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March 06, 2015

Mr. Daniel Greene
Deputy General Counsel and Certifying Officer
25 Beaver Street, 5th Floor
New York, NY 10004

Re: Comments on Development of Draft Scope - Rebuild by Design - "Living Breakwaters Project" and New York Rising "Tottenville Dune Project"
Staten Island, Richmond County, New York
Raritan Bay

Dear Mr. Greene:

The Department of State (DOS) is responding to your letter of January 30, 2015 requesting comments on the draft environmental review of the above-referenced projects.

Our preliminary comments on the draft scoping document and our suggestions for further developing the content of the draft environmental impact statement are attached. The draft scoping documents were reviewed by Program, Consistency and Technical staff. Please feel free to contact us to discuss these comments if needed.

We look forward to coordinating with GOSR throughout the environmental review process and our federal consistency review process.

Sincerely,

Jeffrey D. Zappieri, Manager
Federal Consistency Review
Office of Planning and Development

JZ/ ts
Ecc: Kari Gathen, Esq. – DOS

New York State Department of State **March 6, 2015**

Comments on the Draft Scope of the Environmental Impact Statement for the combined Living Breakwaters and Tottenville Dunes projects.

These comments are provided in support of design and analysis of alternative measures to reduce storm and erosion damages along the south eastern shores of Staten Island, New York. The comments address the general scope of topics and issues that should receive further investigation within the Draft Environmental Impact Statement (DEIS), in addition to the existing content in the 1-30-15 DEIS Scope. The basic information needs relating to various individual project components are identified first, followed by comments on content the EIS should include to help evaluate the benefits and effects of the proposed measures and viable alternatives.

Design/ Project Details – There are four basic project components requiring descriptive detail and impact analysis:

a) In-water components -- the living breakwater system/ individual structures;
b) On-shore component -- the man-made dune structure;
c) On-shore component -- the 'Water Hub' building and uses
d) On-shore components – landscape level activities associated with the water hub (including shoreline modifications, living shorelines, and/ or protective structures)

A preliminary design level of detail is necessary in order to begin to determine and assess the potential impacts (both positive and negative) which may result from the recommended project and the various alternatives to be examined. Information reviewers will expect to be presented in the DEIS, includes, but is not limited to:

- ***Breakwaters*** -- Preliminary designs for the breakwater structure including materials to be used, square feet of surface area of hard structure/ ecological habitat to be created; surface area to volume ratio of each structure; acres of vertical habitat to be created; total cubic yards of fill material to be placed within navigable waters (and further identified per each individual breakwater); full dimensions of each of the proposed structures; distances between each structure with distances indicated from the shoreline; location of navigation channels relative to the structures; and bathymetry across the project area.
- ***Dunes*** – Preliminary designs for the dune structure including depiction of all stone work and sand fill to placed; dimensions of the completed structure; volume of fill; proposed grades; distances landward from MHW; depths of structural elements; overview of proposed planting plan including species to be used and their placement; indication of the means of public accessibility across and to the beach and shoreline.
- ***Water Hub*** – location map and design concept;
- ***Other shoreline activities*** – design level details related to any additionally proposed shoreline modifications, structural elements, or wetland restoration work.

We strongly recommend delineation of project detail by individual project – For clarity, detail within the DEIS should optimally be provided on a site by site basis (i.e. descriptive detail and impact analyses should be presented according to each individual project component). Responses to the SEQR form EAF, for example, in many places are unclear as to which particular project is being referenced. E.g. Section E.2 – average depth to bedrock at the project site (currently estimated as

greater than 100 feet). Reviewers may be unclear as to whether this information applies to the Breakwaters, Dunes, Water Hub or Other Shoreline Activities. Though the DEIS will be developed to address the recommended components collectively, and there are certainly many places where describing them collectively is appropriate, design detail and description, as well as the analysis and discussion of impacts should clearly delineate the respective project components.

Comments relevant to many of the major DEIS topic areas

ECOLOGY

Ecosystem scale analyses – An ecosystem scale analysis of the breakwaters project will be requested by reviewers. It should thoroughly examine current ecological conditions as well as changes which may result from the project. Consider conditions as they affect priority species such as oysters, as well as other species and communities which may establish or be attracted to the reef. Examine the relationships and potential interactions between species in the modified setting. Consider benthic communities as well. Discussion should address effects to submerged aquatic vegetation, if present, and should examine impacts of the proposed changes to water quality as well.

