SCONSET BEACH NOURISHMENT PROJECT

Proponent Responses Following Conservation Commission Meeting #4 (held September 26, 2007)

The information included herein is intended to directly respond to questions asked at the Nantucket Conservation Commission meeting held on September 26, 2007 regarding the Sconset Beach Nourishment Project. At that meeting the Proponent, the Siasconset Beach Preservation Fund, and Project Team members were able to respond directly to many questions from the Commissioners. Meeting constraints, however, prevented the Proponent from directly responding to many questions asked by the public and some of the questions from the Commission itself. Although many answers could have been provided at the meeting had there been sufficient time available, the Proponent hopes that these responses are helpful and informative.

In an effort to be thorough and comprehensive, this document includes responses provided at the meeting itself as well as responses to questions that were left unanswered or required follow-up information. This information is organized according to the order in which questions were raised at the meeting. Where possible, the Project Team has identified the individual asking the question; we apologize if any names are incorrectly recorded here.

PRESENTATION 1: Borrow Site Waterbirds (Dr. Bob Kennedy)

1. Question (Smith): Do diving waterbirds dive for immature clams?

(Kennedy): Scoters and common eiders feed almost exclusively on small shellfish, which include clams, mussels, etc. Nantucket waters also contain large concentrations of amphipods, and the birds may prey on those as well. Long-tailed ducks, for example, normally feed in the water column (on amphipods). The only real way to determine exactly what they feed on is to obtain specimens and perform stomach content analyses.

2. (Bennett): Are you assuming the surface-feeding birds are feeding on prey directly below them?

(Kennedy): Yes. Gulls are opportunists that feed on prey right at the water's surface.

3. (Bennett): Is there an upwelling effect on birds' prey due to the shoals?

(Kennedy): Absolutely. Upwelling effects are particularly pronounced for amphipods within the water column. The interaction of waves and water currents with the bathymetry of the shoals generates a circular flow pattern that brings the amphipods to the surface. Northern gannets, on the other hand, feed on bait-size fish, and these birds actually swim underwater to hunt their prey.

4. (Oktay): What is the typical range or feeding radius for eiders or long-tailed ducks?

(Kennedy): The birds forage wherever food is available. Therefore, if food is available on the shoals they will remain there; if no prey are available there, they will move on to another area.

5. (Oktay): You do not have any radio-tagging results, for example, which would show the birds' range?

(Kennedy): No. Radio tags have been problematic and relatively ineffective in the studies I am aware of.

6. (Oktay): Will you be surveying in the winter, or surveying gulls during construction months?

(Kennedy): Gulls are not generally present during the months encompassing the proposed construction schedule. Given the low population numbers during that period, we have not continued surveys through the proposed construction season. These birds nest at the beginning of the season, and the greatest concentration of gulls will be at the shoreline during that period.

7. (Oktay): You said the Borrow Site habitat represents 0.08% of available habitat within 6 miles?

(Kennedy): Yes, that refers to suitable habitat within 6 miles of Nantucket. Most waterbirds are in the shallow shoal areas, and we sought to compare the size of the Borrow Site to other areas with water depths from 0-60 feet. Most of these waterbirds do not dive below 60 feet, and most prefer depths from 0-30 feet. The bulk of the Borrow Site is 30-60 feet deep.

8. (Oktay): What is the percentage of the Borrow Site relative to highly-populated neighboring sites?

(Kennedy): Our survey data provides some useful insight. During the February 22, 2007 survey, for example, the Borrow Site had close to 1,000 birds per square kilometer, whereas areas in front (i.e., north) of the site had 1,000-3,000 birds while areas behind the site had perhaps 4,000 birds. Based on these numbers, perhaps 10% of the birds are using the Borrow Site. However, when a bird dives down to the bottom, it can be carried significant distances downcurrent. Most of the waterbirds are concentrated in areas around the Borrow Site, but not at the Borrow Site itself.

9. (Oktay): Are you concerned that the proposed dredging could destabilize the shoals, thus impacting waterbird populations?

