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## **Coastal defense megaprojects in an era of sea-level rise: politically feasible strategies or Army Corps fantasies?**

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## **Abstract**

Storm surge barriers, levees, and other coastal flood defense megaprojects are currently being proposed as strategies to protect several U.S. cities against coastal storms and rising sea levels. However, social conflict and other political factors add a layer of complexity that casts doubt on their status as practical climate adaptation options. The specific mechanisms for why some projects do not progress beyond initial planning stages has remained unclear. Here we study the outcome of two U.S. Army Corps of Engineer (USACE) storm surge barrier proposals to explore the political reasons why some coastal flood protection megaprojects break ground in the U.S., while others do not. Using original archive research, we conclude that storm surge barriers are politically challenging climate adaptation options because of 1) modern environmental laws that provide avenues for expression of oppositional views within the decision process and 2) the allure of alternative options that are more aesthetically pleasing and cheaper and faster to implement. To better allocate public resources and the expertise of the USACE, future flood protection megaprojects should first achieve broad support from the public, NGOs, and elected officials before beginning serious planning. This support could be achieved through new innovative designs that simultaneously address adverse environmental impacts and provide co-benefits (e.g., recreation). New designs should be studied to better understand the level of protection offered and associated reliability so that the USACE has confidence in their use.

## Introduction

Megaprojects are large-scale, complex public works projects that typically cost > \$500 million U.S. dollars (USD), take years to plan and construct (sometimes longer than the tenure of government leaders), involve a diverse group of public and private stakeholders, and promise great benefits to some interests, sometimes at the expense of others (Altshuler and Luberoff 2003; B Flyvbjerg, Bruzelius, and Rothengatter 2003b).

Storm surge barriers and levees are coastal flood defense megaprojects that are technically viable options for many densely populated areas to manage rare coastal flood events (e.g., “the 100-year flood”; including those made worse by sea-level rise, e.g., the Fox Point Hurricane Barrier in Providence, Rhode Island; Fig. 1)(Aerts et al. 2014; Jonkman et al. 2013; Mooyaart and Jonkman 2017; Morang 2016; US National Research Council 2014). For example, in 2012, the Stamford (Connecticut) storm surge barrier prevented an estimated \$25 million USD (unadjusted) in damages to businesses and homes from high waters produced by Hurricane Sandy. Stamford’s mayor said, “[the barrier] was extremely effective in protecting areas that would have been flooded completely by this storm. It made all the difference in the world”(Navarro 2012). Densely populated cities, like Stamford, often lack the space to take advantage of natural defenses (e.g., mangrove or wetland restoration), and other coastal adaptation options (e.g., managed retreat, informed land-use planning, building codes, and insurance) can conflict with goals for local development.

The Civil Works program of the U.S. Army Corps of Engineers (USACE), the principal federal agency responsible for studying and designing coastal flood defense infrastructure (USACE 1998), is well positioned to manage sea-level rise and coastal flooding given that it has a wealth of knowledge in scientists, engineers, more than 60 years of experience with coastal risk reduction, a direct connection to Congress and the powerful fundraising ability of the federal government, and, to some extent, coastal jurisdiction through its permitting authorities. The USACE is currently proposing storm surge barriers and levees for several U.S. cities, including New York City, Norfolk, Miami, and the greater Houston metropolitan area (Table 1)(USACE 2016, 2018a, 2018b, 2019b, 2020c, 2020a, 2020b). Non-USACE entities have also proposed similar projects (City and County of San Francisco 2016; City of New York 2013, 2020; Galveston Bay Park: a vision for Houston and Galveston Bay 2020; Sustainable Solutions Lab 2018). In total, these efforts are projected to cost between \$70 and \$193 billion USD. To date, only a few of these coastal flood protection megaprojects have broken ground, despite most being designated as technically feasible (from an engineering standpoint) and economically beneficial (i.e., benefits greater than costs). One would conclude that sound engineering and favorable economics are necessary but, by themselves, insufficient for implementation.

Recent media attention has highlighted the political contentiousness of coastal flood protection megastructures. In Miami, a USACE proposal for a levee system received strong opposition from the public and government officials who instead advocated for nature-based solutions. The chair of Miami’s Downtown Development Authority proclaimed, “[n]obody wants to see the Berlin wall in the middle of Biscayne Bay”(Allen 2020; Harris 2020). In New York City, a detailed plan developed over several years between city officials and several Lower East Side advocacy groups was abruptly replaced with a new design that was less popular with locals. City officials defended the new plan saying it could be completed quicker (three years, as

opposed to five) and would not lead to costly traffic restrictions that would have been necessary under the original proposal (Hanania 2019). In February 2020, an in-progress USACE study of coastal flood protection within New York Harbor and its tributaries was abruptly halted just weeks after President Trump expressed his disapproval of the project, leading to speculation that his opinion may have influenced agency staff (Barnard 2020). If coastal flood protection megaprojects are to remain politically feasible climate adaptation strategies, a better understanding of the complexity that politics adds to these projects is needed (Javeline 2014). This may give coastal managers a priori information regarding the political feasibility of storm surge barriers, levees, and other coastal megaprojects.

In this study, we use archive materials and process tracing to evaluate whether existing megaproject theories can explain why one USACE storm surge barrier project broke ground and why the other did not advance beyond the planning stage. We also propose other plausible mechanisms that can explain megaproject outcomes. The first project, the Fox Point Hurricane Barrier, was completed in January 1966 at a cost of \$16.2 million (unadjusted) and currently protects roughly 1.1 km<sup>2</sup> of downtown Providence and \$2 billion worth of property (Kuffner 2019) (Fig. 1). The second case, the Narragansett Bay Barriers, was a \$90 million proposal (unadjusted) for three massive rock barriers with ungated, navigational openings placed at the entrance to Narragansett and Mt. Hope Bays (Fig. 2)[Narragansett Bay is a coastal estuary consisting of 456 km<sup>2</sup> of total water area and about a dozen islands of various sizes. Roughly 26 cities and towns (17 in Rhode Island and 9 in Massachusetts) dot the shoreline of Narragansett Bay. Providence, the capital, and most populated city of Rhode Island, sits at the head of the bay, while the city of Newport lies at the entrance to the east passage. Narragansett Bay is noted for its shell fishing industry, prevalence of vacation homes, boaters, and being home to a large naval base in Newport. President Eisenhower's Summer White House was also located in Newport in 1958 and 1960 (Hitchcock 2018)]. The Narragansett Bay Barrier project was ultimately cancelled in 1966 after 10 years of study, despite being deemed technically feasible and economically justifiable by the USACE.

Similar empirical case studies have opened the "black box" of politics and identified plausible mechanisms and processes that determine when climate adaptation projects do and do not break ground (Biesbroek et al. 2014; Bisaro and Hinkel 2016; Hinkel et al. 2018; Measham et al. 2011; Sieber, Biesbroek, and de Block 2018; Wellstead, Rayner, and Howlett 2014). Doing so here may give coastal managers a priori information regarding the political feasibility of projects. While some studies exist for Dutch flood projects (Bijker 2002; Disco 2002), to our knowledge, no such assessment has been performed specific to USACE coastal megaprojects. The USACE has been well-studied (Ferejohn 1974; Maass 1951; D. A. Mazmanian and Nienaber 1979; O'Neill 2006; Pilkey and Dixon 1996), including some political aspects of conceiving, designing, and implementing coastal flood defense megaprojects (US National Research Council 1999, 2004, 2011, 2014). However, no detailed case studies have been presented, and little attention has been given to siting-related opposition.

The remainder of this paper is organized as follows. We first give an overview of existing theories for why some megaprojects advance beyond the planning stage and others do not. Then, using process tracing and original archive research, we analyze the Rhode Island storm surge barrier cases and describe plausible mechanisms that led to each project outcome. A detailed written timeline of events is given in the Appendix. Next, we examine the ability of

existing megaproject theories to explain each case outcome and we also identify other potential mechanisms that could inform why some projects advance while others do not. Finally, we provide some recommendations to the USACE and conclude.

### **Existing theories on why megaprojects do or do not advance to break ground**

Social scientists and legal scholars have put forward multiple explanations for why some megaprojects get built while others do not. We broadly classify these into two categories: strategic manipulation and siting conflicts.

#### *Strategic Manipulation*

Analyses that support planning efforts are not entirely objective and impartial. For example, analysts may have significant latitude with respect to estimating cost of constructions and to whether and how to include indirect benefits. Investigators have shown that biased planners and analysts working in a “fish bowl” of politics and public policy making have strategically manipulated benefit-cost analysis (BCA), and other decision-making frameworks, to get public projects approved and built (B Flyvbjerg, Bruzelius, and Rothengatter 2003b; Wachs 1989). Specific tactics for strategic manipulation include exaggerating benefits and excluding or underestimating costs to make projects appear more attractive (Wachs 1989). For example, enumerating indirect benefits or not accounting for environmental impacts, such as the loss of ecosystem services.

Similarly, Altshuler and Luberoff (2003) suggest that megaprojects sometimes originate locally by “rent-seekers” who aim to reap private gains at the public’s expense, resulting in a “tragedy of the commons” scenario when the projects fail to deliver the benefits that were forecast. Ultimately, “strategic manipulation” and rent seeking have led to project cost overruns, delays, and other shortcomings that have negatively impacted government balance sheets and the public (B Flyvbjerg, Bruzelius, and Rothengatter 2003b; Wachs 1989). While strategic manipulation is hard to prove for any particular project, the USACE’s general approach to BCA has been scrutinized. Specifically, environmental NGOs and other critics claim that the USACE’s BCA exaggerates project benefits (Ferejohn 1974) while downplaying both environmental harms (Taylor 1984) and the benefits of ecosystem services and biodiversity, the latter are not currently quantified (Chambwera et al. 2014; Davis et al. 2009; Koller 2019; USGAO 2019; Weber 2020).

#### *Siting Conflicts*

Other megaproject theories focus on siting conflicts (sometimes referred to as “not-in-my-backyard” or NIMBY-related opposition), which can arise when governments attempt to construct megaprojects that aim to increase the general welfare of their citizens but coincidentally impose local adverse impacts (e.g., eminent domain, decreases in property value, deterioration of the natural environment, and lost amenities)(Aldrich 2008; Devine-Wright 2011; Kraft and Clary 1991; McAvoy 1999; Munton 1996; E. Smith and Klick 2007). Infrastructure siting disputes are part of a broader debate in the political science literature over



the role of bureaucracies, experts, and the public in policy making (Aldrich 2008; Dear 1992; Devine-Wright 2011; Dewey 1927; Fischer 2000; Inhaber 1998; Kraft and Clary 1991; Lindblom 1990; Lippmann 1922; D. Mazmanian and Morell 1994; McAdam and Boudet 2012; McAvoy 1999). For instance, modern democracies often rely on government agencies, like the USACE, to administer technical decisions that can sometimes impact the public in adverse ways (e.g., a higher tax burden, degrading environmental quality). These agencies are filled with policy experts that attempt to make informed, good-faith decisions on the behalf of citizens. However, conflict can arise when agencies, elected officials, experts, and the public come to a different understanding of what “good” policy solutions are (Lindblom 1990). For example, variation in risk perception<sup>1</sup> can make it challenging to amass a majority who agree that costs associated with a given project are justified (Huber 1986; Kahan et al. 2011; Kunreuther and Slovic 1996; May 1991; Slovic, Fischhoff, and Lichtenstein 1982). This could be risks that the project purports to reduce (e.g., coastal flood risks) or potential adverse outcomes associated with the project itself (e.g., risk to marine life and recreational boating). Ultimately, megaprojects that are not favored by the public are unlikely to generate both the necessary support needed to pass referendums to finance local cost shares or encourage their congressional delegates to support project authorization and appropriation (Samet 2009). Additionally, adverse impacts associated with some projects can raise environmental justice concerns if they fall predominantly on those with less political power (Aldrich 2008; Devine-Wright 2011; Kraft and Clary 1991; McAvoy 1999; Munton 1996; E. Smith and Klick 2007).

Siting conflicts have also led to regulatory battles in court between the public and federal agencies resulting in project deadlock, delays, and failures (Bligh 2006; Buzbee 2014; Kagan 1991a; Kysar and McGarity 2006; Luther 2006; Murchison 2007). Many of these battles have been facilitated by modern environmental laws that empower minority interests to legally challenge federal projects (Buzbee 2014). Those in opposition to megaprojects comb through lengthy feasibility studies and/or environmental impact statements (EISs) to find technical flaws that can be used as arguments against a project (Buzbee 2014; B Flyvbjerg, Bruzelius, and Rothengatter 2003a; USACE 2019c). As long as critics believe that a project fails to meet scientific and legal criteria, the EIS can be challenged in court (Buzbee 2014; Kagan 1991b; Luther 2006). In some cases, this has led to long delays in bringing about coastal risk reduction (Bligh 2006; Kysar and McGarity 2006; Luther 2006). Altshuler and Luberoff (2003) go as far to say that due to the potential for legal challenges, contemporary megaproject proposals are unlikely to leave the drawing board if they propose even trivial costs on the natural environment.

## Methods

### *Data collection and analysis*

We use a case-oriented approach to 1) test existing theories on megaproject development and 2) propose new plausible reasons regarding why some megaprojects move beyond the drawing board and why others do not. Case studies, while being limited to context-dependent

knowledge, can provide a lens through which to view real-life situations, and multiple case studies taken together can form the basis of expert knowledge for practitioners (Bent Flyvbjerg 2006a). Case studies have also provided depth that generalizable theories cannot (Gerring 2004; Peattie 2001), and they serve as a natural bridge between rich empirical evidence and theory building (King, Keohane, and Verba 1994c).

For both Rhode Island projects, we use written materials from archives and process tracing to identify *plausible* causal mechanisms regarding USACE megaproject outcomes. Process tracing seeks to analyze sequences of events as they unfold over time, from initial conditions to a given outcome. This involves searching for evidence about the process by which a certain outcome was produced, such as reading written records from archives (as in this study). By observing the underlying relationship between actors and other variables, process tracing can uncover what plausible causal mechanisms could be at work to explain cause and effect. This can both produce plausible theories and also uncover observations that refute an existing theory (Beach and Pedersen 2013; John Gerring 2007). The collected documents include primary sources such as memos between government agencies and elected officials, technical reports from federal agencies and academic institutions, speeches, transcripts of congressional hearings and town hall meetings, letters to senators and congressman, newspaper articles that recounted the previous day's events, editorials, and op-eds. Document scans are available on Zenodo (<https://doi.org/10.5281/zenodo.6037787>).

The decision of when to start process tracing is important (Beach and Pedersen 2013). We use the aftermath of Hurricane Carol in 1954 as the "critical juncture" at which the Corps, the City of Providence, and the State of Rhode Island all began to consider coastal flood protection in earnest. While projects can fail during the construction process itself, we limit our analysis to the events leading up to breaking ground on a project. Two projects arising simultaneously with different outcomes can help identify reasons why each outcome occurred. Because the two Rhode Island surge barriers studied here are over a half-century old, we supplement our findings with anecdotal evidence from more recent projects in the discussion.

### *Methodological Caveats*

While process tracing can identify plausible causal mechanisms, it is unlikely to produce strong causal inference because 1) it does not identify a counterfactual situation to what was observed and 2) it does not differentiate between the various effects and relative strengths of multiple explanatory variables and causal mechanisms (King, Keohane, and Verba 1994b). As such, we consider our analysis to be "minimally sufficient explanations" for each storm surge barrier outcome (Beach and Pedersen 2013). In other words, our methodological approach is descriptive and exploratory, rather than confirmatory or inferential. It is based on the details learned from both cases and does not attempt to identify causal mechanisms or produce causal inference. That said, King, Keohane, and Verba (1994) note that mere description is one of the two primary goals of social science (in addition to causal inference)(King, Keohane, and Verba 1994a). Our identified plausible mechanisms serve as hypotheses that can be tested in a subsequent study, and because our findings are not generalizable, we recommend that this study's lessons and conclusions be limited to other comparable cases to address external validity concerns.

## *Applicability of mid-20<sup>th</sup> century projects to inform climate adaptation*

The political environment for megaprojects has changed significantly since the mid-20<sup>th</sup> century. The years between 1950 and the late 1960s have been described as “The Great Megaproject Era” (Altshuler and Luberoff 2003). During this time, unprecedented levels of federal aid poured into cities and states. Public confidence in government was high, and projects often had support from businesses, labor groups, and the media because they generated economic activity (Altshuler and Luberoff 2003). In the 1950s, projects were primarily evaluated in economic terms. Since then, multi-objective planning has emerged to take a more wholistic view and balance multiple social dimensions (e.g., environmental quality, regional development, social well-being, and national income) This change, as well as the proliferation of new laws and regulations, has added complexity to megaproject development (Altshuler and Luberoff 2003; Major and Stakhiv 2019).

The 1960s saw a broad expansion of opposition by citizens and organized groups against the deleterious impacts of megaprojects, including environmental harms. The USACE was a commonly cited offender (Douglas 1969; Drew 1970; D. A. Mazmanian and Lee 1975; Porter, Jr. 1971; Reuss 1971; Sargent, Jr. 1972; St. Louis Globe-Democrat 1971). These protests eventually led to a new approach to federal water resource development, outlined in the *Principles and Standards* (P&S) (Major and Stakhiv 2019; WRC 1973). The P&S committed federal agencies to a multi-objective planning approach and called for the involvement of a broader set of government agencies and actors in project review. While these changes produced more wholistic decision-making, it also made it more difficult in some respects (Altshuler and Luberoff 2003; Major and Stakhiv 2019).

While the decision-making for megaprojects has changed significantly since the 1950’s, many aspects of the USACE’s process leading up to breaking ground on megaprojects have largely remained the same, including close involvement with Congress, state and local elected officials, and other federal agencies (although the list of those involved has grown). First, local interests are still required to initiate all surveys performed by the USACE; the USACE cannot act unilaterally [There are exceptions. Congress can order the Corps to act in an emergency (e.g., flood protection in New Orleans post-Katrina). The law that authorized the Corps to carry out the study of the Rhode Island barriers is still invoked today (Public Law 71, 84th Congress)]. Second, in addition to the public, state and federal agencies are still required to review USACE plans (Samet 2009). Third, the cost of USACE projects is still split between the federal government and local interests (the local cost burden has increased from 30 to 35 percent of the total project cost). Fourth, congressional authorization is still required for all projects (now through Water Resources Development Acts, previously River and Harbor or Flood Control Acts), and lastly, Congress must still appropriate project funds (Carter and Stern 2010).