Identify Target Ecosystem -- Fully describe the target ecosystem characteristics (TEC);

Ecological benefits -- Descriptive narrative for the project in the draft EIS scope references ecological benefits. (e.g. fourth para., p. 2). Documentation should be provided that reasonably demonstrates that benefits are likely to be realized.

Ecological restoration value/ historic populations -- Description of the level of biological recruitment that is anticipated would be beneficial, over what general time frame, how this will be assessed, a plan for monitoring, any long-term maintenance/ stewardship, performance criteria, and guidelines for adaptive management. We suggest supporting detail regarding the historical levels of key species such as oysters, with mapping if possible, and direct comparison to present conditions. Dr. Chester Zarnoch at Baruch College, City University of New York, may be a valuable information source for assistance on oyster restoration. Describe percent of ecosystem restoration that is anticipated; quantify ecological services to be provided by the anticipated restoration; provide an inventory and assessment of stressors which may affect the long-term success of the proposed restoration and the overall success of the restoration efforts. *[See under next two headings.]*

Colonization and Survival of Target and Other Species – If a project alternative is anticipated to produce ecosystem benefits by colonization of new or increased species, documents will need to demonstrate the water quality, temperature, and depth provided in the alternative design are suitable for specific species and the substrate will provide suitable habitat. For example, if any measures are included to initiate or support shellfish colonization, they should be described along with an estimate of their effectiveness. Project development should include assessment of the species for which successful colonization is likely. E.g. With rising water temperatures lobster populations have declined in New York waters and Blue crab (*Callinectes sapidus*) has increased. Projection of future conditions and the likely combined effects of the project and climate change on the ecological community would be helpful.

Invasive species and predator species – The DEIS should provide references to the current inventory of invasive animal and plant species within the Raritan Bay environment. The likelihood of

attachment by invasive mussels, clams or other species to the proposed structural elements should be discussed, along with any preventative or mitigating measures to be taken in this regard. Best management practices for creating and maintaining the proposed habitat or reef areas should be described to minimize disease, parasitism or predation by other organisms (e.g. crabs). The likely success of natural defenses of the supported species, such as oyster calcification/development of sufficiently hard shell material), colonial benefits, food web benefits and long term viability of habitats or reef structures should be discussed. Potential effects of an acidifying marine environment should be considered.

Marine mammals and birds – We recommend providing detail on the anticipated use of the breakwater structures by marine mammals and seabirds. Regarding the suggestion that breakwaters may serve as seal haul outs, a reasonable, non-speculative basis for concluding that this will actually occur should be provided if this is claimed as a project benefit. What similar projects in the region have achieved results comparable to those attributed to each alternative, and what design components are included to emulate the conditions that led to success? What is the population of seals or other species that could successfully take advantage of the site?? During what season(s) would anticipated species use the site, and what effect would their presence have on the biological community, natural processes and human uses?

Fisheries/ habitat – Analysis of the effects of proposed actions for each alternative in conjunction with relevant available Essential Fish Habitat (EFH) data should be included.

Ecological resiliency -- The draft EIS scope states the breakwater would "…foster ecological resiliency by increasing habitat diversity through the establishment of structural habitat, which is currently limited within Raritan Bay." Several issues are raised with respect to this statement:

a) Ecosystem resilience is tied to the adaptive and recovery capacity of the native ecological community. Evidence that the resilience of the community would benefit from the project would need to be presented to support the claim.
b) Replacement of the native ecological community with a new community through the introduction of foreign physical or geo-chemical conditions is not necessarily an improvement. A description of the effects on the native community that would accompany any proposed structures would probably be a prerequisite of environmental approvals. It may be appropriate to describe anticipated outcomes among all viable alternatives for the ecological communities of the project area.
c) Lack of structural habitat within Raritan Bay is characteristic of the native biological community, not detrimental. The introduction of rock structure could be disruptive to the native community or to geographically specific species that depend on the construction locality. A description of the native biological community, its requirements, habitat uses and stressors, and the effects of the proposed alternatives will be needed to support statements that the recommended project will be beneficial.
d) Avoidance of negative effects on species listed as protected, threatened or endangered will be a significant factor in evaluations.
e) The effects of the alternatives on existing management or restoration activities should be reported.