As Dr. Kennedy expressed at the Commission meeting, it would certainly be a concern if the shoals disappeared, and there are many different factors that make the shoals important features. He also explained, however, that he would defer to the geologists for their analysis of any potential effects from the Project, since they are experts in the field.

As the Proponent has explained on numerous occasions, the Borrow Site is landward and entirely distinct from the shoals, and Project engineers do not expect any significant wave transformation to occur at the Borrow Site or in adjacent areas as a result of the proposed excavation. This absence of impacts may be due to the fact that the Project will leave the integrity of associated sand ridges and crest elevations unaffected. Since Borrow Site excavation will be performed with a broad dredge cut of approximately 10 feet, the site bathymetry will not be drastically altered. In fact, natural bathymetric changes due to tidal currents and storm waves are more substantial than the changes that will occur as a result of the proposed dredging. While dredging will likely leave behind a smoother seafloor than presently exists, dynamic oceanic currents will rapidly re-sculpt the seafloor and create natural

variations. As a result, Project activities at the Borrow Site are expected to result in little or no alteration to tidal currents.

Furthermore, modeling results have consistently shown the Project will not have any detrimental effects on sediment transport, wave transformation, or currents in or adjacent to the Project area. Appendix B of the FEIR addresses Borrow Site and seabed elevations. In general, model simulations suggest the seabed around the Borrow Site is stable or slightly accretional. Figures 37 and 38 in FEIR Appendix B illustrate the model predictions for seabed elevation change in a 48-hour period during 20- and 50-year storm events, respectively. Storm-induced patterns of modeled elevation change in and around the Borrow Site do not indicate the shoal is degrading or collapsing into the excavated Borrow Site. Correspondingly, the model does not indicate a significant increase in seabed elevation within the Borrow Site itself, which would be expected if the shoal was collapsing into the excavation areas. All of the best available scientific data consistently indicate that Borrow Site excavation will not destabilize the shoals.

10. (Rudin): I appreciate there is a fairly low density of birds expected in the area during the construction period, but there is some concern that 24/7 construction could disrupt birds with light, noise, etc.

(Kennedy): Have you ever been on a trawler at night? These operations actually attract waterbirds. Gulls and gannets are opportunists, and any activities that release food such as chopped clams into the water column will attract these birds. Project operations, likewise, will probably attract waterbirds; this could conceivably result in a detrimental impact as well, if the waterbirds end up feeding on plovers or terns.

With this said, Dr. Kennedy does not believe gulls attracted to the dredging operations will have any impact on Nantucket's nesting shorebirds. While dredging operations in offshore waters may provide a food source, this source will be located at a distance from the gulls' nesting areas and the birds will be reluctant to forage so far away. Therefore, dredging at the Borrow Site will have limited benefits for gulls nesting on Nantucket's eastern shore.

Similarly, placement of nourishment material on the beach will not negatively impact nesting Piping Plovers or Least Terns by attracting gulls to the extent that numbers increase markedly. While birds such as gulls may be attracted to the immediate construction area by the availability of organic material in the newly-placed sand, construction will begin after the gulls have started nesting and the breeding population is fixed for the season. Gulls are opportunists and will use whatever food source is readily available. Therefore, while gulls already present in the area may benefit from the nourishment fill, this benefit will only occur during the actual construction season. Furthermore, 90% of the construction will be outside areas used by nesting shorebirds. Within the potential shorebird nesting areas (i.e., the remaining construction at Sesachacha Pond and Low Beach), construction will not occur until after the nesting season ends, so gulls will not be attracted to these zones when unfledged chicks are present. By the following year, when shorebirds may begin to utilize the entire nourished beach, there will be no Project-related activities that could benefit gulls.

Dr. Kennedy's weekly beach survey results from the past three years form an effective baseline against which the Proponent will compare construction-period and post-construction monitoring results to quantify any actual effects.

11. (Rudin): The proposed nourishment material will have an 11% gravel content. Will such a gravel concentration affect the nesting choices of plovers and terns, which nest on the Project fringes?

