



Nancy Brighton
Watershed Section,
Environmental Analysis Branch Planning Division
US Army Corps of Engineers, New York District
26 Federal Plaza, Room 2151
New York, New York 10278
Submitted electronically to NYNJHarbor.TribStudy@usace.army.mil

November 5, 2018

Hudson River Sloop Clearwater Scoping Comments to US Army Corps of Engineers regarding Storm Surge Barriers proposed in the USACE New York/New Jersey Harbor & Tributaries Focus Area Feasibility Study

To Whom It May Concern:

We are writing on behalf of Hudson River Sloop Clearwater, Inc., which is a 501(c)(3) tax exempt nonprofit, member-supported corporation whose mission is “to preserve and protect the Hudson River, its tributaries and related bodies of water.” As an organization, Clearwater works to protect the ecology of the Hudson River and the well-being of everyone living in its watershed. For 50 years, Hudson River Sloop Clearwater, Inc. has been at the forefront of the environmental movement as champion of the Hudson River, working to pass landmark legislation such as the Clean Water Act, and providing innovative educational programs, environmental advocacy, and musical celebrations, including the renowned annual Clearwater Festival, the Great Hudson River Revival, to inspire, educate, and activate millions of people, and to expand their experience, awareness and stewardship of this magnificent natural resource. It is from this perspective we offer the following comments.

Clearwater recognizes the critical need for robust measures to protect coastal communities from strengthening storm surges and sea level rise. We support the project's stated need and purpose of the feasibility study to "manage the risk of coastal storm damage in the New York and New Jersey Harbor and tributaries study area, while contributing to the resilience of communities, critical infrastructure, and the environment." That said, the level of analysis and assessment of the proposed alternatives completed to date is insufficient to define a well-considered decision for action moving forward. Clearwater strongly urges the Army Corps to include an Environmental Impact Statement and a complete cost-benefit analysis for each alternative as part of the alternatives analysis and assessment process.

Background

Army Corps of Engineers' Proposed Storm Surge Barriers: On July 5, 2018 the US Army Corps of Engineers issued its *New York/New Jersey Harbor & Tributaries Focus Area Feasibility Study*. However, to the best of our knowledge, the only documentation of this report are several webpages, fact sheets and a series of PowerPoint presentations accompanied by poster boards offered by the Corps at multiple locations along the Hudson River. The original deadline for scoping comments for one of the potential largest projects ever proposed for this region was Sept. 20, 2018, however, due to pressure from the public and from many elected officials, this was extended until November 5, 2018. See: <http://www.nan.usace.army.mil/Media/News-Releases/Article/1568235/army-corps-announces-scoping-meetings-for-new-york-and-new-jersey-harbor-tribut/> and <http://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/New-York-New-Jersey-Harbor-Tributaries-Focus-Area-Feasibility-Study/>.

The *New York-New Jersey Harbor and Tributaries Coastal Storm Risk Management Feasibility Study* is one of nine that the USACE's [North Atlantic Coast Comprehensive Study \(NACCS\) Report](#), issued January 2015, identified for further study. This study, authorized by [Public Law 84-71, June 15, 1955](#) (69 Stat. 132) provides the underpinnings for all of the


resilience projects from Virginia to Maine,¹ and directs the examination of damages in coastal and tidal areas due to coastal storms such as hurricanes, “and of possible means of preventing loss of human lives and damages to property, with due consideration of the economics of proposed breakwaters, seawalls, dikes, dams, and other structures, warning services, or other measures which might be required.” The NACCS *Resilient Adaptation to Increasing Risk Report* explains that a “a true systems approach to coastal storm risk management and resilience requires consideration of the full range of functions, services, and benefits produced by coastal projects and blended solutions.”

The Army Corps has been charged with finding ways to buffer future damage that can be caused by climate change -- including storm surges, flooding and sea-level rise. As per their proposal PowerPoints there are six possible alternative actions:






**New York-New Jersey Harbor and Tributaries
Coastal Storm Risk Management Feasibility Study**

ALTERNATIVES OVERVIEW

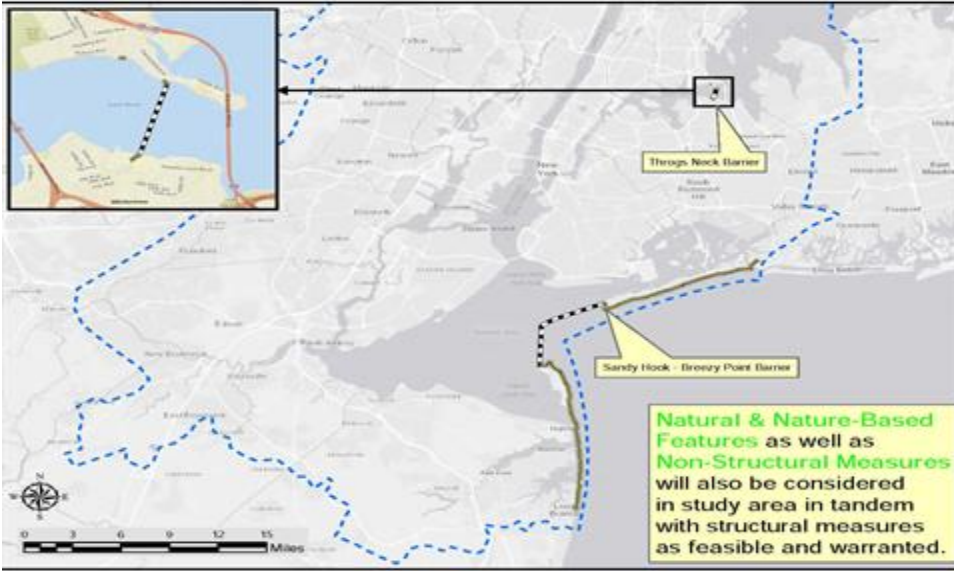
- Alternative 1: No Action
- Alternative 2: NY/NJ Lower Bay and Throgs Neck Surge Barriers (harbor-wide)
- Alternative 3A/3B: Multiple Surge Barriers and Floodwalls & Levee Systems
- Alternative 4: Solitary Bay and River Basin Surge Barriers, Floodwalls & Levees
- Alternative 5: Perimeter Only



New York Harbor.








Alternative #1: Considered the “No Action alternative”, this option does include planned and existing protections, but no additional action by the Army Corps.



**Alternative #2 - NY/NJ Harbor Wide Barrier/Beach Restoration
NY/NJ Harbor and Tributaries Study**

New York and New Jersey



¹ <http://www.nad.usace.army.mil/CompStudy.aspx>

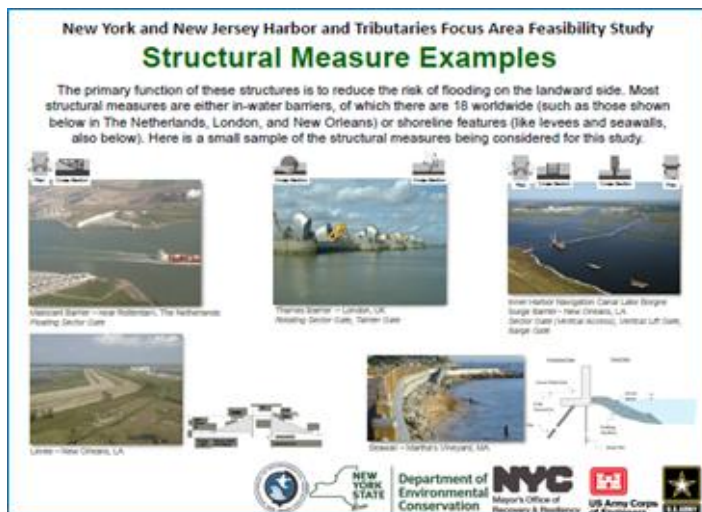
Alternative #2: The NY/NJ Harbor-Wide Barrier would consist of a 5-mile barrier located across the mouth of New York Harbor between Sandy Hook, NJ and Breezy Point in Far Rockaway, Queens, NY, with openings for tidal flow and ship traffic, and second barrier on the upper East River near the Throgs Neck Bridge, to provide a ring of protection to most of the bi-state region. An animated video of a design concept for the NYC Outer Harbor Gateway Storm Barrier demonstrating the enormity of this proposal can be seen at: www.youtube.com/watch?v=8mtvjMHqbHI&feature=player_embedded

Alternative #3A: Set back from the entrance to Harbor, this option would entail multiple large barriers, in NY/NJ Harbor and Long Island Sound near the Verrazano Bridge, the Arthur Kill, and between the Bronx and Queens at Pelham, Throgs Neck, and across Jamaica Bay.