SCHEMATIC DESIGN/ SITE CONDITIONS

Based on the Project Location map (Figure 1), there does not appear to be a correlation between the alignment of the proposed breakwaters and dunes and the natural conditions of the site. It will be important for project success to develop a thorough understanding of the natural geomorphology, hydrology and sediment transport processes. These conditions are central to the performance of constructed features and to the biological community. The following questions may help focus understanding of the scope of considerations in developing appropriate designs and analyses:

a) What are the existing patterns of water flows into and through the site? What are the patterns of tides, currents, waves and water circulation? How are adjacent coastal bays or ponds connected to the circulation system?
b) What are the existing sediment transport patterns, including seasonal and annual volumes, sources and sinks? Are there any seasonal variations in sediment transport direction or volume? How do major storms affect sediment transport, and what is the frequency of those effects? Are there current impairments to natural sediment transport processes, and how will they be affected by proposed alternatives?
c) What is the existing granularity and chemistry of the substrate, underwater where the breakwaters will be placed, and upland where the constructed dune and/or beach will be placed?
d) How do storm conditions differ from routine daily tides and seasonal variations, and what are the effects of those differences on natural features and processes?
e) Do any species or biological communities depend on existing geomorphic or hydraulic conditions or processes? What are these dependencies and how will they be affected by the project? Some species are highly site specific. Periodic transgressive events like major storms are normal in coastal areas and biological communities are adapted to those events and may require them.
f) Once the above factors are understood, the effects of the proposed alternatives on natural processes and conditions can be projected. From those results effects on the biological community can be deduced.

WAVE ENERGY/ ATTENUATION

a) It will be helpful to describe/quantify the wave attenuating capabilities of the proposed breakwater system and to what wave heights and level of storm it is estimated the breakwaters can be expected to effectively provide mitigation to preventing or reduce onshore damages to resources and property.
b) To the extent project alternatives can be adapted or modified in the future to adapt to changing conditions such as sea level rise, that capacity should be described.

RISK REDUCTION

Overall risk reduction capacity of the completed breakwater system – Discuss, in quantitative terms, the risk reduction anticipated from the project alternatives. Compare the risk reducing capacity of the alternatives. Describe whether and how the project components function to complement one

another. Consider each risk reduction component in terms of stand-alone value and expected outcomes versus a combined or additive value.

Residual risks and project redundancy – No project completely eliminates storm and flood risks. For this reason, studies by the National Academy of Engineering following Hurricane Katrina recommended that wherever structures are used for flood protection, redundant measures should be added to minimize damage in the event the primary protection fails for any reason. Analysis of alternatives should include the residual risks of each, a report on the potential for failure or non-performance, and additional recommendations for redundant measures beyond the preferred alternative. The final recommendation should include redundancies sufficient to minimize risk in the event the project does not perform as intended or environmental conditions change. Redundant measures can be components of the project or actions implemented by others. The project report should reflect their importance, determine levels of protection with and without them, and estimate a level of confidence the redundant measures will be implemented.

SEA LEVEL RISE/ CLIMATE CHANGE

a) Climate change, sea level rise and performance – Present an analysis of the anticipated performance of the project components over time in light of future conditions with sea level rise; Discuss how the project designs integrate consideration of sea level rise; Discuss potential impacts of climate change on ecosystem outputs, such as spat and oyster survival, and the overall long term ecological performance of the reef system or living shorelines components.
b) Sea Level Rise Projections - Investigation/assessment should be based on best available data. We recommend using moderate and high sea level rise projections in performance evaluation and modeling. These projections are available through the New York City Panel on Climate Change and the New York State Energy Research and Development Authority (see: Climate Change in New York State, Updating the 2011 ClimAID Climate Risk Information, Supplement to NYSERDA Report 11-18, Responding to Climate Change in New York State). It may be appropriate to address low-end projections of sea level rise as well, if they would affect project performance. They are available from the same sources as above.