(Kennedy): Piping plovers nest in all of Nantucket's isolated beaches, and the grain size differs in each of those areas. I have seen the birds in washout areas containing high concentrations of shells and gravel. The birds will likely seek sandy areas, since they are adapted to dry sand of the upper beach, but I cannot say they will not use the gravelly areas.

12. (Andrews): How long were each of your winter surveys?

(Kennedy): We performed two 26-kilometer surveys, during which we maintained a fairly constant speed of 20 kph. This speed allowed us to approach birds at a reasonable rate so as to detect and record the populations. The operation of any offshore vessel will inherently cause birds to take flight, so we tried our best to record survey data relative to the locations where the birds took flight.

13. (Andrews): Do you have weather data for the surveys?

(Kennedy): We performed surveys when weather conditions were favorable for passengers on board. Sea conditions were below four feet, and we generally headed out to survey around 7:30am. Surveyors recorded the following weather data at the beginning, middle, and end of each survey effort: air and water temperature, wind speed and direction, water current speed and direction, tide, barometric pressure, humidity, and cloud cover.

14. (Andrews): So you did not survey at different times of day?

As Dr. Kennedy explained at the Commission meeting, observation times were kept consistent from survey to survey, because otherwise the surveyors would have had to keep track of information almost daily to see how populations fluctuated. For the survey data to be most informative and useful, the surveys were designed to employ replicable methods, keeping as many variables as possible consistent for each effort.

15. (Andrews): So you essentially only have 7 snapshots? Do you have any other waterbirds data?

(Kennedy): Yes, the surveys provide snapshots of the waterbird populations, but we did supplement our data with information from other surveys.

The Proponent has used the following supplementary data sources for the winter months: (1) Christmas Bird Counts from the past several decades; (2) Dr. Richard Veit's studies of Long-tailed Ducks in Nantucket Shoals; (3) surveys of wintering gulls along the coast from Tom Nevers to Sankaty Head, performed by Dr. Kennedy and Edith Andrews; and (4) Dr. Kennedy's weekly beach monitoring efforts from Hoick's Hollow to Codfish Park between mid-March and September, which record waterbirds and shorebirds present onshore to 0.5 miles or more from shore.

16. (Andrews): Did you perform any surveys in the equilibration zone?

The Proponent did not perform boat surveys of birds in the nearshore area, but the Project's impact analysis has incorporated data from Christmas Bird Counts and from Dr. Kennedy's beach monitoring of the Project area.

17. (Andrews): Were the birds highly-mobile feeders?

(Kennedy): Yes, very mobile and highly opportunistic.

18. Andrews): You mentioned the birds could benefit from material stirred up in the water column by dredging activities. But since there are few waterbirds present in the summer, when construction is proposed to occur, any such benefits would be limited.

(Kennedy): If there is a food source available, then any birds present in the area will pursue that food source.

19. (Oktay): Do you have an idea how Project-generated turbidity may affect diving birds in terms of prey recognition?

(Kennedy): Project engineers have demonstrated that any Project-generated turbidity plume will be very short-lived. I do not foresee any problems related to Project turbidity.

20. (Bobby DeCosta): I am curious as to why the study was only done in the winter, since construction will take place between June and November. I have also seen loons, shearwaters, stormy petrels, etc.

(Kennedy): The study was set up at a time when the Proponent was still considering a winter construction schedule. Since summer waterbird concentrations are drastically smaller in comparison to winter, I was particularly interested in quantifying winter concentrations, when the waterbirds are much more abundant and active in the area. The sheer volume of birds in Nantucket waters is fascinating.

21. (Bobby DeCosta): Given the schedule change, do you feel more surveys would be important?

(Kennedy): I believe the May survey is indicative of waterbird populations that would be present during the proposed construction period.