## **Results: Mechanism-based explanations of each Rhode Island storm surge barrier outcome**

### *Background: Rhode Island requests the USACE’s help with coastal flood protection*

The “Great New England Hurricane” of 1938 was the first major storm in over 120 years to strike Rhode Island. It caused \$57.8 billion in damage to New England (2017 normalized USD\$)(Brown 1938; Weinkle et al. 2018) and was particularly devastating to Rhode Island. Much of downtown Providence flooded, and damages there accounted for roughly one-third of the state’s total loss (Hurricane Tidal Flood Protection in Narragansett Bay 1959). Over 250 Rhode Islanders drowned (U.S. Army Engineer Division, New England 1963). Just six years later, the “Great Atlantic Hurricane” of 1944 ravaged the region. The ‘44 hurricane was not as destructive, causing just \$19.6 billion in damage across several east coast states (2017 normalized USD\$), including Rhode Island (Weinkle et al. 2018). While Rhode Island began to consider flood protection after the ‘44 storm (Providence Journal 1954c), serious and sustained government action did not occur until the next major hurricane, a decade later. On August 31<sup>st</sup>, 1954, Hurricane Carol brought devastating floods again to Rhode Island (Brooks and Chapman 1945), causing roughly \$23.5 billion in damage across New England (2017 normalized USD\$) and killing 19 in Rhode Island alone (Hale 1955). The destruction in Rhode Island amounted to roughly 7.4% of the state’s GDP at the time (Fogarty 1959). Much of the damage resulted from severe flooding throughout Narragansett and Mt. Hope Bays (Secretary of the Army 1966).

As a result of the repeat disasters striking Rhode Island, the USACE presented initial drafts of two projects in 1956, a storm surge barrier at Fox Point and a series of rock barriers in lower Narragansett Bay (Pawtucket Times 1956). Other solutions were proposed, such as re-zoning and retreating from the coastline (Providence Journal 1954b), temporary flood protection measures (e.g., sandbags), and flood proofing lower levels of buildings. Congress also attempted and failed to establish a public flood insurance program (Providence Journal 1957).

#### *The Fox Point Hurricane Barrier*

#### *The public and elected officials broadly support local flood protection megaprojects in Providence*

The demand for the construction of permanent flood protection emerged locally in the days following Hurricane Carol from the public, businesses, and elected officials. It remained strong until approval was given by Congress in 1958. Just one week after Carol, the Governor of Rhode Island wrote to President Eisenhower to ask the USACE to conduct a, “...prompt, preliminary survey of the construction and other means needed to protect Rhode Island Shore areas.” [Governor Roberts justified the request by citing Public Law 875 of the 81<sup>st</sup> Congress, which facilitates federal assistance in developing state and local plans to cope with major disasters.] The Governor emphasized the specific goal of protecting downtown Providence (Roberts 1954). He later remarked, “[t]he enormity of the loss suffered by our people justifies a substantial investment in (permanent flood) protection” (Providence Journal 1954a). The Rhode Island congressional delegation also supported pursuing local flood protection in the wake of the previous three hurricanes (Providence Journal 1958). Congressman John E. Fogarty wrote in his replies to letters from the public calling for action, “...(flood control) is uppermost in the minds of the Rhode Island congressional delegation...” (Fogarty 1955) and, “...I will certainly do everything I possibly can to see to it that the United States Government gives the City of Providence and the State of Rhode Island every possible assistance” (Fogarty 1954).

Elected officials were not the only ones demanding that something be done about recurring flooding in both Providence and elsewhere in the state. Several waterfront property owners (Residents of Touisset 1954), business associations such as Chambers of Commerce (Gilbane 1954), and individual businesses in and outside of Providence (Quinn, Jr. 1954) wrote to the Rhode Island congressional delegation expressing a strong desire for government action on the flood issues, including those specifically calling for permanent flood protection (Providence Journal 1954d). In the first few months after Carol, the Providence Chamber of Commerce passed a resolution calling for an official plan for flood control, “at the earliest possible time”, and the need for flood control to be, “kept upper-most in our minds until a control project becomes a reality” (Providence Chamber of Commerce 1954). The Governor echoed the sentiments of many Providence business owners, “[p]eople cannot be expected to make large capital investments in an area where their investments are threatened by recurring disaster. The only thing we can do to make Rhode Island safe for the investment we need — is to begin actual construction to prevent flooding of our river valleys and shores” (Evening Bulletin 1955). Local businesses also formed a hurricane protection committee in the hopes of maintaining interest in Providence’s flood problem and to also serve as a link to elected officials. Public support was perhaps most strongly expressed during a hearing about the Fox Point Barrier in Providence in 1956. During the hearing, an overwhelming (but not unanimous) majority urged immediate construction of the Fox Point Barrier. The only recorded dissenter was the Allens Avenue Businessmen’s Association, a group of 122 Providence businesses (Dinsmoor 1956; Providence Journal 1964). They opposed the Fox Point Dam because their properties were not in the proposed protection zone (Providence Journal 1956d).

Multiple close calls with other storms in the years after Carol helped sustain public interest in flood protection in Providence. Additionally, local and state-wide election drives kept public attention elevated enough to pass two referendums needed to cover the non-federal share of the barrier cost. A key element in obtaining state-wide approval (i.e., from those who would not directly benefit from protection) was promoting the belief that protecting Providence was important to the overall economic well-being of the state.

#### *Elected officials shepherd the Fox Point Barrier Project through a ‘long, slow obstacle course’*

Support from the Rhode Island congressional delegation was critical for pushing the Fox Point Barrier towards authorization and appropriation, particularly from Congressman Fogarty and Senator Pastore, who played critical roles in amassing support in Congress to bring flood protection to Providence. The congressional process for approving and funding the Fox Point Barrier was described by the *Providence Journal-Bulletin* as, “a long, slow obstacle course” (Dunbar Jr. 1956), in part because of the many policy issues that the U.S. government was giving attention to at the time (e.g., rising Cold War tensions). At multiple decision points, the fate of the project seemed to hang in the balance, only to have Rhode Island’s congressional delegates keep it in play. Obtaining approval from President Eisenhower also was necessary. Back in Rhode Island, the Governor and the Mayor of Providence provided leadership for local efforts to encourage support for the Fox Point Barrier, including for covering local cost shares.

#### *The Narragansett Bay Hurricane Barriers*

*The potential for environmental harms leads to public objection to the Narragansett Bay barriers*

While the Fox Point Barrier received near unanimous support at the public hearings, the initial reception for the Bay barriers was lukewarm. Several concerns were raised by the public. Among them were related to the effects of the barriers on maritime navigation, water quality, salinity, fish and wildlife, and recreational activities in the bay (Providence Journal 1956c). Further understanding was requested regarding these issues, which the public deemed underfunded and understudied (Zinn 1956). However, even after several years of additional analysis, these concerns were still held.

When a reworked plan for the Bay barrier project was released in 1964, it was met with near unanimous opposition. Resistance was again expressed through public hearings, but this time also in editorials and op-eds in the *Providence Journal-Bulletin* (Evening Bulletin 1964b, 1964a, 1964c; Providence Journal 1964) and letters to the Governor, the Rhode Island congressional delegation, and the USACE. Senators and congressmen were alarmed by the mail they were receiving. Senator Pastore described the public's response as, "heavy and overwhelmingly opposed". He reported he had received letters to his office at a rate of at least 10 to 1 against the barriers. Congressman Fernand J. St. Germain said he answered at least 200 letters from Rhode Island residents opposed to the project and had received none in favor (Van Dusen 1964). Unlike the Fox Point project, no Rhode Island congressional delegate promoted the Bay barriers. Congressman Fernand J. St. Germain said, "...I see no reason for promoting or pushing for the construction of this barrier." Senator Claiborne Pell had similar thoughts, "...I do not believe a project of this sort should go ahead unless a majority of the community wishes it" (Van Dusen 1964).

Despite the strong opposition, several Rhode Islanders who opposed the Narragansett Bay barriers stated that they were still in support of non-megaproject based coastal risk reduction. These residents suggested alternative strategies that would comparatively involve fewer environmental harms, would be cheaper (i.e., lower tax burden), and would be faster to implement. This included retreat, re-zoning, establishing a public flood insurance program, implementing shore-based strategies like levees, and implementing building-by-building measures such as flood proofing, and temporary flood barriers. Ultimately, the Chief of Rhode Island's Division of Harbors and Rivers requested stopping the Narragansett Bay barriers because he was unable to foresee voters passing future referendums to pay for the non-federal share of the costs (Isé 1965).

*Rhode Islanders increasingly mistrust the USACE, view agency as an adversary*

Residents noted that the USACE's analysis of the Bay barriers had been heavily focused on engineering; little attention was given to assessing environmental impacts. As such, there was almost no scientific support available for arguments that the public could make to use against the barriers, particularly considering their potential effects on marine life. This caused displeasure among many residents who wanted assurance that the barriers would not ruin commercial and sport fishing in Narragansett Bay (both shell and finfish).

During later public hearings in 1964, several residents became angered after noting an obvious bias in the USACE's depiction of itself as an agency. This included showing a film in which the USACE is portrayed as the "hero" in the fight against villainous New England hurricanes (Hawkes 1964). A resident expressed their displeasure to the USACE, "I resent the biased presentation of the project...the presentation turns out to be a massive campaign to force the barrier upon us; distorted opinions and exaggerated damage figures compiled by persons whose main concern is to assure themselves of continued employment. Your agency should serve the taxpayers, not force your will upon us (at our expense)" (Thomas 1964). Despite overwhelming public opposition, the USACE continued to push the Bay barriers towards authorization, citing the irrationality of project critics. The New England Division's chief engineer, Brig. Gen. Fleming, called the opposition "self-appointed" flood control experts, promoting their own "woefully inadequate" views of technical aspects of projects, rather than relying on the conclusions of the USACE's expert authored studies. Previous USACE leadership had even called the public a "threat" to their projects (Goodrich 1956). In the mid 1950s, Brig. Gen. Fleming observed that many projects aimed at addressing flood issues in Rhode Island had not been dealt with in the past because of objections from "certain minority groups" ("minority" meaning small political interests) and that public opinion had been the "determining factor" in the fate of any flood control effort (Goodrich 1956).

#### *Lengthy and complex decision-making procedures and fading memories of flood disaster*

Deliberation over the impact of the Bay barriers carried on for almost a decade, during which public interest in permanent flood protection diminished. Some who had initially favored the barriers ended up changing their minds. In op-eds and letters to both the USACE and elected officials, several Rhode Islanders made it clear that they would rather live with the risk of a repeat disaster than pay for expensive flood protection that also has the potential to degrade their experience of living on the water. Brig. Gen. Hyzer, the New England Division's chief engineer, contended that some of the opposition had come from those who had previously supported the barriers, "I am puzzled that memories are so dimmed that few now appear to want the protection which, in 1956, they considered so necessary in the bay areas" (Hyzer 1964). In an op-ed, a resident of Fall River, Massachusetts argued that opponents of the Bay barriers needed to recall the disastrous effects of both Carol and the '38 storm and then "re-examine their position (against the proposal)" (Conroy 1964).

The loss of public interest was somewhat expected. In 1956, the *Providence Journal-Bulletin* wrote, "...the biggest immediate danger facing the barrier project is public apathy fostered by the passage of time and the absence of storm threats. It took 20 years to get action on river flood projects that might have made Hurricane Diane a harmless rainstorm. The bay project deserves a better fate than death by disinterest" (Providence Journal 1956a). The USACE also knew that time was not on their side for getting something built. Lt. Col. Miles L. Wachendorf, the Assistant New England Division Engineer, said, "...experience shows that the public in the past has had a tendency to lose interest in flood control as the last major disaster fades in their memory" (Providence Journal 1956b).

#### **Discussion and applicability to modern-day storm surge barrier efforts**

We find that existing theories of megaproject outcomes related to siting disputes and strategic manipulation can, in part, explain the outcomes of the USACE's Rhode Island megaproject proposals. We propose additional plausible factors that can play a role. First, strong and consistent public demand for flood protection appears to encourage support from elected officials; the latter being critical for shepherding projects through Congress. Second, the passage of time can cause memories of disaster to fade, leading to a decrease in public support for flood protection megaprojects. Risk reduction tactics that are smaller, cheaper, more aesthetically pleasing, and faster to implement can also cause decreases in support for megaprojects.

#### *Siting disputes and NIMBY concerns*

The Narragansett Bay barrier project had several features of a siting dispute. The USACE faced a loud and relentless opposition from the public, businesses, and some elected officials. Significant opposition to the project resulted from the public's concerns over the risk of degrading Narragansett Bay's unique natural beauty (e.g., structures themselves are aesthetically displeasing, increased water pollution), threats to maritime travel (recreational, commercial, and naval), and risks of adverse impacts on complex ecosystems (including marine life). In response to the public opposition, elected officials were unwilling to move the project forward.

NIMBY concerns were absent from the Fox Point barrier project. The siting of the barrier in Providence impacted few of the same organized interests that opposed the Bay barriers (e.g., maritime and environmental interests). The Providence River, across which the barrier was built, was already polluted, so there was no increased threat to marine life. The water behind the barrier had no maritime navigational purpose. The only opposition came from property owners outside of the planned protection area. Such conditions are unlikely to exist after over a half-century of improvements in water quality (Robinson, Campbell, and Jaworski 2003; R. A. Smith, Alexander, and Wolman 1987).

The placement of storm surge barriers across waterways continues to raise concerns regarding their environmental impacts (Elizabeth Royte 2019; Ong 2018; Roff and Gallay 2018; Stringer 2019; USACE 2019a), including but not limited to impeding natural tidal flows, habitat destruction, changes in sedimentation rates, trapping pollutants, and degrading water quality (salinity, temperature, circulation, dissolved oxygen, nutrient concentrations, and algal blooms). Studies conducted on the environmental impacts of Delta Works Projects in the Netherlands and the Mo.S.E. barrier in Venice, Italy support these concerns (Bakker, Herman, and Vink 1994; Eelkema, Wang, and Stive 2011; Nienhuis and Smaal 1994; Smaal and Nienhuis 1992; Tognin et al. 2021; van der Tol and Scholten 1997), but impacts remain hard to forecast with the accuracy and precision desired by both modern environmental laws and those in opposition (e.g., the public and environmental NGOs) (B Flyvbjerg, Bruzelius, and Rothengatter 2003a; Fukuyama 2017; Ortolano and Shepherd 1995).

Some scenic regions, such as Narragansett Bay, may be inherently politically unfit for coastal megaprojects due to heavy recreational boating use, commercial fisheries, and cherished natural beauty. The importance of preserving unique natural beauty has been



brought up by those opposed to engineered projects in New York City [past (Nolan 1972; US National Research Council 1971) and present (Elizabeth Royte 2019; Ong 2018; Roff and Gallay 2018; Stringer 2019)]. Recently, Riverkeeper, an environmental NGO, declared that a USACE storm surge barrier proposal for the New York Harbor region would, “threaten the very life of the Hudson River” (Riverkeeper 2018). Also, in Miami, critics argued that a seawall would block views and hinder access to the water (Allen 2020, 6; Weber 2020). Similar claims were made during the planning of the Eastern Scheldt Barrier in the Netherlands (Bijker 2002; Disco 2002), suggesting that these experiences are not unique to the U.S.

While USACE projects are still required to be reviewed by the public, modern environmental protection laws, such as the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), and the Endangered Species Act have made megaproject planning a more complex legal process (D. A. Mazmanian and Nienaber 1979; US National Research Council 2011). For example, under NEPA, USACE projects that pose significant harms to the quality of the natural environment must analyze and publicly disclose a proposal’s environmental impacts through an EIS and receive public comment on the proposal and its alternatives (Luther 2008). Some states and cities duplicate powers and add more project hurdles (e.g., New York City and California) (Buzbee 2014; Side et al. 2005). While this process is not a direct legal barrier to project implementation per se, the transparency of potential ecological harms it provides can trigger public opposition and legal challenges (Buzbee 2014). On the other hand, some environmental laws can block projects altogether. Under Section 404 of the CWA, projects cannot be built in coastal waterways unless 1) the sponsoring agency proves they need to be built in the water or 2) the project will not cause “significant degradation” to important aquatic habitats (Copeland 2016). Despite the complexity these laws add, the Narragansett Bay barrier experience proved that the stricter review process is not necessarily to blame for past and ongoing megaproject siting disputes.

Environmental concerns do not block all coastal flood protection megaprojects outright, or always even emerge at all. For example, the South Shore Staten Island Project has progressed from an initial feasibility report in 2015 to congressional approval. Construction is slated to begin in early 2021 (Michel 2020). Also in New York City, the East Side Coastal Resilience Project (not affiliated with the USACE) recently received approval, despite considerable community opposition, and in Norfolk, a USACE project consisting of a series of structural defense measures, including storm surge barriers, has been congressionally authorized [Sec. 401. Project Authorizations in H.R. 133, 116<sup>th</sup> Congress, 2<sup>nd</sup> Session <https://www.govinfo.gov/content/pkg/BILLS-116hr133enr/pdf/BILLS-116hr133enr.pdf>]. Future work should examine these cases and better understand why these projects progressed without significant environmental concerns while others did not [e.g., other projects in New York City, such as storm surge barriers in Jamaica Bay (Secretary of the Army 1965; US National Research Council 1971) and New York Harbor (Barnard 2020) and a levee proposed for Coney Island (Nolan 1972)]. For example, naval installations in Norfolk may have increased the federal government’s interest in flood protection there.

Concerns over environmental harms incite debate over how to balance environmental protection with the socioeconomic benefits from infrastructure projects. Some scholars who study infrastructure argue that there is too much emphasis on environmental regulation over public safety and economic growth (Fukuyama 2017; Howard 2015; Kagan 1991b, 2001), while

others suggest it is warranted (Ortolano and Shepherd 1995), particularly in light of the USACE's history of understating environmental impacts (Taylor 1984). In this regard, the USACE often finds itself trying to achieve goals and objectives that are not always consistent or compatible with one another (e.g., both credible protection from rare storm surge events and improvement in environmental quality)(US National Research Council 2011).

#### *Strategic Manipulation*

Strategic manipulation of BCA or other decision-making analysis is a tactic for project proponents to advance their megaproject proposals. Unlike most examples of strategic manipulation that go undetected, we found that Rhode Island residents increasingly believed the USACE was intentionally biasing its analysis in support of the Narragansett Bay barrier project. A critical element was downplaying adverse environmental impacts that the public perceived or intuited to be likely. We also found evidence of USACE leadership calling the public an "adversary" in their project development efforts. These factors alienated the public and led to strong opposition of the Bay barrier project and, ultimately, its cancellation. Such sentiments continue today. Critics of the storm surge barriers planned for New York and New Jersey derided the USACE for a lack of transparency, poor public outreach, and short comment period (Fallon 2018; Hellauer 2018). Critics also called the USACE's public outreach process "woefully inadequate"(Riverkeeper 2018).