WATER QUALITY/ CIRCULATION/ NUTRIENT DYNAMICS

The potential impacts of the breakwater or other in-water or near shore components on the normal transport, mixing, and flushing of nutrient loads or other pollutants in the water column should be discussed. Reviewers will be interested in the potential for trapping of nutrients or increasing residence time of nutrients in the open water areas between the breakwater system and shore. Evaluated both in terms of the impacts of proposed structural elements themselves and also in the context of wetlands, oyster beds or other natural communities that may be established (both filtering nutrients and generating organic loads).

PLANNING/ OTHER PROJECTS

Regional and Planning Context – An analysis of the proposed alternatives in relation to other risk reduction or restoration projects that are planned, funded, or in progress for the east and south shores of Staten Island is relevant for the DEIS. The DEIS should discuss the alternatives compatibility with and/or fulfillment of objectives of existing local/regional management plans and

resilience efforts (e.g. the New York Rising Community Reconstruction Plan for Staten Island). An inventory of local plans and projects for reference would be helpful.

Coordination with USACE Staten Island Studies – The Army Corps of Engineers has an active study for storm damage reduction in the project area. Phase 1 of the Corps project extends from Fort Wadsworth south to Oakwood Beach. Phase 2 of the Corps project will include the southerly portion of the eastern shoreline of Staten Island where the proposed actions are located. The DEIS should discuss the relationship of the proposed actions to these Corps projects.

Effect on potential actions and uses in the region – Other shoreline management and upland uses might increase as a result of the project. Alternatively, other measures or uses may be precluded by the project. Any potential limitations of future uses and/ or potential conflicts with existing, planned, or possible compatible uses should be identified (E.g. energy development or transmission uses? Commercial or recreational uses?). Known effects should be evaluated. For example,

- Preliminary studies suggest oyster restoration might be feasible along the shorelines of the project area. What effect would the project have on the potential success of such a restoration effort in the future? What active measures will be incorporated in the project to support oyster restoration or other species or biological communities?
- Externally funded protective measures tend to stimulate increased development of at-risk areas, e.g. Westhampton, New York. What effect will the project have on property values in the protected area, and what are the implications for development? Will any new development be stimulated in at-risk areas? If storm events overcome the project for any reason, will any additional development be affected by surge and flood waters that would not otherwise have been present?
- Will any measures involving land use regulation such as subdivision requirements, site plan requirements, zoning provisions, regulated uses, transfer of development rights, conservation easements, land swaps, relocations, buyouts or acquisition programs be incorporated as part of the project or alternatives reviewed? It will be essential for the recommended project to adapt over the course of time, and these types of programs may be essential for managing storm risk over the long-term.
- Will the project have any effect on definitions of flood risk areas for purposes of flood insurance, local or regional comprehensive plans, hazard mitigation plans or other risk management programs? What changes will take effect and what are the implications for the community and property owners?

ALTERNATIVES ANALYSIS

Comprehensive Assessment of Reasonable Alternatives–

a) For the DEIS, comparable information on all reasonable alternatives should be reported.
b) Non-Structural Options - A review of a non-structural options should be completed to support the conclusion that the recommended strategy is most appropriate. Under the state coastal management program and policies, non-structural approaches to reduce storm damages are preferred to structural measures. State coastal policies (CMP policies), the New York City Waterfront Revitalization Program (WRP) and the National Environmental Policy Act (NEPA) each require investigation reasonable alternatives. To address non-

structural options adequately a basic summation of costs and benefits of buying out and relocating vulnerable development should be provided in project documents. Costs and benefits should include socio-cultural costs and environmental benefits. The feasibility of relocating infrastructure might be involved in the assessment.

c) Full Cost Estimating Analysis of reasonable alternatives and the recommended project should address social, economic and environmental costs and benefits, future site conditions, and residual risks in a format that allows comparisons based on the same performance indicators. Generalized estimates may be suitable for first order cost estimates of alternatives. It may be possible for the DEIS to eliminate some alternatives by reason of unacceptable costs. If so, more detailed estimates can be compiled for the remaining viable alternatives.
d) Pilot Study - Consider a smaller breakwater system or pilot project as opposed to the large scale installation proposed. This would allow for monitoring and assessment of performance and functionality and adaptive design if needed.

