building codes, and preservation standards. The historic preservation community has not committed to developing preparedness guidance which integrates structures preparedness with the complexities of site management. What guidance is available on flood preparedness for historic structures is written primarily for private property owners and is deferential to the Secretary of the Interior’s Standards, which do not formally promote adaptation. This thesis therefore examines what flood preparedness guidance for historic structures at cultural heritage sites does exist and recommends how the cultural heritage stewardship community can improve and promote flood preparedness before irreplaceable structures become functionally obsolete due to flood risk.

Keywords
insurance, disaster planning, mitigation, climate change, risk, site management

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I. Introduction

Early civilizations from Egyptians to Incans, Maoris to Indigenous Americans, had flood myths that were central to their cultural and spiritual traditions.¹ Waterways and oceans have always facilitated human migration and trade, enabling development of the societies that now underpin world heritage. But just as water can foster life and prosperity, it can easily destroy it. In the age of climate change, increasingly frequent floods resulting from violent storms, heavy precipitation, and rising sea levels existentially threaten cultural heritage sites across the United States.

Cultural heritage sites (i.e., sites) are physical spaces where historical and/or creative legacies are memorialized to educate and enrich the public. While heritage sites vary in form and function, this thesis is specifically concerned with sites that are managed by cultural heritage site stewards (i.e., stewards) and that incorporate historic structures (i.e., structures) into their daily operations. Stewards are individuals and/or organizations who preserve cultural resources in order to make them accessible to the public and for posterity.² Structures, as defined in this thesis, are manmade buildings or objects, at least fifty years of age, that are either directly interpreted for their inherent significance or are used to exhibit and/or store other cultural resources (or both).³ It is the great responsibility of stewards to anticipate how flooding will affect the structures they care for and take proactive steps to best preserve them in a changing global climate.

² Stewards could be curators, conservators, building maintenance workers, administrators, educators/interpreters, and other specialists who oversee the preservation and operation of cultural heritage sites.
³ This definition adheres to the Secretary of the Interior’s 50-year age minimum of eligibility for listing in the National Register of Historic Places.
Unlike most other natural disasters, floods can be predicted using knowledge of site-specific topography, hydrology, and meteorological patterns. A steward’s full understanding of their site’s flood risk is critical to knowing what actions need to be taken to mitigate damage to both the structure’s historic fabric and to any cultural resources (i.e., collections) stored inside.

The National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency, has been the primary source of flood risk estimates in the United States since 1968. The NFIP has long struggled to communicate risk to and inspire urgent action among the general public. A large component of this disconnect between the NFIP and the public is the inaccuracy and incomprehensibility of its map-based flood risk rating system.

In June of 2020, the First Street Foundation (FSF), a non-profit flood research and technology group, launched a novel flood risk modeling tool called Flood Factor® which has higher geographic accuracy and integrates future flooding scenarios on more comprehensible timescales than do the NFIP’s risk maps. As a proxy for cultural heritage sites, the author input the coordinates of over 62,000 National Register of Historic Places entries into the FSF model and found that 8,674 historically designated sites, structures, buildings, and districts are at a 1% or greater annual risk of flooding – which is almost twice as many as identified in the NFIP model. Given the disparity between the FSF and FEMA risk models based on that National Register dataset, it is probable that many more cultural heritage sites are at significant risk than

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6 Flood Factor® was created and is maintained by the First Street Foundation, a non-profit research and technology group focused on advancing flood risk mapping and awareness
7 An interactive map and the associated database of these NRHP listings cross referenced with NFIP and FSF ratings can be found at this stable URL: https://bit.ly/2SD0GAN
currently understood. There is no geolocated dataset of the physical locations of all cultural
heritage sites in the United States currently available to flood risk researchers.⁸

Preemptively mitigating flood damage to a historic structure can be technically and
philosophically challenging for stewards and their greater organizations. Stewards must first
research their structure’s unique flood risk and vulnerabilities. Then, with that information,
proactively commit to preparedness undertakings that are potentially disruptive to operations
and resource intensive. Strong risk awareness within a stewardship organization is the best
foundation for prioritizing flood preparedness, but guidance for stewards on actually
implementing mitigation activities is currently lacking.

Whether for lack of will or lack of foresight, the historic structures preservation field has
not established guidance specifically for cultural heritage site stewards which advises on flood
preparedness. The National Park Service (NPS) is currently the only organization in the U.S.
(public or private) that is actively developing guidance about how to prepare historic structures
for flooding. But those resources which have already been developed by NPS are not
immediately applicable to most stewards who are expected to balance a site’s present needs
with future hazards.

The author conducted a national survey titled *Flood Risk: Perception and Preparedness
at Cultural Heritage Sites in the United States* in order to better gauge how stewards today
understand and act on flood risk to their sites in the absence of clear guidance. The survey
revealed a generally low degree of flood risk awareness among stewards, minimal mitigation

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⁸ In 2018, the Institute of Museum and Library Services published the “Museum Data Files” containing
vital information of over 30,000 cultural heritage sites in the U.S. but not provide geographic coordinates
for the sites’ physical locations. This data would have been a major asset to the author and a valuable
contribution to the field.
undertakings, but a surprisingly high degree of confidence that stewardship organizations and sites can recover from flooding.

This thesis will therefore evaluate the interrelationship between federal flood management policy for historic structures, the dearth of guidance on flood preparedness for historic structures available to cultural heritage site stewards, and the current state of flood preparedness at cultural heritage sites in the U.S. in order to illuminate what actions and resources are needed to improve preparedness for historic structures at cultural heritage sites.

II. Limitations

This thesis aims to address gaps in policy and guidance for stewards concerning flood preparedness for historic structures at cultural heritage sites. There are critical distinctions of how “preparedness”, “historic structure”, and “cultural heritage site” are used in the following text.

First, around the 1990s, a subfield within the greater U.S. cultural heritage stewardship field emerged which focuses on disaster preparedness, mitigation, response, and recovery (i.e., the disaster cycle) as a form of preventive conservation. Although disaster planning and response strategies are becoming better integrated in the operations of cultural heritage sites every year, much emphasis remains on the response and recovery phases. The preparedness and mitigation phases are more challenging because they require allocation of significant time, energy, and financial resources to a hypothetical event that may not happen during a steward’s tenure at a site. For that very reason, this thesis specifically focuses on flood preparedness for historic structures, as guidance for flood response and recovery is already available.

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10 A thorough analysis of this phenomenon is explained in Meyer and Kunreuther’s, “The Ostrich Paradox: Why We Underprepare for Disasters” (2017)
Second, not all historic structures represent cultural heritage sites, and not all cultural heritage sites include historic structures – though there is significant overlap between the two. While many cultural heritage sites’ missions are intertwined with historic structures, such as at a historic house museum, others incorporate historic structures to enhance their mission and visitor experience. There are also numerous cultural heritage sites that use modern buildings or “non-significant” older buildings for their daily operations. Furthermore, many now “significant historic structures” are original to their sites and have only become “significant” and “historic” by virtue of aging. The function, preservation standards, and legal status of a historic structure at a site impacts how it is regulated for purposes of flood preparedness.

Third, historic structures which are owned and operated as private residences (i.e., personal homes) or for-profit enterprises (i.e., businesses) do not face the same challenges as those at cultural heritage sites when considering flood preparedness and adaptation strategies. Private property owners typically have more flexibility when it comes to flood preparedness and adaptation strategies because the structure’s primary function is not to be publicly interpreted or experienced for aesthetic and material authenticity. In contrast, cultural heritage sites, which are generally owned and operated by either government or non-profit stewardship organizations, typically opt or are obligated to preserve structures to a high degree of aesthetic and material authenticity for the benefit of the public. This thesis does not directly address historic structures which are privately owned and/or operated as residences or for-profit ventures.

III. Flood Risk Ratings and Cultural Heritage Sites

For nearly two centuries, humans have increasingly exploited fossil fuels for transportation and manufacturing. When fossil fuels like coal, natural gas, and oil are converted to energy by combustion, they release carbon dioxide and other gases into the atmosphere
which absorb and trap heat from solar radiation, amplifying its effects on the temperature and moisture content of the troposphere. The resulting “global warming” has caused melting of ice caps and glaciers, sea level rise, increased precipitation, and more frequent violent storms. Floods resulting from these changes in climate now comprise 90% of all natural disasters in the United States (U.S.).

Well before the effects of global warming were understood, the U.S. federal government recognized its responsibility to protect life and property from the ravages of flooding. Throughout the late 19th and early 20th centuries, federal agencies such as the U.S. Army Corps of Engineers built levees, floodwalls, dams, berms, and culverts along coastlines and waterways to manage floodwaters. But flood management infrastructure could not keep up with development in and migration to floodplains, and floods became increasingly costly and fatal beginning in the early 20th century.

After nearly a century of piecemeal federal flood management policy, the landmark 1968 National Flood Insurance Act was signed into law. The act formalized the National Flood Insurance Program (NFIP), which is the main government entity responsible for guiding and enforcing flood hazard mitigation policy. The NFIP was originally founded under the Department of Housing and Urban Development and is today administered by the Federal Emergency Management Agency (FEMA). The program’s success relies on cooperation across all tiers of government, insurance agencies, mortgage lenders, and private property owners.

The NFIP’s mission has remained fundamentally unchanged since its founding; its primary responsibilities are to map and regulate floodplains in order to minimize the financial

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12 Chronology, American Institutes of Research, 2005
and human tolls from flooding, educated the public about flood risk and flood preparedness, and provide flood insurance to property owners who cannot otherwise get it from the private market. High flood risk communities are expected to enroll in the program in order to benefit from pre and post-flood federal disaster aid, including flood insurance. To fully enroll, a local government must first gain consensus among residents, as well as demonstrate commitment to implementing floodplain regulations in the form of building code enforcement and infrastructure development. Then, NFIP staff geographically models the community’s flood zone boundaries, identifying properties which fall within high-risk zones known as a Special Flood Hazard Areas (SFHA). Once this process is complete, flood insurance becomes available to property owners in high and moderate risk areas. Due to historical economic and social development trends along coastlines and waterways, many historic structures and cultural heritage sites are in these high flood risk zones.

In the 1970s, the NFIP began delineating SFHAs for regulation and insurance purposes based on a standardized flood risk model whereby topographic and hydrologic data of a given geographic area were cross-referenced with hydrological data from past precipitation events (i.e., precipitation volumes, stream and river flows, storm surges). Then, based on a minimum depth threshold of one foot of floodwater, the probability that those conditions would occur within a 1-year time interval were calculated to establish an area’s annual flood risk. The NFIP coined the term “100-year-flood” in an attempt to communicate to the public about areas at significant flood risk (annual risk probability of 1% or greater). The term was (and still is) misunderstood to mean that a significant flood will only happen once every 100 years, while in

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13 Private insurers withdrew from the market in the 1930s after a series of severe floods in the Midwest, leaving property owners without flood insurance coverage until the NFIP was created, leaving the burden of financial recovery on the government and private citizens
fact a “100-year-flood” could happen multiple times within the same year – particularly as the effects of climate change intensify. Correcting the misconception of the “100-year flood” and improving communication strategies about flood risk in general remains one of the NFIP’s greatest barriers to improving flood preparedness among U.S. residents.\(^{15}\)

Adding to the problem of miscomprehension of flood risk is the fact that 58% of NFIP flood risk maps, called Flood Insurance Rate Maps (FIRMs), which delineate 100-year-flood and 500-year-floodplains, i.e., SFHAs, were inaccurate or out of date as recently as 2017.\(^ {16}\) Although the NFIP is currently updating its methods of measuring and conveying flood risk, fifty years of low-accuracy, outdated risk maps and ineffective risk communication have created a culture of low risk awareness among the general population.\(^ {17}\)

In June of 2020, the First Street Foundation debuted an alternative risk modeling and education tool that improves on the NFIP’s FIRM map risk rating system. Their product, Flood Factor\(^\circ\), uses, “first-of-its-kind methodology [that] analyzes flood hazards, projects future climate scenarios, incorporates local adaptation, and validates against satellite and government records.”\(^ {18}\) The private non-profit’s express mission is to make accurate flood-risk data and research accessible to the general public in order to raise awareness and advocate for better long-term flood risk preparedness. According to FSF’s model, 14.6 million known properties in the United States currently have a 1% or greater flood risk – that is almost 6 million more at-risk properties than accounted for by FEMA as of 2020.\(^ {19}\)

\(^{15}\) As early as 1976, the NFIP began attempting to phase out the “100-year-flood” short-hand with limited success


\(^{18}\) A detailed explanation of the Flood Factor methodology can be found here: https://floodfactor.com/methodology.