Alternative #3B includes 9 measures set further back, with barriers at Pelham, Newtown Creek, Gowanus Canal, Arthur Kill, Kill Van Kull and Jamaica Bay, and shoreline measures at East Harlem, NYC Upper West Side and NJ Upper Bay.

Alternative #4 includes eight smaller measures, with barriers at Pelham, Newtown Creek, Gowanus Canal, Jamaica Bay and Hackensack River, and shoreline measures at East Harlem, NYC Upper West Side and NJ Upper Bay. Alternatives #2, #3A, #3B and #4 involve outer and inner harbor barriers that would almost entirely block the Hudson River and/or its tributaries, disturbing the ecology of the river that flows both ways and the ecological features that contribute to its health.

Alternative #5: Perimeter Only Solutions, relies entirely on five shoreline-based floodwalls and levees at East Harlem, NYC Upper West Side, NJ Upper Bay, Gowanus and Newtown Creeks. It would protect our low-lying communities from both storm surges and flooding, while leaving the river and its tributaries to flow naturally.



Nature-Based Measures: The Role of Wetlands

In Clearwater’s opinion, nature-based measures/solutions must be considered and included to the maximum extent possible, and implementation expedited. These measures, contained in Alternative #5, are the best way to address both storm surge and sea level rise while letting the Hudson River flow freely and thrive. Nature-based measures include conservation and restoration (and migration over time) of coastal wetlands, tidal marshes and submerged aquatic vegetation. The Army Corps (USACE) must sincerely consider the value of nature-based measures in protecting New York/New Jersey Harbor from increased storm surges.

The USACE must also acknowledge and factor in the value of the other ecological services provided by wetlands and other nature-based measures such as improved water filtration and quality; sediment and nutrient recycling, retention and export; groundwater replenishment; sequestration of carbon and other greenhouse gases; support of cultural practices; enjoyment of natural surroundings; healthier wildlife and fisheries habitat; and recreational and tourism opportunities (as well as accounting for special properties of ecosystems such as ecological resilience, stability and

collapse). Of these, **carbon sequestration is of prime importance**, because it reduces greenhouse gas emissions in the atmosphere and therefore is an important solution to the global climate crisis (see below). Without environmental impact studies of each of the six alternatives, one can't compare how much carbon sequestration could be increased or diminished by each alternative.

Another important aspect to consider is that nature-based measures are less expensive and more effective than built infrastructures such as in-water barriers. The tremendous value that wetlands can play in protecting against storm surges is well-recognized by The Nature Conservancy; the group has long been a champion of nature-based coastal resilience measures, which they say can save communities hundreds of millions of dollars when severe hurricanes hit the US coastline.

The USACE should maximize the role that nature-based measures such as wetlands and tidal marshes – included in Alternative #5 – play in coastal storm risk management and resilience and explore how to ramp up these measures in a timely manner. While Clearwater appreciates the Corps' attempt to consider natural and nature-based coastal resilience/storm surge protection measures, there needs to be a more thorough analysis of the role these measures can play in coastal storm risk management for the region with the objective of expediting these measures, especially at the outset.

Given the vast evidence of the value of wetlands and other aquatic and terrestrial ecosystems, as it goes through this next phase of the process, the Corps should ask and answer the questions, "Would any of the proposed projects *displace* or otherwise disturb existing wetlands?" and "How can we protect and promote the expansion of coastal wetlands and related habitat?"

Climate Solutions:

One theme heard at the Poughkeepsie, NY presentation and at many of the others, was that the Corp should focus more on mitigating climate change than trying to build protective structures to promote resilience. In an Oct. 3 press release, Westchester County Executive George Latimer echoed this sentiment by saying, "Instead of a focus on building massive man-made structures to control our environment, I urge the federal government to focus on taking immediate and meaningful actions to reduce the human impact on climate change."²

While Clearwater agrees with this in principle, we recognize that the charge of this process is directed at preventing future damage to property and loss of life. That said, there is a way that this undertaking can address climate solutions. When we think of climate solutions we often focus on the first half of the carbon cycle: reducing greenhouse gas emissions. This is typically achieved by switching from fossil fuel to renewable energy generation, by insulating buildings and utilizing energy efficient transportation, reducing food waste, using safer refrigerants and more. However, equally important is the need to protect and enhance systems that sequester and store carbon.

This extremely important point that has not been adequately considered by the Army Corps. Wetlands, tidal marshes, submerged aquatic vegetation and other ecosystem features, which actively sequester carbon and other greenhouse gasses and have real, measurable value in both promoting resilience and reducing the global climate crisis. Traditional environmental impact analyses focus on protecting rare and endangered species, but have not included the importance of carbon sequestration. Two excellent sources of information are Paul Hawken's book and website, *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming* and www.drawdown.org and the Exponential Climate Action Roadmap, published by the Global Climate Action Summit, www.globalclimateactionsummit.org/.

Clearwater urges the Corps to stress the value of Hudson River and Atlantic Ocean ecosystem services in promoting resilience and taking up and sequestering carbon dioxide and other greenhouse gasses. This point was missed in both *New York/New Jersey Harbor & Tributaries Focus Area Feasibility Study* and the *USACE North Atlantic Division Hurricane Sandy: Response, Recovery, Resilience and Risk Reduction Presenter Name Presenter Title North Atlantic Division*, Nov. 2013.³ It was also acknowledged very briefly in NACCS: "The group thought that risk reduction is not just about protecting people but also ecosystems. They discussed criteria for selecting measures such as the measure's ability to reduce risk, provide

² October 3, 2018, News Release: *COUNTY EXECUTIVE GEORGE LATIMER'S TESTIMONY TO THE ARMY CORPS OF ENGINEERS REGARDING THE NEW YORK-NEW JERSEY HARBOR AND TRIBUTARIES FOCUS AREA FEASIBILITY STUDY*

³ <https://www.usace.army.mil/Portals/2/docs/Emergency%20Ops/Hurricane%20Sandy/SandyPresentation.pdf>

floodwater storage, and attenuate waves. They also compared the measures by the benefits they provided – **carbon capture**, ecological/environmental, socio-economic, flood risk management, and shoreline stabilization.”⁴

Natural solutions minimize the consequences of storm surges while burying carbon, thereby removing carbon dioxide from the environment and thus reducing the impacts due to climate change. Research suggests that Hurricane Sandy would have caused an additional \$625 million of property damage had marshlands along the coast not buffered the storm. (see below).

Marine life also has an important carbon sequestration role, contributing to 2.4 - 4.6 percent of global carbon captured and sequestered (Nature). In fact, “despite the small fraction of the ocean surface occupied by salt marsh, mangrove and seagrass ecosystems, they account for 46.9% of the total carbon burial in ocean sediments.” (Nature Climate Change article)

In addition, according to the Smithsonian Environmental Research Center, “under elevated carbon dioxide levels, wetland plants can absorb up to 32 percent more carbon than they do at current levels.”

- Drawdown notes that “Coastal wetlands can store five times as much carbon as tropical forests over the long term, mostly in deep wetland soils.” If the world protected 57 million acres of wetland more than the 18 million acres currently protected, the sequestered carbon could total 3.2 gigatons.⁵
- The Smithsonian Environmental Research Center suggests that wetlands/nature-based solutions are less expensive and more effective. As climate change accelerates, wetlands have a stronger mitigation effect. Wetland plants actually take up more carbon dioxide and other greenhouse gasses when CO₂ is elevated in the atmosphere.⁶
- According to Nature, “Some 2.4 - 4.6 percent of the world’s carbon emissions are captured and sequestered by living organisms in the oceans, and the United Nations estimates that at least half of that sequestration takes place in ‘blue-carbon’ wetlands.”
- Research suggests that Hurricane Sandy “would have been even worse without the wetlands hugging the coastline. Marshlands prevented an additional \$625 million of property damage” - MIT Spectrum, Spring 2018
- “Despite the small fraction of the ocean surface occupied by salt marsh, mangrove and seagrass ecosystems, they account for 46.9% of the total carbon burial in ocean sediments.”⁷

“The carbon buried in coastal vegetated ecosystems can be preserved over millennia, as demonstrated by radiocarbon dating of seagrass, salt marsh and mangrove soils. The efficient preservation of the carbon under these habitats is due to: slow decomposition rates; low nitrogen and phosphorous concentrations in plant tissues; low oxygen levels in the sediments; and the allocation of a large fraction, often exceeding 50%, of plant biomass production to roots and rhizomes that are buried into the soil.”