Development/ Coordination of Viable Project Alternatives –There may be utility in pro-actively soliciting ideas to define beneficial modifications of the proposed action and/or additional alternatives early in the DEIS process. This would ensure that the best version of the alternatives (i.e. the most viable and resilient alternatives in terms of stated project objectives) goes forward. To that end, a small peer group that included experts in coastal processes, disaster mitigation, coastal ecosystems, social welfare and community resilience could review existing conditions with the project development team and formulate one or more alternatives for cost and benefit comparison. The objective of that group would be to advance approaches that fundamentally accomplish the project objectives, yet are most practical, so meaningful alternatives could be compared to the current proposal. Potential candidates for the peer review could include:

a) Coastal ecosystems – a designee from the NY-NJ Harbor Estuary program
b) Coastal processes – Henry Bokuniewicz from SUNY – Stonybrook
c) Community resilience – A representative from the academic community with expertise in planning and resilience, such as David Godschalk, Professor Emeritus, Univ. of NC at Chapel Hill, or Philip Berke, Department of Landscape Architecture and Urban Planning, Texas A&M University, or their designee
d) Mitigation – A designee from the Association of State Floodplain Managers (ASFPM)
e) Social Welfare – A representative from the academic community with expertise in storm resilience and human welfare, such as Susan Cutter, University of South Carolina, or her designee

SITE OWNERSHIP AND ACCESSIBILITY

The breakwaters could lend themselves to become landing areas for boaters and/or fishing. To address this the alternates design and DEIS should examine public access to the breakwater structures or living shoreline features. Will access be permitted (or encouraged)? If the design accommodates landing and disembarkation what features will be provided? [See also next section on attractive nuisance.] Who will own the site (i.e. the newly created structures and the area they immediately occupy)?

The DEIS should clearly indicate the boundaries of public ownership of the currently unoccupied beach, foreshore and underwater lands, as well as ownership or access rights that may change with the project.

Will there be any exclusion zones surrounding the structures to prohibit approach/landing by the public? Who would enforce such provisions, if any?

ATTRACTIVE NUISANCE

New in-water structures could create an attractive nuisance issue with respect to the proposed breakwaters depending on location and accessibility. If swimmers from the shore, boaters or small craft could reach and stand on the breakwaters, they might be attracted to it, resulting in the potential for injury. Additionally, there may be an attraction for people to harvest or eat oysters from this source, impacting the integrity of the reef and posing a potential health risk if people consume tainted oysters. An examination of the attractive potential of the structures, management provisions, and legal liabilities is appropriate to address this issue.

MONITORING

In the Draft Scope document, pg. 15 under mitigation: "Additional measures *may* include pre- and post-monitoring to ensure that the breakwater is installed and performing as designed…" Pre- and post-monitoring of the project should be included in project recommendations to demonstrate the effectiveness of the design, to support additional adaptation measures, and to verify ecosystem effects. We recommend the following parameters be collected, with frequency to be determined based on discriminating natural and project-based effects:

a) Cross-shore topography including beach width, dune height and width, berm height, location/depth of offshore sand bar if present, location and depth of breakwater structures. LiDAR based topographic/bathymetric surveys might be cost effective for capturing this data.
b) Periodic sampling of biological community, including bird, fish and shellfish, on a frequency that captures seasonal and project-based variations. External sources such as bird surveys by others may be utilized if they are reliable.
c) Flood damages and emergency services costs in the community. Reporting estimates for these costs should be part of the routine maintenance agreement for constructing a project. A reasonable basis for cost estimates should be documented. Note that FEMA reports only capture disasters, so routine reporting on lower level damages and costs are needed from the community.

ENGINEERING FEASIBILITY

The final project design report should demonstrate successful functional performance is reasonably certain. The stability, life-cycle, maintenance requirements and operational functionality should be demonstrated by reference to successful implementation of similar projects elsewhere, and by hydraulic modeling of the viable project alternatives. Test installations may be necessary to verify performance, depending on the level of certainty provided by other evidence.