#### *Public demand for the Fox Point Hurricane Barrier increases support from elected officials*

The Rhode Island storm surge barrier projects highlight the intricate and important role that elected officials play in advancing USACE megaprojects. Elected officials heeded the demands from local businesses for permanent flood protection by continuing to support the Fox Point Barrier years after Hurricane Carol. In the case of the Fox Point Hurricane Barrier, the absence of opposition from community boards, civic organizations, and environmental groups proved beneficial for amassing support from the public. Support from Rhode Island's congressional delegation proved to be critical for pushing the Fox Point Barrier through Congress; without it, the project had little chance of being authorized or appropriated.

Support from congressional delegates is still needed to shepherd projects through Congress (Knopman et al. 2017) [Generally, at least four acts of Congress are required between study authorization and appropriations]. The USACE's ongoing South Shore Staten Island Project in New York City (a system of levees and raised embankments estimated to cost \$615 million)(USACE 2016) recently highlighted the importance of congressional support in federal projects. New York Congressman Max Rose and Senator Chuck Schumer led an effort to pass new legislation that allowed the USACE to build a section of the seawall in Great Kills Park, part of Gateway National Recreation Area (Michel 2020), and in Virginia, the entire congressional delegation recently requested additional planning funds for a series of USACE projects in Norfolk (13News Now Staff 2020).

*Alternative risk reduction measures that are more environmentally friendly and faster to implement are often preferred over storm surge barriers and other megaprojects*

The slow speed at which storm surge barriers and other USACE megaprojects move from an initial proposal to implementation has also encouraged support for alternative strategies that some believe can be implemented faster (Cusick 2020; PlaNYC 2013; Stringer 2019; Sustainable Solutions Lab 2018). Even in the 1950s, the media and public viewed the USACE's megaproject protocols as notoriously slow. In the wake of a third major flood in under two decades, Rhode Islanders lamented at the thought of a long, political "obstacle course" that would accompany any USACE-led flood protection effort. Today, environmental laws have added even more steps to what some water infrastructure experts have described as a "remarkably inefficient" process (Knopman et al. 2017). Lengthy planning times have caused flood concerns to fade and projects to stall (Fanta, Šálek, and Sklenicka 2019; Jacobs and Matthews 2012). Ultimately, no other projects received serious consideration besides the Bay barriers. When the barriers were cancelled, interest in flood risk reduction had waned, and ultimately large-scale action was not taken.

During the time when the Narragansett Bay barriers were being considered, the USACE was not required to propose alternative strategies. When the barriers failed to advance, coastal risk reduction efforts failed with it. There was not another active project alternative to consider. Today, the USACE now is required to consider multiple project alternatives, including "green"/nature-based risk reduction measures (e.g., wetlands, dunes, and living shorelines)(USACE 2017) and engineered structures along the shoreline (e.g., buried levees), both lauded by environmental NGOs (Ong 2018; Riverkeeper 2018; USACE 2019c).

Alternative flood risk reduction approaches often receive greater support because their proponents argue that they involve comparatively fewer environmental harms, are cheaper, faster to implement, and have co-benefits, such as recreational amenities and addressing social justice issues. For example, a Boston study unaffiliated with the USACE found that shore-based strategies would be more cost effective, provide flexibility and adaptability, offer social justice co-benefits, and cause minimal impact to the environment (Kirshen et al. 2020; Sustainable Solutions Lab 2018). However, even shore-based strategies like levees have failed to gain support due to concerns over aesthetics and environmental degradation (Harris 2020; Nolan 1972).

Today, concerns over lengthy storm surge barrier construction times have resulted in calls for support for alternative strategies. In a letter to the USACE, the New York City comptroller advocated for shore- and nature-based approaches that could be built faster, "I also am concerned that the long timeline associated with the construction of these barriers – amounting to 25 years – will leave our City all too vulnerable to storms in the decades ahead"[ However, the purpose of nature-based strategies is primarily to reduce wave energy and limit erosion, not to provide reliable flood protection from extreme storm surges (Narayan et al. 2016; Oppenheimer et al. in press; USACE 2015; USGAO 2019)]. The comptroller used the example of Venice's Mo.S.E. barriers to support his argument, which took nearly two decades of construction before becoming operational (Stringer 2019). Megaproject construction times are also often longer than initial forecasts (B Flyvbjerg, Bruzelius, and Rothengatter 2003b; Bent Flyvbjerg 2006b, 2007); the Thames Storm Surge Barrier in London (England), also took almost a decade to construct, following roughly two decades of planning (Horner 1979). In Houston, designers of a smaller-scale surge barrier argued for their design over the USACE's under the

belief that their project could be built faster, “[o]ur biggest concern is the length of time it will take to build. We get a major storm in here about every 15 years. The last one was 2017, so we could see another one before this project is complete”(Cusick 2020).

In some cases, alternatives are not directly comparable. For example, they may not offer the equivalent level of protection for the same area (or address the same variety of flooding, e.g., frequent and minor tidal flooding vs. devastating and rare storm surges)[The USACE does not have authority to address frequent floods as this infringes on zoning laws, which are local issues], provide the same level of reliability, or occupy the same spatial footprint (Boyd and Shabman 2019). A common example is comparing “green”/nature-based solutions with concrete and steel projects (Temmerman et al. 2013; USACE 2015)[What the USACE calls Natural and Nature-Based Features (NNBF)]. The USACE has comparatively little experience with ecosystem solutions and views their effectiveness as more uncertain in part due to a lack of previously successful projects and a poor understanding of reliability, failure rates, and protection levels. Nature-based solutions often require significantly more space to be effective and require time to develop (Boyd and Shabman 2019). These factors make them harder to justify implementing in dense urban areas where the stakes are high in cases of non-performance.

## **Conclusions and recommendations for the Corps**

In the U.S., the conception, design, and implementation of storm surge barriers, levees, and other coastal flood megaprojects are not simply matters of federal agencies drawing up technically feasible designs that are economically justified. Experience with coastal megaprojects in Rhode Island and elsewhere indicates that decision-making is immersed in legal procedures that involve coordination and cooperation from the public, all levels of government, and organized interests (e.g., professional and civic organizations, NGOs). Conflict between these groups has resulted in deadlocks, delays, and failures that have wasted taxpayer money and the time of government agencies and their technical expertise. These scarce resources could instead have gone towards projects that are deemed more palatable by these groups, thus improving the efficiency with which coastal risk reduction strategies are deployed.

We are pessimistic that storm surge barriers will be politically feasible climate adaptation options because of 1) modern environmental laws provide avenues for expression of oppositional views within the decision process, 2) the allure of alternative options that are more aesthetically pleasing and cheaper and faster to implement (even when they do not offer equivalent levels of protection), e.g. green/nature-based solutions , and 3) a shift in water resources planning that adds considerable complexity by considering multiple objectives that are sometimes in conflict (Major and Stakhiv 2019). These impediments have been historically overcome by strong leadership (especially to shepherd projects through Congress) and limited opposition by the public and environmental NGOs.

From our assessment we make the following recommendations to the USACE to increase the efficiency with which public resources are allocated to coastal risk reduction projects:

1. Obtain support from the public, NGOs, and elected officials before pursuing projects beyond the initial scoping phase. This could come in the form of the USACE requesting

local cost shares be covered earlier in project timelines to reflect local commitment to projects (e.g., the public voting on a municipal bond) or increasing public interest in flood risk reduction measures by incorporating desirable co-benefits (e.g., a buried levee that doubles as a bike path or promenade).

2. Increase the transparency of both the effectiveness and reliability of different coastal risk reduction designs, especially “green”/nature-based approaches. Where applicable, research should be undertaken to quantify these important performance measures. A greater understanding of “green”/nature-based approaches could increase the USACE’s confidence in their flood risk reduction capabilities and encourage implementation.
3. Revisit regulations and internal USACE guidance to encourage and facilitate the consideration of new and innovative coastal flood risk reduction infrastructure designs, including “green”/nature-based approaches and designs that are nature-concrete/steel hybrids (e.g., buried levees).

The USACE plays a major role in coastal adaptation given their wealth of technical expertise, more than 60 years<sup>2</sup> of experience with coastal risk reduction efforts, and coastal jurisdiction in terms of navigation, dredging, and filling (Moritz et al. 2016; Samet 2009)[The Corps was involved in two projects in the early twentieth century (Table 2) but studying coastal flood protection was not officially added to their jurisdiction until 1955 (Public Law 71, 84<sup>th</sup> Congress, 1<sup>st</sup> Session)]. Studying the USACE’s experiences can reduce the number of project delays, deadlocks, and failures and better allocate public resources towards coastal risk reduction projects that stand a better chance of being implemented. Given the current level of national interest in these strategies for managing sea-level rise (City and County of San Francisco 2016; City of New York 2013; Sustainable Solutions Lab 2018; USACE 2016, 2018a, 2018b, 2019b, 2020c), such an effort is warranted.

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### Data Availability Statement

We collected nearly 2000 primary and secondary documents from public and private archives between September and November 2019 to reconstruct event sequences associated with the surge barriers as accurately and completely as possible. Documents include internal memos, project-related materials, and newspaper clippings from the New England District of the USACE archived at the U.S. National Archives and Records Administration facility (Waltham, Massachusetts), personal papers from Congressman John E. Fogarty, Senator John Pastore, and Governor Dennis J. Roberts archived at Providence College, over three decades of newspaper articles on microfilm from the Providence Journal and Evening Bulletin archived at both the Rhode Island Historical Society and the Providence Public Library, and additional materials associated with the Fox Point Hurricane Barrier at the Providence City Archive (all Providence, Rhode Island). Scans of all archive documents collected are available on Zenodo as well as an organized subset containing only the artifacts cited in this study (<https://zenodo.org/record/6037787>).

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1181 **Figures**



1182

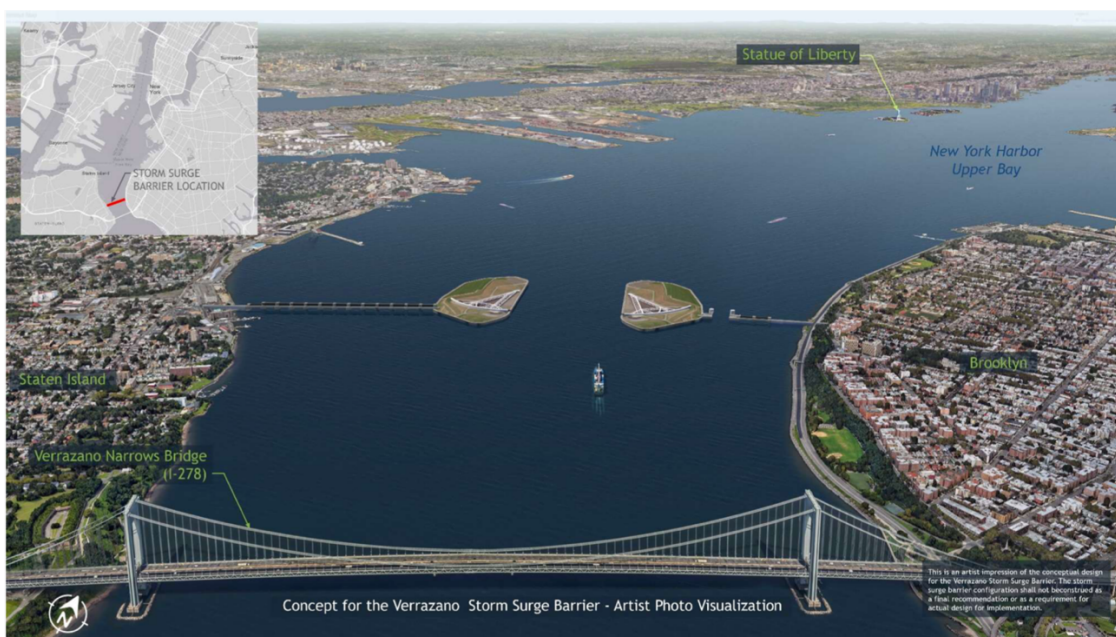
1183 **Figure 1.** The Fox Point Hurricane Barrier following completion in March 1966 (Providence,  
1184 Rhode Island). Photo taken by the New England Division of the U.S. Army Corps of Engineers  
1185 (Waltham, Massachusetts).





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1187 **Figure 2.** Revised plans for the Narragansett Bay barriers, April 1964. Source: New England  
 1188 Division of the U.S. Army Corps of Engineers (Waltham, Massachusetts).



1189

1190 **Figure 3.** Artist rendering of a proposed storm surge barrier at the entrance to New York  
 1191 Harbor. Source: The New York Division of the U.S. Army Corps of Engineers, New York-New  
 1192 Jersey Harbors and Tributaries Feasibility Study

**Table 1.** An incomplete list of proposed public works coastal flood protection projects in the U.S. (USACE is the U.S. Army Corps of Engineers; CSRM is Coastal Storm Risk Management; HUD is Department of Housing and Urban Development; NYC is New York City; SSPEED is the Severe Storm Prediction, Education, and Evacuation from Disasters Center)

Project	Location	Strategy	Year Proposed	Lead Agency	Project Cost	Status (as of 2020)
Boston Harbor Surge Barrier	Boston, MA	Levee/Barrier	2018	UMass-Boston	\$6.5 to 11.8 billion	Proposed
East Side Coastal Resiliency Project	New York, NY	Levee/Nonstructural	2014	NYC/HUD	\$1.5 billion	Under construction
Lower Manhattan Climate Resiliency Project	New York, NY	Coastal Advance/Fill	2019	NYC	\$10 billion	Proposed
Embarcadero Seawall	San Francisco, CA	Seawall	2018	City of SF	\$5 billion	Proposed
Red Hook Integrated Flood Protection System	New York, NY	TBD	2013	NYC	\$0.1 billion	Undergoing a redesign
Coastal Texas Protection and Restoration Project	Coastal Texas	Levee/Barrier/Nonstructural	2015	USACE	\$23.1 to 31.8 billion	Proposed
Galveston Bay Park	Galveston, TX	Levee/Barrier/Nonstructural	2020	SSPEED	\$2.3 to 2.8 billion	Proposed
South Shore of Staten Island CSRM Project	New York, NY	Levee/Nonstructural	1993	USACE	\$0.6 billion	Under construction
Charleston Peninsula: A Coastal Flood Risk Management Project	Charleston, SC	Levee/Seawall	2020	USACE	\$1.1 billion	Proposed
City of Norfolk CSRM Project	Norfolk, VA	Levee/Barrier/Nonstructural	2015	USACE	\$0.9 to 2.3 billion	Authorized
Miami-Dade Back Bay CSRM Project	Miami, FL	Levee/Barrier/Nonstructural	2020	USACE	\$0.9 to 5.2 billion	Proposed
Collier County CSRM Project	Naples, FL	Levee/Barrier/Nonstructural	2020	USACE	\$2.2 billion	Proposed
Fairfield and New Haven Counties, CT CSRM Project	Fairfield and New Haven, CT	Levee/Seawall/Pumps	2019	USACE	\$0.05 to 0.3 billion	Proposed
New York – New Jersey Harbor and Tributaries Project	New York, NY	Levee/Barrier/Nonstructural	2019	USACE	\$15 to 119 billion	Planning suspended

**Table 2.** An incomplete list of erected U.S. Army Corps of Engineers (USACE) coastal flood protection projects

Flood Protection Public Works	Location	Completed	Agency	Cost (unadjusted)
Galveston Seawall	Galveston, TX	1904	USACE	\$1.5 million
Herbert Hoover Dike	Lake Okeechobee, FL	1938	USACE	Unknown
Pawcatuck Hurricane Protection Barrier	Pawcatuck, CT	1963	USACE	\$851,000
New Bedford Hurricane Barrier	New Bedford, MA	1966	USACE	\$18.6 million
Fox Point Hurricane Barrier	Providence, RI	1966	USACE	\$16.2 million
Stamford Hurricane Protection Barrier	Stamford, CT	1969	USACE	\$14.5 million
Charles River Dam	Boston, MA	1978	USACE	\$61.3 million
New London Hurricane Protection Barrier	New London, CT	1986	USACE	\$12.0 million
Lake Pontchartrain and Vicinity Hurricane Protection (Levee/Dike)	New Orleans, LA	in progress, then destroyed	USACE	\$760 million
Inner Harbor Navigation Canal Lake Borgne	New Orleans, LA	2013	USACE	\$1.1 billion

## **A Tale of Two Army Corps Megastructures: Rhode Island's Fox Point and Narragansett Bay Hurricane Barriers**

Since the early 19<sup>th</sup> century, Congress has assigned the responsibility to the federal government to either undertake or assist in the development of water resource projects.<sup>i</sup> This eventually included assigning inland flood protection duties to the U.S. Army Corps of Engineers.<sup>ii</sup> However, the Army Corps did not specifically get involved in flood protection on the coastline until after World War II<sup>iii</sup>, following a series of destructive and deadly hurricanes in New England and elsewhere in the U.S. Between 1956 and 1964, over \$4 million dollars of federal money (unadjusted) was spent on studying hurricanes, flooding, and planning and designing coastal flood protection in New England.<sup>iv</sup> At the time, the Army Corps' New England Division Engineer called the effort, "one of the biggest joint federal, state and local flood control operations in the country."<sup>v</sup> Ultimately, five Army Corps projects were constructed in the region, including the Fox Point Hurricane Barrier, completed in January 1966 at a cost of \$16.2 million and that still sits across the Providence River, 1.4 km south of downtown Providence, adjacent to the Providence River Bridge that carries Interstate 195<sup>vi</sup> (Figure 1). The Fox Point Barrier currently protects roughly 1.1 km<sup>2</sup> of downtown Providence and \$2 billion worth of property<sup>3</sup> against a storm surge of 6.25 m (above mean sea level).<sup>4 5</sup> The project benefit-cost ratio was given as 2.37.<sup>6</sup> The barrier currently protects roughly 1.1 km<sup>2</sup> of downtown Providence and \$2 billion worth of property.<sup>vii</sup> However, the Army Corps cannot unilaterally conceive, design, and implement a flood protection project. With the support of a non-federal sponsor, the Corps' job is to present an engineering solution and economic facts as a basis for decision. The decision to move forward with a given project is up to the public, local and state government, and Congress.<sup>viii</sup> For example, after a project has been formulated by the Corps, the public can pressure elected officials to support or oppose it. The Fox Point and Narragansett Bay storm surge barriers were among the first coastal flood protection public works megaprojects proposed in the U.S.<sup>7</sup> They both possessed an imposing physical presence, a combined price tag of over \$100 million dollars (unadjusted, 1966 USD) and required substantial involvement of public resources. Because it was constructed and the political process is well-documented leading up to breaking ground on the project, the Fox Point Barrier is a good case for understanding when, why, and how flood protection megaprojects get implemented in the U.S.

Knowing why some projects get built is as at least as useful as knowing why they failed to get built. While the Fox Point Barrier achieved broad public support and eventually broke ground, the Narragansett Bay Barriers did not make it past the planning stage. While the Fox Point barrier served those in Rhode Island's capital city, the Narragansett Bay Barriers were a USACE flood protection project designed to provide flood protection for cities and towns in and around

<sup>3</sup> Kuffner, "Rising Threat: Can Providence's Hurricane Barrier Withstand Sea-Level Rise?"