In January of 2021, the author was granted access to FSF’s application program interface (API) in order to determine flood risk to National Register of Historic Places (NRHP) sites, as a proxy for cultural heritage sites. By inputting geolocational data (i.e., coordinates) of 62,453 NRHP listings (current as of 2018) into the FSF API, the author found that 8,674 listings registered a 1% or greater annual risk of flooding, compared to the 4,511 of 1% annual risk sites accounted for by NFIP ratings. Although this NRHP dataset is not fully representative of all cultural heritage sites in the U.S., these comparable findings suggest that many stewards may be misinformed about their site’s flood risk due to the potential inaccuracy of current NFIP ratings. The next section will discuss how NFIP risk ratings of individual properties directly impact flood adaptation policy for historic structures.

IV. Federal Policy and Guidance on Flood Preparedness for Historic Structures

In 1973, the NFIP introduced new structural adaptation requirements for high-risk properties, including elevation, relocation, and flood proofing measures to avert damage and loss. Because the proposed building adaptations required invasive and costly retrofits, structures which pre-dated 1974 or the date when the earliest community FIRM was adopted (known as “pre-FIRM” structures), were exempted without penalty. Pre-FIRM structures, which implicitly included all historic structures, remained eligible for subsidized flood insurance without expectation of meeting adaptation requirements. During a flurry of NFIP revisions in 1989 that partially focused on reducing repetitive insurance claim payouts to high-risk structures, those pre-FIRM exemptions were systematically revoked.

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20 Access to the FSF API was granted to the author via an existing programmatic agreement between FSF and The University of Pennsylvania’s Wharton Risk Management and Decision Process Center. Methodology documentation and a CSV document of the data can be found here: https://bit.ly/2SD0GAN

21 The NRHP data set was used as a proxy for cultural heritage sites in the U.S., because no similar aggregated, nation-wide dataset of heritage sites was available to the author at the time of publication.
One means by which pre-FIRM exemptions were revoked was through the legal definition of *substantial improvements* and *substantial damages*, which specified restoration and retrofit requirements in order to continue to qualify for insurance benefits.\(^{22}\) By the late 1980s, the U.S. historic preservation field had matured enough since passage of the National Historic Preservation Act in 1966 to push back against the NFIP’s new regulations for pre-FIRM structures because they were largely antithetical to the Secretary of the Interior’s Standards for Treatment of Historic Properties (i.e., Sol Standards).

As a result of the pushback, the term *certified historic structure* was introduced into NFIP regulations - marking the first time the agency formally acknowledged the unique needs of historic structures in flood management and adaptation.\(^{23}\) The rule specified that a certified historic structure – by definition, a building which was determined to be on or eligible for a national, state, or local register or inventory of historic places – would continue to be exempted from adaptation requirements so as to preserve historic authenticity and abide the Sol Standards.\(^{24}\)

The NFIP’s intention behind distinguishing *certified historic structures* from merely old structures was to reduce the number of property owners evading flood adaption on the grounds that it would negatively impact the historic character of a building. Under the substantial improvement clause, a historic structure that was not on or eligible for a local, state, or national historic register would have to meet adaptation requirements during any restoration activities

\(^{23}\) Definition of *historic structure* can be found at 44 C.F.R. §59.1.  
\(^{24}\) 44 C.F.R. §60.6(a).
that exceeded 50% of the structure’s market value regardless of if they diminished the building’s historic authenticity.\(^{25}\)

This 1989 rule therefore permanently tied flood adaptation policy for historic structures to the National Park Service (NPS) and the Advisory Council on Historic Preservation (ACHP), because of their responsibility for upholding the SoI Standards and administering the National Register of Historic Places.\(^{26}\) In the twenty years following the 1989 rule, leadership at NPS and ACHP, and by extension much of the historic preservation community, seemingly recused themselves from innovating on flood adaptation policy and technology for historic structures, despite escalating flood frequency and intensity. In 2005, Hurricane Katrina’s vast destruction in New Orleans and along the Gulf of Mexico coast proved a harsh lesson in how much more vulnerable cultural resources were to floods than previously recognized.

In 2010, National Park Service Director Jonathan Jarvis, who was known for his progressive attitudes toward climate change, formally established the NPS Climate Change Response Program.\(^{27}\) During his directorship from 2008-2017 during the Obama administration, Jarvis repeatedly called for innovations in resource management that was responsive to climate change and was an early proponent of “recognized loss” – acknowledging that all resources could not be preserved, given the scientifically projected scale and expediency of climate change impacts.\(^{28}\)

\(^{25}\) No data is available to determine if the 1989 rule stimulated nominations of structures to national, state, or local registered in order to qualify for the NFIP exemptions
\(^{26}\) Most state and local registers adhere to the NRHP standards
Apart from limited guidance from FEMA/NFIP, NPS has been the sole leader in developing climate change adaptation strategies for preserving built heritage resources since 2010. But, NPS strategies have largely focused on adapting management and operational policies and mostly address an internal audience, as opposed to technical or situational guidance which would be immediately useful to the greater site stewardship community. Few NPS resources directly address navigating the daily challenges of operating cultural heritage sites for visitors while planning and implementing adaptations. That type of guidance would be highly valuable to stewards with less research and planning capacity and would set a strong example within the field for proactive flood preparedness.

One useful resource that NPS has published is the scenario planning workflow found in the 2016 Cultural Resources Climate Change Strategy (see Appendix A). Although not specific to flood preparedness planning, the workflow offers a full-cycle assessment, planning, and mitigation framework which could help stewards integrate flood preparedness into their management strategy. An extensive review of relevant federal guidance and policy resources regarding preparedness and adaptation can be found in Appendix B.

The most relevant guidance that NPS has developed specifically concerning flood adaptation for historic structures is published in *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (i.e., Guidelines). Although preservation strategies like relocation and structural elevation have been practiced in the U.S. since the 18th century, and the NFIP has advocated for them since the 1970s, NPS only assented to them with the publication of the Guidelines in November 2019.29 In the Foreword, the authors stated:

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29 See “The History of Building Elevation in New Orleans” (URS group, 2012) and “Moving Historic Buildings” (Curtis, 1979)
The treatments described here may be considered as means of preserving historic properties located in floodplains and making them more resilient to flooding hazards. Flood events can be particularly destructive to historic buildings and therefore may require greater adaptive treatments. While many of these treatments can be undertaken with minimal effects on the historic character of a property, some may require more change than would normally be acceptable in other contexts. Consequently, such treatments would generally not be appropriate to use in the majority of rehabilitation projects when the historic building does not have a flood risk. The treatment selected should always be one that minimizes changes to the building’s historic character. Adaptation treatments should reduce the risk of flood damage as much as possible, but should do so without destroying significant historic materials, features, or spaces.30

The Guidelines essentially reiterate long-established NFIP flood adaptation practices but are overlayed with preservation principles derived from the S&I Standards and collections management practices. The Guidelines touch on a wide range of general to specific planning and implementation considerations, but the binary “recommended/not recommended” format leads to ambiguity in the guidance, sometimes to the point of contradiction.

For example, in the Site and Landscape Alterations section, “Retaining the topography and historic relationship between buildings and the setting” is recommended, while “Changing the grade level of the site if it substantially diminishes its historic character” is not recommended.31 And in the Coverings and Coatings section, where “Installing stanchions, fasteners, or tracks for flood shields in concealed or secondary locations, and in a manner that does not damage, alter, or otherwise impact the historic character of the property” is placed in opposition to, “Installing flood shield fasteners where they would damage, alter, or otherwise impact the historic character of the property”. The expectation that stewards can or should have

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31 Ibid, 17
to altogether avoid “damaging, altering, or otherwise impacting the historic character” may deter them from taking any meaningful preparedness actions.

Relatedly, the Guidelines are written to be highly deferential to the SoI Standards. The SoI Standards have never been formally revised to permit, let alone promote, site or structural adaptation for the sake of long-term preservation. Although it is uncommon for heritage sites to be removed from the NRHP, the threat of being delisted for taking significant adaptation actions is counterproductive to both preservation and flood mitigation goals, and disincentivizes NRHP designation. Preservation law scholars have recently intensified their critiques of the rigid SoI Standards for being unresponsive to intersecting climate, social, and economic crises.32

Scholar Sarah Bronin in her recent article Adapting National Preservation Standards to Climate Change (2021), calls for permanent changes to the SoI Standards, for “the law must adapt as the physical context of historic sites evolves,” and that, “the designation process may need to be overhauled to ensure that the very criteria that qualify a resource as eligible for listing on registers of historic places do not hinder our ability to make changes that ensure the resource withstands or adapts to the effects of climate change.”33

Also, that the Guidelines are written specifically in consideration of the SoI Standards of Rehabilitation may be influenced by the fact that most NFIP policy holders are private property owners. The SoI Standards for Rehabilitation are the least strict in terms of authenticity and most applicable to historic structures which are held as private property either for residences or

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for-profit ventures. Cultural heritage sites, unlike private properties, typically uphold higher authenticity standards of Restoration or Preservation, for which there are no flood adaptation guidelines.

Another resource which directly addresses cultural resources and flood risk is FEMA’s *Integrating Historic Property and Cultural Resource Consideration into Hazard Mitigation Planning: State and Local Mitigation Planning How-To Guide* (May 2005). This extensive booklet offers a four-phase framework that advises local officials and community leaders how to best address cultural resources, particularly built heritage, in municipal hazard mitigation plans. The framework emphasizes community input and cooperation across public and private stakeholders throughout the process.

The How-To Guide closely considers the value and role of cultural heritage sites in community resilience and how cultural heritage advocates can raise support for prioritizing cultural resources. It also clearly addresses how certified historic structures, and their relationship to the NRHP, are treated in flood adaptation regulations. On page 2-4, “Cultural Museum Disaster Preparedness” is specifically called out in a small subsection. The guidance offered about these “cultural museums” refers to the same resources which will be discussed in Section VI.

What the How-To Guide does well is emphasize the role of risk awareness and preparedness, and the integration of planning strategies with external parties, such as governments offices and other property owners. Perhaps the most valuable tool for site stewards from the How-To Guide is the *Inventory Historic Property and Cultural Resource Assets Worksheet* which could be adapted to inventorying assets at individual sites as an act of

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34 The SoI Standards for Rehabilitation are the minimum required standards to qualify for the Federal Historic Tax Credit, which is only available to for-profit ventures.
preparedness (see Appendix C). Ultimately, this resource is written for public officials who have some handle on historic preservation planning in their communities, rather than site stewards whose first professional obligation is to their unique site.

In using the How-To Guide, stewards should recognize that their sites may not be considered a priority by the community, which could result in the site’s exclusion from municipal hazard mitigation planning. Therefore, the How-To Guide may be most effective in reinforcing how stewards should respond to community needs if their sites are to be prioritized during mitigation planning. Without the guarantee of insurance or disaster aid coverage, which will be discussed in the following section, a stewardship organization may find itself existentially dependent on the surrounding community and local government in the event of a flood disasters.

V. Flood Insurance and Cultural Heritage Sites

Pre-FIRM, nonresidential “certified historic structures” continued to be exempted from flood adaptation requirements while still eligible for highly subsidized flood insurance until the passage of the Biggert-Waters Act of 2012 (BW-12). BW-12 significantly revised NFIP regulations in an attempt to regain financial solvency for the program by revoking the insurance subsidization to the remaining exempted categories of high-risk properties. Under the new rules, pre-FIRM nonresidential structures (i.e., all sites) would be charged full-actuarial insurance rates based on risk rating and replacement cost.