The Nature Conservancy has some helpful information about the important role that wetlands can play with regard to carbon sequestration.⁸

- Coastal wetlands – which includes salt marshes, seagrass meadows and mangroves – sequester billions of tons of carbon from our atmosphere in concentrations up to five times higher than terrestrial forests.
- Wetlands draw in carbon as they grow and transfer much of this into the rich soils held by their roots. The stored carbon can remain in the soil for thousands of years, making coastal wetlands a long-term climate mitigation solution.
- Wetlands also serve as a continuous sink – layers of soil accumulate as plants die and are buried in the soil, enabling new plants to grow above. If the wetlands are not stressed by human activity, this upward growth can outpace sea level rise.

⁴ https://www.nad.usace.army.mil/Portals/40/docs/NACCS/Agency_Coord-and-Collaboration_Oct2014.pdf p.68.

⁵ Drawdown: <https://www.drawdown.org/solutions/land-use/coastal-wetlands>

⁶ *How Will the Wetlands Respond to Climate Change?* <https://www.smithsonianmag.com/science-nature/how-will-the-wetlands-respond-to-climate-change-164048534/>

⁷ *The role of coastal plant communities for climate adaptation (Duarte, Hendriks, Losada, Mazarrasa)*
<https://www.nature.com/articles/nclimate3062>

⁸ <https://www.nature.org/newsfeatures/pressreleases/the-nature-conservancy-and-xl-catlin-collaborate-to-bring-blue-carbon-cred-1.xml>

- Coastal wetlands protect coastlines by absorbing incoming wave energy and providing storm protection, often at lower costs than built, or grey, infrastructure like seawalls and levees.
- Research conducted by the Nature Conservancy illustrates how nature-based coastal resilience can save communities hundreds of millions of dollars when severe hurricanes hit the United States coastline, reducing flood damage by up to 29 percent.
- As our climate changes, the conservation and restoration of coastal wetlands can help protect millions of people, while providing many other benefits such as healthier fisheries, water purification and improved local livelihoods.
- Wetlands are being lost at an alarming rate – more than almost any other habitat – due to human activity. Experts estimate that the amount of CO₂ released annually from degraded wetlands is equivalent to the annual emissions of the United Kingdom. It is critical that we protect and restore the world’s “blue carbon” systems. Not only will wetlands deliver ongoing sequestration with a net cooling effect on the planet, they will also provide critical protection from erosion, storms, and floods to communities, shorelines and coastal economies.⁹

Long-Term Sea-Level Rise: Another factor the Army Corps has not adequately considered is the rapidly escalating problem of sea-level rise.

Klaus Jacob is a geophysicist at Lamont-Doherty Earth Institute, who has written and spoken widely about the impacts of sea level rise and storm surges. He has expressed opposition to the hardened storm surge barriers, especially the proposed seawall (Alternative 2).

“My real concern has to do with long-term sea level rise. The barriers are mostly open — the sea level will get in and out of those barriers. Once sea level rise reaches about 6 to 10 feet ... you can’t keep the sea level out (using the barriers) ... because the Hudson brings its water down. You have to get the Hudson water out into the ocean, otherwise the barriers are working the opposite way, they would fill up from behind ... It’s not just the Hudson. It’s the Passaic, the Hackensack, the Raritan. All this inland water has to get out into the ocean.

“You have two options: Either you open the gates and let the ocean in and equalize, or you have to pump out this river water and keep the ocean out all the time. We would become essentially like New Orleans, which has levees and dikes around it. They are below sea level and rely on huge pumping systems to keep out the water from the higher Mississippi and the ocean. They pump it out all the time. 24-7 x 365. Those systems have to work all the time. To do such a pumping system for New York — that would produce a lot of greenhouse gases. It’s another reason why this is unsustainable.”¹⁰

In a September 12, 2018 press release New York City Council Member, Costa Constantinides, also urged the U.S. Army Corps of Engineers to factor sea level rise into plans to guard New York City against storm surges.¹¹

Today’s storm surge of 10 – 15 feet above sea-level could be more like 15 – 20 feet above sea-level by the end of the century. Both Dr. Jacob and Dr. Jackman have indicated that we can’t build our way out of this crisis and that natural and nature based measures, with strategic relocation where needed, may be the wisest course of action.

At a 2016 speech to the New York chapter of the American Institute of Architects, Dr. Jacob noted that, “We have already problems in the current sea level. We know that sea level rise will amplify those risks. We can go about it by protection, and that’s largely what we’re doing, but I think it’s not sustainable in the long run. We can do accommodation again, but it’s an interim [solution] ... And we have **strategic relocation** (*emphasis added*) ... I suggest that this is the only truly sustainable solution.”¹²

⁹ <https://www.nature.org/ourinitiatives/urgentissues/oceans/building-coastal-resilience/coastal-risk-and-resilience.xml>

¹⁰ Sarah Crean, *Storm Surge: An Interview With Climate Change Expert Klaus Jacob On NYC's Post-Sandy Future*; January 17, 2013 <http://www.gothamgazette.com/environment/4149-storm-surge-an-interview-with-climate-change-expert-klaus-jacob-on-nycs-post-sandy-future>

¹¹ <https://council.nyc.gov/costa-constantinides/2018/09/12/constantinides-urges-u-s-army-corps-of-engineers-to-factor-rising-sea-levels-into-plans-to-guard-new-york-city-against-storm-surge/>

¹² <http://newyork.thecityatlas.org/archive/klaus-jacob-transcript/>

Insufficient Time and Information Provided: Reinforcing our concern about the **lack of information** that the Army Corps has provided to the public in regards to the proposals, see the quote below from Julie Welch, Program Manager for the Stormwater Infrastructure Matters (SWIM) Coalition in a September 12 press release from the office of NYC Councilman Constantinides:

“SWIM Coalition fully supports Council Member Constantinides’ call to extend the comment period on the Army Corp’s storm barrier study and proposals. The public needs more comprehensive information. We can’t comment effectively, as is our legal right, without detailed information and data on the social, economic and environmental impacts of each alternative. **The PowerPoint slides and the fact sheet provided to the public to date are completely inadequate.** The Corps needs to publish comprehensive information about all the alternatives being considered, including the environmental impacts on the Hudson and the Harbor. We need more public meetings. The meetings recently posted for July 9-11 are too few, announced too late, and were not advertised so that the public would actually be aware. The Army Corps and the other involved agencies need to provide numerous, comprehensive and well-advertised public meetings throughout the affected area, which includes Long Island Sound, New York Harbor, New Jersey coastal waters and the Hudson to Troy.”

Westchester County Executive George Latimer also commented, “While I recognize the importance of the study’s goals, to reduce the risk of coastal storm damage; contribute to the resilience of communities, critical infrastructure, and the environment; and to enhance public health and safety, I do not believe the public has been given sufficient time or information to comment on a study of this magnitude and potential impacts.”¹³ He went on to suggest the need for an extension of the public comment period to at least 90 days and for the Corps to “provide additional information concerning the project, including more detail on the alternatives presented and some description of how the alternatives were developed.”¹⁴ Additionally, he urged the Corps to work cooperatively with the many communities in Westchester County have experienced coastal storm and flooding damage and have already taken significant actions to protect their communities, residents, environment, critical infrastructure, and improve their resiliency to impacts associated with a changing climate to support and build on the actions they already have underway. Listing these actions would be an important step in the No Action Alternative and the others under consideration.

Also inadequate is the vague map of Study Area (in green) on slide 4 of 37.¹⁵ It is very hard to tell the extent of the Study Area, and what waterfront facilities are in even in the study area. It appears to cover the entire estuary, but all the proposed storm surge measures are mainly in the Harbor and the greater NY metropolitan area.