<sup>4</sup> Or about 5.0 m above MHHW (after adjusting for SLR), roughly the height of the 1000-yr event (not accounting for wave setup or swash)

<sup>5</sup> Engineering News-Record, "Building a Hurricane Barrier Is No Breeze."

<sup>6</sup> Secretary of the Army, "Letter from the Secretary of the Army: Narragansett Bay Area, R.I. and Mass.," 1958.

<sup>7</sup> Morang, "Hurricane Barriers in New England and New Jersey: History and Status after Five Decades," 2016.

Narragansett and Mt. Hope Bays (Fig. 3). The Chief Engineer of the USACE's New England Division described the Bay barriers as, "unrivaled in scope and magnitude by any similar project in the world – a project equally as imaginative as the St. Lawrence Seaway or the International Passamaquoddy Tidal Power Project, and a project that has...posed some of the most challenging problems of professional engineering research."<sup>8</sup> The project was comprised of three massive rock barriers with an ungated, navigational opening large enough to allow sufficient maritime travel, but small enough to constrict the flow of storm surges into the bay. The East barrier was planned for across the eastern bay passage in the vicinity of Castle Hill in Newport, Rhode Island, the West barrier was planned for across the western bay passage at Bonnet Shores, and the third barrier was to be placed across the Sakonnet River between Tiverton and Portsmouth. Both the East and West barriers were to have 40 sluice gates to reduce the current velocity through the navigational opening and to lessen any impact on the normal tidal interchange and flushing of Narragansett and Mt. Hope Bays. Supplemental levees were planned for Bonnet Shore, Mackerel Cove, and Castle Hill. Unlike the Fox Point barrier, the lower bay project did not completely close off the waterway. As such, it merely attenuated storm surge coming into Narragansett Bay.<sup>9</sup> The USACE estimated that the barriers would eliminate 93 percent of the damage from future hurricanes. The projected cost was \$90 million (unadjusted), and the projected benefit-cost ratio was reported to be 1.4, a little more than half of that of the Fox Point project.<sup>10</sup>

During the late 1950s and 1960s, several Army Corps plans for hurricane protection elsewhere in Rhode Island failed to break ground (Figure 2), in part due to public opposition. This group of stalled projects included the Narragansett Bay Hurricane Barriers, a proposed \$90 million dollar effort (unadjusted) designed to provide flood protection for cities and towns in and around Narragansett Bay (Figure 3). The Narragansett Bay Hurricane Barrier plan was described by the Chief Engineer of the Corps' New England Division as, "unrivaled in scope and magnitude by any similar project in the world – a project equally as imaginative as the St. Lawrence Seaway or the International Passamaquoddy Tidal Power Project, and a project that has...posed some of the most challenging problems of professional engineering research."<sup>ix</sup>

In the 1950s and 60s, the Army Corps was largely viewed as a construction-oriented organization with a strong commitment to economic development.<sup>x</sup> It was heavily involved with the construction of megaprojects.<sup>xi</sup> Altshuler & Luberoff (2003) describe period of the Rhode Island hurricane barriers as the "great mega-project era" (1950s to late 1960s)<sup>xii</sup>, a period of "unprecedented" federal investment in public works (e.g., urban renewal, highway construction, and airport development). During this time, public confidence in government was high, and because they aimed at generating economic activity, many of these megaprojects were supported by businesses, labor groups, and the media. However, megaprojects often entail significant threats to some interests and values, even as they promise great benefits to others. By the mid 1960s, it became apparent that many of these projects were negatively

<sup>8</sup> "Hurricane Tidal Flood Protection in Narragansett Bay."

<sup>9</sup> Local officials were required to notify residents at least once a year that the barriers did not provide complete protection from hurricane tidal surges.

<sup>10</sup> Secretary of the Army, "Letter from the Secretary of the Army: Narragansett Bay Area, R.I. and Mass.," 1966.



impacting communities and the natural environment. The Army Corps and their projects were a frequently cited offender.<sup>xiii</sup>

Prior to the mid 1960s, the Army Corps' megaproject planning process largely consisted of local proponents, the Army Corps, and project allies in Congress. It was more or less exclusionary to project opponents and communities. Engineers were often the only experts involved in deciding both how to define the flood problems communities were experiencing and also the objectives and goals of the plan to address the problem. Additionally, alternative plans were rarely produced. Oppositional viewpoints from concerned publics began to disrupt the Army Corps' megaprojects that had previously appeared to be unstoppable in other parts of the country. This movement led to a number of project turndowns by governors and other state authorities, the Narragansett Bay Hurricane Barrier being one of them.<sup>xiv</sup>

In this article, we use several archive materials to reconstruct the series of events that led to the conception and design of both the Fox Point and Narragansett Bay Hurricane Barriers, the decision to move forward with the Fox Point project, and the eventual decision to halt and shelve the Narragansett Bay project.

#### *A period of active hurricane activity in New England creates demand for flood protection*

Records of coastal storms hitting Rhode Island date back to 1635. Over this nearly 400-year timeframe, various levels of hurricane activity have come and gone. The most recent busy period occurred between the late 1930s through the early 1960s<sup>xv</sup> (Figure 4). While previous storms came and went without any substantial government intervention to prevent loss of life and economic damage, this most recent period saw the first serious and sustained involvement of the federal government in managing coastal floods. As damages mounted, national interest in managing hurricanes and coastal floods grew.<sup>xvi</sup>

In September 1938, the "Great New England Hurricane" became the first major storm in over 120 years to ravage Rhode Island, the previous storm being the "Great September Gale"<sup>xvii</sup> of 1815. The '38 storm caused \$57.8 billion in damage to New England (2017 normalized USD\$)<sup>xviii</sup> and was particularly devastating to Rhode Island. Much of downtown Providence flooded in the '38 storm, and damages there accounted for roughly one-third of the state's total.<sup>xix</sup> Over 250 Rhode Islanders drowned.<sup>xx</sup> Just six years later, another hurricane ravaged the region, the "Great Atlantic Hurricane" of 1944. The '44 storm was not as destructive, causing just \$19.6 billion in damage (2017 normalized USD\$) across several east coast states, including Rhode Island.<sup>xxi</sup> While Rhode Island began to consider flood protection after the '44 storm<sup>xxii</sup>, serious and sustained government action did not occur until the next major hurricane, a decade later.

On August 31<sup>st</sup>, 1954, Hurricane Carol brought devastating floods again to Rhode Island (Figure 5).<sup>xxiii</sup> More destructive than the 44' storm but not as damaging or deadly as the 38' storm, Hurricane Carol caused roughly \$23.5 billion in damage across New England (2017 normalized USD\$) and killed 19 in Rhode Island alone.<sup>xxiv</sup> The destruction in Rhode Island amounted to roughly 7.4% of the state's GDP at the time.<sup>xxv</sup> Much of the damage came as a result of severe flooding throughout Narragansett<sup>xxvi</sup> and Mt. Hope Bays.<sup>xxvii</sup> Just over a week and a half after Carol, Hurricane Edna struck neighboring Massachusetts. At the time, the 1954 hurricane season ended up being the most damaging in U.S. history.<sup>xxviii</sup>

*Elected officials in Rhode Island loudly demand for federal coastal flood protection*

The demand for the construction of permanent flood protection emerged locally in the days following Hurricane Carol and quickly made its way up through the ranks of elected officials: from local and state officials to Congress and eventually the U.S. President. The Providence City Planning Commission was the first governing body to act. Just one week after the hurricane, the Planning Commission asked Mayor Walter H. Reynolds to request help from Rhode Island Governor Dennis J. Roberts, who then wrote to President Eisenhower.<sup>xxix</sup> In his letter to President Eisenhower, Gov. Roberts inquired if the president had the authority to direct the Corps to conduct a, "...prompt, preliminary survey of the construction and other means needed to protect Rhode Island Shore areas."<sup>xxx</sup> In the same letter, Gov. Roberts also mentioned that he would ask the Rhode Island congressional delegation to introduce a resolution in Congress to authorize a thorough study of flood protection. Gov. Roberts emphasized the specific goal of protecting downtown Providence.<sup>xxxi</sup> The Rhode Island congressional delegation ultimately heeded both the Governor's and the public's demands for flood protection.<sup>xxxii</sup> Congressman John E. Fogarty wrote in his replies to letters from the public calling for action, "... (flood control) is uppermost in the minds of the Rhode Island congressional delegation..."<sup>xxxiii</sup> and, "...I will certainly do everything I possibly can to see to it that the United States Government gives the City of Providence and the State of Rhode Island every possible assistance."<sup>xxxiv</sup> In the weeks and months after Carol, Gov. Roberts also instructed the Rhode Island Development Council to produce a report on how to best manage recurring hurricane damages.<sup>xxxv xxxvi</sup> Specifically, on the Governor's mind were permanent flood defenses. He said, "[t]he enormity of the loss suffered by our people justifies a substantial investment in (permanent) protection."<sup>xxxvii</sup>

*Local businesses lead the public in the call for flood solutions*

Elected officials were not the only ones demanding that something be done about recurring flooding in both Providence and elsewhere in the state. Several waterfront property owners<sup>xxxviii</sup>, business associations such as Chambers of Commerce<sup>xxxix</sup>, and individual businesses in and outside of Providence<sup>xl</sup> wrote to the Rhode Island congressional delegation expressing a strong desire for government action on the flood issues, including those that specifically called for building permanent flood protection infrastructure.<sup>xli</sup> After Hurricane Carol and the previous '38 and '44 storms, downtown Providence had developed a reputation for being vulnerable to costly coastal floods. Local businessmen, industrialists, and property owners wanted to avoid repeat events in the future. Some businesses went as far as proclaiming that unless action was taken, the financial risk from flooding would be too great for them to continue to do business in downtown Providence.<sup>xlii</sup> In the first few months after Carol, the Providence Chamber of Commerce passed a resolution calling for an official plan for flood control, "at the earliest possible time", and the need for flood control to be, "kept upper-most in our minds until a control project becomes a reality."<sup>xliii</sup> In response, the Chamber of Commerce sponsored a series of public meetings to publicize flood control projects and keep citizens informed and engaged in discussions.<sup>xliv</sup> A hurricane protection committee was also

formed by Mayor Reynolds, comprising of nine business and industrial leaders to study potential hurricane protection options.<sup>xlv</sup>

After Hurricane Carol, local businesses in downtown Providence were very motivated to push for permanent, government-provided flood protection. First, affordable public flood insurance was not yet available. While a congressional effort was made in the late 1950s for a federally backed flood insurance program<sup>xlvi</sup>, it would not emerge until 1968.<sup>xlvii</sup> Private insurance was often not available, but in cases where it was, premiums were reported to be “exceedingly high.”<sup>xlviii</sup> Second, federal disaster aid in the 1950s was much more meager than it is today. In the wake of Carol, President Eisenhower appropriated just \$1.5 million in federal disaster aid to Rhode Island<sup>xlix</sup>, while total damages were in excess of \$200 million (both figures unadjusted).<sup>l</sup> Relief amounted to just 6% of total damages, much less than the government assistance that accompanied recent hurricane disasters.<sup>li</sup> Third, building-by-building interim flood protection measures employed by businesses proved to be expensive. In Providence, the use of temporary sandbag barricades, the installation of pumps and generators, the relocation of some businesses to higher ground, and the flood-proofing of basements and first floors all totaled more than \$1 million (unadjusted). Some of these costs were incurred during every hurricane season after Carol.<sup>lii</sup> A permanent tidal dam was seen as a way to provide long-term economic relief to these businesses.<sup>liii</sup> Gov. Roberts echoed the sentiments of many Providence business owners, “[p]eople cannot be expected to make large capital investments in an area where their investments are threatened by recurring disaster. The only thing we can do to make Rhode Island safe for the investment we need — is to begin actual construction to prevent flooding of our river valleys and shores.”<sup>liv</sup>

#### *The need for swift action on hurricane protection*

Not only was there a wide-spread desire for action, but there was also demand for any project to move forward quickly. The imminency of another devastating storm flooding Providence and other parts of Rhode Island was often expressed in *The Providence Journal-Bulletin* throughout the planning phase for both the Fox Point and Narragansett Bay Barriers.<sup>lv</sup> During the planning of the Fox Point and Narragansett Bay Hurricane Barriers, close calls with other hurricanes continually put Rhode Islanders and elected officials on edge, specifically Hurricanes Connie, Diane, and Ione (1955), Cindy (1959), Donna (1960), Esther (1961), and Ginny (1963).<sup>lvi</sup> Speaking to the Senate Public Works Committee in April of 1955, Gov. Roberts said, “We must have a complete study and adequately documented, authoritative engineering recommendations at the earliest possible date...we cannot tell how soon the next major hurricane will strike...the record shows that on average, severe tropical storms have struck the North Atlantic coast every three to four years...with full scale hurricanes every eleven years.”<sup>lvii</sup>

While plans for hurricane barriers were discussed after Carol, it was also anticipated that involvement of both the Army Corps and Congress would lead to a long and slow “obstacle course” for any project.<sup>lviii</sup> It was locally known that it took 19 years and multiple disasters to begin flood control for the Blackstone River in the Woonsocket Valley.<sup>lix</sup> The desire for quick action was so much so that many private engineering firms and state and town officials came forward with proposals in the event the federal government was not able to get involved in construction in a timely manner.<sup>lx</sup> The president of a Providence engineering firm proclaimed,

“[t]he Army people are great hydraulic engineers...but they are very busy. I think it would take them from five to eight years to complete the project once it had been authorized while private engineers, I believe, could have it completed in four years.”<sup>lxi</sup>

There was little public objection voiced against the presented plans devised by private engineers, particularly for Providence. However, some criticism was aimed at an early proposal crafted by two engineers (Dahl and Anderson) for a series of barriers at the head of Narragansett Bay. The arguments against were: 1) that such a monumental effort might detract from building flood protection in Providence as soon as possible<sup>lxii</sup>, 2) that residents might be unwilling to cover a bond issue of tens of millions of dollars (unadjusted) to finance the project, and 3) that increases in the currents at the entrance to the bay may lead to opposition from the Navy and recreational boaters.<sup>lxiii</sup> Some experts suggested further study would be needed for such a project.<sup>lxiv</sup> In hindsight, these initial concerns regarding the Narragansett Bay proposal were a harbinger that the project was doomed to fail.

The idea of Providence and Rhode Island proceeding with flood protection without the Corps’ help had precedent. Providence had previously considered a privately funded proposal for the construction of a barrier in downtown Providence as recently as the year before Carol. However, it was reported that state officials were “skeptical” and ultimately decided against pursuing the idea.<sup>lxv</sup> With that experience in mind, Rhode Islanders seemed committed to taking action instead of letting the issue “die” as had occurred after the storms in 1938 and 1944.<sup>lxvi</sup> *The Providence Journal* wrote, “...the biggest immediate danger facing the barrier project is public apathy fostered by the passage of time and the absence of storm threats. It took 20 years to get action on river flood projects that might have made Hurricane Diane a harmless rainstorm. The bay project deserves a better fate than death by disinterest.”<sup>lxvii</sup> The Corps also knew that time was not on their side for getting something built. Lt. Col. Miles L. Wachendorf, the Assistant New England Division Engineer, said, “...experience shows that the public in the past has had a tendency to lose interest in flood control as the last major disaster fades in their memory.”<sup>lxviii</sup>

#### *The Army Corps enters coastal flood protection*

The aftermath of Hurricane Carol eventually led to Congress adding coastal flood protection to the Corps’ list of authorized duties. The Corps was a natural choice for involvement in coastal flood protection for multiple reasons.<sup>lxix</sup> First, the Corps had decades of experience with inland flood protection.<sup>lxx</sup> In the months following Hurricane Carol, *The Providence Journal* highlighted Army Corps projects in Hartford (Connecticut) and Cincinnati (Ohio) as examples of urban flood protection success stories.<sup>lxxi</sup> Additionally, the Rhode Island General Assembly noted that the Corps has the “...staff, the know-how, and the experience to make the necessary studies and to formulate and carry out an effective protective program”. The Rhode Island Development Council also recommended that “...every effort be made to secure promptly the definitive study of the entire hurricane flooding problem in the State, which can best be done by the USACE.”<sup>lxxii</sup> Second, at the time, roughly 90% of the cost of inland flood protection built by the Corps was paid for by the federal government, an attractive approach when considering that the proposed flood protection solutions in Rhode Island were projected to run into the tens to hundreds of millions of dollars (unadjusted).<sup>lxxiii</sup> Third, the fact

that any surge barrier project would alter navigable waters required the Corp to issue a permit<sup>lxxiv</sup>, thus making it a federal issue. Fourth, Narragansett Bay was home to naval installations at Newport, Quonset Point, and Davisville.<sup>lxxv</sup> For these reasons, the Rhode Island congressional delegation was unanimous in its conclusion that there was a federal interest and responsibility in coastal flood protection which affected the navigable waters of Narragansett Bay and its tributaries.

In the 1950s, the Corps had little prior experience with coastal flood protection<sup>lxxvilxxvii</sup>, and more generally, very little was scientifically known about the characteristics of hurricane-induced flooding and storm surge, especially in Narragansett Bay, where limited records of tidal data existed.<sup>lxxviii</sup> Furthermore, Rhode Island's hurricane protection problem was described by the New England Division's chief engineer, Brig. Gen. Robert J. Fleming, Jr., as "unique", declaring that there is "...no problem I know of anywhere in the world like that of Narragansett Bay, where you have an inverted funnel pointed like a dagger at a built-up industrial area."<sup>lxxix</sup> Joseph R. Brennan, chief of planning of the Corps' civil works section, noted that the agency had never built tidal protection -- only river protection -- and mentioned that the authority of the Corps to engage in tidal flood control had not yet been clearly established. Brennan noted that new legislation was needed to specifically allow surveys of tidal flood measures and construction of tidal flood structures. Two precedents for coastal flood control were cited -- the Galveston sea wall (Texas) and levees around Lake Okeechobee (Florida). However, those projects proceeded under beach erosion and navigation laws, respectively, not flood control.<sup>lxxx</sup>

In the spring of 1955, multiple bills were introduced in Congress an effort to initiate and fund a large, interim hurricane survey, which included authorization for the Army Corps to investigate coastal flood protection. The authors of this study did not find evidence that suggests that there was strong opposition to carrying out a survey on flood protection, at least not locally. Some members of Congress objected to not having their state included in the hurricane survey bill. South Carolina Senator Strom Thurmond wanted his state to also receive Corps' attention after being heavily ravaged by Hurricane Hazel.<sup>lxxxi</sup> A bill was ultimately passed and signed into law by President Eisenhower on June 16, 1955 (Public Law 71, 84th Congress; or P.L. 71-84).