After BW-12, the cost of flood insurance for high-value, high-risk structures at heritage sites could be tens of thousands of dollars per year without subsidies – potentially resulting in stewards declining to carry flood insurance for inability to afford it and because nonresidential structures are less closely regulated by lenders and governments. Also, NFIP claim payouts are capped at $500,000 for structural damage and $500,000 for private property damage which, for
most heritage sites, may not be sufficient if a flood causes significant damage to a site.

According to property insurance agents who specialize in historic structures, many historic property owners underinsure their buildings because they cannot afford policies proportional to the full appraisal value of their historic structure, suggesting many sites may be un- or underinsured against flood damage.35

This hypothesis is difficult to confirm because most flood insurance research exclusively addresses rates and affordability for private homeowners.36 The Insurance Information Institute calculated that as of July 2020, only 4% of NFIP policies were held by businesses and nonresidential entities.37 In an interview with the state of Maryland’s NFIP Coordinator Kevin Wagner, he said that in the over fifteen years he had held the position, he had never coordinated an NFIP insurance policy for a cultural heritage site or even a nonprofit entity.38 This reinforces how unlikely it is that sites are participating in the flood insurance market at all. Given the scant information available about NFIP impacts on nonresidential policy holders, the low take-up rate of flood insurance policies by nonresidential owners, and the likely high cost of insurance to sites following BW-12, it is clear that the NFIP is not serving the cultural heritage community. There is also a great deal of confusion about if and how publicly-owned

sites are insured against flooding, adding to the confusion about how sites are financially preparing for flood risk.\textsuperscript{39}

Recovering a structure from flood damage can be highly invasive, costly, and protracted. Without flood insurance coverage, stewards must rely on regular operating budgets, FEMA disaster assistance grants, small business loans, and fundraising campaigns to recover their structures and collections, burdening already thinly stretched financial resources of government and granting programs. The best way to avoid the need for intensive and costly recovery is for sites to implement strong preparedness practices, as will be discussed in the following section.

\section*{VI. Historic Structures and Flood Risk Mitigation Planning at Cultural Heritage Sites}

Water is the most ubiquitous and pernicious agent of deterioration for historic structures. Its short and long-term effects can compromise a structure’s stability, integrity, and internal environment, jeopardizing safety of collections and visitors if left unmitigated. Stone can spall, bricks can fracture, mortar can disaggregate, wood can decay, plaster can disintegrate, and metals can corrode as a result of prolonged water exposure. Flooding often compounds water’s most insidious impacts with the sudden blunt traumas of hydrostatic pressure and debris strikes. Although some architectural materials, designs, and site contexts can better withstand flooding, rarely will a structure be altogether unharmed following a flood (see the \textit{Building & Structures} column in Appendix D).

Unlike collections and other moveable materials at cultural heritage sites, structures cannot be relocated immediately prior to flooding. Flood preparedness strategies for historic structures require long-term, continuous planning and domain knowledge of historic architectural materials and systems, water-related pathologies, physical site context, legal


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codes, and specialized insurance. These factors may be out of the purview, and therefore the minds, of many stewards who are tasked with disaster preparedness planning. Furthermore, the “moveability factor” of collections makes preparedness planning for those cultural resources more realistic and achievable, therefore more embraced by stewards.

Disaster preparedness and response protocols for collecting institutions (i.e., museums and archives) have become standardized and widely accessible over the past two decades in the form of web resources, templates, how-to guides, trainings, mutual support networks, and more. The American Institute for Conservation (AIC), the primary professional membership organization for cultural heritage conservators, is a leader in the field on developing, promoting, and coordinating disaster preparedness and response protocols. AIC’s non-profit arm, and the Foundation for Advancement in Conservation (FAIC), receives grants and private donations to further this mission.40

AIC/FAIC’s contributions to the field of disaster preparedness and response for cultural heritage are extensive, but they almost exclusively focus on collections, with a disproportionate emphasis on response and recovery. In collections-focused disaster planning resources, there is rarely acknowledgement of or guidance on documenting, preparing, adapting, and insuring the significant historic structures in which many collections are stored. Structures are instead referenced in these resources as things that must be “stabilized”, “secured”, and, at best, “salvaged” following disasters. Upon a review of disaster planning resources from twelve leading U.S.-based cultural heritage stewardship organizations (governmental and nonprofit), only two: the National Trust for Historic Preservation and the National Park Service, directly acknowledge

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40 Grantors to FAIC include the National Endowment for the Humanities, the National Endowment for the Arts, the National Center for Preservation Technology and Training, the Institute for Museum and Library Services, the Andrew W. Mellon Foundation, the Getty Foundation, and others
and advise on disaster preparedness for historic structures. See Appendix E for a table of disaster preparedness resources from leading U.S. cultural heritage stewardship organizations which notes whether their resources do or do not acknowledge historic structures.

Perhaps this dearth of historic structure-specific guidance for stewards is due to inattention from the field of architecture and historic structures preservation. Although there are seemingly active disaster planning working groups in professional membership organizations such as the Association for Preservation Technology, the American Institute of Architects, the American Planning Association, and the National Council of Structural Engineers Associations, their efforts are focused only on disaster response and recovery, modern retrofits, and resilient design for new construction.

Unlike AIC/FAIC and other collections-focused organizations, the historic preservation field has scarcely sought funding for research on the subject of flood preparedness for historic structures. Between 1994 and 2019, the National Center for Preservation Technology and Training, a branch of NPS, has only awarded three grants for researching flood preparedness and adaptation for historic structures.\footnote{The three grants were: “A Comparative Study of Flood Approaches to Develop Recommendations for Different Types of Historic Buildings on Varying Types of Sites” to the National Trust for Historic Preservation (2016), “Planning to Preserve Our Coastal Heritage and Culture: Disaster Planning and Recovery for Heritage and Cultural Sites in Coastal Georgia, Coastal South Carolina, and Northeast Florida” to the Bryan-Lang Foundation, Inc., (2006), and “Disaster Science and Heritage Resources: Modeling and Mapping the Risks to Critical Heritage Infrastructure in New Orleans” to Louisiana State University (2005); NCPTT. “Awarded Grants.” National Park Service. Accessed May 30, 2021. https://www.ncptt.nps.gov/grants/awarded-grants/.
} The Preservation and Access division of the National Endowment for the Humanities commonly offers recovery grants for institutions that have incurred flood damage, but seemingly does not subsidize research for preparedness.\footnote{The National Endowment for the Humanities. “Grants.” Accessed May 31, 2021. https://www.neh.gov/grants.}
It is unclear whether this lacuna is caused by the irrefutable challenge of preparing historic structures for flooding, undue pessimism or optimism that historic building systems can endure flooding, or a field-wide preference for restoration over prevention. Whatever the reason, the historic preservation field is forgoing an important opportunity to develop, advocate for, and educate on strategies to preserve, through preparedness, the integrity of historic structures subject to flooding. Without guidance from historic structures preservationists, stewards from other specialties will likely continue to disregard the unique needs of historic structures in their flood disaster planning.

VII. Survey: Insights on Flood Risk Awareness and Mitigation Activities Among Cultural Heritage Site Stewards Today

Survey Methodology

A core research component of this thesis was a mixed method online survey titled *Flood Risk: Perception and Preparedness at Cultural Heritage Sites in the United States*. The survey intended to gain an understanding of how cultural heritage site stewards and organizations in the U.S. currently perceive and respond to flood risk at their sites, with specific regard for preservation of historic structures. This thesis demanded primary data collection because empirical, nationally-representative data on the subject was not available to reference.

Some survey components were inspired by the Heritage Health Index Survey, facilitated by the Institute of Museum and Library Services in 2004 and 2014, which sought to establish the state of collections preservation in the U.S. Due the geographic breadth of both flood hazards and heritage sites, alternative empirical data collection methods such as direct interviews, would not have been as efficient, representative, or impartial.
The aim of the survey was to garner responses from staff employed by site stewardship organizations whose daily operations incorporate historic structures. Respondents ideally had knowledge of a site’s operations, collections management, facilities management, and/or administrative matters. For example, the head of collections management at a state history museum located in a historic building or the head of facilities at a historic house museum would have been ideal respondents.

The survey was entirely anonymous to avoid disclosure issues that might have influenced responses. Although introductory text reiterated intended audience, the anonymous nature of the survey precluded eligibility validation. Participants were not solicited from known flood risk areas, and due to the anonymity of the survey, there was no way to confirm whether a particular respondent’s site was at significant flood risk unless self-reported.

Survey questions were designed to gauge flood risk awareness among stewards and degrees of preparedness among stewardship organizations. Heritage sites, as defined in this thesis, varied widely across primary function, size, organizational structure, and region – but ultimately all stewards working in the field are informed by the same guidance (or lack thereof). Due to inconsistent representation across subgroups, responses according to those organizational and regional categories were not directly compared in the following summary of findings.

The survey was open for a total of four weeks from February 22 to March 22, 2021. A link to the survey with a statement of intent was distributed online via targeted message board postings, listserv emails, social media posts (Facebook and Twitter), and direct outreach to relevant umbrella organizations. Survey participation requests were posted to the publicly-

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43 Five respondents did not fit ideal criteria, but their responses did not significantly impact overall survey conclusions and were therefore retained
accessible message boards of the American Alliance of Museums, the American Association of State and Local History, the American Institute for Conservation/Foundation for Advancement in Conservation, the Society for American Archivists, and the National Trust for Historic Preservation.

Direct outreach to stewards through an active listserv called Museum-L and FAIC’s Alliance for Response (AFR) chapter listservs also helped increase response rate.44 Last, responses were solicited by posting to professionally-oriented, active Facebook groups such as Historic Preservation Professionals, Emerging Conservation Professionals Network, and Museum Collections Management. Some contacts from regional networks such as the Puerto Rico, Texas, and New York AFR chapters and the Midwest and Southeast Regional Museum Associations redistributed the survey through their communication channels.

Survey Design

Qualtrics© February 2021 survey software was used to build the survey.45 Respondents answered between 33 and 45 qualitative and quantitative multiple choice questions about the respondent’s flood risk awareness and flood preparedness activities at their sites. A copy of the survey questions can be found in Appendix F. The survey garnered 134 responses from 35 states, Washington, D.C., and Puerto Rico, with a 90% completion rate.46 Data were processed using the analytic tools built into the Qualtrics platform, as well as hand-calculated, without any weighting or other data manipulation.

Survey questions and response choices were configured to gauge respondents’ own awareness of risk to their site and to illuminate any positive or negative trends among

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44 The Alliance for Response is an initiative of the Foundation for the Advancement in Conservation (FAIC)
45 Documentation on Qualtrics Survey Software here: https://www.qualtrics.com/core-xm/survey-software/
46 The remaining 10% (11 total) answered between 52-95% of the questions
stewardship organizations relating to flood risk awareness, prioritization, and mitigation. The survey anticipated that respondents represented a site that incorporated a historic structure in its mission or daily operations, and across all 134 sites represented in the survey, 63% (81 total) were listed on a national, state, or local historic register. The survey intent was to understand if, why, and how stewards were undertaking flood preparedness activities, with particular regard for historic structures, in order to inform research conclusions presented in previous sections of this thesis.

There are an estimated 46,000 cultural heritage sites in the United States encompassing museums (history and art), repositories (archives, libraries, specialized collections storage), and interpreted built heritage sites (historic house museums, military history sites). Based on that estimate, the response rate to this survey was only 0.3% of sites. It should therefore be noted that conclusions derived from the survey results are more empirically informative than statistically representative of the cultural heritage site stewardship field.

Summary of Findings

Flood Risk Awareness Among Cultural Heritage Site Stewards

Basic flood risk awareness among site stewards is the first and arguably most critical step to achieving good flood preparedness at a site. Flood risk awareness entails knowing a site’s probability of flooding, what assets, systems, and access points may be endangered, and to what degree, as well as what response and recovery options are available based on that

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47 Estimate drawn from combining the IMLS’ 2019 Heritage Health Index Survey (31,390 collecting institutions) and researcher Susan Orr’s 2010 graduate thesis, “Historic House Museum Sustainability in the 21st Century” (15,000 historic house museums)

48 A table of all survey results can be found here: https://bit.ly/2SD0GA. Some information has been redacted for privacy.
probability and intensity. Analysis of the survey findings focuses on flood risk awareness to
gauge a baseline degree of flood preparedness among site stewards.