PROJECT LIFE EXPECTANCY

If a lifespan over which the project will be effective is known, or limiting conditions under which the project will perform satisfactorily, they should be clearly identified in the DEIS. Deconstruction or decommissioning activities, if any, should be described along with associated costs. Planned adaptations or opportunities to expand or rebuild the project may be incorporated, affecting operations or effectiveness over time, or extending functional life.

POTENTIAL REGULATORY APPROVALS

Re: State of New York – The description of Coastal Consistency, page 5, should include all types of federal actions: funding, federal direct actions and federal permitting actions.

CONSTRUCTION/BEST MANAGEMENT PRACTICES

Information on the best management practices that will be employed during construction of the breakwaters project to minimize disturbance, turbidity and water pollution from the construction activities should be included in the DEIS. Describe any specific measures that will or should be taken during construction to avoid, minimize, or mitigate impacts to sensitive species. Include consideration of seasonal mitigations or appropriate windows to conduct various types of work in the various locations. Describe debris removal BMPs. If any on-site contaminant issues are known, describe management measures that will be employed.

PREPARATION/ TIMING/ PHASING OF CONSTRUCTION

Phases of work – The DEIS should fully describe the time frame for beginning and completing each of the projects and detail the anticipated phasing of each as much as possible. This should be coordinated with evaluation of impacts.

Demolition – Part e. of the EAF references “demolition” as part of Phase I – For each viable alternative, describe fully the demolition requirements and how they relate to the project. What is the need for demolition? If appropriate, what is the scheduling or phasing of the demolition? This information may be incorporated into permits.

DURABILITY OF DESIGN

The underwater and nearshore environments are exposed to substantial natural forces. The DEIS should describe the engineering mechanisms and methods for fixing structures to or into the benthos or shoreline and ensuring their long-term stability. Any measures which will be taken to prevent their movement, displacement, or migration should be identified.

MAINTENANCE/ RESPONSIBILITY

a) For the components of the viable alternatives, describe long-term maintenance and stewardship requirements. Through what means will structures, processes or administration be maintained?

What entity is responsible for maintaining and ensuring proper functioning of the components for their intended purposes?

DEBRIS REMOVAL

Please discuss responsibility and procedures for removal and proper disposal of any plastics or other debris which may tend to accumulate on or among the breakwaters.

NAVIGATION AND SAFETY

Evaluation of potential effects on navigable waters and designated channels may be required by involved agencies and stakeholders. The location of breakwaters in relationship to the federal navigation channels should be illustrated in DEIS documents. Any potential conflicts with commercial and recreational vessels both offshore and inshore of proposed breakwaters should be identified. Potential revisions to navigation mapping are likely and should be discussed in the DEIS. The presence of breakwaters or other in-water features will need to be mapped to facilitate safe passage between them to reach the shore and harbor entrances. Locations, sizes, structure types and schedules for in-water construction staging areas may be necessary and should be discussed with the US Coast Guard Any needs for permanent buoys, lights, or other indicators to alert boaters to the presence of in-water structures should be discussed. The effects of alternatives on small craft such as kayaks should be discussed.

FEMA/ POTENTIAL FIRM CHANGES

The project alternatives may affect the Flood Insurance Rate Maps (as was noted on p. 5 of the Preliminary Draft Scope). The DEIS should discuss whether or not this possibility has been addressed directly with FEMA pursuant to the proposed alternatives. Include relevant communications from FEMA in this regard.

PARKS

The DEIS should discuss any impacts of the project alternatives on existing parklands, accessibility, and uses. Any parkland alienation and/or new parkland created by an alternative should be discussed. Any marine protected areas or special use or exclusion areas affected by the alternatives should be discussed.

DREDGING

The DEIS should provide details on the location of dredging sites (if any) dredging methods, volume and type of material to be removed, purpose and need, and disposal details. If possible it is advantageous to keep clean sediment within the littoral transport system. Effects of dredging or placement on sediment budgets and littoral transport should be discussed in the DEIS.

LIVING SHORELINES

The value of living shoreline components of project alternatives, including environmental services provided. To the extent project alternatives emulate natural processes quantifiable and non-market benefits may be reported. The DEIS should clearly state that beach nourishment related to any proposed dunes is a structural protective measure rather than a living shoreline approach. In general, Living Shorelines are erosion management measures that restore ecosystem functions where they are otherwise reduced or lost.