22. (Bobby DeCosta): I fish Quidnet Rip, and during the construction season we occasionally see small bluefin tuna as well as shearwaters and stormy petrels. To say that one May sampling covers the whole summer seems a bit of a stretch,

(Kennedy): I agree more surveys would be helpful. Shearwaters do occur occasionally, but are quite rare during the months encompassing the proposed construction schedule. Regarding the Common Loon, this bird is actually quite common in Nantucket waters. Common Loons and red-throated loons are often weather-oriented, and large numbers can pass through these waters, at times numbering in the hundreds if not thousands. In an ideal situation we would certainly like to conduct more surveys, because they broaden our baseline of knowledge.

23. (Josh Eldridge): Do you know if grain size affects the nesting success of plovers and terns?

(Kennedy): I cannot answer that question. Studies generally focus on distance from the ocean and distance from vegetation rather than grain size. From my accumulated knowledge, I would say that grain size has little impact; the color of the sand would have a greater impact on the birds. We have samples from the Borrow Site and the beach, and they are quite similar. Success rate is more predator-related, and predation has a huge impact on plovers. Adjacent populations of gulls or feral animals would be more of an issue than a change in grain size.

Ernie Steinauer, a representative from the Massachusetts Audubon Society on Nantucket, interjected that from what he observed this past summer, plovers and terns nest in a variety of grain sizes. He informed meeting attendees that a spoils pile from the Sesachacha Pond dredge cut, which has quite a bit of gravel, contained nests. Mr. Steinauer stated that plovers and terns nest in a variety of different materials, and he is not aware of any detailed studies documenting the issue.

24. (Ernie Steinauer): How big is the Borrow Site in square kilometers?

(Kennedy): It is 195 acres, so less than 1 square kilometer.

25. (Ernie Steinauer): So even given the relatively low concentrations, a significant number of birds still use the Borrow Site. Did your surveys ever stop at the Borrow Site to see if birds returned to the area to dive again?

(Kennedy): If we stationed at the Borrow Site, the ducks would not return there simply because of our presence. With that said, we did not stop at any given location during our surveys because we wanted our observation time per survey kilometer to remain consistent throughout each transect.

26. (Ernie Steinauer): On your graphical presentation of survey results, does the concentration at kilometer 15 include the Borrow Site?

(Kennedy): No, that is not part of the Borrow Site.

27. (Ernie Steinauer): I know Cape Wind performed 500-foot aerial surveys over Nantucket Sound during the winter with a twin-engine Cessna. An added benefit from those surveys was that they ended up recording a lot of sea turtles as well. I think if you did aerial surveys you could include mammals.

As Dr. Kennedy explained at the Commission meeting, he is aware of Simon Perkins' study and the equipment used. However, winter aerial surveys over the ocean, particularly in areas east and south of Nantucket, can be quite dangerous even in a twin-engine plane. One local pilot, who is also a charter fishing boat captain, refused to fly out over the ocean in the winter at the altitudes required for waterbird surveys; another potential navigator also declined to participate due to safety concerns. Boat-based surveys were deemed most practical and enabled a greater window of opportunity in which to perform the actual survey work.

28. (Bam LaFarge): It seems that even though dredging will occur during the summer, the Project will be impacting the bottom so fish and birds that feed there will be affected the next year. You cited a 1-3-year recovery, but say very few studies have been done. How do we know this is the recovery period?

As presented in the fisheries section, the 1-3-year benthic recovery period is based on data from a number of sources, including the National Research Council. We have used data from studies conducted in Florida and New Jersey waters, to name a couple. Results from a seven-year biological monitoring program conducted jointly by the U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and New Jersey Division of Fish and Game suggest recovery may occur even more rapidly (Burlas, Ray and Clarke, 2001[1]). That program monitored biological recovery following placement of more than 19 million cubic meters of sand over approximately 21 miles of high-energy beaches between Manasquan Inlet and Asbury Park, New Jersey; this effort was associated with two dredge events and a project duration of seven years. Biological monitoring showed that intertidal and nearshore species abundance, biomass, and taxa richness recovered within 2-6.5 months of filling, that offshore invertebrate biomass at the borrow site recovered in 2-2.5 years, that ichthyoplankton sustained no detectable impacts, and that finfish distribution, abundance, and food habits were unaffected.