Flood risk awareness was primarily measured by respondents’ knowledge of their site’s
flood history (Question 30), flood risk assessment (FRA) status (Question 35), NFIP flood risk
rating status (Question 38), and flood insurance status (Question 48). Stewards who responded
“not sure” to those questions were deemed to have low risk awareness, while those who
responded affirmatively (“yes” or “no”) were deemed to have high risk awareness.

Flood History

A site having been previously flooded is an indicator that it is likely to flood again under
certain weather conditions. By retrospectively measuring the amount of precipitation that fell
over a certain time interval and then extrapolating that data into predictable repeat
meteorological scenarios, hydrologists can produce a “recurrence interval” or statistical
likelihood of repeat flood events.49 From 2009 to 2018, the number of properties in the U.S.
which experienced repeated flooding increased by 43%.50

Fifty-nine stewards out of 134 (44%) responded that, to their knowledge, their site had
previously flooded, and 59 responded that their site had not previously flooded, while only 16
(12%) were not sure. The respondents’ high awareness of their site’s flood history (regardless if
it had or had not flooded) suggests a basic recognition of risk. Of the 59 stewards who claimed
their sites that had flooded, almost all also knew how recently and how many times it had

topic/water-science-school/science/100-year-flood?qt-science_center_objects=0#qt-
science_center_objects.
flooded, as well as the source of the floodwaters. This population also had the lowest rate of uncertainty about flood insurance coverage (35% “not sure” compared to an average of 41% across all respondents) and FRA status (21% “not sure” compared to an average of 35% across all respondents).

Among the 12% of respondents that were unsure of their site’s flood history, 50% of them were unsure if their site had ever conducted an FRA, compared to the 35% average across all respondents, and 50% of them were also unsure if their organization carries flood insurance, compared to the 41% average across all respondents. These statistics suggest that a steward’s low awareness of a site’s flood history correlates to other indicators of low awareness. But, as is suggested in the next section, a high degree of flood history awareness does not necessarily correlate to a steward’s overall high awareness.

**Flood Risk Assessments**

Flood preparedness requires that stewardship organizations research and carefully consider the full extent of risk and vulnerabilities to their site. Comprehensive flood risk assessments evaluate flood history, flood risk rating, flood exposures, and environmental, social, and economic contexts which determine potential impacts on the site’s operations. Many FRAs are not quite that extensive, but at minimum should include flood history, flood risk ratings, and potential impacts. Often, FRAs are embedded within larger all-risk assessments that include multiple hazard scenarios like structural failure, pest infestation, vandalism, and theft, as well as other natural disasters such as tornadoes, wildfires, and earthquakes. Having a relatively

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51 A reported 80% of flood events at survey sites have happened within the last 15 years, which may be influenced by heightened knowledge of near past events and not representative of actual flood-frequency.

up-to-date FRA can be a strong indicator of flood risk awareness and a sign of prioritization if the FRA is widely shared with staff and continuously referenced in mitigation planning.

Half of all survey respondents stated that an FRA had been conducted either individually or as part of a larger risk assessment for their site, while 35% of respondents were unsure if one had ever been conducted, and the remaining 15% confirmed their organization had not conducted one. Though among those 50% of stewards who had done an FRA, 46% of them still did not know their risk rating status and 41% were not sure if their organization carried flood insurance. FRAs are intended to provide strong grounding for flood emergency and flood mitigation planning, but if the findings are not shared widely among site staff and stakeholders and used to inform mitigation planning decisions, the assessment’s value to a site’s overall preparedness is minimal.

_Flood Risk Ratings_

Risk is a measure of hazard, exposure, and vulnerability. The NFIP models flood risk based on hydrologic and hydraulic mapping, topographical elevation, flood history, property types, and recurrence intervals. The program then uses that model to determine risk ratings for certain geographic areas for the purposes of building code regulation, insurance appraisals, and disaster aid eligibility. High-risk areas are called Special Flood Hazard Areas (SFHA) by the NFIP. Ratings which start with A and V are in high-risk zones, while ratings that start with X are in minimal-to-low risk zones.\(^53\) If a site is in an a high-risk zone, (i.e., in an SFHA), it is automatically regulated by the NFIP and the properties owners are expected to carry flood insurance. Although new risk rating tools such as Flood Factor® are now available, NFIP risk ratings still

dictate the government’s regulatory authority over property owners and determine their eligibility for certain disaster aid funding.

Among the 134 survey respondents, 74 (57%) were unaware of their site’s risk rating status – indicating an alarmingly low degree of basic knowledge of risk and its legal implications among stewards. Only 15 stewards could confirm that their site is in an SFHA and 43 could confirm that they their site is not in an SFHA. Even among those 59 stewards whose sites had previously flooded, 56% of them were nonetheless unaware of their site’s risk rating status. The stewards whose sites had not flooded were actually more aware of their risk rating status than those whose sites had flooded (51% “not sure” compared to 56%). These findings suggest two things; first, knowledge of past flooding does not correlate to awareness of risk rating status and two, site stewards are also subject to the NFIP’s struggle to raise awareness about flood risk.54

Flood Insurance

Risk ratings are not merely informational – they correspond to insurance coverage and building code requirements set forth by the NFIP to reduce disaster aid spending and mitigate flood losses. The NFIP has historically struggled to compel high-risk property owners to purchase and maintain flood insurance, due in part by the program’s weak regulation enforcement and compliance mechanisms.55 Penalties for noncompliance are retroactive, typically coming in the form of withheld disaster aid after a building has been damaged, which can seriously hinder a steward’s ability recover the building.

For example, in 2002 the central library and city museum of Rouseau, Minnesota, was inundated with six inches of water causing substantial damage to the structure. The city had not insured the building against flooding, despite it being in an SFHA. Recovery funds from FEMA to help restore the building were subsequently reduced by 78% from $337,711 to only $73,877 for the city’s noncompliance with NFIP insurance requirements.\textsuperscript{56} As the NFIP identifies more at-risk properties in their upcoming risk-rating efforts, situations that like that of the noncompliance penalty levied against the Rouseau City Museum and Library could become more frequent.\textsuperscript{57}

In the survey, 44% percent of all respondents answered “not sure” about whether their organization carries flood insurance for their historic structures. Of that population, 60% were also not sure of their site’s flood risk rating, compared to the average of 57%, and 55% were not sure if their organization had ever undertaken a flood risk assessment, compared to an average of 35% – reinforcing the correlation between low awareness indicators.

Among the 42 stewards (31% of all responses) who confirmed that their organization does carry flood insurance for their structures, 6 carried NFIP-backed insurance, 5 carried private flood insurance, 11 were not sure why type they carried, and 20 of them claimed that they were self-insured (18 government-operated and 2 were non-profits). While the NFIP accepts self-insurance by government entities as a form of compliance, the expectation is that that local government/property owner will singularly fund the cost of recovery from its general

\textsuperscript{56} "FEMA 1419-DR-MN; City of Roseau; Project Worksheet 1042; Library and Museum." Accessed April 14, 2021. \url{https://www.fema.gov/appeal/library-and-museum}.

disaster recovery budget, which could be quickly depleted in the event of widespread flooding. Referring back to FEMA’s How-To Guide, if a site is not considered a community priority and is not individually insured against flooding, the organization may not receive sufficient public funds necessary to expediently recover a historic structure. Self-insurance, while seemingly cost effective and pacifying for organizations, could result in a protracted, underfunded recovery similar to what happened to the Rouseau museum and library.

Flood Mitigation and Adaptation at Cultural Heritage Sites

The degree of attention given to flood preparedness of a historic structure depends on a steward’s risk awareness and understanding of mitigation options, as well as the value a stewardship organization places on its structure’s utility and authenticity. Meaningful mitigation activities to minimize flood damage can take years of planning and may require difficult, expensive choices. If a steward does not value a structure enough to invest in mitigative actions, they risk allowing it to become functionally obsolete if severely and/or repeatedly damaged by flooding.

The University of Iowa’s Museum of Art, designed by noted modernist architect Max Abramovitz, opened in 1969 in the floodplain of the Iowa River in Iowa City. The university undertook major renovations in 2003, adding more gallery and storage space but making no flood mitigation investments. In 2008, an major riverine flood forced the staff to evacuate the entire 12,400 item collection.

Following the flood, FEMA declined the university’s appeals to provide funds to fully replace the damaged building, citing the substantial damage clause, and the university refused

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to use the insurance money to rehabilitate and retrofit it. In 2011, when asked about the status of the original building, the new museum director stated that people, “confuse the importance of the art and the building; a museum is its collection, not the building it’s housed in,” and that they would lose accreditation if they returned to it.”60 By the time of the flood, the building would have only been about 40 years old, so not yet the standard minimum age for historic designation. The once celebrated structure became functionally obsolete due to its flood risk and was abandoned before it could age into its eligibility for a historic register.61 The unfortunate outcome of the University of Iowa’s original Museum of Art building might have been avoided if flood mitigation had been integrated in the museum’s operations.

The above anecdote alludes to how easily structures can be devalued if they are perceived as deficient and suggests a related unwillingness to invest in substantial mitigative actions in order to preserve a building. In the survey, stewards were asked directly what, if any, steps their organization had taken to prepare their historic structures for flooding. Options included landscape adaptation, purchasing emergency supplies, dry and wet floodproofing, elevation, purchasing flood insurance, and other.

Of all the mitigation steps, landscape adaptation to retain or divert water away from the historic structure was selected the most (70 selections out of 224), and purchasing emergency supplies such as sandbags and generators was selected the second most (67 out of 224). Stewards probably favor these two mitigation methods because they are minimally invasive to

the structure and require less planning and resources than structural adaptations. But these methods are also less effective at keeping water out during major flood events, which are happening more and more frequently.\footnote{A major flood is, “is defined to have extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.”} Also, although these two common mitigation strategies seem cost effective and therefore attractive to stewards, they require diligent maintenance (particularly of landscaping), on-site storage, and continual staff training, and may ultimately be more expensive in the long-term.

Far fewer respondents had undertaken the more permanent, substantial mitigation activities such as those recommended by the NFIP. Twenty-two respondents stated their organizations had undertaken wet-floodproofing, which involves elevating utilities like electrical and HVAC equipment above predicted flood levels. Wet-floodproofing may also involve introducing flood vents into foundation walls to allow water to pass through the structure, rendering the levels below the vents unusable for collections storage or interpretive space. Seventeen respondents had implemented dry-floodproofing, which involves completely sealing the foundation, exterior walls, and all ground-level openings, typically with modern materials, and structurally reinforcing interior walls to withstand hydrostatic pressure. Twelve had elevated their structures, which requires raising the structure above anticipated flood or wave height and is most common in coastal regions. Elevating an existing building will impact its barrier-free access, storage capacity, and relationship to the landscape. Twenty-one respondents selected “other”, some of which steps included applying waterproof coatings to

\footnote{A major flood is, “is defined to have extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.”; National Weather Service. “High Water Level Terminology.” NOAA’s National Weather Service. Accessed May 31, 2021. \url{https://www.weather.gov/apr/fc/terminology}.}
subgrade exterior walls, keeping flood recovery specialists on retainer, and installing sump pumps. Twenty-five respondents selected “no, none of these apply”.

When asked if respondents agreed that flood preparedness was a consistent priority for their organization, 48% strongly or somewhat agreed, 14% were neutral, and 39% strongly or somewhat disagreed. Sixty-four percent of those who strongly or somewhat agreed represented a site that had previously flooded, a rate twice as high as those representing sites that had not previously flooded – reinforcing flood history as a basis for preparedness prioritization. That 48% who believe flood preparedness was a priority within their organization were also more likely to carry flood insurance, to know their flood risk rating status, and to have taken more permanent flood mitigation steps such as dry and wet floodproofing (see Appendix G for cross comparison of flood preparedness prioritization confidence ratings and flood risk awareness indicators).

