

STATE OF NEW YORK
COMMUNITY DEVELOPMENT BLOCK GRANT
DISASTER RECOVERY (CDBG-DR) PROGRAM
NON-SUBSTANTIAL AMENDMENT NO. 19

January 16, 2018

Additions to: New York State Action Plan Incorporating Amendments 8-17

In sections: Rebuild by Design Projects

Summary:

Action Plan Amendment 19 (APA 19) will address the following items:

- A. *Living Breakwaters: Tottenville Pilot*: Provides updates to the project description to address HUD requirements associated with the Living Breakwaters Rebuild by Design (RBD) project.
- B. *Living with the Bay: Slow Streams*: Provides updates to the project description to address HUD requirements associated with the Living with the Bay RBD project.

Changes are indicated in red text.

A. Living Breakwaters: Tottenville Pilot

Description of changes: In approving the State’s Action Plan Amendment 15 on June 16, 2017, HUD required GOSR to make edits to its Action Plan to include additional detail regarding the Rebuild by Design projects in accordance with the *Federal Register* Notices at 79 FR 62184 and 81 FR 54114. This amendment includes all the additional detail required.

From page 109 of the New York State Action Plan:

Table 36: New York State awarded proposals

Project	Location	Total Project Cost	CDBG-DR Allocation
Living Breakwaters: Tottenville Pilot	Richmond County	\$75,500 70,000,000*	\$60,000,000
Living with the Bay: Slow Streams	Nassau County	\$125,000,000**	\$125,000,000

*At ~~39~~preliminary 60% design; **In final scoping and preliminary design phase

From pages 109-117 of the New York State Action Plan:

Living Breakwaters: Tottenville Pilot

National Objective: Low- and Moderate- Income and Urgent Need

Eligible Activity: Rebuild by Design

CDBG-DR Allocation: \$60,000,000

Project Description: Richmond County (Staten Island), one of the City of New York’s five boroughs, sits at the southernmost part of New York State. The island is at the mouth of the New York Bight, the waters off the Atlantic Coast extending from the Cape May Inlet in New Jersey, to Montauk Point on the eastern tip of Long Island. The tidal waters surrounding the Borough shape its myriad industries; transportation, housing, and culture. In October 2012, Superstorm Sandy devastated Staten Island’s east and south shore neighborhoods. The driving wave action bombarded the coastline, damaging or destroying an unprecedented number of Staten Island homes and businesses, resulting in loss of life and significant harm to the local economy. Tottenville, a community at the southernmost point of Staten Island, experienced some of the most destructive waves in the region during Superstorm Sandy. Historically known as “The Town the Oyster Built,” the community was once protected by a wide shelf and series of oyster reefs, much of which was harvested by local oystermen. Today, much of the shore of Staten Island is void of these natural systems, and remains exposed to wave action and coastal erosion.

Figure 4: Map of Staten Island And New York Bight



Living Breakwaters: Tottenville Pilot (Living Breakwaters) is an innovative coastal green infrastructure project that aims to increase physical, ecological, and social resilience. The project is located in the waters of Raritan Bay (Lower New York Harbor), along the shoreline of Tottenville and Conference House Park, from Wards Point in the Southwest to Butler Manor Woods in the Northeast. The project area is a shallow estuary that has historically supported commercial fisheries and shell fisheries. This project also fulfills New York City's Resilience Plan Coastal Protection Initiative 15ⁱ.

The Living Breakwaters project consists of both on-shore and off-shore components:

- (1) A system of specially designed off-shore breakwaters which will attenuate waves and physical habitat enhancements on the breakwater system, including shellfish (oyster) restoration on the breakwaters (along with an area of shoreline restoration along the shoreline); counteract beach erosion;
- (2) Ecological Oyster cultivation Ecological enhancement and activities, including supporting future oyster restoration including: Oyster cultivation, (hatchery expansion, remote setting facility, etc.), shell collection and curing, and the installation of permitted oyster nurseries;
- (3) A community Water Hub and accessory seasonal dock. The Water Hub is an on-shore: A public facility space (building and site) shoreline treatments that will provide enhance would provide a physical space for access to the waterfront as well as a location for orientation, education and informational information on shoreline resiliency, community gathering space and equipment storage for NYC Department of Parks and Recreation (NYCDPR) maintenance; and
- (3) Programming including educational, stewardship, and capacity building informational activities related to the above shoreline resiliency and the breakwaters; and
- (4) Shoreline restoration to provide sand fill to a segment of the beach which has experienced significant erosion up to and including Superstorm Sandy (at the rate of approximately 2 feet per year from 1978 to 2012).

In addition to the Living Breakwaters project components described above, an additional project was proposed by the Staten Island New York Rising Community Reconstruction (NYRCR) Committee Plan. Working collaboratively with the NYCDPR NYC Department of Parks and Recreation (NYCDPR) and the New York City Mayor's Office of Recovery and Resiliency, the Tottenville Shoreline Protection Project (TSPP) would will provide shoreline protection features as a coastal resiliency strategy for the Tottenville area from approximately Carteret Street to Page

Avenue. The TSPP ~~would be~~ is a separate project from Living Breakwaters, but the two projects ~~would will~~ complement each other to reduce risk, enhance ecology, and foster community and stewardship along the Tottenville shoreline. The environmental review of both projects ~~will be~~ is jointly addressed in a single Environmental Impact Statement (EIS). ~~If approved,~~ The TSPP ~~would will~~ be designed by a separate design team from the Living Breakwaters project however, the design of the two projects ~~would will~~ be coordinated given their overlapping objectives and functions.

~~The Living Breakwaters is a comprehensive approach to resiliency through two components:~~

- ~~1. **Off-Shore:** The construction of a system of breakwaters along the coast of Tottenville to attenuate wave energy, addressing both event-based and long-term shoreline erosion along with preserving beach width, and providing habitat for marine ecologies. The project also includes an area of shoreline restoration.~~
- ~~2. **On-Shore:** The construction of an on-shore community Water Hub to promote social resiliency. The Water Hub will provide a place for community education on coastal resiliency efforts directly tied to and building off the structural components of the Living Breakwaters project.~~

~~The Living Breakwaters project would~~ significantly complement the TSPP noted above. Throughout the development of the Living Breakwaters project, the design team worked closely with many community partners, including the Staten Island NYRCR Planning Committee, ~~(Committee).~~ The Living Breakwaters project design team ~~would will~~ work closely with the design team of the TSPP. The TSPP ~~may will~~ include a system of shoreline protection treatments including an earthen berm, stone-core sand-capped ~~hybrid dune, eco-/revetment, eco-revetments~~ and ~~an armored~~ raised pathway. The project ~~would will~~ support the goals of Living Breakwaters – helping to protect communities from damaging wave action and ~~improve erosion as well as improving~~ access to the waterfront, ~~while also providing a level of protection from coastal flooding.~~ While independently valuable, the TSPP ~~would will~~ be further strengthened by the Living Breakwaters project, as the breakwaters will protect the dunes, the adjoining beach area, and other on-shore project elements against harmful effects caused by coastal erosion. As mentioned above, the State will be coordinating design efforts of both the Living Breakwaters and the TSPP with various New York City agencies and through the environmental review.