BREAKWATERS PROJECT AS EROSION CONTROL

Natural erosion rates - A stated objective of the project is "…to address wave action and long-term shoreline erosion…" (Draft Scope, p. 2, second para.) Under natural conditions shoreline erosion contributes sediment to area beaches and near shore habitats. Eliminating this erosion could have negative consequences that should be investigated and reported in the DEIS.

The shoreline of Staten Island was lined with oyster reefs until the early 20th century, which significantly reduced erosion. Restoration of similar conditions might improve environmental quality, but the evaluation of potential benefits would have to be carried out in conjunction with a thorough understanding of present and historic biological community. Ecosystem restoration benefits would have to be measured within the context of a broader conservation or restoration program. To estimate benefits, consider the context of the present versus historic ecological community. What benefits would the proposed alternative deliver in that context?

DUNES

Natural dunes accumulate through processes of onshore sand transport during storms, sub-aerial sand transport, and vegetative entrapment. The normal functioning of coastal dunes includes erosion and sediment contributions to the beach and nearshore during storms, breaches creating natural inlets, and retreat in response to sea level rise. Natural dunes in coastal areas are inherently transient and not permanent. They are not of uniform dimension and include discontinuities. The biological community is adapted to these conditions and may be impaired if the habitat is "stabilized". To the extent the project emulates natural processes and features, the constructed measures may be referred to as "artificial dunes".

The construction described in the draft scoping document (page 4) does not provide the features and functions of natural dunes as described above, and are more aptly described as a levee.

a. Possible treatments of dunes in the DEIS: If the intention of the project is to maintain a stone core covered by sand in a specific alignment, it would be more appropriate to refer to it as a levee. Effects of the proposed system on the beach berm and nearshore should be examined and reported, along with sand quantities and other maintenance requirements over time, and anticipated response to periodic storm events .
b. If academic or engineering papers are available that support the assertion (page 4) that planted vegetation and root structures "…bind the sand, helping to reduce wind and water erosion…" are available, those references would be useful and appropriate to include.

c. If the project objective is to recreate a natural dune system in the project area, large quantities of additional sand are likely to be needed in the nearshore. Check with the Army Corps of Engineers to determine whether a modeling system is available that would evaluate the potential for dune formation and sustenance. If so, the initial construction and sand maintenance requirements for this measure may be estimable with the program. As per the discussion above, effects of the proposed system on the beach berm and nearshore should be reported, along with sand maintenance quantities and response to periodic storm events.
d. For all viable alternatives storm damage benefits should be estimated, along with the expected performance life and capacity to be adapted to future conditions.

SUGGESTED DATA SOURCES FOR RESEARCH

Hudson-Raritan Estuary Comprehensive Restoration Plan, Vol. I (2009)

*Section 3.1.4 –Oyster Reefs –and references to specific sources contained within this section; in particular Coen and Luckenback (2000) on oyster reefs as breakwaters; Reference to the Great Beds historically present; oyster industry background, MacKenzie (1992); also NYS DEC recommendations for project sponsors developing oyster reef proposals and considerations for the same in New York waters; *Figure 2-3 – Historic Presence of Oysters in the HRE study area [Source: Metropolitan Sewerage Commission 1911]; *Map 3-4 – Oyster Reefs Restoration Opportunities; *P.10, paragraph 2 – to p. 13 [description of physical and chemical alterations and their anthropogenic causes which led to decline of the eastern oyster in the study area]

Hudson-Raritan Estuary Comprehensive Restoration Plan, Vol. II (2009)

Guide to planning and regulatory considerations for conducting restoration projects; Guide to restoring Target Ecosystem Characteristics; Many additional useful references

http://www.harborestuary.org/watersweshare/resources.htm

Many partner agencies and contributing organizations to the HRE Plan are listed.

Great Kills Harbor Breakwater Study: Final Project Summary Report (NEIWPCC, 2014)

Guidance on the use of offshore breakwaters as an adaptive strategy to respond to wave damage and erosion due to coastal storm events and long-term coastal land loss; development of Quality Assurance Project Plan (QAPP), hydrodynamic models, analysis of finding, and recommendations.