Respondents were also asked if any perspectives about barriers to achieving good flood preparedness for historic structures applied to their organizations. Among that 48% whose sites consistently prioritized flood preparedness, the most common response after “no, none of these statements apply” (29 out of 63) was “structure can’t be adapted” (17 out of 63), followed by “adaptation options too expensive” (10 out of 63). These results suggested that even if a steward expressed a commitment to flood preparedness, the technical and financial challenges of mitigation may supersede the organization’s ability to implement steps. For the 39% of stewards who expressed that flood preparedness was a low priority for their organization, a “lack of staff or planning resources” (19 out of 51), followed by “low awareness of flood adaptation or mitigation options” (11 out of 51) were the most common statements selected.
VIII. Conclusion and Recommendations

The cultural heritage site stewardship community in the United States is generally underprepared to protect historic structures from the rapidly mounting threats of more frequent and destructive flooding. As evidenced by the survey results, basic awareness of flood risk among stewards is low, and stewardship organizations which have not previously dealt with flooding are much less likely to prioritize flood preparedness. Even among stewards who have experienced flooding and do supposedly prioritize flood preparedness, the most common mitigation solutions are overwhelmingly low-investment and short-term.

Findings from the survey suggest an overall lack of urgency to meaningfully prepare structures for a future with more frequent flooding, which is consistent with the challenges that NFIP has long faced in compelling the general public prioritize preparedness. The NFIP and the cultural heritage stewardship community should therefore launch a significant risk-awareness campaign, which will first require geolocating all at-risk cultural heritage sites in the U.S. Then, leaders in the field of cultural heritage stewardship such as the National Trust for Historic Preservation and the American Alliance of Museums, in conjunction with the NFIP, can conduct targeted outreach to educate stewards about their sites’ risk and convey what mitigation options are available to them, as well as the projected consequences of inaction.

While moveable collections can be shepherded to safety, the historic structures that are integral to a site’s value are often left fully exposed to floodwaters’ destructive forces for lack of any clear strategies to best prepare them immediately prior to a flood. But just as collections preparation and recovery strategies have been developed, collated, and shared widely by collections specialists, built heritage preservation specialists can do the same for historic structures with enough will and intention. Site stewards of all specialties must recognize that regardless if a structure is the main attraction at a site, or an aesthetically pleasing container for
collections, its unique value and contribution to a site’s mission must not be overlooked during flood preparedness planning. If a site’s critical historic structures become unsafe for collections or visitors to return to following a flood, then recovery efforts will be stalled, and operations cannot resume – endangering the steward’s mission altogether.

The guidance currently available on flood preparedness for historic structures was primarily developed for private owners or government officials and does not speak to the tremendous challenge of operating a heritage site for the public amidst implementing mitigation activities. Future guidance should acknowledge and closely consider the variable function, value, and vulnerabilities of a historic structure within a site’s greater context, and represent a collaboration between all of a site’s stakeholders, including the surrounding community. Historic structures specialists can work closely with stewards and professionals of other specialties to develop more holistic, comprehensive preparedness strategies while simultaneously encouraging greater prioritization of structures in disaster preparedness planning.

New flood preparedness guidance for structures should be practical, actionable, and financially quantifiable in order to be readily useful to stewards. Maintenance and preventive strategies for protecting structures from hydrostatic pressure and moisture damage are well established; structures specialists need only collate these strategies and reframe them for application in near and mid-term flood preparedness mitigation, while also advocating for long-term adaptation. This will require more commitment to researching the subject from the built heritage preservation field and higher expectations among professionals to share information in the form of publications and presentations. For example, Vizcaya Museum and Gardens, which recently received a $3.6 million FEMA Hazard Mitigation Grant, should publish a case study on
the planning and implementation process of hazard mitigation activities based on its experience.63

The National Park Service’s *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* is a good semi-technical resource which outlines adaptation options with consideration for historic preservation principles. But, the Guidelines’ ambiguous position on certain recommendations, abetted by deference to the Secretary of the Interior’s Standards for Treatment of Historic Properties which do not promote adaptation, is problematic. Every built heritage preservation stakeholder must demand the Secretary of the Interior’s Standards for the Treatment of Historic Properties promote long-term flood adaptation strategies which prioritize basic survival and continued utility over aesthetic or material integrity. Also, the Guidelines’ intended audience is more so private property owners than site stewards. The Federal Emergency Management Agency’s *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning: State and Local Mitigation Planning How-To Guide* is also not intended for site stewards, rather for public officials who are responsible for working with communities and private citizens to prioritize threatened cultural resources. The How-to Guide is most useful to stewards in explaining how a site can be integrated into municipal-level flood preparedness planning, as well as highlighting how critical it is to a site’s long-term survival that the surrounding community values and prioritizes it.

Given the apparent prioritization of landscape adaptation and non-invasive mitigation options based on survey results, the historic preservation stewardship community should work more closely with landscape architects, environmental specialists, infrastructure specialists, city

planners, and flood-supply manufacturers to develop flood preparedness solutions that satisfy both historic preservation standards and flood mitigation best practices. Better funding sources for this type of research would spur development of more short, mid, and long-term preparedness strategies and support awareness campaigns. The National Center for Preservation Technology and Training and The Keeping History Above Water project has already begun this research and information dissemination, and can be leveraged to improve guidance specifically for site stewards. Stewards themselves should also intentionally document and publish on their mitigation undertakings, for the benefit of the field. Non-cultural heritage specific funders such as FEMA, insurance agencies, infrastructure and construction firms, and flood barrier manufacturers should also fund preparedness research and advocate for better guidance as an investment in community resilience.

It imperative that flood preparedness strategies for historic structures be integrated into disaster planning resources already being used by cultural heritage site stewards, as more sites are at risk of flooding every year in the era of climate change. The built heritage conservation field and collections management field must collaborate more dynamically to ensure that happens. There is truly no time to wait; thousands of irreplaceable historic structures that are the backbones of cultural heritage sites, the protectors of invaluable collections, the north-stars for communities, and the material reminders of diverse historic and artistic legacies may be permanently lost if they are not better prepared for a future with flooding.

Bibliography


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Appendix A. Climate Change Scenario Planning Workflow from the National Park Service’s *Cultural Resources Climate Change Strategy* (2016)

For Baseline Inventory

- Climate Projections
- Landscape Scale Vulnerability Assessment

= Prioritization of Areas to be Inventoried

For Resource-Specific Vulnerability Information

- Climate Projection & Impacts
- Known Resources

Resource Vulnerability Assessment

For Vulnerable Resources

- Significance Evaluation
- Resource Vulnerability

Prioritization of Resources for Action

Develop Goal for Vulnerable Resources

Identify Range of Adaptation Options

Filter Options with Constraints and Opportunities

Adopt and Implement Actions

Monitor Resource and/or Adjust Condition Assessment Cycle

LEGEND

- Climate change data & techniques (Science Pillar)
- Ongoing cultural resources management
- Climate change response technique (Adaptation Pillar)
- Integrated Climate and Cultural Resources Management

Graphic 3. *Cultural Resources Management - Climate Change Integration Flow Chart*. This chart outlines major touchpoints between climate change and research, planning, and stewardship stages of cultural resources management.
Appendix B. Review of Federal Guidance on Flood Preparedness for Cultural Resources

<table>
<thead>
<tr>
<th>Agency</th>
<th>Year</th>
<th>Resource Title</th>
<th>Summary &amp; Relevance</th>
<th>Strengths</th>
<th>Weaknesses</th>
<th>URL accessed 5/2021</th>
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<td>FEMA</td>
<td>2005</td>
<td>Integrating Historic Property and Cultural Resources into Hazard Mitigation Planning</td>
<td>How-to guide directed toward public officials to conduct community-level planning to prioritize cultural resources for mitigation planning</td>
<td>Instructive and comprehensive, introduces community engagement and community-driven prioritization, offers planning worksheets and tools</td>
<td>Not specific to flood preparedness interventions, not directed toward cultural heritage sites and stewards</td>
<td><a href="https://www.fema.gov/pdf/firma/386-6_book.pdf">https://www.fema.gov/pdf/firma/386-6_book.pdf</a></td>
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<tr>
<td>FEMA</td>
<td>2005</td>
<td>Before and After Disasters - Federal Funding for Cultural Institutions</td>
<td>Overview of various grants and funding opportunities for cultural institutions to support preparedness, mitigation, and recovery processes</td>
<td>Cultural institution specific, clear explanation of available funds and stipulations</td>
<td>Out of date, primarily focuses on post-disaster response and recovery, no mention of historic structure restoration</td>
<td><a href="https://www.arts.gov/about/publications/and-after-disasters-federal-funding-cultural-institutions">https://www.arts.gov/about/publications/and-after-disasters-federal-funding-cultural-institutions</a></td>
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<tr>
<td>FEMA</td>
<td>2007</td>
<td>DAP5S21.3 - Disaster Assistance Policy for Private Nonprofit (PNP) Facility Eligibility</td>
<td>Policy explanation of how private nonprofits can access FEMA funds to repair, restore, reconstruct, or replace facilities</td>
<td>Definitive policy on how sites can access funds, relevant to site stewards</td>
<td>Primarily focuses on disaster response and recovery, jargon-y, and reference other obscure policy documents</td>
<td><a href="https://www.federalregister.gov/documents/2003/06/23/03-15171/private-nonprofit-facility-eligibility">https://www.federalregister.gov/documents/2003/06/23/03-15171/private-nonprofit-facility-eligibility</a></td>
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<td>NPS</td>
<td>2010</td>
<td>Climate Change Response Strategy</td>
<td>Outlines NPS’s four integrated components of response strategy: science, adaptation, mitigation, communication, and goals/steps for their implementation</td>
<td>Forward-looking framework for action and collaboration, inspiring call to action, expressly directed toward cultural heritage sites and stewards</td>
<td>Not specific to flood preparedness interventions, speaking to a NPS audience</td>
<td><a href="https://www.nps.gov/subjects/climatechange/upload/NPS_CC-508compliant.pdf">https://www.nps.gov/subjects/climatechange/upload/NPS_CC-508compliant.pdf</a></td>
</tr>
<tr>
<td>NPS</td>
<td>2013</td>
<td>Using Scenarios to Explore Climate Change: A Handbook for Practitioners</td>
<td>Step-by-step explanation of logic behind long-term scenario planning to make better, fact based management choices for cultural heritage sites (specifically parks)</td>
<td>Thorough guidance to shifting managerial approaches in recognition of climate change projections, expressly directed toward cultural heritage sites and stewards</td>
<td>Focused on natural resources, written for high-level stewards and managers, assumes availability of many resources, dense and lengthy, not specific to flood preparedness interventions</td>
<td><a href="https://toolkit.climate.gov/reg-ports/using-scenarios-explore-climate-change-handbook-practitioners">https://toolkit.climate.gov/reg-ports/using-scenarios-explore-climate-change-handbook-practitioners</a></td>
</tr>
<tr>
<td>NPS</td>
<td>2012</td>
<td>NPS Policy Memo N42 - Applying National Park Service Management Policies in the Context of Climate Change</td>
<td>Call to reexamine how approach to park management in consideration of how climate change alters responsibility to cultural resources and the public</td>
<td>Realistically acknowledges limitations of NPS in changing climate change driven outcomes, relieves burden of restraining natural processes on resources, expressly directed toward cultural heritage sites and stewards</td>
<td>Internal memo, no specific actions, or plans</td>
<td><a href="https://www.nps.gov/policy/M-PendCC.pdf">https://www.nps.gov/policy/M-PendCC.pdf</a></td>
</tr>
<tr>
<td>NPS</td>
<td>2012</td>
<td>Climate Change Action Plan</td>
<td>Explanation of directives and eight priority action areas for climate change response in parks including emissions reduction, sustainability improvements, and planning tools for adaptation</td>
<td>Overarching, motivational call to action which covers a broad range of issue areas concerning adaptation strategies to resource management practices</td>
<td>Written expressly for park staff, no specific guidance for implementing strategies</td>
<td><a href="https://www.nps.gov/subjects/climatechange/upload/CCActionPlan-508compliant.pdf">https://www.nps.gov/subjects/climatechange/upload/CCActionPlan-508compliant.pdf</a></td>
</tr>
<tr>
<td>NPS</td>
<td>2014</td>
<td>NPS Policy Memo 14-02 - Climate Change and Stewardship of Cultural Resources</td>
<td>Summary of 6-point plan for adjusting decision making for cultural resources in the era of climate change, call to action</td>
<td>Concise, realistic, comprehensive, forward-looking plan, expressly directed toward cultural heritage sites and stewards</td>
<td>Internal memo, no specific actions, or plans</td>
<td><a href="https://www.nps.gov/policy/P45Memos/PM-14-02.htm">https://www.nps.gov/policy/P45Memos/PM-14-02.htm</a></td>
</tr>
<tr>
<td>Source</td>
<td>Year</td>
<td>Title</td>
<td>Description</td>
<td>URL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPS</td>
<td>2015</td>
<td>Coastal Adaptation Strategies Case Studies</td>
<td>24 short case studies describing how specific parks with varied resources are preparing for and responding to unique climate change impacts</td>
<td><a href="https://www.nps.gov/subjects/climatechange/coastaladaptationstrategies.htm">https://www.nps.gov/subjects/climatechange/coastaladaptationstrategies.htm</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPS</td>
<td>2016</td>
<td>Coastal Adaptation Strategies Handbook</td>
<td>Explanation of full extent of NPS strategy to manage and mitigate climate change impact on coastal resources, with tools, tables, case studies, diagrams, etc.</td>
<td><a href="https://www.nps.gov/subjects/climatechange/coastalhandbook.htm">https://www.nps.gov/subjects/climatechange/coastalhandbook.htm</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPS</td>
<td>2016</td>
<td>Cultural Resources Climate Change Strategy</td>
<td>Outline of 4 overarching goals for adapting stewardship practices for cultural resources: &quot;connect impacts and information, understand the scope, integrate, uses practice, learn and share&quot;, uses different case studies to illustrate goals, offers exhaustive table of different resource types and types of deterioration from climate change forces</td>
<td><a href="https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm">https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C. Inventory Historic Property and Cultural Resource Assets Worksheet from FEMA’s Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning

### Inventory Historic Property and Cultural Resource Assets

#### Worksheet #3

**Hazard:** Flood  
**Date:** January 8, 2007  
**Phase:**  
**Step:**  3

Make a copy of a blank worksheet for each hazard of concern. Fill in the name of the hazard and the date. List the name and address of vulnerable historic properties and cultural resources in Column 1. For each property/cultural resource (row) fill out Columns 2 to 10 to complete the information about the asset. For Columns 11 to 15, use results from Worksheet #5 to fill in the applicable columns. For Column 16, use the ranking from Column 7 of Worksheet #4. See the Building Data Requirement table below to determine what additional columns to add to this worksheet, depending on the hazard.

Examples of the types of information to fill in for Columns 3, 5, and 6:

- **Column 3:** Type of Property/Resource (include, but not limited to, buildings, structures, objects, sites, and districts)
- **Column 5:** Structural System (e.g., concrete, wood frame, and steel)
- **Column 6:** Primary Material(s) of Property/Resource (e.g., brick veneer, concrete, and plaster)

<table>
<thead>
<tr>
<th>Building Characteristics</th>
<th>Flood</th>
<th>Earthquake</th>
<th>Tsunami</th>
<th>Tornado</th>
<th>Coastal Storm</th>
<th>Landslide</th>
<th>Wildfire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Type/Type of Foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Code Design Level/Date of Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topography</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance from the Hazard Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

2-10 STATE AND LOCAL MITIGATION PLANNING how-to-guide: Historic Properties and Cultural Resources

47
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
<th>Column 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name and Address of Asset Subjected to Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northwest Ave House</td>
<td>50 Main Street</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Property Resource</td>
<td>Commercial Breeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of County/ Local Government Creation</td>
<td>1905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square Footage</td>
<td>40,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural System</td>
<td>COURSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Material/ Condition</td>
<td>WOOD, MATERIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Use</td>
<td>COMMERCIAL Breeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Function/Use</td>
<td>PUBLIC GARDEN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is Owner Interested in Mitigation (Owner)?</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (Tape it Owner)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>EXCELLENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>January 8, 2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column 1</td>
<td>Column 10</td>
<td>Column 11</td>
<td>Column 12</td>
<td>Column 13</td>
<td>Column 14</td>
<td>Column 15</td>
<td>Column 16</td>
<td></td>
</tr>
<tr>
<td>----------</td>
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<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>Name and Address of Asset Subject to Hazard (same as previous page)</td>
<td>Hazard Zone, Open Area, or Wooded</td>
<td>Level of Property Vulnerability (High, Medium, Low)</td>
<td>Loss to Structure ($)</td>
<td>Loss to Contents ($)</td>
<td>Loss of Function or Use ($)</td>
<td>Total Loss for Hazard Event ($)</td>
<td>Action</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

**State and Local Mitigation Planning How-to Guide: Historic Properties and Cultural Resources**
Appendix D. Matrices describing how different cultural resources are affected by water-related pathologies from the National Park Service’s Cultural Resources Climate Change Strategy (2016)

### Precipitation Change

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of stratigraphic integrity that cracks and heaves damage in three soil</td>
<td>Water stress may inhibit growth of some species</td>
<td>Stresses on culturally significant species impacts subsistence practices</td>
<td>Limited water supply for cooking, heating, other</td>
<td>Increased in dry soil deposits near marshy and swampy sites which hydrate and infiltrate during prolonged events causing spalls and fractures</td>
</tr>
<tr>
<td>- Degradation of wetland studies</td>
<td>Decline/disappearance of some vegetation species, other species favored</td>
<td>Indirect effects to ceremonial cycles and religious practices involving weather control</td>
<td>- Reduced humidity, stress on buildings (possible benefit)</td>
<td>- Reduced humidity, stress on buildings (possible benefit)</td>
</tr>
<tr>
<td>- Exposure of submerged sites due to lower water levels in lakes</td>
<td>Soil infertility due to decreased microbial activity</td>
<td>Effects to some water supplies (transportation)</td>
<td>- Soil erosion</td>
<td>- (Cracking and splitting of wooden, concrete, and stone materials due to complete drying)</td>
</tr>
<tr>
<td>- Sites more vulnerable to flooding</td>
<td>Limited water supply inhibits established vegetation practices</td>
<td>Loss of regular sources of water for drinking, medicine, cooking, pets, etc.</td>
<td>- Limited on travel due to floods</td>
<td>- Increased in dry soil deposits near marshy and swampy sites which hydrate and infiltrate during prolonged events causing spalls and fractures</td>
</tr>
<tr>
<td>- Increased exposure to vegetation loss and erosion</td>
<td>Increased soil erosion</td>
<td>Loss of culturally relevant plants and animals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post-Flood

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of historic integrity and site integrity from direct force of water</td>
<td>Increased tree fall (due to water logging)</td>
<td>Altered harvesting techniques, especially in hard cultivars due to changes in precipitation patterns</td>
<td>Limited ability to plant in waterlogged soil</td>
<td>Increased risk of rot and fungal disease attack</td>
</tr>
<tr>
<td>- Soil disturbance</td>
<td>Limited ability to plant in waterlogged soil</td>
<td>Delay in planting cycles, shorter life spans, and permanent damage to agricultural land</td>
<td>Loss of historical integrity with improved drainage systems</td>
<td>Increased risk of rot and fungal disease attack</td>
</tr>
<tr>
<td>- Damage to unEuropeized artifacts and site integrity from direct force of water</td>
<td>Loss of vegetation species</td>
<td>Decreased soil fertility due to erosion, waterlogging, leaching</td>
<td>Loss of landscape features</td>
<td>Increased risk of rot and fungal disease attack</td>
</tr>
<tr>
<td>- Damage to unEuropeized artifacts and site integrity from direct force of water</td>
<td>Increased susceptibility to destruction from floods</td>
<td>Loss of landscape features</td>
<td>Increased susceptibility to destruction from floods</td>
<td>Increased risk of rot and fungal disease attack</td>
</tr>
<tr>
<td></td>
<td>Damage to unEuropeized artifacts and site integrity from direct force of water</td>
<td>Disruption of delay of additional maintenance practices (e.g. burning)</td>
<td>Erosion of earthworks</td>
<td>Increased risk of rot and fungal disease attack</td>
</tr>
</tbody>
</table>

### During Flood

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of cultural places due to inundation/evacuation</td>
<td>Wash out or damage to roads, trails, and landscape features throughout parks</td>
<td>Loss of cultural places due to inundation/evacuation</td>
<td>Wash out or damage to roads, trails, and landscape features throughout parks</td>
<td>Wash out or damage to roads, trails, and landscape features throughout parks</td>
</tr>
</tbody>
</table>

### Collections

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
</tr>
</tbody>
</table>

### Buildings & Structures

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of cultural places due to inundation/evacuation</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
<td>Collection of waterlogged soil</td>
</tr>
</tbody>
</table>

### Post-Flood

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
</table>

### During Flood

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural collapse from moving force of floodwaters</td>
<td>Structural collapse from moving force of floodwaters</td>
<td>Structural collapse from moving force of floodwaters</td>
<td>Structural collapse from moving force of floodwaters</td>
<td>Structural collapse from moving force of floodwaters</td>
</tr>
</tbody>
</table>

### Post-Flood

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased risk of soil loss due to storms and high winds</td>
<td>Increased risk of soil loss due to storms and high winds</td>
<td>Increased risk of soil loss due to storms and high winds</td>
<td>Increased risk of soil loss due to storms and high winds</td>
<td>Increased risk of soil loss due to storms and high winds</td>
</tr>
</tbody>
</table>
## Sea Level Rise

### Climate Change Related Impacts by Cultural Resource

<table>
<thead>
<tr>
<th>Archeological Resources</th>
<th>Cultural Landscapes</th>
<th>Ethnographic Resources</th>
<th>Museum Collections</th>
<th>Buildings &amp; Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total submergence of coastal sites&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Erosion of beaches and shorelines due to wave action&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Decrease in important sites due to marine flooding</td>
<td>Flooded museum storage areas&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Submergence of coastal sites&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Erosion of beaches and shorelines due to wave action&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Erosion of beaches and shorelines due to wave action&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Increase in important sites due to marine flooding</td>
<td>Increase in museum flooding leading to loss of valuable objects&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Increase in museum flooding leading to loss of important sites&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increased risk of flooding from ocean&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Increased risk of flooding from ocean&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Increased risk of flooding from ocean&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Increased risk of flooding leading to loss of cultural resources&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Increased risk of flooding leading to loss of cultural resources&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increased erosion of sites due to coastal flooding</td>
<td>Increased erosion of sites due to coastal flooding</td>
<td>Increased erosion of sites due to coastal flooding</td>
<td>Increased erosion of sites due to coastal flooding</td>
<td>Increased erosion of sites due to coastal flooding</td>
</tr>
<tr>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
</tr>
<tr>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
<td>Extreme weather conditions</td>
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</tbody>
</table>

### Increased Frequency and Severity of Storm Surges

<table>
<thead>
<tr>
<th>During Surge:</th>
<th>Post-Surge:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destruction - total site loss&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Destruction - total site loss&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Erosion from wave impact&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Erosion from wave impact&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Post-Surge:</td>
<td>Post-Surge:</td>
</tr>
<tr>
<td>Disturbance or removal during response and clean-up&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Disturbance or removal during response and clean-up&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

### Increased Coastal Erosion

| Full loss of coastal sites and artifacts<sup>2</sup> | Partial loss of coastal sites and artifacts<sup>2</sup> |
| Exposure of new and unknown archaeological sites<sup>1</sup> | Exposure of new and unknown archaeological sites<sup>1</sup> |
| Altered or removed patterns from reduction changes in Arctic sea ice<sup>1</sup> | Altered or removed patterns from reduction changes in Arctic sea ice<sup>1</sup> |
| Increased risk of flooding from exposure<sup>1</sup> | Increased risk of flooding from exposure<sup>1</sup> |