Hudson River Foundation Studies Storm Tides:

Preliminary Evaluation of the Physical Influences of Storm Surge Barriers on the Hudson River Estuary¹⁶

Constructing large barriers at the mouths of rivers and estuaries is a potential way to mitigate flood damage from storm surges resulting from hurricanes, nor’easters, and other extreme weather events. The construction of barriers to protect the New York-New Jersey Harbor has been discussed for many years, but has gained added attention in the aftermath of Hurricane Sandy. Notably, the Corps of Engineers is considering a broad range of options to address coastal storm risks through the New York – New Jersey Harbor and Tributaries Coastal Storm Risk Management Feasibility Study (HATS), including construction of large barriers in the Harbor and Long Island Sound.

The Hudson River Foundation and the New York – New Jersey Harbor and Estuary Program commissioned a preliminary evaluation of the potential physical influences that large barriers could have on the estuary by Drs. Philip M. Orton, Professor at Stevens Institute of Technology) and David K. Ralston, Associate Scientist at Woods Hole Oceanographic Institution. A link to the report of that examination, [*Preliminary Evaluation of the Physical Influences of Storm Surge Barriers on the Hudson River Estuary*](#), is provided at www.hudsonriver.org.

¹³ *Op Cit.* Latimer October 3, 2018, News Release:

¹⁴ *Ibid.*

¹⁵ www.nan.usace.army.mil/Portals/37/docs/civilworks/projects/ny/coast/NYNJHAT/NYNJHAT%20NEPA%20Scoping%20Presentation%203%20Oct%202018.pdf?ver=2018-10-12-151150-907

¹⁶ *Preliminary Evaluation of the Physical Influences of Storm Surge Barriers on the Hudson River Estuary*, (9,686 kb - 81 pages) at: <http://www.hudsonriver.org/download/HRF-preface-to-barriers-report-ltrhead.pdf>

In the Preface to the [Report](#), HRF outlined the purpose of this study, as follows:

- Identify and evaluate possible hydrodynamic and hydrologic changes resulting from a large barrier at the Harbor's entrance;
- Evaluate the utility of existing mathematical models; and
- Identify model issues, data gaps, and research needs

"It is important to note that this was not an effort to assess the value or efficacy of surge barriers to mitigate risk to people and property associated with the threats of coastal storms and sea level rise, but the first major step in examining the potential ecosystem impacts associated with barriers in the overall evaluation of options to respond to these threats. We expect and encourage this work to:

- Provide a basis for an integrated investigation of how potential hydrodynamics changes could affect water quality, fish and marine mammal migration, larval recruitment, contaminant transport, wetlands stability, and related issues;
- Inform [Hudson Estuary Program] HEP's¹⁷ many partners, including the public agencies, utilities and civic partners represented on the Policy Committee; and
- Inform the Corps' HATS Study¹⁸ and the work of its other partners, including the New York State Department of Environmental Conservation, the New Jersey Department of Environmental Protection and the City of New York).
- Inform the Foundation's 2019 Call for Proposals for future scientific research."

The Hudson River Foundation sponsors monthly scientific seminars about the quality and management of the Hudson River ecosystem including the New York/New Jersey Harbor. On October 12, 2018, Drs. Orton and Ralston presented their report on the physical influences of proposed storm surge barriers in New York Harbor. Dr. Ralston reviewed existing literature and project and Dr. Orton spoke about modeling conducted for the New York/New Jersey Harbor to evaluate storm surge flooding during the 1821 hurricane and Hurricane Sandy, and how man-made barriers and natural systems alter flood elevations. Many of the areas with deeper flooding were former wetland areas.

A recent study extending the annual maximum storm tide in the New York/New Jersey Harbor area back to 1884 shows the height of 10-year storm tides has increased by about 72 cm (28 cm on top of the about 44 cm increase from sea level rise). Reasons for this change were postulated, including climate variability, climate change, and changes to the harbor such as loss of wetlands and deeper channels. Their modeling work set out to evaluate different approaches to reduce flooding events during hurricanes. Model outputs predict Jamaica Bay wetlands decrease local flood elevations by inches while the shallowing of deeper channels, such as the one in Jamaica Bay surrounding the wetland, reduce flood elevation by up to several feet. Placement of man-made barriers further reduced flood elevations over natural systems. But protection barriers can also multiply risk by increasing the rate water rises if the barrier is overtopped.¹⁹

Computational models have been used to examine the environmental impact of storm surge barriers in several coastal regions around the world. New York Harbor is a partially-mixed estuary and the amount of mixing varies greatly in the neap-spring tide cycle. Orton and Ralston conclude that many studies are done on harbors and estuaries that are dissimilar to New York Harbor and therefore not representative of the impact the storm surge barriers could have in New York. In particular, research has been done on barriers built on broad, shallow deltas (Netherlands Delta Works, New Orleans), on freshwater tidal rivers (Thames, Ems, Eider), and estuaries with minimal freshwater input (Oosterscheldt, New Bedford, Providence, Stamford) [Kirshen et al., 2018]. A barrier with physical scales similar to the Hudson was constructed for St. Petersburg, but the tides in the Baltic are negligible, and no large-scale studies have been done on its effects.²⁰ The Netherlands coastline is one of the more similar areas and extensive assessment has been done on the environmental impact since the barriers were built. In the Netherlands, the barrier ultimately led to disruptions in phytoplankton and salt marsh plant community growth patterns as a result of the restricted tide flow through the barriers. The reduced tide amplitude leads to more sedimentation of suspended particles allowing

¹⁷ The New York - New Jersey Harbor and Estuary Program (HEP)

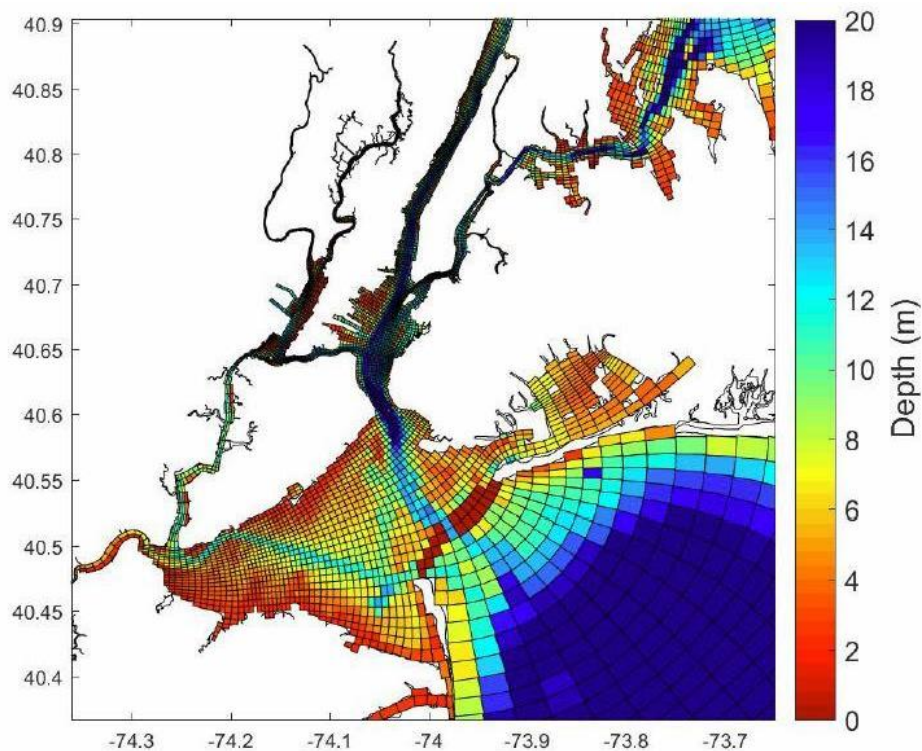
¹⁸ New York – New Jersey Harbor and Tributaries Coastal Storm Risk Management Feasibility Study (HATS)

¹⁹ Lisa Rossman, NOAA Office of Restoration and Response, Lisa.Rosman@noaa.gov in [OR&R Weekly Report](#). <https://response.restoration.noaa.gov/about/media/hudson-river-foundation-studies-storm-tides.html>

²⁰ *Op Cit.* http://www.hudsonriver.org/download/surge_barrier_report_V9.pdf

photosynthesizing organisms to thrive for longer periods in the clearer water.²¹ In Boston, models showed larger impacts on navigation. In order to understand potential impacts in the New York Harbor, Orton and Ralston applied several models and evaluated the limitations of each model.