Public Law 71-84 addressed the issues of scientific understanding and the Corps' authority to undertake coastal studies. More specifically, Public Law 71-84 called for an interim hurricane survey to compile data on the behavior and frequency of hurricanes, improve hurricane warning services along Atlantic and Gulf coasts, and to give the Corps the authority to examine both the technical feasibility and economic justification for hurricane protection measures in Rhode Island and Massachusetts, including storm surge barriers, levees, and seawalls. The hurricane survey began the following month.<sup>lxxxii</sup> Notably, the bill did not yet place the responsibility of paying for hurricane protection on the federal government; this was left for later debate. Today, P.L. 71-84 is still invoked to authorize examination and surveys of coastal and tidal areas in the U.S. In response to this new authority, the New England Division Engineer proclaimed, "...the protection of coastal areas from hurricane induced tidal inundation constitutes a revolutionary development in flood control in the U.S."<sup>lxxxiii</sup>

After about a year and three months of study, the Corps presented an initial draft of plans for two projects, a storm surge barrier at Fox Point and a series of rock barriers in lower Narragansett Bay.<sup>lxxxiv</sup> Storm surge barriers were not the only proposed solution in the months

following Carol. Also discussed was re-zoning and retreating from the coastline<sup>lxxxv</sup>, temporary flood protection measures (e.g., sandbags), and flood proofing lower levels of buildings, the latter two done building-by-building. Congress also attempted and failed to establish a public flood insurance program.<sup>lxxxvi</sup>

#### *Public input on the Corps' storm surge barriers*

Vocal public opposition to the Fox Point and Narragansett Bay barrier projects did not become widely apparent until the Army Corps formally revealed them to the public. Holding public hearings is standard Corps practice before projects are eligible to continue towards receiving congressional authorization. In all Army Corps projects – both historically and presently – the public is given a chance to provide comment in such forums.<sup>lxxxvii</sup> Public interest shown at these hearings is an important factor in congressional consideration of project approval and financing, and meeting transcripts commonly accompanied the engineering reports to Congress.<sup>lxxxviii</sup> In addition to these standard hearings, engineers from the New England Division of the Corps attend numerous gatherings of service clubs and other civic and private organizations to speak on the survey and the various plans of protection that were being studied.<sup>lxxxix</sup> Congressman Fogarty also arraigned a cruise of the bay barrier sites with Corps engineers, members of the House Public Works Subcommittee, the Navy, the Rhode Island Development Council, and various local marine interests.<sup>xc</sup> Roughly a week before the public hearings were held, the Rhode Island Hurricane Survey Advisory Committee voted in favor of the Corps' plans, but concluded that more study should be undertaken in order to ascertain the effects of lower bay barrier construction.<sup>xc</sup>

Public hearings were held in Providence, Newport, and Fall River (Massachusetts) in October 1956. In total, nearly 380 people attended the meetings.<sup>xcii</sup> Henry Isé, Chief of Rhode Island's Division of Harbors and Rivers, noted that, "[i]t is very important for the success of this project that we get as good a turnout as possible. A poor turnout, I know, would have a very bad effect in Washington."<sup>xciii</sup> In addition to business owners and other members of civil society, those in attendance included the New England Division's Chief Engineer, Gov. Roberts, members of the Rhode Island congressional delegation, Mayor Reynolds, and engineers who headed the survey of Narragansett Bay.<sup>xciv</sup> In Providence alone, more than 200 people turned out for the two-and-a-half-hour hearing that included 17 presentations. Senator Pastore said the turnout was, "one the finest expressions of good citizenship I have seen in many a day."<sup>xcv</sup>

#### *Public reception to Fox Point and Bay Barriers*

Public feedback for both projects was mixed. An overwhelming (but not unanimous) majority urged immediate construction of the Fox Point Barrier, while the reception for the Bay barriers was lukewarm. The only recorded dissenter for the Fox Point project was the Allens Avenue Businessmen's Association, a group of 122 Providence businesses. They opposed the Fox Point Dam because their properties were not in the proposed protection zone. The Association instead advocated for an alternative design that included their properties, many of which were heavily impacted by flooding from hurricane Carol.<sup>xcvi</sup>

Several concerns were raised regarding the Bay barriers. Among them were related to the effects of the barriers on maritime navigation, water quality, salinity, fish and wildlife, and recreational activities in the bay.<sup>xcvii</sup> The presented studies at the hearings had been heavily focused on engineering design; little attention was given to assessing environmental impacts. As such, there was almost no scientific support available for arguments that the public could make to use against the barriers, particularly in light of their potential effects on marine life. This caused displeasure among many attendees. Several wanted assurance that the barriers would not ruin commercial and sport fishing in Narragansett Bay (both shell and finfish). As such, further study was recommended, particularly for impacts on marine life, which had been noticeably underfunded and understudied. In an op-ed in *The Providence Journal*, Donald J. Zinn of the Rhode Island Wildlife Federation noted that, "... the Corps thus far has a generally sad record with their more or less public-wishes-be-damned policy when it has come to a question of dam construction versus natural resources." Zinn pointed out the imbalance of preliminary study funds for a biological investigation from the U.S. Fish and Wildlife Service (\$6,000) and Corps' budget (\$500,000; both unadjusted).<sup>xcviii</sup> *The Evening Bulletin* also raised concerns about marine life, "...until questions about the effect of the dam on marine life are answered satisfactorily hundreds of residents of this state are bound to oppose construction of a dam that might put them out of business or ruin a major source of salt-water recreation. The way things are going right now, it will be impossible to find out what the effect will be until plans are so far along the way that construction will be the next step. Let's get the answers now and re-draw preliminary plans, if necessary, to save that marine life."<sup>xcix</sup> Leaders in the seafood industry also called for more studies of the barrier's effect on natural resources.<sup>c</sup>

While the environmental impact of the Narragansett Bay barriers was subject to heavy scrutiny, these concerns were noticeably absent from discussions around the Fox Point project. One possible reason is that, unlike Narragansett Bay, the Providence River was already heavily polluted. A report on pollution of the waters in Rhode Island from 1946 indicated that the water around Providence had attained "grossly polluted" levels, the highest category on the report's pollution assessment scale. In the same report, most of the water in Narragansett Bay was assigned to the cleanest water category.<sup>ci</sup> Reports in 1955 also indicated pollution issues. In early 1955, it was mentioned that the Providence River was too polluted to be used for the cooling condensers on the Narragansett Electric Company's South Street Station, a coal-fired power plant adjacent to the proposed site of the Fox Point Barrier.<sup>cii</sup> By 1956, dramatic improvements in sewage treatment had reduced the amount of effluence being fed into the Woonasquatucket and Moshassuck that emptied into the Providence River. But even after these efforts, there still remained in the river what was called, "the problem of foul morass of mud and trash."<sup>ciii</sup>

Maritime navigation concerns associated with the Bay barrier's East Passage were also raised by the Navy.<sup>civ</sup> It was believed that an opening in one of the barriers in the initial design would not be wide and deep enough to accommodate some of the Navy's largest ships. The night of the Corps' Newport hearing, the Newport City Council voted (5-2) to turn down the Bay barrier project, citing infrequent use of flood protection (i.e., floods are rare) and daily use of the East Passage by the Navy. The Newport City Council instead favored the construction of roughly two miles of dikes and seawalls along the Newport Harbor line.<sup>cv</sup> Other calls for barrier alternatives were made elsewhere in the state<sup>cvi</sup>, and some individuals even preferred no

government action. A former sewer commissioner from Warren, RI wrote in an op-ed, “I’d much rather take my chances on hurricanes without barriers. Anyone living close to the bay who stands to suffer damage from hurricanes should take steps to prevent such damage and leave the barriers for the birds.”<sup>cvii</sup> It was concluded that the USACE’s plans for the Narragansett Bay barriers required more study, particularly the impact of the barriers on marine life.<sup>cviii</sup> Almost a full eight years would pass before a more complete study was ready to be presented to the public. In the meantime, the Fox Point barrier would advance towards breaking ground.

#### *Public support for bond referendums to pay for local share of Fox Point Barrier*

After a long, up-hill battle in Congress<sup>cix</sup> (Figure 6), the Fox Point hurricane barrier was authorized in 1958<sup>cx</sup>, roughly two years after the public hearings. After the hearings, several Army Corps and congressional hurdles needed to be cleared prior to project authorization, including arriving at a 70-30 federal-local cost sharing agreement.<sup>cxii</sup> Following authorization, another three years of detailed engineering by the Corps would occur before construction of the Fox Point barrier would begin. Additionally, two state and local referendums were needed to issue government bonds that would pay for the 30 percent non-federal share of the project. In November 1959, Providence voters showed just how seriously they wanted flood protection. A special election was held, and Providence overwhelmingly voted to approve three bond issues to pay for \$4.6 million (unadjusted) of the non-federal share (voter support margin was 6 to 1). The turnout was admittedly meager (slightly less than 9 percent of Providence’s eligible voters). Mayor Reynolds expressed disappointment at the lack of voter interest. He said it represented “terrible apathy” towards such important matters.<sup>cxiii</sup> A year later, all of Rhode Island was eligible to vote to approve a state bond needed to pay the remaining local share of the hurricane barrier.<sup>cxiv</sup> However, this time there was some public opposition to supporting the state referendum by communities outside of Providence who would not directly benefit from the Fox Point Hurricane Barrier. Central Falls City Council asked legislators and citizens of Blackstone Valley to band together against the Fox Point Hurricane Barrier. The opposition was intended to be retaliation against the state for failing to give relief to higher sewer rates in the Valley, which had come from the construction and maintenance of a new Valley sewer system.<sup>cxv</sup> In a firm rebuke, *The Providence Journal* editorial board argued the Fox Point situation was different. *The Journal* asserted that protecting Providence meant protecting the economic heart of the state, therefore the Fox Point Barrier was simply not a local issue but rather one the entire state must support.<sup>cxvi</sup> In the lead up to the statewide referendum, an “all-out” campaign was waged to generate state-wide approval for the Fox Point Barrier. The state received a timely reminder of how badly flood protection was needed just before the election when a half-million dollars in damages from Hurricane Donna occurred in downtown Providence.<sup>cxvii</sup> Ultimately, the \$1.75 million bond issue was approved by state voters<sup>cxviii</sup>, and the Fox Point Hurricane Barrier broke ground in July 1961.<sup>cxix</sup> It was completed five years later in March of 1966 (Figure 2).

*After further study, Bay barriers again ready for public scrutiny*



After nearly eight years of further study, the Corps released revised plans for the Bay barriers in late 1963.<sup>cxx</sup> The Fox Point and Bay barrier Army Corps hearings in 1956 had concluded that the Bay barrier project required more study to 1) determine the effects of the Lower Bay Barriers on natural resources, 2) to secure further data on velocities through the navigation openings, and 3) to further study the design of the barrier foundations.<sup>cxxi</sup> The Army Corps' updated plans were designed to meet the objections that had been previously voiced.<sup>cxxii</sup> Brig. Gen. Peter C. Hyzer, the new Chief of Engineers of the New England division of the Corps, wrote, "During the eight years we have studied this proposal, primary consideration has been given to determining the possible effects of the barriers and to refining the design so as to eliminate or minimize those found to be undesirable."<sup>cxxiii</sup> Ultimately, more than 15 barrier plans were considered at 25 different locations throughout Narragansett Bay using a 1:1000 horizontal and 1:100 vertical scale model (Figure 7).<sup>cxxiv</sup> The final three barrier locations were selected as a result of 1) extensive testing of changes in the tidal flow, 2) recommendations by the Navy, and 3) economic assessment of alternative structures.<sup>cxxv</sup> The most significant changes focused on minimizing the restriction of the normal tidal flow in and out of the bay in order to limit impacts on marine life and boating. The final designs used navigational openings whose width had been doubled and also incorporated dozens of sluice gates that would close when high water was forecast. Overall, the openings in the barriers had been increased by 270 percent over the old plan.<sup>cxxvi</sup> The Corps insisted that the new design would not have an impact on marine life since they claimed the same volume of water would flow in and out during each tidal cycle.<sup>cxxvii</sup> However, the larger navigational openings meant that protection afforded by the barriers would be reduced. As a result, local officials would be required to notify residents at least once a year that the barriers did not provide complete protection from hurricane tidal surges.<sup>cxxviii</sup> The estimated cost of the revised barrier plans was \$90 million (unadjusted).

Assessments performed by other federal agencies that accompanied the Corps' report were either inconclusive (i.e., suggested more study required) or found adverse impacts were likely. The U.S. Public Health Service determined that the barriers would not have a noticeable effect on the water quality in the upper region of Narragansett Bay but said that more study was needed to reach a confident conclusion on possible increases in pollution in the lower portion of the Bay.<sup>cxxix</sup> Studies on marine life were less supportive of barrier construction. The U.S. Fish and Wildlife Service claimed that the Corps' revised plan had the potential to, "...significantly alter the aquatic environment and adversely affect the finfish and shellfish resources of the area." The U.S Fish and Wildlife service also concluded that the proposed barriers could have an adverse effect on recreational boating in the lower Bay due to increased tidal currents.<sup>cxxx</sup>

Despite the mixed reviews from other federal agencies, the Corps continued to claim that the new design would not adversely impact the bay. In a letter to Congressman Fogarty, New England Division Engineer Brigadier General Seymour A. Potter, Jr. wrote, "The problems of effects on pollution and water quality, fisheries and wildlife...have been satisfactorily resolved...the lower bay barriers would cause no important effect on water quality, oxygen and pollution in the bay...[and] the U.S. Fish and Wildlife Service, concluded that the overall impact of the Lower Bay barriers on fishery resources would be small."<sup>cxxxi</sup> John B. McAleer, the head of the Corps' hurricane unit, stressed that there would not be a change in the volume of water

entering and leaving the bay each tidal cycle. As such, McAleer argued that no change in flushing time, salinity, or temperature would result. He cited experiments with the Corps' scale model of the Bay.<sup>xxxxii</sup> Brig. Gen. Hyzer also claimed that the effects of the barriers would be dwarfed by that of the normal seasonal changes within the bays.<sup>xxxxiii</sup> Despite the Corps' attempt to cast doubt on the findings of the other agencies, opposition to the revised plans not only remained, but it also grew louder.

#### *Revised Narragansett Bay barrier plans met with overwhelming public opposition*

Public hearings were once again held to inform local interests of the Corps' updated plans for the Bay barriers.<sup>xxxxiv</sup> The hearings took place in April 1964 in Newport, Providence, and Swansea (Massachusetts). A total of 611 people attended (232 in Newport, 237 in Providence, and 142 in Swansea)<sup>xxxxv</sup>, a markedly higher turnout than the previous hearings in 1956, which had also included consideration for the Fox Point Hurricane Barrier. While the Fox Point project was received with near unanimous support at the hearings in 1956, this time the Bay barrier project was met with near unanimous opposition. In addition to the hearings, opposition also was expressed through letters to the Governor, the Rhode Island congressional delegation, and the Corps. Senator Pastore reported he had received letters to his office at a rate of at least 10 to 1 against the barriers. Congressman Fernand J. St. Germain said he answered at least 200 letters from Rhode Island residents opposed to the project and had received none in favor.<sup>xxxxvi</sup> Brig. Gen. Hyzer also reported that more than 300 letters from Rhode Islanders had been received at the Corps' New England office in Waltham, Massachusetts.<sup>xxxxvii</sup> In addition to letters, a number of editorials and op-eds were printed in *The Providence Journal-Bulletin*, most of them sounding off against the barriers. Generally, grievances were similar to those expressed at the earlier Corps hearings, namely objections over the impact on recreational boating, tides, pollution, marine life, and the high cost of the non-federal share of the project.<sup>xxxxviii</sup>

Even before barriers were formally introduced and discussed at the public hearings in April 1964, several boaters (both professional and amateur) spoke out against the project<sup>xxxxix</sup>, including those who had called for flood protection in the wake of Hurricane Carol in 1955.<sup>cxl</sup> Many boaters did not believe the Corps' claim that the currents in the openings in the new barrier design would not exceed three knots for a mean tide and four knots during a high tide (the latter being roughly double the existing velocity).<sup>cxli</sup> Preston R. Gladding, a Barrington, Rhode Island resident and a naval architect and partner in the Gladding-Hearn Shipbuilding Corporation believed that the Corps' calculations were, "...ridiculously less than foreseen by local pilots...", and contended that high velocities and turbulence of flowing water would make passing through any of the three navigational openings extremely dangerous and at times virtually impossible, except for large ships. Rhode Island Governor John H. Chafee, himself a sailor, also bluntly opposed the barrier plan, "I am against it. I vote no."<sup>cxlii</sup> The Corps admitted that the top tide velocities would pose problems for sailboats but pointed out that the conditions would not be dissimilar from those of the approach to Galilee in Point Judith Pond, a popular Rhode Island sailing spot.<sup>cxliii</sup> Halsey Herreshoff, crewman of the 1958 champion America's Cup sailing team and of the famous Bristol yacht-building family, believed the barriers would constrict the tidal flow into the Bay and create currents that would be, "too

strong for most sailboats to navigate.”<sup>cxliv</sup> The America’s Cup had taken place in Newport since 1930 and was again slated to host the event in 1964. At the time, Narragansett Bay was described as the “yachting center of the world.”<sup>cxlv</sup> Herreshoff stated that he personally would recommend that future America’s Cup races be held elsewhere if the barriers were built.<sup>cxlvi</sup> A counter point to the yachtsmen’s claims was made by the Corps. The Corps claimed that yacht races were often held in Long Island Sound, where water velocities were sometimes 50% greater than those projected to occur in the area of the barrier’s navigational openings.<sup>cxlvii</sup>

In addition to impacts on recreational boating, many cited concerns related to the barrier’s potential to cause ecological damage to the Bay. Conservationists and marine biologists echoed the U.S. Fish and Wildlife’s conclusions.<sup>cxlviii</sup> Dr. Theodore J. Smayda, a marine biologist at the University of Rhode Island Narragansett Marine Laboratory (a yachtsman<sup>cxlix</sup> and also an assistant to the U.S. Fish and Wildlife service in their report to the Corps), argued that the barriers should not be built until more is known about potential impacts on marine life. Dr. Smayda believed that the barriers could warm the waters in the bay in the summertime, lead to decreases in salinity that could cause the bay to freeze over in the winter, increase the number of red tides in the bay, and also cause additional shellfish pollution.<sup>cl</sup> In an editorial in *The Providence Journal*, Smayda claimed that, “[e]ven the most minute changes (e.g., a degree or two of temperature change) could have profoundly adverse effects in an ecology in which all factors operate in the most delicate balance.” On a morning radio broadcast, Dr. Nelson Marshall, professor of oceanography at the University of Rhode Island, questioned the Corps’ conclusions regarding possible changes in sedimentation on the bottom of the bay, and described the revised plans as, “at best, a gamble.”<sup>cli</sup> Dr. Marshall also opposed the barriers on esthetic grounds.<sup>clii</sup>