Since the approval on April 13, 2015 by HUD of New York State's Action Plan Amendment 8 (APA 8), the Living Breakwaters project has progressed from conceptual plan ~~through the 30 to a preliminary 60%~~ design phase. Throughout the planning ~~and,~~ design and engineering ~~phase,~~ the State has worked closely with the design teams as well as with the State's environmental team to further identify the technical challenges and solutions needed to construct this ground-breaking project. The State has consulted various federal, State and city agencies, as well as non-governmental organizations, on project design. The State has filed for the necessary permits to construct the Living Breakwaters project and has published the Draft ~~Environmental Impact Statement (DEIS) EIS~~ for the project. On April 1, 2015, the State published the *Coastal and Social Resiliency Initiatives for Tottenville Shoreline, Staten Island, NY – Environmental Impact Statement Draft Scope of Work*ⁱⁱ (Draft Scope of Work). Along with the opportunity for the public to provide input on APA 8, the State held two public hearings on the Draft Scope for Work for the project. On April 1, 2016, the State published the ~~Environmental Impact Statement EIS~~ Final Scope of Workⁱⁱⁱ and provided responses to all comments received through the public comment process. ~~On March 24, 2017, the State published the Draft EIS, offering interested stakeholders the~~

opportunity to comment through May 8, 2017. The Final EIS is expected to be filed before the end of calendar year 2017 or Quarter 1 2018. In addition, the State formed a Citizens Advisory Committee (CAC) for the Living Breakwaters project to provide an additional opportunity for the public to advise the State on design of the project.

Throughout the design phase, the State expanded its technical team to ~~include a vendor that acted as~~ an independent peer reviewer on all design elements of the project and deliverables by the design team.

Off Shore: Living-Breakwaters System

The off-shore breakwaters consist of a series of ecologically enhanced breakwater segments off ~~of~~ the southwestern tip of Staten Island. Made of a combination of hard stone and biologically enhanced concrete armor units, the breakwaters are rubble mound structures. The system has been designed to reduce or reverse erosion (grow beach), and reduce coastal storm risk through wave attenuation.

A network of ecological enhancements integrated into the breakwater's physical structure ("reef streets," "reef ridges" and water retaining elements) and targeted material selection (bio-enhancing concrete) are aimed to increase biodiversity by providing various ecological niches and improving the ecosystem services provided by the structures. The project will also include ecological restoration activities by creating new habitat in Raritan bay, which would also be amenable to active restoration of bivalves such as eastern oysters (*Crassostrea virginica*) on and within the breakwaters, as well as an oyster nursery system (floats, anchors and oyster trays) and bottom placement of "spat" (juvenile oysters) attached to shells.

Living Breakwaters is currently at ~~a 30preliminary 60%~~ design level, with 60% ~~and 100%~~ design expected to be completed through the final permitting and environmental review stage. 100% design is anticipated to be completed by the end of 2018.

Breakwaters System

The breakwaters system ~~will include an estimated 10~~ at the preliminary 60% design stage includes a 9 breakwater segments, with approximately 3,930 linear feet of breakwaters in total. The breakwaters will be located between ~~200730~~ and ~~2,1001,200~~ feet offshore and in water depths of approximately 2 feet to 10 feet below mean low water (NAVD88). They will be set back a minimum distance of 500 feet from the Federal Navigation Channel with most project segments set back between 1,000 and 1,500 feet from the channel.

While the breakwater segments are similar in character and construction, three breakwater types, defined largely by their differences in crest elevation and overall height, are being employed in the ~~30preliminary 60%~~ design to meet the different bathymetric conditions, shoreline conditions, and priorities within each project zone. Each breakwater type differs in length and crest height (and thus, width). Side slopes are the same for all breakwater types. In addition to the main (traditional) breakwater segment, the breakwaters are being designed to include "reef ridges" and "reef streets". These rocky protrusions (reef ridges) and the narrow spaces between them (reef streets) on the ocean-facing side of the breakwaters, will create diverse habitats including interspaces of narrow rocky conditions within the intertidal (littoral) and subtidal (sublittoral) zones composed of textured surfaces and water retaining elements (in the intertidal zone).

The breakwaters will be primarily constructed as rubble mound (rock) structures with a bedding layer, stone core and outer layers consisting of armor stone or bio-enhancing concrete armor units.

In the subtidal and intertidal areas, up to one third of the armor stone will be bio-enhancing concrete units rather than stone, creating an “enhanced” habitat surface. The bio-enhancing concrete units will be integral components of the breakwater, functioning structurally as any stone armor unit would. But, unlike typical stone, the bio-enhancing concrete units are specially designed to promote biological recruitment. The units use special concrete admixtures as well as textured surfaces to promote biogenic accretions and micro-habitat and biological community development. Some units will receive additional surface treatments beyond the basic surface texture; such treatments will include: fish hubs; ~~oyster~~-shell containers; tidal planters; ~~oyster~~ hatchery units; and tidal pool units.