Previous models have been constructed for a variety of coastal environments including harbors and estuaries. While each has its own limitations with regards to scale, precision, and accuracy, Orton and Ralston implement three models to present potential environmental impacts of a storm surge barrier being built in the New York Harbor as proposed by the Army Corps of Engineers in Alternative 2. Their results show changes in tidal range, circulation, stratification, and salinity of the Harbor. The effects of the storm surge barriers grow steeply with barriers that allow a flow area of 40% or less when open than without barriers. The effects were especially noticeable during spring tides. Overall, the models show less mixing in the harbor with barriers installed, leading to higher residence times and potential hypoxia. While the three models used suggest strong negative impacts, few models have been constructed for partially-mixed estuary environments such as the New York Harbor and Orton and Ralston advocate for more rigorous modeling of potential behaviors with careful consideration of model sensitivity, scale, and specific behaviors that arise with the introduction of storm surge barriers.



Example of bathymetry grid with surge barriers with a gated flow area of 44%, from NYHOPS. Dark red grid cells in the estuary-ocean entrance represent areas blocked at all times by a barrier at the location proposed by Alternative #2.

The attention given to surge barriers has generated considerable interest among a wide range of parties in the region. Proponents are hopeful that barriers may provide substantial flood mitigation benefits, while there are also concerns that these barriers pose the possibility of generating very serious ecosystem-wide impacts. As there are substantial uncertainties challenging a reliable assessment of the full range of these impacts, it is clear that relevant new and existing science will be critical in evaluating potential physical, chemical and biological effects associated with any barrier proposal.

²¹ Bakker, C., Herman, P. M. J., & Vink, M. (1990). Changes in seasonal succession of phytoplankton induced by the storm-surge barrier in the Oosterschelde (SW Netherlands). *Journal of plankton research*, 12(5), 947-972

The presentation at the Hudson River Foundation was interesting, but only began to address a proposed sea-wall, and did not answer many questions relating to the specific alternatives, which the ACE is urgently considering. Fortunately, the Corps has recently announced that it will not try to narrow their alternatives this fall, and will issue an interim report for additional comment before making a decision. This report did not focus on the implications of any of these alternatives on habitat or ecosystems, however the Hudson River Foundation has issued another RFP to begin to address the biological aspects and implications of these proposals (see below).

Hudson River Foundation's New RFP: The Hudson River Foundation announced its 2019 Request for Hudson River Fund Research Proposals. Pre-proposal deadline: Monday, November 5, 2018

The Foundation seeks to elucidate the dynamic interactions among the physical, chemical, and biological processes that are important to the Hudson River ecosystem. In particular, the Foundation encourages research in areas that are both scientifically important and relevant to current or anticipated public policy and resource management issues affecting the River and its watershed. Recognizing that both basic and applied research are fundamental to the management of Hudson River resources, the Foundation places special emphasis on research that has clearly articulated significance for policy issues identified in the management programs described below and is conducted in the context of other ongoing research and monitoring in the River and its watershed.

THE CASE AGAINST LARGE, IN-WATER STORM BARRIERS

This storm surge barrier project is likely to be one of the largest public works projects in the New York City metropolitan region over the past century and will pave the way for how the city and the region adapts to climate change. We need to get this right and that means accounting for projected sea level rise, e.g. one-foot sea level increase by 2050. Also need to account for contaminants being contained within the harbor and connected waterways as well as the impact on local wildlife. Hundreds of thousands of the metropolitan region's residents living along the shore are threatened by sea level rise.

Any coastal storm protection plan must address flooding from sea level rise; not just from storm surge. While they may be appealing as a "quick fix," the massive, in-water barriers included in several of the current alternatives would not be effective in regards to protecting against flooding from sea level rise.

In order to provide helpful and effective input, the public needs more comprehensive information about the Army Corp's storm barrier study and proposals. The public needs more detailed information, reports and data on the social, economic and environmental impacts of each alternative, including impacts on the Hudson and the Harbor (that will be used in the Army Corp's decision-making).

Dr. Klaus Jacob, a geophysicist specializing in climate change adaptation at Columbia University's Lamont-Doherty Earth Observatory, says storm barriers will not be effective in a 100-year time frame. Rising sea levels would eventually necessitate the barriers being closed most of the time, which will cause a range of problems.²²

Dr. Jacob points out that the storm barriers will likely take so long to plan and build, that many of the mitigation efforts would have to be done anyway. He argues that it makes more sense to put money towards nature-based measures; which would require far less state and federal approval and funding. "I never ruled out the mid-term utility of barriers in the next half-century or so, but I rule them out categorically if not combined with an 'exit strategy,'" by which he means, "a managed and planned retreat to higher ground when sea level renders the barrier useless."²³

Dr. Jacob, who accurately predicted subway and tunnel flooding in Superstorm Sandy, also points out that "Barriers are initially effective against storm surges, when they are closed only during storms. But when sea-level rise (SLR) becomes comparable to storm surges, say by at latest 2100, but perhaps as early as the 2050s, then the barriers need to be closed permanently to keep the rising ocean out all the time to prevent permanent flooding by inundation."

²² <https://www.metropolismag.com/cities/landscape/the-6-billion-question-coastal-cities-storm-surge-barriers/>

²³ <https://www.metropolismag.com/cities/landscape/the-6-billion-question-coastal-cities-storm-surge-barriers/>

However high you make the barriers, that's how high the flooding would be inside the barriers, because the Hudson River gets trapped behind them. "In the end, the rivers and the ocean need to equalize to whatever SLR will bring, even if storms on top of it could be kept out," Jacob said, painting a grim picture of New York City and river communities dealing with overwhelming sea-level rise all at once, instead of gradually. "The \$20+ billion to build barriers could more effectively be used for adaptation measures for the SLR scenarios we need to face," he added.²⁴

Dr. Jacob concludes that "Barriers create short-term benefits and delayed long-term liabilities, if not disastrous, delayed long-term coastal havoc. They would create intergenerational inequity by protecting us in the short term, reaping benefits for waterfront development for a few decades, while making our children and grandchildren pay the price for our reckless selfish behavior."

Riverkeeper ecologist, Dr. George Jackman, has stressed that the seawall and other proposed structures would seriously interfere with active and passive fish migration and have devastating effects on the ecology of the Hudson River.

Both have looked at the Netherlands and Germany and concluded that "we are not going to be able to build ourselves out of this" -- that as the oceans swell those who are and have been using storm barriers are having to repeatedly increase their height and width in an unending cycle to try to keep up with the ongoing and worsening problems of sea level rise, storm surges and severe weather events. In the Netherlands, which is ahead of the curve with regard to water infrastructure and flood mitigation, strategies are shifting. Increasingly, the country has moved to "make room for the river,"²⁵ or find ways to coexist with more water rather than block it out completely. After all, over the coming decades sea level rise could render today's most fail-safe infrastructure useless.²⁶

An integrated system of unobtrusive on-shore projects would be less expensive and less destructive to the region's environment and communities. These include building dunes, dykes, levies and improving natural conditions, such as wetland restoration, to handle storm surges and rising sea levels.

Connecticut Fund for the Environment/ Save the Sound offers these comments: "In-water storm surge barriers are unacceptable. ... Storm barriers spanning across water bodies, except for a few gates that would remain open during non-storm weather, would worsen water pollution by restricting tidal exchange of pollutants and sediment, impede fish migration, and result in unsafe congestion of all boat and ship traffic. The barriers could suffocate marine life by decreasing oxygen levels and increasing algae blooms due to pollutants that are no longer flushed. Sediment transport would similarly be affected."²⁷

Peter Stillman, a professor of political science and environmental studies at Vassar College, noted that storm surge barriers often raise environmental justice issues. "Unless the surge hits the barrier straight on, some of the surge and its energy will travel along the barrier and hit the places where the barrier stops much harder," he explained. In this case, the Rockaways and parts of New Jersey would receive the brunt of future storm surges, he added.²⁸ And the large, in-water barriers could be delayed by lawsuits for year -- yet another reason they may be an impractical option.