However, other experts believed that there was little to worry about regarding impacts on marine life. Julian H. Gibbs, a chemistry professor at Brown University, spoke in favor of the barriers at one of the Corps’ hearings, arguing that tidal exchange in the bay would not be reduced. Additionally, Ralph A. Schmidt, a regional supervisor of river basin studies for the U.S. Fish and Wildlife Service, also supported the conclusion that marine life would not be harmed.<sup>cliii</sup> But these counter arguments were very much in the minority. Alfred L. Hawkes, Executive Director of the Audubon Society of Rhode Island, noted that there was, “almost no agreement among engineers and biologists we rely upon as to the real effects of these barriers.”<sup>cliv</sup> Overall, it was clear that most believed Rhode Island could not afford to run the risk of irreversible ecological damage to Narragansett Bay. Too much was simply at stake. Just months before the Army Corps’ hearings, a University of Rhode Island-Kingston study estimated that Narragansett Bay was valued at being worth \$145 million (unadjusted) annually to the state of Rhode Island.<sup>clv</sup>

The risk of ecological harm also threatened the Narragansett Bay shellfish and finfish industry. Businesses spoke out to oppose the barriers both loudly and often, including those who had originally desired flood protection.<sup>clvi</sup> In a letter to Congressman Fogarty, Frederick H. Richardson, Vice President of Blount Seafood Corporation noted that his corporation had suffered “very severe damage” from Carol, but still opposed construction of the barriers because he felt that “[the] cure would be worse than the disease.” Richardson said, “We have thus far been able to recover from hurricane damage, but we would be put out of business completely if our bay is ruined for shellfishing.”<sup>clvii</sup> At the hearings in 1956, the Blount Seafood

Corporation did not outright oppose the project, but did express desire for further study of barrier impacts.<sup>clviii</sup> The Rhode Island Shellfish Industry opposed the construction of the barriers until, “it is proven conclusively by Biologists, Bacteriologists and the U.S. Fish & Wildlife Service, that erection of said Barriers will not be detrimental to the natural resources of Narragansett Bay.”<sup>clix</sup> Francis B. Manchester of Manchester Seafoods, Inc. wrote, “...I would rather take the risk of storm damage than risk the possible pollution of our Bay Areas, the loss of fishes in our Bays and Rivers, and the damage to our shellfish due to increased silting, pollution, and reduced salinity. We deal directly with approximately one hundred fishermen during the year, and I do not know of one who is in favor of these proposed barriers.”<sup>clx</sup>

Opposition also emerged from residents with waterfront properties who stated that they were aware of the risks of living on the water and simply did not want the government’s help. In several op-eds and letters to Rhode Island’s congressional delegation, residents noted that they had experienced disastrous flooding from both the ‘38 Storm and Hurricane Carol but decided they would rather take their chances with having a repeat disaster than degrade their experience of living on Narragansett Bay. In an op-ed in *The Providence Journal*, Irving C. Sheldon took a stand against the barriers and claimed that, “[t]hose who would be protected by the barriers are those who invested in locations with full knowledge that they were taking a chance on water damage from hurricanes.”<sup>clxi</sup> In another case, a Rhode Island resident wrote to Congressman Fogarty, “...I’ve recently bought a house on the water, which was partially flooded in the 1954 hurricane, but I am not asking Uncle Sam to bail me out.”<sup>clxii</sup> The Narragansett Bay Home Owners Association said it would be better to “accept the possibility of a devastating storm once or twice every hundred years rather than tamper with Narragansett Bay.”<sup>clxiii</sup> Some residents also attempted to discredit the need for flood protection by claiming that wind was the most damaging peril associated with hurricanes in Rhode Island.<sup>clxiv</sup>

Those who opposed the bay barriers were not necessarily against all flood damage reduction measures. Many gave suggestions for alternative solutions. For example, the Audubon Society of Rhode Island proposed re-zoning, purchasing of endangered areas for public recreational facilities and open space, obtaining easements to limit or control development in the flood plain, and encouraging private property owners to maintain the natural state of their lands.<sup>clxv</sup> Byron Blount of Blount Seafood Corporation mentioned that he was not opposed to certain types of safety measures to reduce flood damage, but barriers that he believed threatened the conditions of the bay were, “out of the question.”<sup>clxvi</sup> In an editorial in *The Evening Bulletin*, it was mentioned that, “...much can be done in those communities to prevent flood damage without a dam, as in zoning to prevent building in flood-prone, low-lying areas.”<sup>clxvii</sup> In lieu of barriers, Barrington, Rhode Island resident Preston R. Gladding proposed improved weather forecasting and warnings, federal flood insurance, temporary barriers erected on a seasonal or ad hoc basis, and shore-based protection measures that provide local protection without changing tidal flow patterns.<sup>clxviii</sup> The Newport Redevelopment Agency also suggested that new building developments incorporate private flood mitigation as opposed to relying on large public projects like the bay barriers.<sup>clxix</sup>

Some opposed to the Bay barriers expressed that they had supported the Corps’ Fox Point project. *The Providence Journal* editorial board was a strong supporter of the Fox Point barrier, but cautioned against the Bay barriers without further certainty of their environmental impacts.<sup>clxx</sup> They asserted that the Fox Point project was a different situation because it

protected downtown Providence, "at no risk of any kind to marine life or boating" due to the water above the barrier not being, "suited for boating or marine life."<sup>clxxi</sup> *The Providence Journal* also described the Fox Point Hurricane Barrier as, "badly wanted", and claimed there was no active desire in any community around Narragansett Bay or Mt. Hope Bay, for a \$90 million dollar (unadjusted) series of barriers.<sup>clxxii</sup> Others made similar comparisons. In an op-ed, Irving C. Sheldon noted that the Fox Point Barrier is entirely different because it protects a business center that affects the livelihood of a majority of Rhode Islanders<sup>clxxiii</sup>, and in a letter to Brig. Gen. Hyzer, a Providence resident wrote that he has, "...always rooted for the Fox Point Dam", but was opposed to the Bay Barriers.<sup>clxxiv</sup> Manchester Seafoods also noted no objection to the Fox Point Barrier.<sup>clxxv</sup> Some also argued that hurricane damage in the future should be much less serious if the Fox Point barrier would prove to be effective given that a large part of damage from the '38 storm and Hurricane Carol was in Providence.<sup>clxxvi</sup> Without given a reason, Governor Chafee also doubted that the Bay barriers would receive the same statewide appeal that the Fox Point project did.<sup>clxxvii</sup>

Despite the overwhelming opposition, there were supporters of the Bay barrier project. The Allens Avenue Businessmen's Association<sup>clxxviii</sup> was the lone reported supporter at the Corps' Providence hearing.<sup>clxxix</sup> They were a group of 122 Providence businesses who had voiced opposition to the Fox Point Barrier proposal at the 1956 meeting<sup>clxxx</sup> because they had been left out of the planned protection area. After widening the navigational opening of the East barrier, the Navy became supportive of the revised plan,<sup>clxxxi</sup> and at the meeting held in Swansea, residents representing the shores of Mt. Hope Bay and the banks of the Taunton River expressed a desire and willingness to support the project.<sup>clxxxii</sup> In an op-ed, a resident of Fall River, Massachusetts argued that opponents of the Bay barriers need to recall the disastrous effects of both Carol and the '38 storm and then "re-examine their position."<sup>clxxxiii</sup>

#### *Despite public opposition, the Corps advances plans for Narragansett Bay barriers*

Even in the face of strong public opposition, the Corps continued to advance the Bay barrier project (Figure 8). Rhode Islanders took note and continued to voice their objections. Charles B. McGowan of the Narragansett Bay Home Owners Association said, "...it is impossible to understand the position taken by the Corps in the face of practically unanimous local opposition."<sup>clxxxiv</sup> Some even began to attack the Corps as an organization. The public vocalized their issues with the Corps' presentations and lackluster rapport with those in the community. Some even interpreted the Corps actions as subversive tactics intentionally performed in order to get their projects built. For example, after clear public disinterest, the Corps floated the possibility that the barriers could be fully paid for by the federal government,<sup>clxxxv</sup> although when questioned on the matter, Brig. Gen. Hyzer admitted that he was "not yet sure" how to recommend the full financing.<sup>clxxxvi</sup> This particular gesture was interpreted by some as a ploy to generate public support. A resident from Barrington expressed his displeasure in a letter to the Army Corps, "I resent the biased presentation of the project...the presentation turns out to be a massive campaign to force the barrier upon us; distorted opinions and exaggerated damage figures compiled by persons whose main concern is to assure themselves of continued employment. Your agency should serve the taxpayers, not force your will upon us (at our expense)."<sup>clxxxvii</sup> The Narragansett Bay Home Owners Association said that the Corps' studies on

the effect of the barriers on natural resources were, “superficial and completely inadequate for the purpose.”<sup>clxxxviii</sup> Dr. Nelson Marshall, an oceanographer, suggested that a scientific body “completely neutral” make a “more thorough cost-benefit analysis.”<sup>clxxxix</sup> In an op-ed in *The Providence Journal*, Robinson C. Locke wrote, “It is frightening that government bureaucrats against the wishes of the people concerned, are still trying to force an unpopular project upon us... After months of hearings on this matter around the bay it would seem that the Army engineers would realize that the great majority of people do not want this noble experiment forced down their throats. To me this is far from a democratic move.”<sup>cxc</sup> Lincoln Cone, a representative of the American Merchant Marine Institute (an association of steamship companies) took issue with the Corps because they had not consulted with his institute on the possible effects of the barriers, despite the obvious potential to impact the commercial shipping industry.<sup>cxc</sup> However, not all were critical of the Corps. Some commended them for presenting “an extremely honest appraisal” of the barriers.<sup>cxcii</sup>

Brig. Gen. Hyzer had written about his frustrations with the public to Congressman Fogarty, arguing that those opposed to the projects were filled with “misconceptions, lack of understanding and fears”. Brig. Gen. Hyzer contended that some of the opposition had come from those who had previously supported the barriers, “I am puzzled that memories are so dimmed that few now appear to want the protection which, in 1956, they considered so necessary in the bay areas.” He believed these fears were a largely a result of “misunderstood engineering and technical considerations.”<sup>cxciii</sup> In an attempt to clear up any confusion, Brig. Gen. Hyzer wrote a summary, published by *The Providence Journal*, in which he, in question and answer format, responded to ten of the most common complaints and fears that had been expressed about possible long-term adverse effects of the barrier system.<sup>cxciv</sup> He also questioned why the opposition was so strong when the purpose of the Lower Bay barriers was the same as that of the Fox Point project – to reduce hurricane damage.<sup>cxcv</sup> The Corps accepted only two valid points made by the public during the hearings, 1) that the barriers were expensive and 2) that the barriers would increase the tidal velocities through the ungated navigation openings in the East and West Passages.<sup>cxcvi</sup> The Corps continued to insist that no other changes would take place in the bay if the barriers were installed.

In the wake of the opposition, Brig. Gen. Hyzer saw three options, 1) drop the project if opposition continued, 2) request funds for further studies, or 3) go ahead and recommend construction under the belief that the expressed public opposition does not reflect a regional consensus.<sup>cxcvii</sup> Brig. Gen Hyzer believed the latter to be true, and he decided to advance the plans in the hope that a clearer understanding of the “purposes and effects” of the project would come to light upon congressional authorization. The Board of Engineers for Rivers and Harbors agreed stating, “[i]n similar cases, these problems are resolved as the purposes and effects of the plan become more clearly understood. Although full support of the plan is not now apparent, authorization of the plan by Congress would be a major step in this direction.”<sup>cxcviii</sup>

While the Corps was able to advance the project for approval from the Board of Engineers for Rivers and Harbors<sup>cxcix</sup>, they were well aware that support from elected officials would be needed prior to receiving congressional authorization. Brig. Gen Hyzer admitted that he had become “quite concerned” about this particular step.<sup>cc</sup> Unlike the Fox Point project, not a single Rhode Island congressional delegate promoted the Narragansett Bay barriers. The

members of the congressional delegation were quite alarmed by the mail they were receiving at their offices. Senator Pastore described the response as, “heavy and overwhelmingly opposed”. Congressman Fernand J. St. Germain said, “...I see no reason for promoting or pushing for the construction of this barrier.” Senator Claiborne Pell had similar thoughts, “...I do not believe a project of this sort should go ahead unless a majority of the community wishes it.” Congressman Fogarty said that because an estimated \$26-27 million dollars (unadjusted) would be required from local sources (30 percent share), he “[would] let the people decide” if the project should go ahead. Senator Pastore agreed, “[w]ithout [the willingness of the public to share the cost], I don’t think it’s got a ghost of a chance.”<sup>ccci</sup>

*After state officials object, the Bay barrier plans are shelved*

The lack of public support ultimately doomed the Narragansett Bay barrier project. Upon receiving approval by the Army’s Chief of Engineers, the next step was for the Corps to obtain comments from state officials in both Rhode Island and Massachusetts. The Rhode Island congressional delegation believed that the decision on the barrier should be made by the state government since the state would be required to put up most of the local share of the cost.<sup>ccii</sup> Ultimately, the State of Rhode Island requested that the construction of the bay barriers be postponed until, “citizens of the state have expressed approval of the project.” In a letter to the Army’s Chief of Engineers, Henry Isé, the Chief of the Rhode Island Board of Engineers and Rivers and Harbors, wrote, “There is considerable fear among a great number of people in Rhode Island that the proposed barriers would adversely affect navigation, the quality of water inside the barriers, fish and wildlife resources of the state, and recreation in the bay. Grave doubts have also been expressed by many citizens regarding the efficiency of the project to provide sufficient protection and damage reduction to justify the large financial outlay necessary for construction and maintenance. In view of the widespread opposition to what is considered by many a ‘questionable project’, it is extremely doubtful that appropriation of funds for the local share of the cost would be approved. Therefore, the State of Rhode Island hereby urgently requests that no construction of the hurricane barriers be undertaken until such time as the citizens of the state have expressed approval of the project. Such approval has not been given to date.”<sup>cciii</sup>

The defeat of the Bay barriers was celebrated by *The Providence Journal-Bulletin* (Figure 9), but the editorial board cautioned that Rhode Islanders should not be, “too rough on the Army Engineers”, for it was many of them who had so desperately called for the Corps’ help in undertaking the studies which led to the barrier proposal that was so widely disliked. *The Journal* wrote, “Rhode Islanders should not completely close their minds to the possibility that the day may come when some kind of a hurricane barrier at the mouth of the bay is feasible and desirable... Another blow like the doubleheader the state received 11 years ago might change a lot of minds.”<sup>cciv</sup> The Army Corps’ Chief of Engineers, Lt. Gen. William F. Cassidy, responded to Isé’s letter and stated that his report to congress will, “recommend that no project be authorized for the lower Narragansett Bay Area at this time.” Lt. Gen. Cassidy stated that future authorization would be dependent on upon future local agreement for participation.<sup>ccv</sup>

*A failed attempt at a revival*

In the late 1960s and early 1970s, the Army Corps came under national scrutiny for an increasingly poor track record of giving little consideration to the natural environment and also to sustaining decision-making protocols that ignored oppositional viewpoints.<sup>ccvi</sup> Ultimately, the amassing of project failures similar to the Narragansett Bay Hurricane Barriers across the U.S. started an organizational shift within the Corps that was further solidified with the passage of the National Environmental Protection Act (NEPA) in 1970.<sup>ccvii</sup> The NEPA allowed for citizens and other groups to secure significant litigation powers (who have otherwise had no direct say in projects) and also facilitated transparency in terms of the potential negative impacts of projects through environmental impact statements. The added complexity to project planning did not completely dissuade the Army Corps from considering the projects once again.

In the mid-1970s, the lower Narragansett Bay hurricane barrier project re-emerged as possibly being included in a new \$6.1 million-dollar (unadjusted) round of Corps water resource studies. The plan was to update the project to meet new environmental protection standards in the event that interest in the project re-emerged,<sup>ccviii</sup> a possibility foreseen by some groups that opposed the project. Both the Narragansett Bay Home Owners Association and the Jamestown Protective Association were worried that the barriers, “might be authorized in a moment of panic after a severe storm or as a boondoggle.”<sup>ccix</sup> The mentioning of the Bay barrier project did not go unnoticed. In an editorial in *The Providence Journal*, the Corps was accused of acting in their own self-interest to use tax-payer dollars in order to make grandiose plans for projects no one wants. The editorial further stated there was no “whisper of desire” from anyone to take a second look at the barriers and described the original Army Corps plan as “...ultimately never generat[ing] any support in the cities and towns the dams were supposed to protect.”<sup>ccx</sup>

While Rhode Islanders have endured just a few hurricanes since the 1960s, none have come close to causing destruction on the level of the Great New England Hurricane of 1938 or Hurricane Carol. If another disastrous storm strikes, the Narragansett Bay Barrier plans might get pulled from the shelf, dusted off, and debated once again. The mid-century experience serves to remind the U.S. Army Corps of Engineers, Rhode Islanders, and their elected officials of the political challenges in bringing about coastal flood protection megaprojects.