Given the dynamic conditions in the Project area, recovery would be particularly rapid in response to the importation of sediment, nutrients, and organisms. Post-construction monitoring will verify the rapid recolonization.

29. (Ian Goldling): At Monday's meeting, you said there would be a slow rate of in-fill at the Borrow Site. If that is the case, how could benthic recovery occur rapidly?

Dynamic oceanic conditions will transport sand into the excavated area soon after dredging ceases, but infill of the Borrow Site will occur relatively slowly given its large area. Habitat recovery will occur relatively rapidly, particularly given the rapid colonizers inhabiting the area.

30. (Ian Goldling): That rapid recovery will occur despite the exposure of a completely different bottom?

(Barrett): The excavation of nourishment material will not result in habitat conversion at the Borrow Site; to the contrary, the post-dredging substrate will be quite similar to what currently exists.

31. (Ian Goldling): You said the Borrow Site contains only 0.08% of the habitat available to waterbirds, but isn't the total area of habitat you are considering relatively arbitrary? Doesn't the Borrow Site constitute a much higher percentage of the overall area of best available habitat for waterbirds?

(Kennedy): Several factors went into that calculation. First, the Borrow Site is 195 acres in size. Second, the primary habitat for ducks occurs where water is 0-60 feet deep. To estimate habitat coverage, we identified areas within 6 miles of Nantucket where water depths suggest primary habitat suitable for waterfowl; much of the prime habitat occurs on the shoals themselves, which is where we found the highest bird concentrations. At Great Point, where waters are deeper, there are virtually no

[1] Burlas, M.; Ray; G.L.; and Clarke, D. 2001. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project. Final Report. U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station. http://www.nan.usace.army.mil/business/prjlinks/coastal/asbury/index.htm.

birds; after the shoals, populations are similarly small. The primary habitat encompasses shallower shoal areas, and the bulk of the Borrow Site is actually 30-60 feet deep. Most of the birds are in waters less than 30 feet deep.

32. (Doug Smith): You mentioned the dredged material would contain a lot of organic material from the benthos. If herring gulls and black-backed gulls increase in the nourishment area, what impact would that have on nesting plovers and terns?

As Dr. Kennedy explained at the Commission meeting, birds will be attracted to areas where sand is deposited on the beach. When nesting begins in May, however, recruitment ends and the breeding population of summering gulls becomes fairly fixed. By the time construction begins in June, the population size will be stable and not prone to a sudden increase. Gulls already present in the area will be opportunistic feeders, preying upon whatever happens to be available. It is important to note, however, that any Project-induced enhancement in prey will only occur during active nourishment. While this means the gull population may fare better during the actual construction season, perhaps enabling more gulls to fledge, this effect will be temporary. Project activities can also be expected to attract other shorebirds migrating through the area.

Furthermore, nourishment material will not be placed near historic nesting areas until after all Piping Plovers and Least Terns have fledged. Roughly 90% of construction will occur outside areas used by nesting shorebirds. For those parts of the beach where shorebirds may nest (i.e., Sesachacha Pond and Low Beach), construction will not occur until after the nesting season ends; therefore, no gulls will be attracted to these areas when unfledged chicks are present. By the following year, when shorebirds may begin to utilize the entire nourished beach, there will be no Project-related activities to benefit gulls.

33. (Pete Kaiser): Were all of your waterbird survey transects performed parallel to the beach?

(Kennedy): To maintain consistency, we tried to replicate conditions from survey-to-survey. We tried to make as many variables as consistent as possible. Shore-parallel transects were located 2.5-3 miles from shore.

34. (Pete Kaiser): Did you find any differences in bird abundances during slack tide or a running tide? If you perform additional surveys, you might consider assessing the relation to the tides.

(Kennedy): We did not specifically gear our surveys to the tide itself.

35. (Pete Kaiser): When do clams spawn?