Figure 5 – Living Breakwaters at Preliminary 60% Design



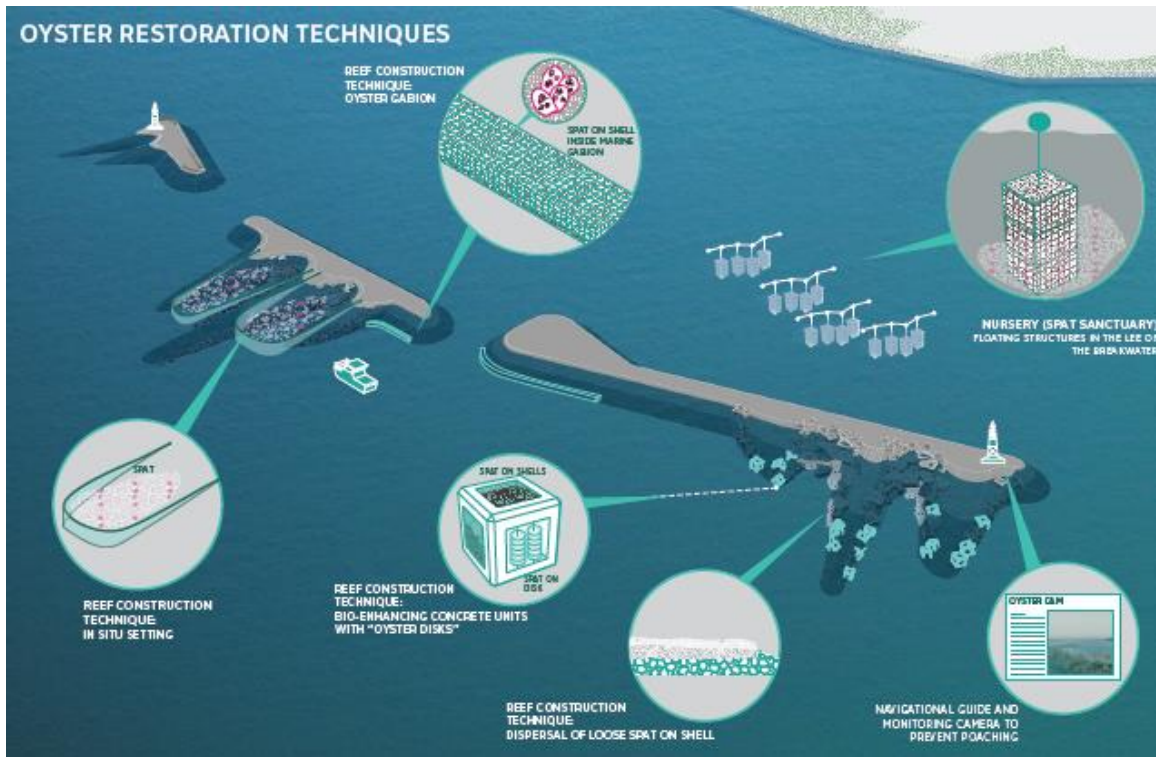
Active Restoration

~~A floating dock to be moored offshore, Under the breakwaters regulatory oversight of the New York State Department of Environmental Conservation (NYSDEC) and the US Army Corps of Engineers (USACE), active bivalve, including oyster restoration activities, will provide access to the breakwaters and surrounding waters for restoration, research be studied and education activities run developed as part of the post-construction ecological enhancements. These efforts will be by the New York Harbor Foundation’s Billion Oyster Project (BOP), and potentially which is implementing other non-profits or academic institutions. The dock will be accessible by water craft launching from the Water Hub, but should also accommodate research vessels.~~

Active Restoration: Proposed Oyster Installations

~~Active ongoing oyster restoration efforts and studies within other New York City waterways. Subject to ongoing scientific study activities and permitting, active restoration on or adjacent to the breakwaters will may include: incorporation of spat placement into a small percentage of the bio-enhancing concrete units, the use of oyster shell gabions (nonstructural units), spat on shell (placed in reef streets and potentially adjacent to the breakwaters), oyster nurseries and in-situ setting pilots. The oyster gabions will would use the same design being employed in the other oyster restoration projects in other harbor locations as part of the Hudson Raritan Estuary Comprehensive Restoration Plan. Spat-on-shell installations will would be based on techniques developed and deployed during the Oyster Restoration Research Project, and oyster nurseries will be based on designs developed and currently in place or being installed by the BOP at Governors Island, Wallabout Bay and Jamaica Bay. Additional oyster cultivation efforts are being implemented for study prior to breakwater construction in order to support the oyster installations described active restoration activities.~~

Figure 5: Proposed Oyster Restoration Techniques



Shoreline Restoration

The project includes a targeted area of shoreline restoration along approximately 800 linear feet of shoreline between Manhattan Street and Loretto Street. This one-time shoreline restoration will ~~be used to construct a beach berm and establish a new shoreline~~ restore it to its 1978 condition, at this narrow and erosion-prone location. The shoreline of the newly filled beach will change somewhat over time, but the breakwater system will hold the newly established shoreline, generating ~~a net~~ approximately a 50-foot increase in beach width from the current condition.

~~On-Shore:~~ Social Resiliency

Along with the living breakwaters, the project includes social resiliency plans. The ~~community~~ Water Hub₂ will provide a gathering space for lectures, ~~and~~ community meetings, and other necessary public use events thereby increasing community awareness of the benefits provided by the other elements of the project and enhancing the community's social resilience. The Water Hub will ~~join existing~~ provide a venue for public and private programming ~~exhibitions~~ as well as on-site ecological educational space and facilities. The Water Hub will provide the educational and programmatic support necessary to introduce the Living Breakwaters project to the surrounding community and visitors, provide resources and support to educators, and offer direct waterfront access and recreation opportunities to residents. ~~It is anticipated that the Water Hub will be located at the east end of Conference House Park, near the foot of Page Avenue, or in the west end of Conference House Park in or near an existing Parks building. An accessory seasonal dock would also compliment the Water Hub and provide direct water access from the shoreline.~~ In developing the concept for the Water Hub, the State and design team worked with the Living Breakwaters CAC and the public to identify opportunities for programming ~~at the facility~~. This was the main driver for the size and location of the ~~facility's space~~. ~~Schematic design followed by 100% design for the~~

~~Water Hub and accessory seasonal dock is expected to be completed in 2017. During these design phases, operating partners will be formally identified, and construction is expected to follow in 2018. After undertaking a feasibility study of alternatives, including constructing a new building at Page Avenue and the renovations of existing historic structures in Conference House Park, both of which presented challenges to implementation, a third option is being considered for this aspect of the project. Rather than occupying a building on-shore the third option for the water hub would take the form of: 1) A mobile US Coast Guard-certified passenger vessel which can directly access the breakwaters and is equipped to provide educational, monitoring and stewardship activities onboard (it would be owned and operated by the BOP); and 2) an on-shore system of informational, interactive and wayfinding elements on the shoreline at key vantage points.~~

~~The~~ BOP and the New York Harbor School – operated by the New York Harbor Foundation^{iv}, a non-profit organization – are critical partners in the Living Breakwaters project to bolster Staten Island’s social resiliency. In 2016, GOSR entered into a subrecipient agreement with the New York Harbor Foundation to provide funding for their work on the Living Breakwaters project. BOP plans to restore one billion live oysters to New York Harbor over the next 20 years while educating thousands of youth in the region about the ecology and the economy of their local marine environment. The Living Breakwaters project builds on this foundation by working with the schools, businesses, nonprofits, and individuals that ~~comprise BOP, to cultivate~~ engage with BOP, to provide new opportunities to study and develop plans for the cultivation of oysters and grow existing and new educational programs. Through the expansion of this coastal stewardship and educational programming, the Living Breakwaters project design fosters a vibrant, water-based culture, and invests in students, shoreline ecologies, and economies. Promoting stakeholder participation in local communities will organically create local stewards ~~organically, ensuring, helping to ensure the~~ long-term ~~impacts~~ success ~~impact~~ of the Living Breakwaters ~~project~~ project’s social resiliency components.

Citizens Advisory Committee

The Living Breakwaters CAC was officially formed in July 2015, and is comprised of local and regional stakeholders with diverse backgrounds. Up to ~~2025~~ members may serve on the CAC. GOSR encourages applicants from all cultures and socioeconomic backgrounds in order to represent the diverse communities across Staten Island and the region. Representatives are selected by the State through on-line application submissions, or through paper submissions. The CAC has two-designated co-chairs. Serving in an advisory role, the CAC members not only represent residents of Tottenville and the adjacent communities in Staten Island, but educators, ecologists, and interested citizens from the larger New York City and New Jersey region. As of ~~January~~ October 2017, the CAC has held ~~six~~ seven public meetings and all presentations from CAC meetings are made available on GOSR’s website (<https://stormrecovery.ny.gov/>).

Benefit Cost Analysis

A Benefit Cost Analysis (BCA) for the Living Breakwaters project was prepared following the HUD BCA Guidance provided in a HUD Guidance Notice (CPD-16-06). The analysis was completed using generally accepted economic and financial principles for BCA as articulated in OMB Circular A-94.