### **Acknowledgements**

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2001 **Replication Materials**

2002 Scans of all archive documents used are available on Zenodo

2003 (<https://doi.org/10.5281/zenodo.4429944>)

2004

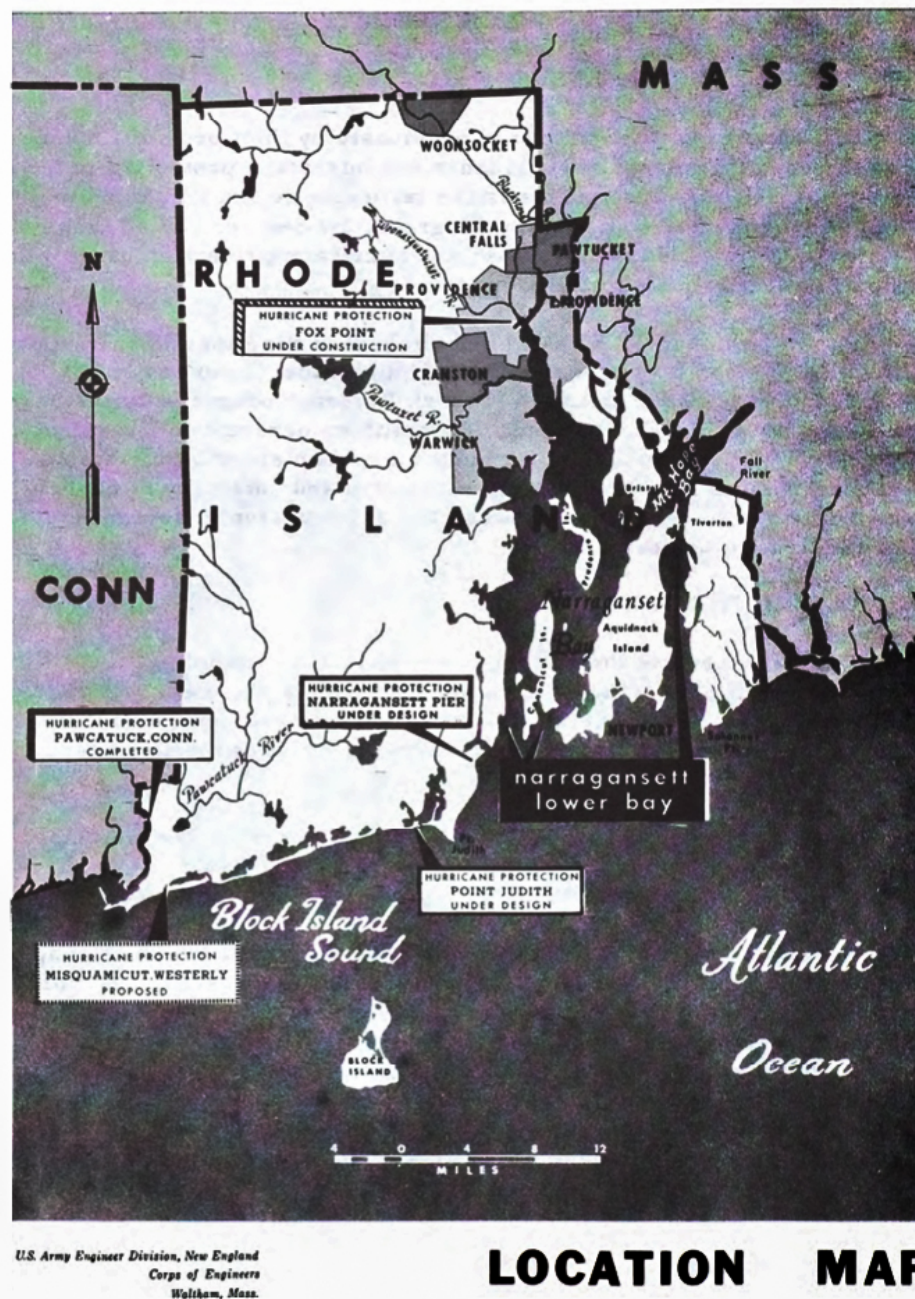
2005



2006

2007 **Figure 1.** The Fox Point Hurricane Barrier following completion in March 1966 (Providence,  
2008 Rhode Island). Source: the U.S. Army Corps of Engineers, New England Division. Waltham, Mass.

2009



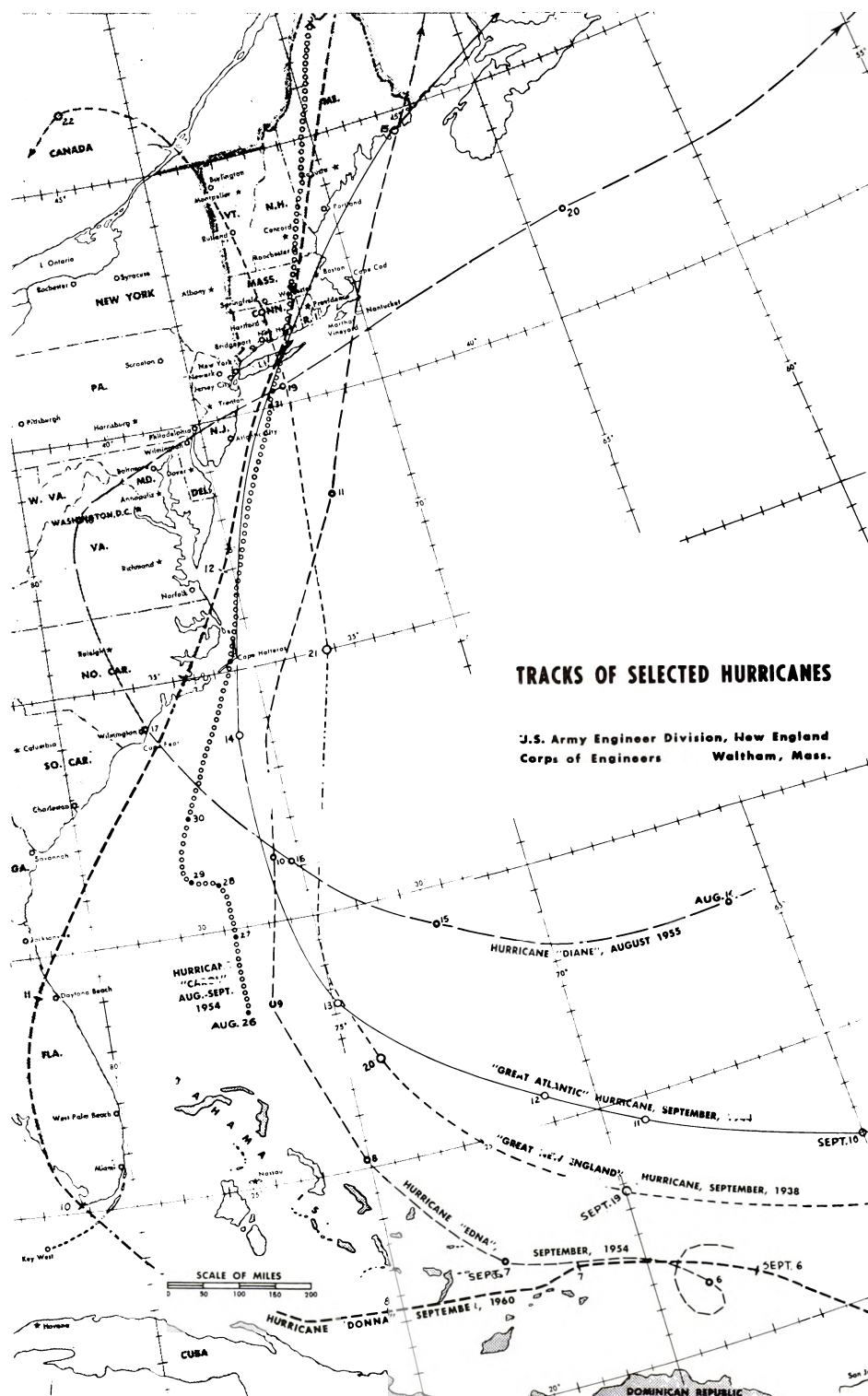
**Figure 2.** A map showing coastal flood protection projects in Rhode Island in the early 1960s that are either under design, have been proposed, or are currently under construction. *Source: the U.S. Army Corps of Engineers, New England Division. Waltham, Mass.*





**Figure 3.** Revised plans for the Narragansett Bay barriers, April 1964. *Source: the U.S. Army Corps of Engineers, New England Division. Waltham, Mass.*

2015  
2016  
2017  
2018



**Figure 4.** Tracks of hurricanes impacting New England (1938 to 1960). *Source: the U.S. Army Corps of Engineers, New England Division. Waltham, Mass.*

2019  
2020  
2021  
2022



A.



B.



C.



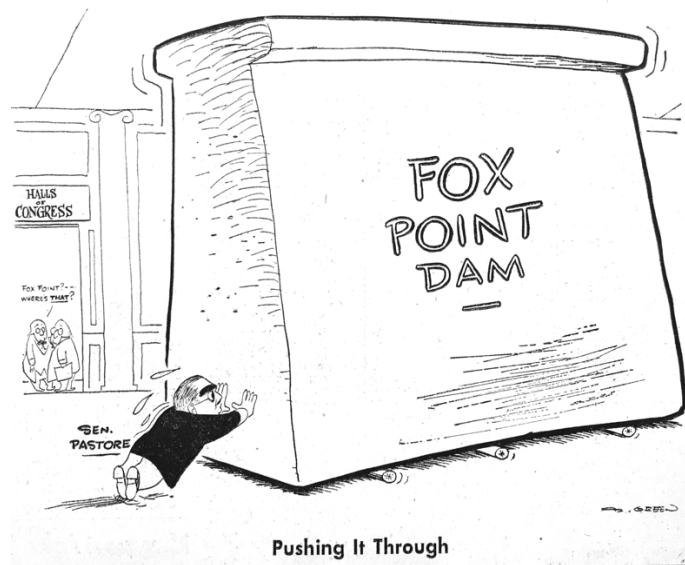
D.



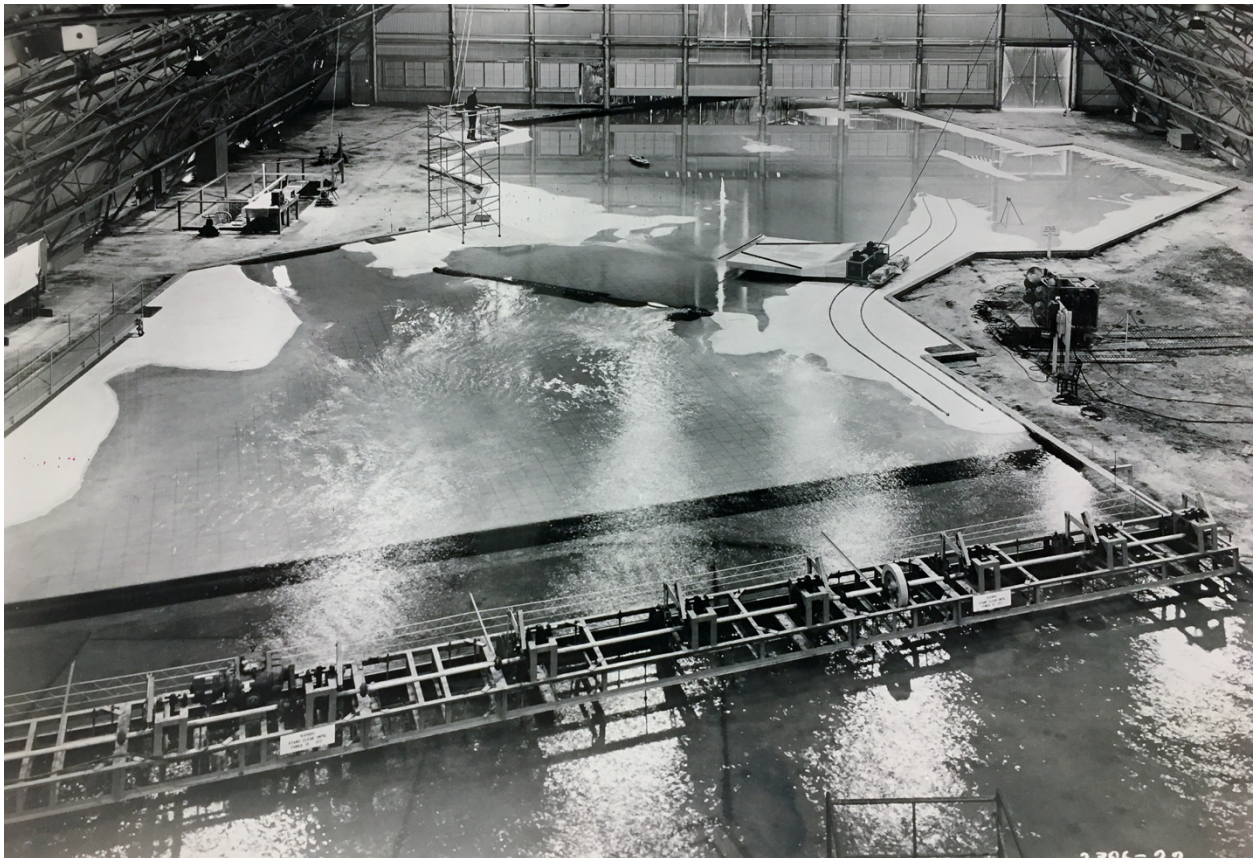
**Figure 5.** A) Flooding in downtown Providence, Rhode Island during Hurricane Carol on August 31, 1954; B) Flooded offices of *The Providence Journal-Bulletin*; C) Photo of flooding in downtown Providence, Rhode Island looking up Westminister Street towards the business section; D) Aerial photo of destruction from Hurricane Carol in Oakland Beach, Rhode Island. Source: “Hurricane Carol Lashes Rhode Island”, Published by *The Providence Journal-Bulletin*.

2023  
2024  
2025  
2026  
2027  
2028  
2029  
2030





**Figure 6.** A political cartoon depicting the struggle that Rhode Island's congressional delegation endured in pushing the Fox Point Barrier through Congress. *Source: The Providence Journal-Bulletin, 5/24/1957.*



**Figure 7.** A hydraulic model of the East Passage of Narragansett Bay in Vicksburg, Mississippi. A wave generator is visible in the foreground. A wind generator is on a track on the right. The hurricane barrier extends from Castle Hill (right) to Southwest Point (left). *Source: the U.S. Army Corps of Engineers, New England Division. Waltham, Mass.*



It Can't Happen Here

**Figure 8.** A political cartoon depicting the how Rhode Islanders felt after the U.S. Army Corps of Engineers was attempting to continue to advance the Bay barriers following strong and consistent public opposition. *Source: The Providence Journal-Bulletin, 11/18/1965.*



R.I.P.

2047 **Figure 9.** A political cartoon depicting the Army Corps grieving the loss of the Narragansett Bay  
 2048 Barrier project after more than a decade of planning and deliberation. *Source: The Providence*  
 2049 *Journal-Bulletin*, 1/6/1966.  
 2050

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<sup>i</sup> John Lonnquest et al., eds., *Two Centuries of Experience in Water Resources Management: A Dutch-U.S. Retrospective* (Alexandria, VA, 2014).

<sup>ii</sup> Joseph L. Arnold, *The Evolution of the 1936 Flood Control Act* (Fort Belvoir, VA: Office of History, United States Army Corps of Engineers, 1988).

<sup>iii</sup> The Corps was involved in two projects in the early twentieth century (Table 2) but studying coastal flood protection was not officially added to their jurisdiction until 1955 (Public Law 71, 84<sup>th</sup> Congress, 1<sup>st</sup> Session).

<sup>iv</sup> Providence Journal, “Engineers to Close Field Study Office,” *Providence Journal-Bulletin*, May 7, 1964.

<sup>v</sup> Joseph L. Goodrich, “Threat Seen to N.E. Flood Control Plan,” *Providence Journal-Bulletin*, September 15, 1956.

<sup>vi</sup> Andrew Morang, “Hurricane Barriers in New England and New Jersey: History and Status after Five Decades,” *Journal of Coastal Research* 317 (2016): 181–205, <https://doi.org/10.2112/JCOASTRES-D-14-00074.1>.

<sup>vii</sup> Alex Kuffner, “Rising Threat: Can Providence’s Hurricane Barrier Withstand Sea-Level Rise?,” *Providence Journal-Bulletin*, March 31, 2019.

<sup>viii</sup> Melissa Samet, “A Citizen’s Guide to the Corps of Engineers” (American Rivers and the National Wildlife Federation, 2009).

<sup>ix</sup> “Hurricane Tidal Flood Protection in Narragansett Bay” (American Society of Civil Engineers (Rhode Island Section), University of Rhode Island, May 11, 1959).

<sup>x</sup> Daniel A. Mazmanian and Jeanne Nienaber, *Can Organizations Change? Environmental Protection, Citizen Participation, and the Corps of Engineers* (Washington, D.C.: The Brookings Institution, 1979); US National Research Council, *National Water Resources Challenges Facing the U.S. Army Corps of Engineers* (Washington, D.C.: The National Academies Press, 2011), <https://doi.org/10.17226/13136>.



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<sup>xi</sup> B Flyvbjerg, N Bruzelius, and W Rothengatter, *Megaprojects and Risk: An Anatomy of Ambition*, Megaprojects and Risk: An Anatomy of Ambition (Cambridge University Press, 2003); Alan A. Altshuler and David Luberoff, *Mega-Projects: The Changing Politics of Urban Public Investment* (Washington, D.C.: Brookings Institution Press, 2003).

<sup>xii</sup> Altshuler and Luberoff, *Mega-Projects: The Changing Politics of Urban Public Investment*.

<sup>xiii</sup> William O. Douglas, “The Corps of Engineers: The Public Be Damned,” *Playboy*, 1969; Elizabeth B. Drew, “Dam Outrage: The Story of the Army Engineers,” *Atlantic Monthly*, 1970; Daniel A. Mazmanian and Mordecai Lee, “Tradition Be Damned! The Army Corps of Engineers Is Changing,” *Public Administration Review* 35, no. 2 (1975): 166–72, <https://doi.org/10.2307/975176>; E. F. Porter, Jr., “Former Army Engineer Critical of ‘Beaver Corps,’” *St. Louis Post-Dispatch*, October 5, 1971; Henry S. Reuss, “Needed: An About-Face for the Army Corps of Engineers,” *Reader’s Digest*, 1971; Colonel Howard L. Sargent, Jr., “Fishbowl Planning Immerses Pacific Northwest Citizens in Corps Projects,” *Civil Engineering*, 1972; St. Louis Globe-Democrat, “Corps of Engineers’ Levee Plan Draws Fire from Ex-Chief,” *St. Louis Globe-Democrat*, October 1, 1971.

<sup>xiv</sup> Henry Isé, “Letter from Henry Ise to Lt. Gen. Wilson Requesting No Construction of the Hurricane Barrier,” August 18, 1965.

<sup>xv</sup> Emery R Boose, Kristen E Chamberlin, and David R Foster, “Landscape and Regional Impacts of Hurricanes in New England,” *Ecological Monographs* 71, no. 1 (2001): 22.

<sup>xvi</sup> Arthur B. Dunbar Jr., “Broader Survey Asked on Hurricane Damage,” *Providence Journal-Bulletin*, April 20, 1955.

<sup>xvii</sup> The word “hurricane” was not yet used in American English at the time of the storm.

<sup>xviii</sup> Robert M. Brown, “The New England Hurricane of September 21, 1938,” *Journal of Geography* 37, no. 8 (November 1938): 293–300, <https://doi.org/10.1080/00221343808987531>; Jessica Weinkle et al., “Normalized Hurricane Damage in the Continental United States 1900–2017,” *Nature Sustainability* 1, no. 12 (December 2018): 808–13, <https://doi.org/10.1038/s41893-018-0165-2>.

<sup>xix</sup> “Hurricane Tidal Flood Protection in Narragansett Bay.”

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<sup>xx</sup> U.S. Army Engineer Division, New England, “Narragansett Bay Hurricane Flood Protection Rhode Island and Massachusetts: Study of Lower Bay Hurricane Barriers” (Waltham, Massachusetts: U.S. Army Corps of Engineers, December 12, 1963).

<sup>xxi</sup> Weinkle et al., “Normalized Hurricane Damage in the Continental United States 1900–2017.”

<sup>xxii</sup> Providence Journal, “Flood Control Action Urged,” *Providence Journal-Bulletin*, November 30, 1954.

<sup>xxiii</sup> Charles F. Brooks and Conrad Chapman, “The New England Hurricane of September, 1944,” *Geographical Review* 35, no. 1 (1945): 132–36, <https://doi.org/10.2307/210937>.