A HYBRID OR BLENDED APPROACH

According to the NACCS Report, an example of a blended solution, breakwaters manage risk of shoreline erosion by attenuating wave energy and can provide additional recreational opportunities, valuable aquatic habitat, and carbon or nutrient sequestration with wetlands incorporated into the design. Natural features, such as coastal wetlands, forests, or oyster reefs, provide environmental and social benefits and can also contribute to coastal storm risk management or resilience. Natural and Nature-Based Features (NNBF), such as engineered beaches and dunes, or ecosystem restoration projects involving coastal wetlands, forests, or oyster reefs, can provide a range of environmental and social benefits, including those related to coastal storm risk management. Nonstructural measures may reduce social vulnerability due to changing sea levels and coastal storms and can also allow for wetland migration over time or support increased

²⁴ Susan Hellauer, *A Death Threat for the Hudson River*; Nyack News and Views; July 25, 2018.

<http://nyacknewsandviews.com/2018/07/earth-matters-army-corps-of-engineers-storm-surge-barriers/>

²⁵ <https://www.scientificamerican.com/article/how-the-dutch-make-room-for-the-river/>

²⁶ <https://www.fastcompany.com/90138474/ike-dike-the-15-billion-storm-surge-barrier-houston-cant-agree-on>

²⁷ <http://www.ctenvironment.org/2018/08/25/sea-barriers-proposed-for-long-island-sound-new-york-harbor/>

²⁸ <https://ourworld.unu.edu/en/retooling-new-york-for-apocalyptic-storms>

socioeconomic benefits associated with recreation. An interesting article produced by Bill Whitaker of CBS News, "[How Dutch stormwater management could have mitigated damage from Hurricane Florence](#)" advocates for a hybrid approach.²⁹

In 1953 the Dutch experience severe flooding resulting in huge loss of life and property. It was what Dutch designer Henk Ovink calls the Netherland's Katrina moment. It actually swallowed the southwestern part of the Netherlands. The dams, dikes and levees broke and the water flowed in, taking away the lives of almost 2,000 people. Many families were ripped apart. The Dutch still refer to it as "the" disaster, because they haven't had one since – not a single death from flooding in 65 years. They've learned the lessons of the past well.

Dutch engineers now calculate how high and strong dikes and dams must be to withstand the most extreme weather – a 1-in-10,000 storm. In addition to implementing many natural and structural measures, they have also learned to give their rivers and seas elbow room, incentivizing strategic relocation in areas that are most vulnerable. One examples of combining natural and structural features is the manmade dunes protect the town of Katwijk from the sea; underneath the dunes is a large parking garage.



Dawn Zimmer was mayor of Hoboken, NJ, a city of 55,000 people, when Hurricane Sandy hit. The city was almost entirely underwater, with some neighborhoods experiencing 10-ft. floodwaters. Hoboken applied for and was awarded money from FEMA to put things back pretty much the way they were, but decided that they wanted to rebuild smarter. With Shaun Donovan, then secretary of Housing and Urban Development, they tapped Henk Ovink for President Obama's Hurricane Sandy Task force. They came up with an idea for a \$1 billion an international design competition to fix what Sandy had destroyed, following the Dutch philosophy: rebuild differently for the future, of which Hoboken was awarded \$230 million of the competition money. A Dutch design team came up with the winning plans, with a Dutch twist: a storm surge defense disguised as a park with a boathouse, benches and outdoor seating as barriers to keep the Hudson from drowning the city again. Dawn Zimmer says she is very confident that "when that next storm hits, because it's going to hit – it's not a matter of if, it's a matter of when – and [Hoboken] will be prepared and we will be a model to show that this approach can work."

Need for Environmental Economist/Costs

Need for reliable expertise: At the Corps' Storm Surge Barrier public meeting in Poughkeepsie on July 11, 2018, USACE spokespersons acknowledged that it does not have in-house expertise in environmental economics. We strongly suggested that they should therefore retain contractors that do, to ensure a valid cost-benefit analysis. Environmental economics is a well-advanced science. NYS DEC, NOAA and many other state and federal agencies have staff that specialize in this field of knowledge. Given the actual and potential costs and impacts of this project, this expertise is clearly necessary, and if not available within the Corps, should be procured as soon as possible

Costs and Avoided Costs: Estimates for the potential cost for the alternatives proposed for this project vary considerably and need to be defined by the Corps in its upcoming Interim Report. "A storm surge barrier system protecting New York City and parts of New Jersey could cost **\$2.7 million per meter**," Michael Cembalest, the asset manager's chairman of market and investment strategy, wrote in his annual "*Eye on the Market*" energy newsletter in April, 2018. He added that governments would probably struggle to pay that cost, perhaps turning to either bonds or outright privatization.³⁰

There is info on cost in "*How Dutch Stormwater Management...*" article cited above. For example, the gates alone could cost \$500 million.

²⁹ CBS News, "[How Dutch stormwater management could have mitigated damage from Hurricane Florence](#)", Sept., 23, 2018. www.cbsnews.com/news/storm-water-management-dutch-solution-henk-ovink-hurricane-florence-damage-60-minutes/

³⁰ *Climate Change Will Get Worse. These Investors Are Betting on It*; 10.08.2018 <https://www.bloomberg.com/news/articles/2018-10-08/climate-change-will-get-worse-these-investors-are-betting-on-it>

“The gates [of *The Maeslantkering storm surge barrier*] guard one of the largest ports in the world and most of the Dutch population. They don't have hurricanes like we do, but ferocious storms with hurricane-force winds can blow in from the North Sea and push in huge storm surges. When that happens, the two arms seal off the Rhine River and Rotterdam.” The gates took six years to build and **cost \$500 million**. Bill Whitaker of CBS remarked, “That's a big investment for something that you've only had to use once or twice since it was built.” To which, Henk Ovink replied, “**\$150 billion were lost in New Orleans**. I don't think I need to say more. How many people were killed? Sandy, another storm, **\$70 billion**. We [in the Netherlands] don't have those damages.”

Riverkeeper notes that If the Army Corps, New York, and New Jersey are going to spend billions of dollars – the latest figures are in the **\$140 to \$200 billion range** – on coastal storm protection, they need to be asking the right questions; doing the proper and comprehensive studies; proposing and implementing solutions that protect people, ecosystems, and our waterways, including the Hudson River; while being transparent and engaging communities throughout the affected geographical region.³¹

Need Comprehensive Environmental Impact Study on all Six Alternatives

The Corps and the public really need to understand overall Environmental Impacts **before** narrowing Alternatives to one or two options. Funds spent on such an endeavor will be well invested, if for no other reason than failing to undertake a comprehensive assessment of costs, benefits, impacts and alternatives could result in legal challenges, which would delay taking action. A comprehensive Environmental Impact Study with a complete cost-benefit analysis for each alternative as part of the alternatives analysis and assessment process before narrowing the selection would have multiple benefits to ensuring a wise, environmentally-protective and cost-effective decision-making process.

This work should coincide with the process that results in the Interim Report, which has been promised.

Consider Building in Renewable Energy Generation

Tidal Generating Stations: If the Army Corps does decide to build a structural barrier, it might consider attempting to harness the power of the tides as a valuable feature of the project. One example is the **Annapolis Royal Generating Station**, a 20 [MW](#) tidal power station located on the Annapolis River upstream from the town of Annapolis Royal, Nova Scotia, Canada.³² It is the only tidal generating station in North America, and one of only a few in the . This dam and generating station harnesses the tidal difference created by the large tides in the Annapolis Basin, a sub-basin of the Bay of Fundy. Opened in 1984, the Annapolis Royal Generating Station was constructed by Nova Scotia Power Corporation, which was, at the time, a provincial government Crown corporation that was frequently used to socially benefit various areas in the province. It is one of only a few in the world that generate power from tidal fluctuations. High tides flow thru the dam and are trapped behind it, then released at lower tide thru turbines to generate power.



Turbine being lowered into the Bay of Fundy, where it is anchored to the bottom to capture tidal flows for power generation.

They are experimenting with how to harness the tidal energy on the huge bay. The picture above is of a turbine that is being lowered into the huge Bay of Fundy. It's anchored to the bottom and has flexible blades, since earlier fixed blades were unable to stand the enormous stresses and cracked. If there were an environmentally sound and cost effective way to harness all the tidal energy of the Bay of Fundy, it would supply all of Nova Scotia's power needs.