The project’s cumulative present value of net benefits is \$13.7 million and the Benefit Cost Ratio is 1.22. These measures of project merit demonstrate that the project is viable and ~~would~~ will add

value to the community, the environment and the economy. Using a 7% discount rate, and a 50-year planning evaluation horizon, the project will generate significant net benefits to the shoreline community of Tottenville, Staten Island, New York, as well as other beneficiaries from the New York metropolitan region, and regional visitors who use this community asset.

According to the BCA, the lifecycle costs to build and operate the Living Breakwaters project (amounting to \$62.4 million in constant 2016 present value dollars) ~~would~~will generate the following quantified benefits (not including qualitative benefits that cannot be quantified):

Total Benefits of \$76.1 million, of which:

- Total Resiliency Values are \$53.2 million
- Total Environmental Values are \$11.6 million
- Total Social Values are \$8.3 million, and
- Economic Revitalization Benefits are \$2.95 million.

The project's future annual benefit and cost streams, projected over the 50-year horizon were also subjected to a sensitivity analysis examining the impacts of the implementation phase and identified operational risks. The sensitivity analysis examined potential cost overruns and increases as well as significant reductions in the largest benefit categories. The results showed that the net present value of the project's benefits outweigh the costs and are robust, as they can withstand these stress events and remain positive over this period. The largest group of benefits consists of resiliency values related to wave attenuation provided by the project. The BCA demonstrates and quantifies the reduction of flood risk associated with this project.

The Living Breakwaters project BCA can be found at Appendix D to the New York State Action Plan [at https://stormrecovery.ny.gov/funding/action-plans-amendments](https://stormrecovery.ny.gov/funding/action-plans-amendments).

Maintenance and Operations

~~The State of New York, non-profit organizations and other government agencies involved in the construction and ownership of elements of the Living Breakwaters project will maintain and operate their respective project components. Through final design, GOSR will develop robust maintenance and operation plans along with budgets, working collaboratively with appropriate state, city and federal agencies, as well as non-profit organizations. The State of New York certifies that prior to construction and the use of CDBG-DR funds, maintenance and operation plans and budgets will be in place.~~

Project Feasibility and Effectiveness

~~The Living Breakwaters project has been and will be continually engineered, modeled and tested during the on-going phases of design development utilizing risk management tools with the purpose of providing feasible and effective hazard mitigation and risk management, including provisions for climate change.~~

~~The State will utilize risk management tools to reflect changing conditions. Indeed, New York's Community Risk and Resiliency Act (CRRA) requires State agencies to consider future physical climate risks caused by storm surges, sea level rise, or flooding in certain permitting, funding, and regulatory decisions. CRRA required NYSDEC to adopt regulations by January 1, 2016 establishing science-based State sea level rise projections, and to update such regulations every five years. GOSR is coordinating with State partner agencies in implementing the provisions of the Act,~~

including with regard to the Living Breakwaters project, to reduce risks to public safety caused by wave damage and to support resilient communities, now and into the future.

Engineering and modeling are important risk management tools being utilized to review such matters as the design specification of materials, degree of scour protection, and the integration of ecological elements. Specifically, with regard to the reduction/reversal of erosion, completed shoreline modeling of the breakwaters system estimated that over a 20-year timeframe – including potential sea level rise of up to 30 inches – the beach adjacent to the shoreline protection elements would grow while still maintaining the shoreline within other parts of the project area. The results are greatly improved with the inclusion of the planned shoreline restoration.

Numerical and physical hydrodynamic modeling is also being used to manage the risk of changing environmental conditions by testing design modifications and iterations to better understand the breakwaters' influence on sediment transport, potential scour, water circulation, and wave conditions. With regard to wave attenuation, the breakwaters have been designed to - assuming 30 inches of sea level rise - reduce waves below 3 feet in height in the event of a 100-year storm. Thus, risk management tools are helping to refine the reef street design, including parameters such as length, number, spacing, orientation, and location on the breakwater segment to optimize ecological performance.

Finalization of the 60% design of the breakwaters will occur after the current design plan has undergone an extensive modeling exercise which involves the construction of a scale model of the system which is placed in a tide pool simulating the conditions in the project site. Based on the data collected and observations by specialized marine engineers, this modeling exercise will validate that the current design will achieve the hazard mitigation goals established for the project according to the standards set by the best available science,— and factoring in anticipated changes in environmental conditions over the coming decades. Thus, the project, as designed, will provide protection against current and future threats, including future risks associated with climate change.

After the 60% design has been finalized, it is anticipated that the USACE and the NYSDEC will render a determination on the permit application, which has been the subject interagency consultation and cooperation. GOSR will continue to develop a regionally coordinated and resilient approach to infrastructure investment through continued coordination with organizations such as USACE and FEMA. GOSR has, since 2015, engaged in several conversations and consultations with the Regional Coordination Working Group to discuss the project and elicit feedback.

Construction of the breakwaters and the beach fill will be undertaken directly by GOSR. GOSR will issue open and competitive procurements for a construction management firm and a marine construction contractor. The procurements will require experience in marine construction in order to perform all the functions necessary to certify that the plans and specifications are to industry standards. The construction management team will monitor, inspect and approve payments to the contractor. For added assurance of compliance with industry, engineering and code standards, GOSR will utilize a qualified and experienced peer reviewer to review technical aspects of design and construction documents prepared for this project. The peer review firm is responsible for ensuring that the design documents and procedures meet professional and engineering standards. GOSR certifies that the design will meet the appropriate code, industry design and construction standards.

The November 18, 2013 Federal Register Notice (78 FR 69104) requires grantees “to identify and implement resilience performance standards that can be applied to each infrastructure project.” In

the “Resilience Performance Standards” of its Action Plan, the State identifies a set of performance standards that it uses to measure resiliency which include:

- Robustness
- Redundancy
- Resourcefulness
- Response
- Recovery.

In determining its resilience performance standards, the State of New York has relied on national and global sources such as the Federal Hurricane Sandy Rebuilding Strategy,¹ the US Department of Commerce Community Resilience Planning Guide for Buildings and Infrastructure Systems,² World Economic Forum Global Risk Report,³ the United Nations,⁴ and Rockefeller Foundation City Resilience Framework,⁵ as well as New York State sources including as the 2100 Commission Report,⁶ Sea Level Rise Task Force Report,⁷ and NYS Hazard Mitigation Plan. The State also sought scientific input from the New York State Resiliency Institute for Storms and Emergencies (RISE).⁸ State action on resilience performance standards is also informed by the Community Risk and Resiliency Act (CRRA), signed into law on September 22, 2014.

Together, these strategies, regulatory actions, and innovative program initiatives have helped inform the State approach to setting resilience performance standards. The various studies stress several qualities of resilient systems identified above and in the “Resilience Performance Standards” section of the Action Plan – robustness, redundancy, resourcefulness, response and recovery. One or more of these resilience qualities are considered for each infrastructure project, including the RBD projects.