(Barrett): They spawn once a year, typically in June or July.

36. (Pete Kaiser): Does the spawn remain localized?

(Barrett): With active currents, spawn can travel quite far.

37. (Pete Kaiser): If clams spawn in June, how much of the spawn could be entrained by the dredge?

(Barrett): We have not evaluated that, but our ichthyoplankton samples did not collect much spawn. There is certainly spawning occurring, however.

38. (Pete Kaiser): How large are the clams the birds feed upon?

(Kennedy): Waterbirds will pretty much feed on anything as large as their bills will allow, so could perhaps feed on clams up to 2 inches long.

39. (Pete Kaiser): If the birds are there, they are obviously eating something. If Project surveying was predominantly for large clams, then there is still some uncertainty as to how many small clams are there and could be impacted.

(Kennedy): To support more than 100,000 waterfowl, the shoals must be an extremely rich source of food. The Proponent is performing dive surveys in the area, and I plan on participating to look at some of the smaller clams.

40. (Pete Kaiser): Will that survey be a drift-dive? To adequately assess clams, which could be buried, the survey would need to use jets.

As explained at the Commission meeting, the dive survey will be a drift-dive that will collect video images and assess habitat. The Proponent will also deploy a Van-veen grab sampler from the vessel to collect supplementary information on surf clams of all sizes.

41. (Pete Kaiser): It seems there are large amphipod populations in the area.

(Kennedy): The amphipod populations are probably species that are more prevalent in the winter. It is my theory that Nantucket was once so popular for whaling because of large amphipod populations. The amphipods are a huge offshore resource.

42. (Pete Kaiser): Inshore and offshore amphipods are quite different in size.

(Kennedy): Yes, you would expect to see different species in these different zones.

43. (Pete Kaiser): We often see rafts of amphipods on which striped bass gorge themselves; from Bass Rip in, at times there are hundreds of birds present.

(Kennedy): That is true. During my weekly surveys from shore in the Project area, populations of gulls spotted offshore begin to increase dramatically in August.

44. (Oktay): In the Commission's FEIR comment letter, we quote several different references regarding benthic recovery and potential impacts to waterbirds. Benthic recovery can be accompanied by a change in species distribution, resulting in a significantly different benthos when compared to pre-construction characteristics. CPE has also documented this change in species diversity. Should we be concerned about this at the Borrow Site?

As Dr. Kennedy presented at the Commission meeting, the surveys we have conducted suggest the majority of waterbirds are using the shoals and not the Borrow Site itself. Another point to consider is the Borrow Site contains a small fraction of the waters of that depth that are in the area and available to feeding birds. A multitude of adjacent areas containing similar water depths will still support the same

abundance and diversity of fauna. Furthermore, the extensive biological monitoring program affiliated with the Manasquan Inlet-Asbury Park nourishment efforts showed rapid benthic recovery (in distribution, abundance, and diversity), and no impacts to finfish (see Question/Response 28).

45. (Oktay): There is a great deal of patchiness between 2005 and 2006 data, as one would expect. There seems to be a lot of natural variability.

(Kennedy): There is a tremendous amount of natural variability. A greater number of surveys would likely show those differences evening out.

46. (Oktay): If this were your own personal program, how long would you like to see surveys extend to provide sufficient data? I generally try to perform studies for three years, perhaps.

As Dr. Kennedy explained at the Commission meeting, it is difficult to define a "sufficient" duration for a scientific study, although certainly longer-duration studies provide more detailed information. As one might expect, longer studies often provide higher-resolution data, but it is possible to reach a point of diminishing returns with greater frequency and duration of surveys. Ideally, three years would be a sufficient period of time to provide a clear record of population dynamics around the Borrow Site. Regardless, Dr. Kennedy asserts that the first year of survey results does demonstrate that the majority of waterbird activity occurs to the north, east, and south of the proposed Borrow Site.

47. (Andrews): Do you have any idea what affect the proposed railroad tie mitigation structure might have?