Impacts on Soil and Wildlife: While effectively generating electricity, the blocking of water flow by the dam (to allow the tidal difference to accumulate every six hours) has resulted in increased river bank erosion on both the upstream and downstream ends. The dam is also known as a trap for marine life. Two notable cases occurred in:

³¹ <https://www.riverkeeper.org/general/riverkeeper-testifies-at-nyc-council-hearing-on-storm-barrier-study/>

³² https://en.wikipedia.org/wiki/Annapolis_Royal_Generating_Station Photo courtesy of Caroline Paulson.

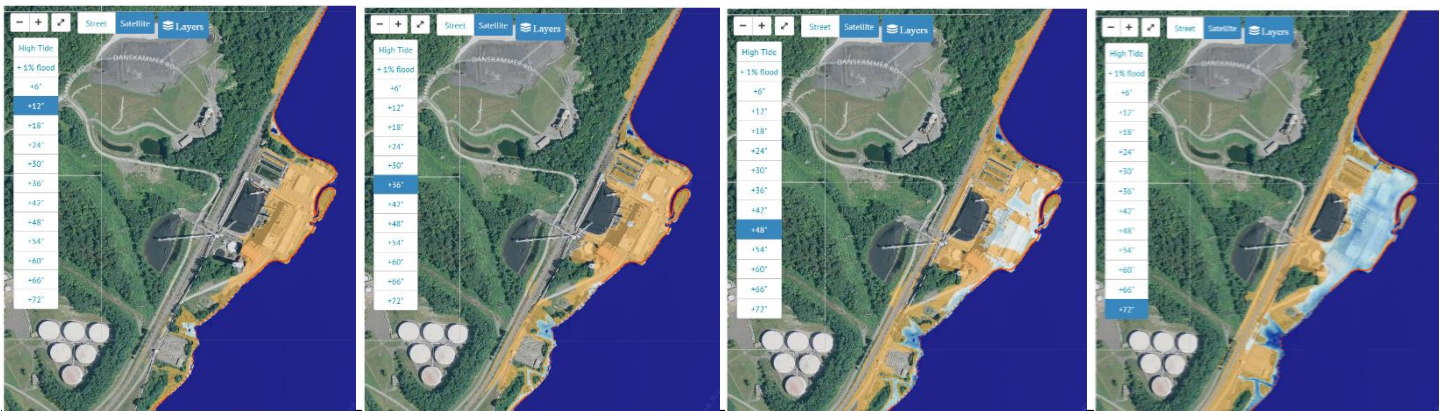
- August 2004: a mature Humpback whale (nicknamed *Sluice*) swam through the open sluice gate at slack tide, ending up trapped for several days in the upper part of the river before eventually finding its way out to the Annapolis Basin.
- Spring 2008: the body of an immature Humpback whale was discovered near the head of tide in the river at Bridgetown; a post-mortem was inconclusive but suggested the whale had become trapped in the river after following fish through the sluice gates.

If the Corps is to build a sea-wall or other structure that could harness the power of the tides, it should invest in research to see if there is a way to do so without harming the ecosystem or wildlife living in the Harbor and beyond.

Special Cases: Although it is not clear what exactly the Study Area includes, Clearwater would like to call the Corps’ attention to two special cases in the Hudson River Estuary. The first, the proposed year-round, baseload fossil fuel burning power plant located just north of the Newburgh-Beacon Bridge, is an example of a planning strategy that can reduce the need for storm surge barriers by respecting the inevitability of sea-level rise and storm surges and wisely deciding against building in a floodplain. The second, the case of Indian Point Nuclear Power Facility, embodies the need to look closely at shoreline facilities that produce or store hazardous, or in the case highly radioactive materials, structures and waste – and to ensure regulatory solutions that will protect public health and safety.

Building in the Floodplain: Proposed Danskammer Power Plant in Newburgh; other power plants and critical infrastructure

Danskammer is a 65-year old power plant located on the shores of the Hudson River in the Town of Newburgh. After being severely damaged by storm surges and flooding during Hurricane Sandy in 2012, the older coal-burning facility was closed and mothballed – considered to no longer be a viable source of electricity by the New York Independent System Operator (NYISO). Then, incentivized by the Lower Hudson Valley Capacity Zone and other market capacity incentives, Mercuria renovated the plant from coal-burning to a gas-fired peaker facility, which currently operates less than 10% of the time, burning so-called “natural gas” with oil as a backup fuel. The existing facility has four operating steam turbine generators with a combined nominal capacity of 511 MW. Tiger Infrastructure now proposes to build a \$400 million gas-fired baseload power plant (525 – 575 MW) in its place on the same 180-acre site, Danskammer Point, jutting out into the river that will be subject to increasing flooding as climate change worsens. Sea-level is now predicted to rise 4’ – 6’ by the end of this century. As sea level rises and storms increase in intensity, the Danskammer site will flood repeatedly and will ultimately be under-water. Scenic Hudson’s [sea level rise mapper](#) demonstrates this very clearly.



Screen shots of Danskammer Point at 1-foot, 3-foot, 4-foot and 6-foot sea level rise.

Because the new plant will be a baseload facility -- operating all the time – it will emit more greenhouse gasses and other pollutants than the current facility, which will impact air quality in the City and Town of Newburgh as well as other nearby communities for years to come.

It also should be noted that the methane gas that would be its primary fuel should no longer be referred to as “natural” because it is now almost always obtained by hydraulic fracturing. This has significant impacts at the fracking site and all along the chain from fracking, through processing, and transportation along pipelines and at compressor stations and

beyond – with well-documented releases of fugitive methane – a very highly potent greenhouse gas, much worse than carbon dioxide. The term “natural gas” was used to refer to the now rare underground pockets of methane that were more easily captured by simple drilling. Fracked methane gas has significant environmental and climate impacts and should never be considered “natural” or thought of as a “bridge fuel”.

Preventing this fool-hardy construction is one of the resilience principles the Army Corp should employ. The Corps should also consider other power plants and pipelines located along the shores of the Hudson and other tributaries to NY Harbor. Water and waste water plants, hazardous waste and brownfields sites, and railroads located in low-lying areas all present similar challenges.

Endangered Shorelines



Nuclear Power

Special Case: Indian Point During Superstorm Sandy in October 2012, when Indian Point nuclear power plant faced an 11' storm surge, the Nuclear Regulatory Commission (NRC) allowed the facility to continue to operate. However, loss of power in New York City resulted in an unplanned, emergency shutdown – known in the nuclear industry as a “SCRAM” – at both Indian Point in Buchanan, and at Nine Mile Point, across the state in Oswego – also due to a grid disturbances.³³ Both Clearwater and Riverkeeper had called the RC to urge precautionary closure, but the NRC claimed that under current regulations, the storm surge would have had to reach 15' for them to order a safer, planned shutdown. Other sources say there is currently no protocol for planned shutdown in the face of storm surges, but there are for wind speed. This needs to be clarified. Scrams produce pressure that usually leads to the venting of radioactive vapor. Plant operators and the NRC will say that these releases are well within “permissible” levels – however, “permissible” is the same as “safe.”

During Superstorm Sandy, Oyster Creek in Ocean County, NJ was already closed for refueling, but the highly radioactive spent fuel rods stored in it fuel pools were at risk of loss of power to the pumps needed to circulate cooling water.³⁴

These are exactly the kind of regulatory issues that must be addressed as we face sea level rise, increasingly severe storms and storm surges moving forward. Indian Point’s reactors are scheduled to shut down in 2020 and 2021, but approximately 1750 tons of highly-radioactive waste will remain on site stored in fuel pools and dry cask storage, perhaps indefinitely. Clearwater and Riverkeeper are actively working to promote the safest possible decommissioning of this facility with a just transition for plant worker. Nine Mile Point and two other nuclear plants in western NY are slated to close in approximately 2030, and also have huge amounts of radioactive waste on site. The Army Corps of

³³ *Superstorm Sandy Shows Nuclear Plants Who’s Boss* <https://capitoilette.com/2012/10/30/superstorm-sandy-shows-nuclear-plants-whos-boss/>

³⁴ Ibid.

Engineers should take an active role in seeking protective policies with regard to nuclear plant operations and the storage of highly radioactive nuclear waste on the shores of the Hudson and other rivers and their tributaries.

Threats from Sea Level Rise or Storm Surges

CLIMATE CHANGE: A CRISIS, NOT A THEORY



Hurricane Sandy,
22-ft. storm surge





FACT:
The Hudson River flows only a few feet above sea level.