GOSR has developed a Resiliency Monitoring Schedule (set out in Table 38, below) which will ensure that the completed project will achieve the resiliency benefits and mitigation features that the design anticipates, including beach growth/stabilization, wave attenuation, water quality and biological enhancement. This approach to resiliency monitoring, which is detailed in the section on Maintenance and Operations in this Action Plan, will be further developed and refined during the upcoming design phases and the permitting of the structures by NYSDEC and USACE.

GOSR will ensure that all appropriate mitigation measures are put in place and meet applicable federal and State standards. The Resiliency Monitoring Schedule will also include the evaluation methodology, which GOSR will implement after the project is complete. The purpose of the evaluation methodology is to determine the Living Breakwaters project’s efficacy level in addressing the community’s needs through a robust inspection and data collection program. Inspection data will be captured in a report that documents findings that establish a baseline, monitor progress and establish benchmarks to gauge the effectiveness of the project against

¹ <https://www.hud.gov/sites/documents/HSREBUILDINGSTRATEGY.PDF>

² <http://nvlpubs.nist.gov/nistpubs/specialpublications/NIST.SP.1190v1.pdf>

³ <http://reports.weforum.org/global-risks-2013/>

⁴ <http://www.unisdr.org/2014/campaign-cities/Resilience%20Scorecard%20V1.5.pdf>

⁵ <https://www.rockefellerfoundation.org/report/city-resilience-framework/>

⁶ <http://www.governor.ny.gov/sites/governor.ny.gov/files/archive/assets/documents/NYS2100.pdf>

⁷ http://www.dec.ny.gov/docs/administration_pdf/slrffinalrep.pdf

⁸ <http://nysrise.org>

anticipated outcomes. As detailed below, inspections will assess effectiveness of components, and identify any major unexpected conditions (i.e., deviations from expectations). Lessons learned will be documented as required by HUD.

Maintenance and Operations

NYSDEC will own and operate the breakwaters and will be fully responsible for their maintenance and for monitoring their performance. The State of New York is committed to the long-term maintenance and operation of this important resiliency measure. NYSDEC is the state agency whose mission is to conserve, improve and protect the State’s natural resources and the environment. NYSDEC includes a Division of Marine Resources with specific responsibility for managing and enhancing marine resources and their habitats, and is therefore uniquely qualified to undertake the responsibilities of the long-term maintenance of the breakwaters.

Basic maintenance and operations of breakwater structures is anticipated to be minimal, with visual inspection of structures required no more than annually. Maintenance will likely only be necessary following storm events. The breakwaters have a 50-year design life and are designed to function in a 100-year storm. A basic post-storm event inspection may reveal maintenance work such as stone adjustments or replacement, but such maintenance is expected to be, at most, minimal. See below for anticipated operations and maintenance schedule.

Table 37: Anticipated Operations and Maintenance Schedule

<u>Basic Operations and Maintenance Tasks</u>	<u>Suggested frequency of Inspections</u>
<u>Baseline Inspection and as-built survey</u>	<u>Once, immediately after construction</u>
<u>Above water visual inspections</u>	<u>Annually for first 5 years, every 2 to 3 years after that</u>
<u>Surveys at settlement monuments</u>	<u>Monthly for first 6 months, then routine inspections (annually)</u>
<u>Post storm event visual inspection and (if needed) survey</u>	<u>Following storm event roughly equivalent of 10-year return period or greater</u>

Based on a review of similar structures, operations and maintenance costs for rubble mound breakwaters are typically between 1% and 5% of the construction cost, over the lifetime of the project. Based on a conservative estimate of the construction cost of these breakwaters, their operations and maintenance costs over the 50-year life of the asset would be between \$500,000 and \$2.5 million.

Monitoring for the project’s resiliency performance will require on-going attention over at least 5 years after the completion of construction. NYSDEC will be responsible for the necessary monitoring tasks. The exact term and cost of these monitoring tasks has not yet been determined, but will be determined before construction is complete. Below is a Resiliency Monitoring Schedule outlining the anticipated monitoring tasks and likely frequency.

Table 38: Resiliency Monitoring Schedule

<u>Monitoring Tasks</u>	<u>Suggested frequency & duration of Monitoring</u>
<u>Shoreline change and bathymetry: beach profile surveys + sediment samples</u>	<u>Twice annually, spring / fall, min 3 years after construction, ideally 5+ years</u>

<u>Wave climate monitoring: wave height and direction</u>	<u>Minimum 6 months after construction for at least 5 years</u>
<u>Post storm event visual inspection and transect surveys</u>	<u>Following a storm intensity equivalent to 10-year event or greater</u>
<u>Monitoring of biological and ecological performance of flora and fauna: sessile communities</u>	<u>Quarterly for 1st year, semi-annually for 2nd year, annually for 5 years</u>
<u>Monitoring of biological and ecological performance of flora and fauna: fish and other motile species</u>	<u>Quarterly for 1st year, semi-annually for 2nd year, annually for 5 years</u>
<u>Water Quality Sampling, in situ and lab samples</u>	<u>Quarterly for 1st year, semi-annually for 2nd year, annually for 5 years, per permitting requirements</u>
<u>Sediment Characteristics & Chemistry: turbidity, total suspended solids, etc.</u>	<u>Quarterly for 1st year, semi-annually for 2nd year, annually for 5 years or per permitting requirements</u>

Budget

The budget amount submitted in the overall design proposal to the RBD competition for the Living Breakwaters project was \$73,904,000. Based on the Living Breakwaters ~~30~~preliminary 60% design, the estimated overall cost for the Living Breakwaters is ~~\$75,500~~approximately \$70,000,000. With a CDBG-DR allocation of \$60,000,000, the State will continue to explore additional funding options to fill any unmet needs and analyze the budget further to implement a reduced scale project which still meets the project objectives. The environmental review and permitting process currently underway may help shape the potential implementation requirements of the project through the 60% design phase that ~~are~~were not ~~currently~~-identified at the 30% design level.

Table 3739: Living Breakwaters Budget*

Break-down	Cost
Planning	\$ 58 <u>58</u> ,000,000
Pre-Development	\$3,000,000
Capital Construction Costs*	\$ 66,500 <u>58</u> ,000,000
Program Delivery	\$1,000,000
Total Project Cost	\$75,500<u>70</u>,000,000

* At ~~30~~preliminary 60% design, includes construction of the Living Breakwaters project, which includes the breakwaters, environmental enhancements, shoreline restoration, and Water Hub

Timeline

In the 3rd Quarter of 2016, the Living Breakwaters project achieved the milestone of 30% design. As of ~~early~~late 2017, the State is ~~in~~progressing through the planning and design phase of the project and continuing with design of the breakwaters through ~~the finalization of~~ 60% level design, to be followed by 95% and 100% design, and development of construction bid documents which are expected in the ~~2nd Quarter of 2018. The State has also begun schematic design of the Water Hub, with final design expected in the 3rd Quarter of 2017, followed by the development of construction documents. The breakwaters project is expected to begin construction in the 2nd to 3rd Quarter of 2018; the Water Hub is expected to begin construction in the 2nd Quarter of 2018.~~ 4th Quarter of 2018. Managed concurrently with these design efforts, the State has completed and published a

Draft EIS for the project and permits have been filed with the appropriate regulatory agencies for the project.