(Kennedy): Any structure on the bottom will attract a greater diversity of organisms. I think that by providing that diversity, the bird life will benefit.

48. (Andrews): Is the benthic community in the New Jersey study similar to this benthic community?

(Barrett): It is similar with regard to substrate type. However, there are differences in water temperature, for example, which can influence the species matrix.

49. (Andrews): Do you have studies from Massachusetts regarding benthic recovery times?

There have never been any dredging projects of this type in Massachusetts. However, a considerable body of research shows that full recovery of the benthic community (abundance and species diversity) typically occurs within 1-3 years of disturbance (National Research Council, 1995[2]). Results from a seven-year biological monitoring program conducted jointly by the U.S. Army Corps of Engineers,

[2] National Research Council, 1995. *Beach Nourishment and Protection*. Committee on Beach Nourishment and Protection Marine Board; Commission on Engineering and Technical Systems. National Academy of Sciences, National Academy Press, Washington, D.C. 352 pp.

National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and New Jersey Division of Fish and Game suggest recovery may occur even more rapidly (Burlas, Ray and Clarke, 2001[3]). That program monitored biological recovery following placement of more than 19 million cubic meters of sand over approximately 21 miles of high-energy beaches between Manasquan Inlet and Asbury Park, New Jersey; this effort was associated with two dredge events (performed fall 1997 and fall 1999) and a project duration of seven years. Biological monitoring results showed the following: (1) impacts were confined to the dredge and fill areas; (2) intertidal and nearshore species abundance, biomass, and taxa richness recovered within 2-6.5 months of filling; (3) offshore invertebrate biomass at the dredging location recovered in 2-2.5 years; (4) invertebrate abundance at the borrow site returned to pre-dredge conditions by the following spring; (5) there were no detectable impacts to ichthyoplankton; and (6) distribution, abundance, and food habits of finfish (surfzone and offshore) were unaffected. Of additional interest, the program confirmed that nourishment enhanced suitable nesting and growing habitat for piping plover and least tern. The study also documented that turbidity did not significantly exceed background conditions except within the swash zone itself, where localized elevated turbidity had a lateral extent of only several hundred meters.

Benthic communities exposed to regular disturbance under natural conditions, like those in Sconset's high-energy environment, recover more quickly than benthic communities in more stable environments because they are more adapted to dynamic conditions. Post-construction monitoring will determine the impact area's specific recovery period. Several studies in soft-sediment habitat suggest that the 1-to-3-year recovery occurs through the migration of motile adults, vertical migration of infauna living deep within underlying substrate, and movement of infaunal organisms through sediment bedload transport (Blake, Doyle and Cutler, 1996[4]; Byrnes, et al., 2004[5]; and Newell, Seider and Hitchcock, 1998[6]). Hard substrate is typically recolonized by sessile organisms through the dispersal of eggs and larvae from adjacent areas during the winter and spring months. Sand waves at the Borrow Site demonstrate there is a lot of sand movement, but in-filling will occur relatively slowly because the Borrow Site is so large. Despite the relatively slow rate of in-filling, the area is certainly dynamic, and by all indications recovery will be relatively rapid.

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[3] Burlas, M.; Ray; G.L.; and Clarke, D. 2001. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project. Final Report. U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station. http://www.nan.usace.army.mil/business/prjlinks/coastal/asbury/index.htm.

[4] Blake, N.J.; Doyle, L.J.; and Cutler, J.J. 1996. Impacts and direct effects of sand dredging for beach nourishment on the benthic organisms and geology of the West Florida Shelf. Final Report. U.S. Department of the Interior, Minerals Management Service, Office of International Activities and Marine Minerals. Herndon, Virginia. OCS Report MMS 95-0005. 109 pp.

[5] Byrnes, M.R.; Hammer, R.M.; Thibaut, T.D.; and Snyder, D.B. 2004. Potential physical and biological effects of sand mining offshore Alabama, USA. Journal of Coastal Research. Volume 20, Number 1. Pp. 6-24.