<sup>xxiv</sup> Stuart O. Hale, “Hurricane Carol Laid R.I. Low Just Year Ago,” *Providence Journal-Bulletin*, August 31, 1955.

<sup>xxv</sup> John E. Fogarty, “Statement of Honorable John E. Fogarty, U.S. Representative of the Second Congressional District of Rhode Island before the Committee of Public Works in Support of H.R. 2185, a Bill to Authorize Modifications of Local Participation in Flood Control Projects” (1959).

<sup>xxvi</sup> Narragansett Bay is a coastal estuary consisting of 456 km<sup>2</sup> of total water area and about a dozen islands of various sizes. Roughly 26 cities and towns (17 in Rhode Island and 9 in Massachusetts) dot the shoreline of Narragansett Bay. Providence, the capital and most populated city of Rhode Island, sits at the head of the bay, while the city of Newport lies at the entrance to the east passage. Narragansett Bay is noted for its shell fishing industry, prevalence of vacation homes, boaters, and being home to a large naval base in Newport. President Eisenhower’s Summer White House was also located in Newport in 1958 and 1960 (Hitchcock, “The Age of Eisenhower: America and the World in the 1950s”)

<sup>xxvii</sup> Secretary of the Army, “Letter from the Secretary of the Army: Narragansett Bay Area, R.I. and Mass.,” House Document, 89th Congress (2nd Session) (Washington, D.C.: House of Representatives, 1966).

<sup>xxviii</sup> Nona Brown, “Northeast Hurricanes: Freaks or Portents?,” *New York Times*, October 24, 1954, Sunday edition.

<sup>xxix</sup> Providence City Planning Commission, “Minutes from the City Planning Commission Meeting,” October 5, 1954; Dennis J. Roberts, “Letter from R.I. Governor Roberts to President Eisenhower on Flood Protection,” September 10, 1954.

<sup>xxx</sup> Governor Roberts justified the request by citing Public Law 875 of the 81<sup>st</sup> Congress, which facilitates federal assistance in developing state and local plans to cope with major disasters.

<sup>xxxi</sup> Roberts, “Letter from R.I. Governor Roberts to President Eisenhower on Flood Protection,” September 10, 1954.

<sup>xxxii</sup> Providence Journal, “A ‘Well Done’ to Four Men in Washington,” *Providence Journal-Bulletin*, July 8, 1958.

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<sup>xxxiii</sup> John E. Fogarty, “Letter from John E. Fogarty to the Secretary of the Hopkinton-Richmond-Charlestown-Exeter Chamber of Commerce,” January 8, 1955.

<sup>xxxiv</sup> John E. Fogarty, “Letter from John E. Fogarty to the President of the Exchange Realty Company,” December 2, 1954.

<sup>xxxv</sup> Roberts, “Letter from R.I. Governor Roberts to President Eisenhower on Flood Protection,” September 10, 1954; Rhode Island Development Council, “Report on Hurricane Flood Protection for Providence, Rhode Island” (Providence, Rhode Island: Rhode Island Development Council, January 1955).

<sup>xxxvi</sup> The Rhode Island Development Council report ultimately drew together inputs from federal agencies, several consulting engineering organizations, and the Rhode Island Development Council’s own staff. The Rhode Island Development Council report compared and evaluated them as the basis for proposing a solution of the flood problem.

<sup>xxxvii</sup> Providence Journal, “Army Aid or Not, State Will Study R.I. Flood Barrier,” *Providence Journal-Bulletin*, September 18, 1954.

<sup>xxxviii</sup> Residents of Touisset, “Letter from Residents of Touisset Addressed to Warren Town Council Requesting the Army Engineers Come to Warren and Make Survey,” September 10, 1954.

<sup>xxxix</sup> Thomas F. Gilbane, “Letter from the President of the Providence Chamber of Commerce to John E. Fogarty,” December 22, 1954.

<sup>xl</sup> John K. Quinn, Jr., “Letter from the Secretary of the Hopkinton-Richmond-Charlestown-Exeter Chamber of Commerce to Congressman John E. Fogarty,” Letter, December 29, 1954.

<sup>xli</sup> Providence Journal, “R.I. Seeks Study of Flood Barrier,” *Providence Journal-Bulletin*, September 11, 1954.

<sup>xlii</sup> Providence Journal, “Flood Barrier Study Slated,” *Providence Journal-Bulletin*, September 21, 1954.

<sup>xliii</sup> Providence Chamber of Commerce, “Resolution on Flood Control” (Providence Chamber of Commerce, November 29, 1954).

<sup>xliv</sup> Gilbane, “Letter from the President of the Providence Chamber of Commerce to John E. Fogarty,” December 22, 1954.

<sup>xl</sup> Providence Journal, “Hurricane Body Named for City,” *Providence Journal-Bulletin*, March 6, 1955.

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<sup>xlvi</sup> Evening Bulletin, “Disaster Insurance Gets a Solid Boost,” *Providence Journal-Bulletin*, August 25, 1955; Providence Journal, “Government Seeks Some Way to Provide Flood Insurance,” *Providence Journal-Bulletin*, August 31, 1955; Arthur B. Dunbar Jr., “Flood Insurance Speedup Seen,” *Providence Journal-Bulletin*, December 15, 1955; Gene Smith, “Flood Insurance Held Unfeasible,” *Providence Journal-Bulletin*, December 25, 1955; Providence Journal, “Flood Insurance Unit Dropped for the Year,” *Providence Journal-Bulletin*, June 22, 1957; Providence Journal, “Flood Insurance Dead,” *Providence Journal-Bulletin*, June 20, 1957.

<sup>xlvi</sup> The National Flood Insurance Program was established by the National Flood Insurance Act of 1968 (NFIA, 42 U.S.C. §4001 et seq.) Jared T Brown, “Introduction to FEMA’s National Flood Insurance Program (NFIP)” (Washington, D.C.: Congressional Research Service, 2016).

<sup>xlvi</sup> Evening Bulletin, “Disaster Insurance Gets a Solid Boost.”

<sup>xlvi</sup> Bernard M. Shanley, “Letter from the Special Council to the President to Governor Roberts,” September 24, 1954.

<sup>i</sup> Hale, “Hurricane Carol Laid R.I. Low Just Year Ago.”

<sup>ii</sup> US National Research Council, *Reducing Coastal Risk on the East and Gulf Coasts* (Washington, D.C.: The National Academies Press, 2014), <https://doi.org/10.17226/18811>.

<sup>iii</sup> Hale, “Hurricane Carol Laid R.I. Low Just Year Ago.”

<sup>iii</sup> Douglas W. Cray, “Cost to Merchants Here Over Million,” *Providence Journal-Bulletin*, September 18, 1955, Sunday edition; Providence Journal, “Costly Storm Preparations Could Be Avoided,” *Providence Journal-Bulletin*, September 23, 1955.

<sup>iv</sup> Evening Bulletin, “Flood Area Business Aid Discussed,” *Providence Journal-Bulletin*, August 25, 1955.

<sup>iv</sup> Providence Journal, “How Can We Hurry up Hurricane Planning?,” *Providence Journal-Bulletin*, March 31, 1955; Providence Journal, “A Hurricane Dam Raises Policy Questions,” *Providence Journal-Bulletin*, September 24, 1956; Providence Journal, “Donna Asks: Where Is the Fox Point Dam?,” *Providence Journal-Bulletin*, September 13, 1960; Providence Journal, “How Many Hurricanes Will Hit before 1965?,” *Providence Journal-Bulletin*, June 30, 1955.

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<sup>lvi</sup> Providence Journal, “The State Has Learned Its Hurricane Lesson,” *Providence Journal-Bulletin*, September 14, 1960; Providence Journal, “Donna Asks: Where Is the Fox Point Dam?”; Providence Journal, “The State Benefits from Past Hurricane Lessons,” *Providence Journal-Bulletin*, September 22, 1961; Providence Journal, “If Ginny Had Come: Incomplete Barrier Would Have Stood,” *Providence Journal-Bulletin*, October 29, 1963; Providence Journal, “Costly Storm Preparations Could Be Avoided”; Providence Journal, “Diane’s Lesson: Watch the Back Door,” *Providence Journal-Bulletin*, August 23, 1955; Providence Journal, “Connie Reminds Us: R.I. Needs Hurricane Protection,” *Providence Journal-Bulletin*, August 11, 1955.

<sup>lvii</sup> Dennis J. Roberts, “Governor Roberts Statement before the Public Works Committee of the Senate of the United States,” April 20, 1955.

<sup>lviii</sup> Stuart O. Hale, “Long Road Lies Ahead If We Seek U.S. Funds,” *Providence Journal-Bulletin*, October 16, 1954; Stuart O. Hale, “Plan Offered to Protect R.I. From Hurricanes,” *Providence Journal-Bulletin*, November 11, 1954; Arthur B. Dunbar Jr., “Rhode Island’s Hurricane Dam Project Still Must Run a Long Obstacle Course,” *Providence Journal-Bulletin*, September 30, 1956; Stuart O. Hale, “Long Wait for That Bay Dam,” *Providence Journal-Bulletin*, November 20, 1955, Sunday edition.

<sup>lix</sup> Providence Journal, “From Woonsocket Comes a Lesson in Flood Control,” *Providence Journal-Bulletin*, October 20, 1959.

<sup>lx</sup> Providence Journal, “Flood Barrier Study Slated”; Providence Journal, “Would This Do It? Dike Across Providence River Termed Feasible,” *Providence Journal-Bulletin*, September 29, 1954; Providence Journal, “Fox Point Hurricane Barrier Is Called Best at Least Cost,” *Providence Journal-Bulletin*, December 31, 1954; Stuart O. Hale, “Plan Offered to Protect R.I. from Hurricanes,” *Providence Journal-Bulletin*, November 11, 1954; Editorial, “Planning a Bar to the Hurricane’s Flood: If the Whole Bay Can’t Be Protected, a Shield for the City’s Core Offers the Next Best Bet,” *Providence Journal-Bulletin*, December 13, 1954.

<sup>lxi</sup> Providence Journal, “Flood Control Action Urged.”

<sup>lxii</sup> Editorial, “Planning a Bar to the Hurricane’s Flood: If the Whole Bay Can’t Be Protected, a Shield for the City’s Core Offers the Next Best Bet.”

<sup>lxiii</sup> George C. Hull, “\$10-Million Hurricane Protection Plan,” *Providence Journal-Bulletin*, January 19, 1955.

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<sup>lxiv</sup> Stuart O. Hale, “Bay Changes Foreseen With Breakwaters,” *Providence Journal-Bulletin*, November 11, 1954.

<sup>lxv</sup> Carroll Tillman, “Protection Against Floods (Op-Ed),” *Providence Journal-Bulletin*, September 16, 1954;  
*Providence Journal*, “R.I. Seeks Study of Flood Barrier.”

<sup>lxvi</sup> *Providence Journal*, “Flood Control Action Urged.”

<sup>lxvii</sup> *Providence Journal*, “A Hurricane Dam Raises Policy Questions.”

<sup>lxviii</sup> *Providence Journal*, “Army Engineers Finish Study of Bay Flood Protection Plans,” *Providence Journal-Bulletin*, January 19, 1956.

<sup>lxix</sup> Unless directed by Congress to take action, local interests are required to initiate help from the USACE. The USACE cannot act unilaterally.

<sup>lxx</sup> Evening Bulletin, “Hurricane Plans: The Assembly Chose a Sound Approach,” *Providence Journal-Bulletin*, January 9, 1955.

<sup>lxxi</sup> Stuart O. Hale, “Dam Saves Industries From Cincinnati Flood,” *Providence Journal-Bulletin*, October 15, 1954;

Stuart O. Hale, “10 Miles of Dikes and Flood Walls Have Kept Hartford Dry 10 Years,” *Providence Journal-Bulletin*, October 14, 1954.

<sup>lxxii</sup> Rhode Island Development Council, “Report on Hurricane Flood Protection for Providence, Rhode Island.”

<sup>lxxiii</sup> *Providence Journal*, “A Hurricane Dam Raises Policy Questions.”

<sup>lxxiv</sup> See Rivers and Harbors Appropriations Act of 1899, 30 Stat. 1121, 1151 (codified in 33 U.S.C. § 401) (“It shall not be lawful to construct or commence the construction of any bridge, causeway, dam, or dike over or in any ... navigable water of the United States until the consent of Congress shall have been obtained . . . .”); An Act to Provide Security for the Lives of Passengers on Board of Vessels Propelled by Steam, 5 Stat. 304 (1838) (providing that “it shall not be lawful for the owner . . . of any steamboat . . . to transport any goods, wares, merchandise or passengers, in or upon ... navigable waters of the United States . . . without having first obtained . . . a license”).

<sup>lxxv</sup> *Providence Journal*, “Congress Urged to Get Study of R.I. Hurricane Barrier,” *Providence Journal-Bulletin*, January 15, 1955.

<sup>lxxvi</sup> Evening Bulletin, “Hurricane Plans: The Assembly Chose a Sound Approach.”

<sup>lxxvii</sup> The Corps was involved in two projects in the early twentieth century (Table 2) but studying coastal flood protection was not officially added to their jurisdiction until 1955 (Public Law 71, 84<sup>th</sup> Congress, 1<sup>st</sup> Session).

<sup>lxxviii</sup> Evening Bulletin, “Engineers Advocate Bay Tide Gauges,” *Providence Journal-Bulletin*, September 28, 1955.

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<sup>lxxix</sup> Providence Journal, “Chamber Urges Flood Barrier Plan Be Ready,” *Providence Journal-Bulletin*, November 5, 1955.

<sup>lxxx</sup> Hale, “Long Road Lies Ahead If We Seek U.S. Funds.”

<sup>lxxxi</sup> Dunbar Jr., “Broader Survey Asked on Hurricane Damage.”

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<sup>lxxxiv</sup> Pawtucket Times, “Fox Point Hurricane Barrier, 3 In Lower Bay Proposed,” *Pawtucket Times*, September 19, 1956.

<sup>lxxxv</sup> Providence Journal, “Chance to Rule Out Shoreline Storm Traps,” *Providence Journal-Bulletin*, December 29, 1954.

<sup>lxxxvi</sup> Providence Journal, “Flood Insurance Dead.”

<sup>lxxxvii</sup> Linda Luther, “The National Environmental Policy Act: Background and Implementation” (Washington, D.C.: Congressional Research Service, 2008); Mazmanian and Nienaber, *Can Organizations Change? Environmental Protection, Citizen Participation, and the Corps of Engineers*.

<sup>lxxxviii</sup> Providence Journal, “Flood Barrier Hearing Slated,” *Providence Journal-Bulletin*, September 30, 1956.

<sup>lxxxix</sup> Providence Journal, “Flood Barrier to Be Discussed,” *Providence Journal-Bulletin*, July 8, 1956; Secretary of the Army, “Letter from the Secretary of the Army: Narragansett Bay Area, R.I. and Mass.”

<sup>xc</sup> Providence Journal, “U.S. Officials Get Close-Up View of Bay Flood Plans,” *Providence Journal-Bulletin*, October 5, 1956.

<sup>xc<sup>i</sup></sup> Henry Isé, “Letter from the Chief of the Division of Harbors and Rivers to Governor Roberts Supporting the Corps’ Plans for Hurricane Barriers at the Entrance to Narragansett Bay and at Fox Point,” September 24, 1956.

<sup>xc<sup>ii</sup></sup> Secretary of the Army, “Letter from the Secretary of the Army: Narragansett Bay Area, R.I. and Mass.”

<sup>xc<sup>iii</sup></sup> Providence Journal, “Flood Barrier Hearing Slated.”

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- <sup>xciv</sup> Providence Journal, “Public Endorses Flood Barriers,” *Providence Journal-Bulletin*, October 2, 1956.
- <sup>xcv</sup> Providence Journal, “Proposals for Further Flood Studies Made,” *Providence Journal-Bulletin*, October 2, 1956.
- <sup>xcvi</sup> John C. Dinsmoor, “Letter from the 2nd Vice President of the Allens Avenue Businessmen’s Association to the New England Division of the Army Corps,” February 14, 1956.
- <sup>xcvii</sup> Providence Journal, “Concerns Emerge about Lower Barriers,” *Providence Journal-Bulletin*, September 19, 1956.
- <sup>xcviii</sup> Donald J. Zinn, “Resources Must Be Protected (Op-Ed),” *Providence Journal-Bulletin*, July 15, 1956.
- <sup>xcix</sup> Evening Bulletin, “Protecting Marine Assets,” *Providence Journal-Bulletin*, September 29, 1956.
- <sup>c</sup> Byron B. Blount, “Should Look Before They Leap (Op-Ed),” *Providence Journal-Bulletin*, October 12, 1956.
- <sup>ci</sup> Rhode Island State Department of Health, “Report on Pollution of the Waters of the State” (Providence, Rhode Island: Rhode Island State Department of Health, December 23, 1946).
- <sup>cii</sup> Robert N. Cool, “A Vital Element for Electric Company,” *Providence Journal-Bulletin*, January 2, 1955, Sunday Edition edition.
- <sup>ciii</sup> Providence Journal, “River Is to Be Free of Sewage for First Time next Summer,” *Providence Journal-Bulletin*, February 19, 1956.
- <sup>civ</sup> Evening Bulletin, “Navy Opposes Barrier Plan,” *Providence Journal-Bulletin*, October 3, 1956.
- <sup>cv</sup> Frank Cyganowski, “Barriers for the Birds (Op-Ed),” *Providence Journal-Bulletin*, October 4, 1956.
- <sup>cvi</sup> Providence Journal, “Marine Study Comes First,” *Providence Journal-Bulletin*, October 8, 1956.
- <sup>cvi</sup> Cyganowski, “Barriers for the Birds (Op-Ed).”
- <sup>cvi</sup> Providence Journal, “Public Endorses Flood Barriers.”
- <sup>cix</sup> Providence Journal, “A ‘Well Done’ to Four Men in Washington.”
- <sup>cx</sup> Providence Journal, “Congress Okays Fox Point Dam,” *Providence Journal-Bulletin*, June 26, 1958.



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<sup>cx</sup><sub>i</sub> Providence Journal, “The Fox Point Dam Is Still Worth the Price,” *Providence Journal-Bulletin*, May 29, 1958; Providence Journal, “A ‘Well Done’ to Four Men in Washington.”

<sup>cxii</sup> As of 2020, the federal-local cost sharing split for structural coastal projects is 65-35 (per the Water Resources Development Act of 1986), but in extreme cases the full cost has been paid for by the federal government (e.g., the Lake Borgne storm surge barrier outside of New Orleans, Louisiana, constructed after Katrina)

<sup>cxiii</sup> Providence Journal, “City’s Voters Okay Fox Point Barrier,” *Providence Journal-Bulletin*, November 11, 1959.

<sup>cxiv</sup> Providence Journal, “State Signs Pact on Dam,” *Providence Journal-Bulletin*, November 11, 1960.

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