Environmental Review and Permitting Schedule

The State has published the *Coastal and Social Resiliency Initiatives for Tottenville Shoreline, Staten Island, NY* Draft EIS for the Living Breakwaters and TSPP projects. The Draft EIS analyzed the environmental impacts of four project alternatives: 1) No action; 2) Construction of the Living Breakwaters project; 3) Construction of the TSPP; or 4) construction of the Living Breakwaters project and TSPP (Preferred alternative). The ~~Draft EIS is currently under State received agency and public review, and the State is soliciting comments to the Draft EIS. It is expected that a Final EIS will be published in the 2nd Quarter of during the review period ending May 8, 2017.~~

~~The State has filed for necessary permits to construct the Living Breakwaters project. This includes the filing of a Joint Permit Application with the US Army Corps of Engineers (USACE) and NYS Department of Environmental Conservation (DEC). It is expected that the project will be permitted by regulatory agencies in the 3rd Quarter of 2017.~~

~~The State has filed for necessary permits to construct the Living Breakwaters project. This includes the filing of a Joint Permit Application with USACE and NYSDEC. Large scale oyster restoration activities, which have independent utility from the resiliency and ecological benefits provided by the breakwater structure, are currently undergoing scientific and agency review, and may be subject to additional review and permitting requirements prior to implementation in the post-construction phase. Since the Draft EIS was published and the permit applications filed, the State has engaged in a rigorous dialogue with all the relevant local, state and federal agencies which commented on the Draft EIS or have permitting authority. As part of the EIS process, GOSR has met and consulted frequently with key government agencies including the USACE, NYSDEC, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Services. GOSR also presented the plans to the Sandy Regional Infrastructure Resiliency Coordination Federal Review and Permitting Team. This dialogue has prompted refinements of the original submissions and will ensure that all necessary permits are secured and that the final design and construction of the project will adhere to all relevant codes. It is anticipated that the Final EIS and Record of Decision will be published in the 4th Quarter of 2017 or 1st Quarter of 2018, and that the regulatory agencies will render their permit determination in 2018.~~

Breakwater Schedule

Concurrent to finalizing the EIS and permitting for the Living Breakwaters project, the next phase of work will include advancing the breakwaters through final design and preparation of construction documents. There are many steps that will be taken during the next phase of design to refine, modify, and test the current design scenario, and solidify the approach for final design.

~~Design refinement, first to Finalizing the 60% design, then 95% and then bid documents (100%) will be the focus of the next design phase. In terms of design, engineering and modeling, this will include Developing the preliminary 60% design involved refinement of the breakwater system and segment design to optimize their performance relative to the project objectives, taking into account feedback on the 30% design from regulatory agencies, the Living Breakwaters CAC and other stakeholders, as well as further modeling and analysis of design options and tradeoffs. This will include refinement of breakwater design parameters like crest elevation, orientation and shape, as well as detailed design and specification of stone and other materials, scour protection, and the~~

~~integration of ecological elements. This will also include refinement of the reef street design including parameters such as length, number, spacing, orientation, and location on the breakwater segment. Both numerical and physical hydrodynamic modeling will be used to test design modifications and iterations and better understand the breakwaters' influence on sediment transport, potential scour, water circulation, and wave conditions. This included refinement of breakwater design parameters like crest elevation, orientation and shape.~~ The next phases of design refinement will also include close coordination with the TSPP design team.

Completion of 60% design of the breakwaters is expected in the ~~2nd to 3rd~~ 1st Quarter of ~~2018~~2017; Completion of 95% design is expected in the ~~4th~~2nd Quarter of ~~2018~~2017; and completion of 100% design is expected in the ~~1st~~3rd Quarter of 2018. Procurement for breakwaters construction is anticipated to take place in the ~~2nd~~4th Quarter of 2018 with construction to follow. Construction is expected to take up to ~~18~~24 months to complete, depending on permitting restrictions.

Water Hub Schedule

~~To date, The State has completed a Water Hub feasibility study. Based on this study, in close coordination with regarding how best to achieve the social resiliency components of the NYCDPR, and project partners, and is now seriously considering a preferred alternative that will consist of a vessel equipped with educational and exhibition space. The vessel will be able to travel to and dock near the Breakwaters, thereby eliminating the need for construction of a building and a floating dock. There will also be an onshore interpretive design system likely including the Billion Oyster Project, signage and other educational features. The Water Hub will advance to 10% and schematic design, followed by design specifically to accomplish the RBD project's social resiliency goals and will be purchased by the development of construction documents (100% design) and BOP in time for the Breakwater construction.~~

~~The State, working with the Living Breakwaters design team, governmental partners and the CAC, will continue to design the completion by early 2021. The on-shore Water Hub based on future utility access surveys, geotechnical data, tree surveys, construction feasibility, programming needs and budget.~~

~~Completion of 10% design of the Water Hub is expected in the 1st Quarter features will be designed in cooperation with the TSPP project and constructed as a part of 2017; Completion of schematic design is expected by the 2nd to 3rd Quarter of 2017; and completion of final design (construction documents) is expected in the 3rd to 4th Quarter of 2017. Based on the length of the construction procurement process, construction of the Water Hub is anticipated to begin in the 2nd to 3rd Quarter of 2018. Construction may take up to one year to complete that effort also by 2021. If either of the original land-based alternatives were pursued, their construction would be undertaken during the term of the breakwater construction, beginning in early 2019 and finishing by early 2021.~~

Oyster Restoration and Social Resiliency Schedule

The New York Harbor Foundation entered into a subrecipient agreement with GOSR in the 4th Quarter of 2016 to continue work on ~~scientific studies necessary to implement oyster cultivation and education / stewardship efforts needed to support the Living Breakwaters project~~, as well as to refine the design of oyster installations for the breakwaters and provide input on the Water Hub program and design. The agreement and scope of work runs through the 2nd Quarter of 2018 to coincide with final design of the Living Breakwaters project. ~~The next phase of work, up to but not including the actual installation of oysters on the breakwaters, is anticipated to include design of~~

~~oyster installation and floating nursery, oyster permitting support, Water Hub programming and design support, BOP educational programs and curricula development, cultivation and propagation of oysters, BOP will continue scientific evaluation and development of the suitability of an active bivalve restoration plan under regulatory authority and technical review of NYSDEC.~~

This includes continued work on installation and operation of oyster nurseries at Great Kills and Lemon Creek, development of a workforce training program, and the BOP Shell Collection and Recycling program. Scientific and other information from these pilot studies will ultimately be used to develop a plan for larger scale oyster restoration, which will be subject to the review and approval of NYSDEC. All activities will run through final project design.

~~It is anticipated that the New York Harbor Foundation, specifically the BOP, will work closely with the breakwater design team to develop designs for the oyster installations on the breakwaters and for the floating nursery and floating dock. These elements will be integrated into the design and final design drawings of the breakwaters.~~

Oyster restoration activities are expected to take place after the breakwaters are constructed. It³⁸Table 38It is likely that these restoration activities would begin as smaller scale pilot studies, and that larger scale oyster restoration would be developed as BOP completes its evaluation of ongoing pilot projects. Table 40 provides the anticipated project schedule by quarter.