### Higher Water Tables

| Damage to artifacts, stratigraphy, soil features from overflowing of site from below<sup>1</sup> | Damage to artifacts, stratigraphy, soil features from overflowing of site from below<sup>1</sup> |
| Decline/disappearance of important vegetation species, other species favored<sup>2</sup> | Decline/disappearance of important vegetation species, other species favored<sup>2</sup> |
| Soil integrity due to waterlogged, anaerobic conditions<sup>2</sup> | Soil integrity due to waterlogged, anaerobic conditions<sup>2</sup> |

### Facilities

- Added strain on existing museum facilities and staff due to salvage operations<sup>2</sup>
- Increased risk of flooding leading to loss of important sites<sup>2</sup>
- Increased risk of flooding leading to loss of important sites<sup>2</sup>
**Appendix E. Review of disaster preparedness and response resources from leading built environment and cultural heritage organizations in the United States for specific acknowledgement of historic structures**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Resource or Webpage Name</th>
<th>Resource Type</th>
<th>Acknowledges Historic Structures?</th>
<th>URL accessed 5/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association for State and Local History</td>
<td>Field Services Alliance Tips: Emergency Preparedness</td>
<td>Webpage with links to resources from other organizations</td>
<td>NO</td>
<td><a href="https://aaslh.org/field-services-alliance-tips-emergency-preparedness/">https://aaslh.org/field-services-alliance-tips-emergency-preparedness/</a></td>
</tr>
<tr>
<td>American Institute of Conservation/Foundation for the Advancement of Conservation</td>
<td>REPP Resources</td>
<td>Downloadable resource and webpage</td>
<td>NO</td>
<td><a href="https://www.culturalheritage.org/resources/emergencies/risk-evaluation-and-planning-program">https://www.culturalheritage.org/resources/emergencies/risk-evaluation-and-planning-program</a></td>
</tr>
<tr>
<td>Association for Preservation Technology</td>
<td>Disaster Response Initiative Task Group</td>
<td>N/A</td>
<td>NO</td>
<td><a href="https://www.apti.org/disaster-response-initiative-task-group">https://www.apti.org/disaster-response-initiative-task-group</a></td>
</tr>
<tr>
<td>American Planning Association</td>
<td>Disaster Recovery Resources</td>
<td>Webpage with links to resources from other organizations</td>
<td>NO</td>
<td><a href="https://www.planning.org/resources/disaster/hurricane">https://www.planning.org/resources/disaster/hurricane</a></td>
</tr>
<tr>
<td>National Council on Structural Engineers Associations</td>
<td>Emergency Response</td>
<td>N/A</td>
<td>NO</td>
<td><a href="http://www.ncsea.com/resources/emergencyresponse">http://www.ncsea.com/resources/emergencyresponse</a></td>
</tr>
<tr>
<td>General Services Administration</td>
<td>Guidelines For Salvaging Historic Building Materials In The Event Of A Disaster</td>
<td>Downloadable resource</td>
<td>YES</td>
<td><a href="https://www.gsa.gov/node/88442?Form_Load=88442">https://www.gsa.gov/node/88442?Form_Load=88442</a></td>
</tr>
<tr>
<td>Smithsonian Cultural Rescue Initiative/National Heritage Emergency Task Force</td>
<td>Planning, Preparedness, and Mitigation Resources</td>
<td>Webpage with links to resources from other organizations</td>
<td>NO</td>
<td><a href="https://culturalrescue.si.edu/hentf/resources/planning-preparedness-and-mitigation-resources">https://culturalrescue.si.edu/hentf/resources/planning-preparedness-and-mitigation-resources</a></td>
</tr>
<tr>
<td>National Trust for Historic Preservation</td>
<td>Disaster Recovery</td>
<td>Blog entries</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
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<td>-----</td>
<td></td>
</tr>
<tr>
<td>National Park Service</td>
<td>Flood Mitigation Decision Guide</td>
<td>Online Quiz</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farnsworth House Flood Mitigation</td>
<td>Case Study</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guidelines on Flood Adaptation for Rehabilitating Historic Buildings</td>
<td>Downloadable resource</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cultural Resources Climate Change Strategy</td>
<td>Downloadable resource</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preserving Coastal Heritage</td>
<td>Webinar series</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Museum Management Program</td>
<td>Webpage</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Museum Handbook</td>
<td>Downloadable resource</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>National Center for Preservation Technology and Training (NPS)</td>
<td>Disaster Plan</td>
<td>Webpage</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resilient Heritage: Protecting Your Historic Home from Natural Disasters</td>
<td>Downloadable resources</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>
Appendix F. Author-designed survey “Flood Risk: Perception and Preparedness at Cultural Heritage Sites in The United States” including preamble text and survey questions. Results available at this URL: https://bit.ly/2SD0GAn

Survey Flow:
- Organizational Profile (17 Questions)
- Site Profile (10 Questions)
- Flood Risk Profile (14 Questions)
- Flood Preparedness Profile (6 Questions)
- Flood Insurance Profile (8 Questions)
- Additional Comments (3 Questions)

Preamble text (Q1-Q7 on the survey):
“This survey is a core component of my master's thesis research for the University of Pennsylvania's Graduate Program in Historic Preservation. The questions are directed toward individuals working for cultural heritage site management organizations. Respondents will ideally have knowledge of a site's operations, collections management, facilities management, and/or administrative matters.

The survey should take 10-15 minutes to complete. Questions are designed to be answered without need for research. Results are recorded entirely anonymously.

The purpose of this survey is to gain an understanding of how cultural heritage site management organizations in the U.S. currently perceive and respond to flood risk at their sites, with specific regard for preservation of historic structures.

Cultural heritage sites in this context are defined as managed sites which serve primarily educational purposes (i.e. museums, archives, galleries). Flooding in this context is defined as inundation of a structure with floodwater due to extreme-weather events. Historic structures in this context are loosely defined as buildings that are at least 50 years old and have historical significance.

Results from the survey will be analyzed in conjunction with current flood mitigation strategies and disaster risk management policy for cultural heritage sites. The goal of the thesis is to illuminate areas of potential improvement to flood risk management practices at cultural heritage sites, both at a site-management and policy level.

I recognize that the COVID-19 pandemic has drastically altered operations at most cultural heritage sites. Please base your responses off whatever "normal" operations used to or might again look like. Full survey results can be made available upon request in June 2021. Thank you in advance for your time and contribution. The survey will begin on the next page.”
Q8
ORGANIZATIONAL PROFILE: Location
In what state is your cultural heritage site located?
▼ AK ... WY

Q9
ORGANIZATIONAL PROFILE: Function
Please mark the primary (1) and (if applicable) secondary (2) function of your cultural heritage site
_____ History Museum
_____ Historic House Museum/Interpreted Site
_____ Art Museum/Exhibition Space
_____ Archive/Library/Repository
_____ Other: (please describe)

Q10
ORGANIZATIONAL PROFILE: Organizational Structure
How would you classify your organizational structure?
○ Non-profit
○ Government sector (local, state, federal)
○ For-profit/small business
○ Education sector (university affiliated)
○ Other: (please describe) ____________________________________________________

Q11
ORGANIZATIONAL PROFILE: Budget
In what range was your average annual operating budget for FY17-20 (i.e. pre-COVID)?
○ <$100,000
○ $100,000-$500,000
○ $500,000-$1,000,000
○ $1,000,000+
○ Prefer not to say
○ Not sure

Q12
What are your organization's primary funding sources? (select up to 3)
○ Public funds (i.e. local, state, federal tax allocations)
○ Grants & Revolving Funds
○ Private Donations/Sponsorships
○ Endowment(s)
○ Visitor and/or Researcher Fees
○ Other: (please describe) ________________________________________________
Q13
ORGANIZATIONAL PROFILE: Staffing
How many full-time staff are employed at your site?
- 1-10
- 11-30
- 31+
- n/a

Q14
How many part-time staff are employed at your site?
- 1-10
- 11-30
- 31+
- n/a

Q15
How many seasonal staff are employed at your site during a normal peak season?
- 1-10
- 11-30
- 31+
- n/a

Q16
How many volunteers regularly work at your site?
- 1-10
- 11-30
- 31+
- n/a

Q17
ORGANIZATIONAL PROFILE: Staffing
Does your organization have a staff member whose duties specifically include emergency preparation?
- Yes
- No
- Not Sure

Q18
SITE PROFILE: Historic Structures
How many historic structures does your site include?
- 1-2
- 3-5
- 6+
Q19
Does your organization own or lease your site?
  o Own
  o Lease
  o Not Sure
  o Other: (please describe) ________________________________________________

Display This Question: If Q19 = Lease

Q20
Who owns your site?
  o A federal government entity
  o A state or local government entity
  o A trust
  o A non-profit entity
  o A for-profit entity
  o Not Sure
  o Other: (please describe) ________________________________________________

Display This Question: If Q19 = Lease Or Q19 = Other

Q21
SITE PROFILE: Maintenance
Who is primarily responsible for overseeing site maintenance (i.e. upkeep of structures, grounds, utilities)?
  o Primarily my organization
  o Primarily the owner
  o Equally my organization and the owner
  o Not sure
  o Other: (please describe) ________________________________________________

Q22
How much would you agree with the statement, "My site's primary historic structure(s) is well maintained"?
  o Strongly agree
  o Somewhat agree
  o Neutral
  o Somewhat disagree
  o Strongly disagree
Display This Question: If Q22 = Neutral Or Q22 = Somewhat disagree Or Q22 = Strongly disagree

Q23
SITE PROFILE: Maintenance
Does your organization experience any of the following barriers to improving site maintenance? (select all that apply)
  o Lack of staff/planning resources
  o Low priority for funders
  o Low priority for leadership
  o Too disruptive to daily operations
  o External limitations (permitting, liability, location, etc.)
  o Other: (please describe) ________________________________________________

Q24
SITE PROFILE: Historic Designation
Is your primary historic structure(s) on a local, state, and/or national register of historic places?

Q26
SITE PROFILE: Mission & Place
How much would you agree with the statement, "My organization could fulfill its mission at a different site"?
  o Strongly Disagree
  o Somewhat Disagree
  o Neutral
  o Somewhat Agree
  o Strongly Agree

Q27
SITE PROFILE: Mission & Place
Feel free to comment on your response

Q28
FLOOD RISK PROFILE: Hydrology
Is your site located within 1 mile of a body of water? (i.e. ocean, river, lake, canal, etc.)
  o Yes
  o No
  o Not Sure
Display This Question: If Q28 = Yes

Q29 What type? (select all that apply)
- Ocean, gulf, or sea
- Bay, sound, inlet, or tidal basin
- Delta, marsh, or wetland
- River
- Major stream, creek, or tributary
- Lake or pond
- Canal, reservoir, dam
- Other: (please describe) _______________________________________________

Q30
FLOOD RISK PROFILE: Flooding History
To your knowledge, has your primary historic structure(s) ever incurred damaged from weather-related flooding?
- Yes
- No
- Not sure

Display This Question: If Q30 = Yes

Q31
FLOOD RISK PROFILE: Flooding History
How many times has weather-related flooding damaged your primary historic structure(s)?
- 1-3 times
- 4-6 times
- 7-10 times
- Over 10 times
- Not sure

Display This Question: If Q30 = Yes

Q32
When did the last weather-related flood that damaged your primary historic structure(s) occur?
- Less than 15 years ago
- 15-30 years ago
- 31-50 years ago
- 51+ years ago
- Not sure
Display This Question: If Q30 = Yes

Q33
What was the source(s) of floodwaters during the most recent weather-related flood? (select all that apply)
- Ground water (percolated up through the ground)
- Overflow of nearby body of water
- Ocean tidal waves, high tides, storm surges
- General sea level rise, coastal erosion
- Heavy rain or snow melt runoff
- Infrastructure failure (i.e. levees, dams, floodwalls)
- Not sure
- Other: (please describe) ________________________________________________