FACT:
Sea level rise could be 6 feet – or more – this century!



Danskammer: Proposal to build a \$400 million gas-fired, year-round baseload power plant in floodplain.



Nuclear Waste should NOT be stored in a floodplain. The longer nuclear power plants run, the more highly radioactive nuclear waste they generate – and the climate crisis now upon us wasn't foreseen or taken into consideration when these plants were originally designed, built and permitted. At Indian Point, the waste in the fuel pools is at a much lower elevation than the canisters of fuel stored in dry cask storage. Issues of canister and cask safety remain, but the fact that the waste in dry cask storage is out of the reach of storm surges for the foreseeable future is reassuring. However, in many areas around the country spent – but still highly radioactive – spent fuel rods ARE stored in a floodplain. San Onofre in San Clemente CA is a classic and highly dangerous example of this. Nine nuclear plants are within 2 miles (3 kilometers) of the ocean and four reactors [have been identified by Stanford academics](#) as vulnerable to storm surges and sea-level rise, flooding is common, according to David Lochbaum, a former nuclear engineer and director of the nuclear safety project at the Union of Concerned Scientists (UCS). An interactive map from [Carbon Brief](#) shows the location of nuclear power plants around the world. According to [maps](#) prepared by the [World Association of Nuclear Operators](#) (WANO), around one in four of the world's 460 working commercial nuclear reactors are situated on coastlines. Many were built only 10–20 meters (30–70 feet) above sea level at a time when climate change was barely considered a threat. Lochbaum notes that [over 20 flooding incidents](#) have been recorded at US nuclear plants since the early 1980s. "The most likely [cause of flooding] is the increasing frequency of extreme events."³⁵

³⁵ Entergy Unveils Plan for New Spent Fuel Storage Pad at Pilgrim <https://www.capecod.com/newscenter/entergy-unveils-plan-for-new-spent-fuel-storage-pad-at-pilgrim/>

“There was no consideration of climate change when most US plants were built,” says Natalie Kopytko, a University of Leeds researcher who has studied nuclear power plant adaptations to climate change. “They used conservative models of historical reference. Also, they were largely built at a calm period, when there were not many major storms.”³⁶ “While an accident has never yet happened due solely to sea-level rise and storms, the flooding experienced at Fukushima resembles what could occur in the future from sea-level rise,” says Kopytko, and the most comprehensive research yet conducted also shows [sea-level rises are accelerating](#) as ice caps melt.³⁷

The other thing that was not taken into consideration was the length of time after decommissioning that nuclear waste would be stored on site. It was assumed that a national repository would be selected, built and operational by the time these now more than 40-year old plants were closed. However, there has been no real progress in this regard. Yucca Mountain is not a geologically sound solution and transportation of nuclear waste across the country through major cities on bumpy roads or rails is a highly dangerous prospect. These are important considerations as the Army Corps goes through its planning process regarding storm surge barriers.

In England, a 41-ft. high, 3,000-ft. long defensive concrete seawall is being planned at Hinkley Point C Nuclear Station, at a cost of \$25 Billion. Regulators and engineers hope it will withstand the strongest storm surge, the greatest tsunami and the highest sea-level rise. However, independent nuclear consultant, Pete Roche, a former adviser to the UK government and Greenpeace, points out that the tidal range along this stretch of coast is one of the highest in the world, and that erosion is heavy and notes that the new seawall does not adequately take into account sea-level rise due to climate change. Plans were drawn up before the increasing volume of melting of the Greenland ice cap was well understood. “Now estimates of sea level rise in the next 50 years have gone up from less than 30 centimeters to more than a meter, well within the operating lifespan of Hinkley Point C — let alone in 100 years’ time when the reactors are finally decommissioned or the even longer period when spent fuel is likely to be stored on site,” says Roche.³⁸

On a positive note, recently Entergy agreed to move the 46 years of highly radioactive fuel rods stored at Pilgrim Nuclear Power Station from 25 feet to 75 feet above mean sea level and 700 feet from the shore of Cape Cod Bay in Plymouth, MA, when the plant closes in June, 2019.^{39, 40}



Pilgrim Nuclear Power Plant, like so many others, is located on what may become a floodplain -- and in some cases already is.

Long Island and other neighboring regions

Clearwater expresses our support for similar concerns being raised by numerous organizations, officials and many more who are calling on the Army Corps to undertake a more thorough economic and environmental analysis of the proposed alternatives, and to consider likely impacts throughout the entire affected area, including Long Island Sound as well as Long Island’s South Shore Estuary Reserve (especially the western extent of the Reserve).

The issues that must be assessed in detail in the Environmental Impact Statement and prior to the elimination of any alternatives include, but are not limited to, the following:

- Potential deflection and induced flooding into coastal communities (especially to the low-lying and vulnerable communities), potential resulting harm and necessary mitigation measures to protect these communities from even further flooding.
- Impacts on tidal flushing, as related to pollutants and sedimentation, both inside and outside of barriers.
- Impacts to fish migration, and threatened and endangered species.
- Impacts to other coastal resiliency measures, due to location of construction and changes to waterbody channelization and flow.

³⁶ Ibid.

³⁷ Ibid.

³⁸ Ibid.

³⁹ *Decision by Entergy Corp. is welcome news for Pilgrim activists* <https://www.capecodtimes.com/news/20181026/nuclear-waste-to-be-moved-to-higher-ground>

⁴⁰ *Entergy Unveils Plan for New Spent Fuel Storage Pad at Pilgrim* <https://www.capecod.com/newscenter/entergy-unveils-plan-for-new-spent-fuel-storage-pad-at-pilgrim/>

- Potential disturbance of polluted sediments.
- Impacts to the shorelines of coastal communities, e.g. shoreline erosion.
- The potential for natural and nature-based measures at the core of these alternatives, rather than merely supplementary.
- Criteria relied upon to determine location of storm barriers, including demographics of surrounding communities.

It is important that the Army Corps study take into consideration the information presented within the Long Island Sound Comprehensive Conservation and Management Plan (2015) and ensure that any selected alternative(s) comply with its goals. This study is the long-term plan for Long Island Sound and was prepared and adopted by the Long Island Sound Study (a partnership of the US EPA and the States of New York and Connecticut to restore and protect the Sound). The study should do the same in regards to the South Shore Estuary Reserve Comprehensive Management Plan; ensuring that any selected alternative(s) comply with its goals.

Finally, Clearwater requests that communities around Long Island Sound and along the South Shore Estuary Reserve be included in the public comment process for the upcoming Interim Report and Draft EIS, with analyses conducted throughout the entire affected area.

Conclusion and Recommendations:

Clearwater and other stakeholders need more information to make informed comments, including a document that contains:

- Clearly identified the Study Area
- Specifically, which municipalities are within the Study Area and beyond are already doing, so that we can better understand Alternative 1, the No Action Alternative.
- Specifically, what infrastructure is proposed for each of the other alternatives, including both natural and nature-based measures and structural features.

USACE needs to:

- Perform a comprehensive Environmental Impact Study with a complete cost-benefit analysis for each alternative as part of the alternatives analysis and assessment process **before** narrowing their selection
- Create an accurate cost-benefit analysis of each of the proposed alternatives, which includes the financial and ecological life-cycle costs for construction and maintenance and the value of carbon storage, room for accommodating storm surges, flooding and sea-level rise.
- Retain an environmental economist, who can and will include the economic value of carbon sequestration and the environmental cost of the energy and materials mined, harvested and processed
- Consider revised predictions of sea-level rise for each of the proposed alternatives.

Clearwater's major concern regarding massive hardened structural storm surge barriers is the impact they would have on the ecosystem of the Hudson River and its tributaries and on outlying regions during a hurricane or a severe weather event and with the now unavoidable magnitude of sea level rise. If a valid, life-cycle cost-benefit analysis is performed many of these negative impacts can be avoided, in favor of more cost-effective alternatives.

Thank you for considering these comments. We look forward to learning more as this process continues and to offering comment on an ongoing basis.

Sincerely,

Manna Jo Greene

Manna Jo Greene, Environmental Director
 Hudson River Sloop Clearwater, Inc.
 724 Wolcott Ave., Beacon, NY 12508
 845-265-8080 x 7113 845-807-1270 (cell)
mannajo@clearwater.org www.clearwater.org