Table 403840: Living Breakwaters Proposed Schedule

	Start	Finish
Living Breakwaters	Quarter 4 2014	Quarter 2-2020 <u>4-2021</u>
Study, Research Planning: This Phase will outline all additional studies, research and planning needed prior to the design and engineering phase. As necessary, this phase will be incorporated into the Environmental and Review and Permitting stage as well as the Engineering Phase.	Quarter 4 2014	Quarter 2 2016
Environmental Review and Permitting: This Phase will include scoping for and preparation of an environmental impact statement, as well as the submittal of permits applications to the appropriate governmental agencies. This Phase will include significant opportunities for public review and comment, as well as intergovernmental consultation. Additionally, as required by State and federal law, the EIS will evaluate alternatives to the proposed project. This timeline is meant to represent an overview of the expected Environmental Review Process for all aspects of the Living Breakwaters. It should be noted that the environmental review and permitting timeline is dependent on the permitting requirements of agencies with jurisdiction, including the United States Army Corps of Engineers, NOAA-NMFS, USFWS, and the New York State Department of Environmental Conservation.	Quarter 4 2014	Quarter 3-2017 <u>1-2018</u>
Design and Engineering: This phase will include all design and engineering work required for Living Breakwaters culminating with complete construction specs. Depending on the progress and outcome of the Environmental Review and Permitting process, this process will be able to run concurrently for some components of the project. This phase will include any and all necessary procurement and contracting as appropriate.	Quarter 4 2015	Quarter 14 2018
Site Development: This Phase will include all necessary elements for site development from the Design and Engineering Phase that will prepare for the construction phase of Living Breakwaters. GOSR will evaluate a potential phased site development schedule for different project components (e.g., upland components and in-water components) and coordination with the TSP.	Quarter 3 2016	Quarter 4-2017 <u>1-2018</u>
Construction: This Phase will include all elements of construction related to Living Breakwaters outlined in the Design and Engineering Phase. For Living Breakwaters, the timeline is extended to reflect that the nature of the project will only allow for construction in specific building seasons. GOSR will evaluate a potential phase construction schedule for different project components (e.g., upland components and in-water components).	Quarter 2-2018 <u>1-2019</u>	Quarter 1 2021 <u>2020</u>
Closeout: This phase will include the closeout of the entire project, including but not limited to: Final site visits and review, release of final contingency payments and all applicable CBDG-DR construction closeout requirements.	Quarter 4 2020 <u>2019</u>	Quarter 2-2020 <u>4-2021</u>

B. Living with the Bay: Slow Streams

Description of changes: In approving the State's Action Plan Amendment 16 on August 14, 2017, HUD required GOSR to make edits to its Action Plan to include additional detail regarding the Rebuild by Design projects, in accordance with the *Federal Register* Notices at 79 FR 62184 and 81 FR 54114. This amendment includes all the additional detail required.

Edits to text begin from final sentence of the 'Benefit Cost Analysis' subsection of the 'Living with the Bay: Slow Streams' section of the Action Plan.

From page 139 of the New York State Action Plan:

The LWTB project BCA can be found at Appendix E to the New York State Action Plan at <https://stormrecovery.ny.gov/funding/action-plans-amendments>.

Project Feasibility and Effectiveness

LWTB will utilize proven, accepted engineering methods such as retention basins, check valves, green streets, living shorelines, and wetland and marshland restoration, to achieve the project objectives identified in the Project Description, and to address a variety of flooding sources throughout the project area in a comprehensive, practical and feasible manner. The design for each component of LWTB ranges from preliminary designs through 90% design and continues to advance into 100% (final) designs. GOSR certifies that the preliminary designs consider the appropriate code, or industry design and construction standards, and that the final design will adhere to all relevant codes and construction standards when it is complete. All project components will incorporate standard engineering principals and guidelines under the direction of New York State Licensed Professional Engineers who will certify that the final design met the appropriate code, or industry design and construction standards.

Engineering and modeling are risk management tools utilized to review such matters as design specification of materials, erosion protection and the integration of ecological elements. As a tool to manage risk, theThe project will be engineered, modeled and tested during the on-going phases of design development to provide feasible and effective hazard mitigation and risk management, including provisions for climate change. The projectsdesign of project components will consider the impacts of large storm events, increasing storm frequency, tidal and storm surges, and sea level rise. Specifically, the LWTB modelling will consider scenarios including storm events ranging from 1-year to 100-year events, storm surges ranging from five (5) to fifteen (15) feet, and sea level rise of up to 30 inches, individually and combined.

By modelling anticipated changes in environmental conditions over the coming decades, the final project design will provide protection against current and future threats, including future risks associated with climate change. For instance, the effects of sea level rise will be minimized through ensuring that the elevation of berms, bulkheads and living shorelines are adequate. Additionally, hardening of storm water infrastructure will help prepare for increasing storm frequencies associated with climate change and sea level rise. In addition, rainfall from storm events can be mitigated through retention of storm water and leaching into soils or diversion into wetlands or living shorelines that can absorb the flow-, and the energy of tidal and storm surges can be dissipated by restoring coastal marshlands and wetlands. Modeling will be performed by experienced engineers (in co-operation with FEMA and USACE) for each project to determine the

level of protection offered for rainfall, storm surges and sea level rise, and optimize technologies utilized.

The use of risk management tools will help ensure that the benefits achieved through implementation of LWTB include providing increased coastal flood protection—and, while enhancing waterfront access and open space resources, improving water quality and habitats, and providing public education and work force development in the project area of the Mill River watershed.

In addition to the Resilience Strategy detailed later in this section, New York’s CRRA requires State agencies to consider future physical climate risks caused by storm surges, sea level rise, or flooding in certain permitting, funding, and regulatory decisions. CRRA required NYSDEC to adopt regulations by January 1, 2016 establishing science-based State sea level rise projections, and to update such regulations every five years. GOSR is coordinating with State partner agencies in implementing the provisions of the Act, including with regard to the LWTB project, to reduce risks to public safety caused by flooding and to support resilient communities, now and into the future.

The November 18, 2013 Federal Register Notice (78 FR 69104) requires grantees “to identify and implement resilience performance standards that can be applied to each infrastructure project.” In the “Resilience Performance Standards” of its Action Plan, the State identifies a set of performance standards that it uses to measure resiliency which include:

- Robustness
- Redundancy
- Resourcefulness
- Response
- Recovery.

In determining its resilience performance standards, the State of New York has relied on national and global sources such as the Federal *Hurricane Sandy Rebuilding Strategy*,⁹ the US Department of Commerce *Community Resilience Planning Guide for Buildings and Infrastructure Systems*,¹⁰ World Economic Forum *Global Risk Report*,¹¹ the United Nations,¹² and Rockefeller Foundation *City Resilience Framework*,¹³ as well as New York State sources including as the *2100 Commission Report*,¹⁴ *Sea Level Rise Task Force Report*,¹⁵ and *NYS Hazard Mitigation Plan*. The State also sought scientific input from the New York State Resiliency Institute for Storms and Emergencies (RISE).¹⁶ State action on resilience performance standards is also informed by the Community Risk and Resiliency Act (CRRA), signed into law on September 22, 2014.