Q34
FLOOD RISK PROFILE: Personal Property Risk
Does your historic structure(s) have subgrade levels (i.e. basement) used for any of the following?
- Exhibition or interpreted spaces
- Collections storage
- Offices and administrative records storage
- Inventory and non-collections storage
- Utilities equipment (electrical box, HVAC, furnace/boiler)
- Restrooms
- None of these apply/ No subgrade levels
- Other: (please describe) ________________________________________________

Q35
FLOOD RISK PROFILE: Risk Awareness
Has your organization ever undertaken a flood risk assessment for your site (either individually or as part of a larger risk assessment)?
- Yes, individually
- Yes, as part of a larger risk assessment
- No
- Not sure

Display This Question: If Q35 = Yes, individually Or Q35 = Yes, as part of a larger risk assessment

Q36
FLOOD RISK PROFILE: Risk Awareness
Who conducted the assessment?
- In-house staff
- Outside consultant
- Local emergency management official
- Insurance agent
- Not sure
- Other: (please describe) ________________________________________________

60
Display This Question: If Q35 = Yes, individually Or Q35 = Yes, as part of a larger risk assessment
Q37 When was it last updated?
- Within the past 5 years
- 5-10 years ago
- Over 10 years ago
- Not sure

Q38
FLOOD RISK PROFILE: Risk Awareness
Without looking it up, do you know if your site is in a FEMA-designated "Special Flood Hazard Area" (SFHA)?
- Yes, it is
- No, it's not
- Not sure
- Not familiar with the term

Display This Question: If Q38 = Yes, it is
Q39
FLOOD RISK PROFILE: Risk Awareness
What is your site's SFHA zone designation?
▼ A ... VE

Q40
FLOOD RISK PROFILE: Risk Awareness
Without looking it up, do you now if your local government participates in the National Flood Insurance Program's (NFIP) Community Rating System (CRS)?
- Yes, it does
- No, it doesn't
- Not sure
- Not familiar with the term

Display This Question: If Q40 = Yes, it does
Q41 What is community's current your CRS rating?
▼ 10 ... 1

Q42
FLOOD PREPAREDNESS PROFILE: Prioritization
How much would agree with the statement, "Flood preparedness is a consistent priority within my organization"?
- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Strongly Disagree
Q43
FLOOD PREPAREDNESS PROFILE: Prioritization
Feel free to comment on your previous response:

Q44
FLOOD PREPAREDNESS PROFILE: Preparedness of Structures
Has your organization or the owner taken any of the following steps to mitigate potential flood damage to the historic structures(s)? (select all that apply)
- Site adaptation (ex. improving drainage)
- Purchased emergency supplies (ex. sandbags, generator)
- Wet-floodproofing (ex. installed flood vents, elevated utilities)
- Dry-floodproofing (ex. reinforced walls, waterproofed utility equipment)
- Raising structure above base flood elevation
- Purchased flood insurance
- No, none of these apply
- Other: (please describe) ____________________________

Q45
FLOOD PREPAREDNESS PROFILE: Preparedness of Structures
Do any of the following statements apply to your organization or owner’s perspective on flood preparedness for your historic structures? (select all that apply)
- Not a current priority for the organization
- Not a current priority for the building owner
- Low awareness of flood risk or mitigation options
- Adaptation options too expensive
- Lack of staff or planning resources
- Structure can’t be adapted
- No, none of these statements apply
- Other: (please describe) ____________________________

Q46
FLOOD PREPAREDNESS PROFILE: Preparedness of Collections
Has your organization taken any of the following steps to mitigate potential flood damage to the collection(s)? (select all that apply)
- Prepared a flooding emergency response plan
- Trained staff in flood emergency protocols
- Purchased response and recovery supplies
- Relocated valuables from subgrade levels
- Established an emergency savings fund
- Purchased fine arts property insurance
- None of these apply/no collections
- Other: (please describe) ____________________________
Q47
FLOOD PREPAREDNESS PROFILE: Preparedness of Collections
Do any of the following statements apply to your organization's perspective on flood preparedness for your collections? (select all that apply)
- Not a current financial priority for the organization
- Not a current financial priority for funders
- Low awareness of flood risk or mitigation options
- Hasn't been discussed lately/ no pressure from stakeholders
- Lack of staff or planning resources
- Not sure where to start
- None of these apply/no collections
- Other: (please describe) ________________________________________________

Q48
FLOOD INSURANCE PROFILE: Flood Insurance Coverage
Does your organization carry any form of flood insurance?
- Yes, just for the collections
- Yes, just for the historic structure(s)
- Yes, for both the collections and the historic structure(s)
- No, we do not carry flood insurance for the collections or the historic structure(s)
- Not sure
- Other: (please describe) ________________________________________________

**Display This Question: If Q48 = Yes, just for the historic structure(s) Or Q48 = Yes, for both the collections and the historic structure(s)**

Q49
FLOOD INSURANCE PROFILE: Flood Insurance Provider
What type of flood insurance does your organization carry for your historic structure(s)?
- Federally subsidized (NFIP-FEMA)
- Private, but backed by the NFIP
- Private, not backed by NFIP
- Self-insured (typically limited to government entities)
- Not sure
- Other: (please describe) ________________________________________________

**Display This Question: If Q48 = Yes, just for the collections Or Q48 = Yes, for both the collections and the historic structure(s)**

Q50
FLOOD INSURANCE PROFILE: Flood Insurance Provider
What type of flood insurance policy does your organization carry for your collections:
- Fine arts policy (usually covers all water events)
- Standard personal property policy
- NFIP personal property policy
- Not Sure
- Other: (please describe) ______________________
Display This Question: If Q48 = No, we do not carry flood insurance for the collections or the historic structure(s) Or Q48 = Yes, just for the collections

Q51

FLOOD INSURANCE PROFILE: Flood Insurance Coverage
What are potential reasons for why your organization does not carrying flood insurance for your historic structure(s)? (select all that apply)
- Not legally required to
- Low or no probability of flooding
- Not a current financial priority for leadership/stakeholders
- Premiums are cost prohibitive
- Hasn't been discussed recently
- No one else nearby carries it
- Structure irreplaceable
- Other: (please describe) ________________________________

Display This Question: If Q19 = Lease

Q52

FLOOD INSURANCE PROFILE: Flood Insurance Coverage
Does the owner carry flood insurance for your historic structure(s)?
- Yes
- No
- Not Sure

Display This Question: If Q52 = Yes

Q53

FLOOD INSURANCE PROFILE: Flood Insurance Provider
What type of flood insurance does the owner carry for the historic structure(s)?
- Federally subsidized (NFIP-FEMA)
- Private, but backed by the NFIP
- Private, not backed by NFIP
- Self-insured (typically limited to government entities)
- Not sure
- Other: ________________________________
Display This Question: If Q52 = No
Q54
FLOOD INSURANCE PROFILE: Flood Insurance Coverage
What are potential reasons for why your building owner does not carry flood insurance for the historic structures(s)? (select all that apply)
- Not legally required to
- Low or no probability of flooding
- Not a current financial priority for owner
- Premiums are cost prohibitive
- Hasn't been discussed recently
- No one else nearby has it
- Not sure
- Other: __________________________________________________________

Q55
FLOOD INSURANCE PROFILE: Financial Recovery
In your opinion, could your organization financially recover within 1 year from a major flood (>1 foot of water) without flood insurance?
- Definitely yes
- Probably yes
- Maybe
- Probably not
- Definitely not

Q56
ADDITIONAL COMMENTS
Please share any additional comments or information on the topic of flood risk preparedness at cultural heritage sites.
Appendix G. Cross comparisons of respondents’ confidence rating about flood preparedness prioritization at their sites and flood risk awareness indicators (flood history, flood risk assessment, flood risk rating, flood insurance)

(Q42)* How much would you agree with the statement, "Flood Preparedness is a consistent priority within my organization"?

<table>
<thead>
<tr>
<th>Agree - High Priority</th>
<th>Disagree - Low Priority</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Count*:</td>
<td>63</td>
<td>51</td>
</tr>
<tr>
<td>Total Percent:</td>
<td>48%</td>
<td>39%</td>
</tr>
</tbody>
</table>

(Q30) To your knowledge, has your primary historic structure(s) ever incurred damaged from weather-related flooding?

| Yes       | | | |
|-----------|-----------|------|
|           | 40        | 13   | 4    |
|           | 63%       | 25%  | 22%  |

| No        | | | |
|-----------|-----------|------|
|           | 20        | 28   | 11   |
|           | 32%       | 55%  | 61%  |

| Not sure  | | | |
|-----------|-----------|------|
|           | 3         | 10   | 3    |
|           | 5%        | 20%  | 17%  |

*132 out of 134 respondents answered Q42
*(Q42)* How much would you agree with the statement, "Flood Preparedness is a consistent priority within my organization"?

<table>
<thead>
<tr>
<th>Agree - High Priority</th>
<th>Disagree - Low Priority</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total count*: 63.0</td>
<td>51.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Total percent: 48%</td>
<td>39%</td>
<td>13%</td>
</tr>
</tbody>
</table>

*(Q35)* Has your organization ever undertaken a Flood Risk Assessment for your site?

<table>
<thead>
<tr>
<th></th>
<th>Yes, individually</th>
<th>Yes, as part of a larger risk assessment</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>count</td>
<td>percent</td>
<td>count</td>
<td>percent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, individually</td>
<td>19</td>
<td>30%</td>
<td>22</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4%</td>
<td>13</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>6%</td>
<td>8</td>
<td>44%</td>
</tr>
<tr>
<td>Yes, as part of a larger risk assessment</td>
<td></td>
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<tr>
<td>No</td>
<td>8</td>
<td>13%</td>
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<td>11%</td>
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<td>20%</td>
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<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Not sure</td>
<td>14</td>
<td></td>
<td>26</td>
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<td>18</td>
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<td></td>
<td></td>
<td>39%</td>
</tr>
</tbody>
</table>

*132 out of 134 respondents answered Q42
**Q42** How much would you agree with the statement, "Flood Preparedness is a consistent priority within my organization"?

<table>
<thead>
<tr>
<th></th>
<th>Agree - High Priority</th>
<th>Disagree - Low Priority</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Count</strong>*:</td>
<td>63</td>
<td>51</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total Percent</strong>:</td>
<td>48%</td>
<td>39%</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Q38** Without looking it up, do you know if your site is in a FEMA-designated "Special Flood Hazard Area" (SFHA)?

<table>
<thead>
<tr>
<th></th>
<th>Yes, it is</th>
<th>No, it's not</th>
<th>Not sure</th>
<th>Not familiar with the term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>count</strong></td>
<td>11</td>
<td>20</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td><strong>percent</strong></td>
<td>17%</td>
<td>32%</td>
<td>41%</td>
<td>10%</td>
</tr>
</tbody>
</table>

*132 out of 134 respondents answered Q42*
(Q42) How much would you agree with the statement, "Flood Preparedness is a consistent priority within my organization"?

<table>
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</thead>
<tbody>
<tr>
<td>Total Count*:</td>
<td>61</td>
<td>49</td>
<td>16</td>
</tr>
<tr>
<td>Total Percent:</td>
<td>48%</td>
<td>39%</td>
<td>13%</td>
</tr>
</tbody>
</table>

(Q48)* Does your organization carry any form of flood insurance?

<table>
<thead>
<tr>
<th>(Q48)*</th>
<th>Does your organization carry any form of flood insurance?</th>
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<tr>
<td></td>
<td>Yes, just for the collections</td>
</tr>
<tr>
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<td>count</td>
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<tr>
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<td>percent</td>
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<td>Yes, just for the historic structure(s)</td>
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<tr>
<td></td>
<td>Yes, for both the collections and the historic structure(s)</td>
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<td>percent</td>
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<td>No, we do not carry flood insurance for the collections or the historic structure(s)</td>
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<td>count</td>
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<tr>
<td></td>
<td>percent</td>
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<tr>
<td></td>
<td>Not sure</td>
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*126 out of 134 respondents answered Q48
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