Together, these strategies, regulatory actions, and innovative program initiatives have helped inform the State approach to setting resilience performance standards. The various studies stress

⁹ <https://www.hud.gov/sites/documents/HSREBUILDINGSTRATEGY.PDF>

¹⁰ <http://nvlpubs.nist.gov/nistpubs/specialpublications/NIST.SP.1190v1.pdf>

¹¹ <http://reports.weforum.org/global-risks-2013/>

¹² <http://www.unisdr.org/2014/campaign-cities/Resilience%20Scorecard%20V1.5.pdf>

¹³ <https://www.rockefellerfoundation.org/report/city-resilience-framework/>

¹⁴ <http://www.governor.ny.gov/sites/governor.ny.gov/files/archive/assets/documents/NYS2100.pdf>

¹⁵ http://www.dec.ny.gov/docs/administration_pdf/slrffinalrep.pdf

¹⁶ <http://nysrise.org>

several qualities of resilient systems identified above and in the “Resilience Performance Standards” section of the Action Plan-- robustness, redundancy, resourcefulness, response and recovery. One or more of these resilience qualities are considered for each infrastructure project, including the RBD projects.

GOSR will develop a Resilience Strategy Plan by January 2018 for the continued design and ultimate construction of LWTB to ensure that the completed LWTB project will have appropriate continuity and connection to implementation of subsequent phases of the selected RBD proposal or other associated resilience activities. The Resilience Strategy Plan will be a public plan and include LWTB’s objectives; geography; hydrology; floodplains; bathymetry; community outreach; areas of concern for flooding; projects to address the areas of concern; scoring and ranking of projects and plans to monitor the effectiveness and efficacy of LWTB.

The LWTB project will primarily be funded by HUD’s CDBG-DR allocation for RBD, although additional sources of grants will be sought. The LWTB budget will be maintained within approved grant funding, with regular budget reviews. Contingent reserves will be held for each project component as well as the overall LWTB project to ensure that the project does not exceed budget. Designs and engineering estimates will be reviewed by third parties for reasonableness and accuracy. As additional grants are secured, consideration will be given to enhancements that can be incorporated into LWTB. While the project will introduce improvements to the community, based upon the results of the BCA, it is not anticipated that LWTB will expand the local economy to the point of potential displacement of residents, businesses, and other entities due to potentially increasing costs of rent and property ownership in the years following the completion of the LWTB project.

As part of the design process, GOSR will develop a Monitoring Plan to establish the baseline of flooding and surface water quality near select LWTB project components and in the project area. The plan will specify the parameters to monitor. After completion of construction for LWTB, the monitoring will be repeated to allow a comparison of the project’s effectiveness before and after construction. The forthcoming Monitoring Plan will set out actions and approaches for evaluating the impact of LWTB on:

- Flood reductions,
- Water quality improvements and
- Levels of protection against rainfall, surges and sea level rise.

During implementation of the Monitoring Plan, GOSR will ensure that all the appropriate mitigation measures are put in place and meet applicable Federal and State standards. The Monitoring Plan will also include the evaluation methodology, which GOSR will implement after the project is complete. The purpose of the evaluation methodology is to determine the LWTB project’s efficacy level in addressing the community’s needs through a robust inspection and data collection program. Inspection data will be captured in a report that documents findings that establish a baseline, monitor progress and establish benchmarks to gauge the effectiveness of the project against anticipated outcomes to support long-term operation of the flood protection system. Inspections will consist of site visits to assess maintenance effectiveness, observe operational components, and identify any major unexpected conditions (i.e., deviations from expectations). Lessons learned will be documented as required by HUD.

Maintenance and Operations

GOSR certifies that the long-term operation and maintenance of the LWTB RBD Project will be adequately funded from each governmental subrecipient’s reasonably anticipated annual operating budget, recognizing that operation and maintenance costs must be provided from sources other than CDBG and CDBG–DR funds. As described below, GOSR will ensure the availability of funds through specific provisions within agreements with subrecipients.

Based on the BCA for LWTB, the present value of the operating and maintenance costs is estimated to be approximately \$17.4 million (with a basis of 2017-2067; constant 2017 dollars and a 7% discount rate). Specific costs will be identified as the design is finalized. OPRHP, on behalf of New York State, and through a Memorandum of Understanding (MOU), is responsible for funding the long-term operations and maintenance of all components of the project within HLSP, including but not limited to the new building and the dams. The remaining components of the project will be operated and maintained by the local government or authority with jurisdiction over the respective property or asset. These subrecipients will implement the construction of these components of LWTB through a subrecipient agreement with GOSR. The subrecipient agreement, monitored and enforced by the State, will specify the mandatory requirements of operating and maintaining each respective component of the project, including the annual expected cost expenditure by the local government. With the exception of some of the components (e.g., dams) within HLSP, LWTB is comprised of passive non-mechanical infrastructure that will improve drainage and reduce flooding throughout the Mill River watershed. Thus, as set out in the BCA, the annual operating costs of these components is expected to be low, and maintenance activities will consist of standard activities such as periodic inspections, cleaning, and repair, as necessary.

Through final design, GOSR will develop robust operation and maintenance and operation-(O&M) plans, along with budgets, by working collaboratively with appropriate State, city and federal agencies, as well as non-profit organizations. GOSR certifies sub-recipientsThe O&M plans will describebe required through agreements to adequately funddescribe the procedureslong term operationprocedures and responsibilities for routine maintenance, communication, and timing of activation in the eventRBD project from reasonably anticipated revenue, recognizing that operation and maintenance costs must be provided from sources other than CDBG and CDBG DR fundseven of an impending storm. GOSR will serve as a monitoring entity with regard to enforcement of project O&M. O&M for each project component will be provided by the relevant subrecipient. The O&M commitments for project components will be established within applicable subrecipient agreements.

From page 144 of the New York State Action Plan

Table 41: Leveraging of Funds – RBD Unmet Need

Project	Location	Total Project Cost	CDBG-DR Allocation	RBD Unmet Need
Living Breakwaters	Richmond County	75,500 \$70,000,000*	\$60,000,000	\$45,500 \$10,000,000
Living with the Bay	Nassau County	\$125,000,000**	\$125,000,000	\$0

*At ~~30~~preliminary 60% design; **In final scoping and preliminary design phase

ⁱ http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch3_Coastal_FINAL_singles.pdf

ⁱⁱ https://stormrecovery.ny.gov/sites/default/files/uploads/coastal_and_social_resiliency_initiatives_-_tottenville_draft_scope.pdf

ⁱⁱⁱ https://stormrecovery.ny.gov/sites/default/files/uploads/Coastal%20and%20Social%20Resiliency%20Initiatives%20-%20Tottenville%20FINAL%20SCOPE%20and%20RTC_1.pdf

^{iv} <https://www.newyorkharschool.org/crew/new-york-harbor-foundation/>