[6] Newell, R.; Seider, L.; and Hitchcock, D. 1998. The impact of dredging works in coastal waters: A review of the sensitivity to disturbance and subsequent recovery of biological resources on the seabed. Oceanography and Marine Biology. Volume 36. Pp. 127-178.

PRESENTATION 2: Regulatory Compliance

50. (Rudin): You discussed performance standards for LUO as relevant to the nourishment area; do they not also apply to the Borrow Site?

(Barrett): Yes, they do apply to the Borrow Site.

51. (Bennett): You keep saying the Project does not involve any "coastal structure", but the regulations do not directly refer to a "soft" or "hard" structure.

Dirk Roggeveen intervened here and stated that the presentation set forth the laws and regulations as the Proponent interpreted them and determined compliance. He explained that the Commission staff has provided 300 pages of its own regulatory interpretations for the Commissioners to review. Mr. Roggeveen declared that from the staff's perspective, the terraces qualify as a structure. However, he went on, the Proponent has not only the right but the obligation to present its interpretation of the regulations and how the Project complies with them. Any Order of Conditions, however, will express the laws and regulations as the Commission staff understands them.

52. (Oktay): Can you give us a percentage that quantifies how closely the new slope will match the existing slope at full equilibrium (referencing page 37 of the presentation)?

Below mean low water, the new slope will be an average of approximately 3.6% steeper than the existing beach. Above mean low water, the Project's beach slope will be very similar to the existing conditions. These descriptions are based on the assumption that the slightly coarser-grained material from the northern excavation area will be utilized for the initial Project nourishment.

53. (Oktay): There is a slight difference in grain size between the nourished beach and coastal bank, for instance, and I was wondering whether that could be quantified. There will be some variability between the material you are using and the native material, and I was wondering whether you could quantify how those differences may alter natural sediment transport. I'm not sure whether that is possible.

Composite grain size data presented at the Commission meetings are weighted calculations. Most material for the initial Project nourishment will likely come from the northern excavation area, which is slightly coarser-grained than the southern excavation area. From an engineering aspect, the coarser-grained sediment performs (i.e., resists erosion) more favorably, so it would be preferable to incorporate the larger grain size into the design beach so that segment of the Project is more robust. The 11.5% gravel from the northern excavation area is actually quite close to the 10.9% gravel in the native beach.

Furthermore, while it is true that the natural beach has a composite mean grain size of 0.86 mm and the nourished beach will have a mean grain size of 0.92 mm, this difference is statistically small (roughly 7%) and will not have an ecological impact or detrimental effect on sediment transport. This variation in grain size is not a significant difference for benthic species utilizing the wet portion of the beach, nor is it significant for piping plovers or other shorebirds.

In addition to mean grain size, the Proponent evaluated sediments in terms of composition, sorting, and percent silt; data are presented in the table below. Based on these data, the sand fraction is extremely compatible between the native beach and the Borrow Site. Overall composition of sediment from both areas is predominantly rounded quartz grains with a low percentage of rounded feldspar grains, some shell fragments, and trace amounts of heavy minerals such as magnetite and ilmenite. Native beach sediments and borrow site sediments were derived from the same glacial outwash source material, and have been reworked by wave energy along the east-facing portion of Nantucket.

In addition to exhibiting a compatible composition, sediments at the native beach and Borrow Site have a similar sorting value (1.61 and 1.57, respectively). These sorting values classify sediments from both areas as poorly–sorted, which means there is a wide distribution of different grain sizes throughout both areas. This characteristic results in sediments with a lower overall porosity relative to well-sorted sediments, since smaller grains will fill the interstitial spaces between larger ones.

In terms of silt content, Borrow Site sediments are composed of approximately 0.95% silt while the native beach has a silt content of approximately 4.2%; although the silt content of the Borrow Site is lower, it is still very compatible with the native beach. All data related to composition, grain size, sorting values, and silt content demonstrate that Borrow Site material is an extremely close match to the native beach and will provide appropriate, compatible nourishment material.

Additionally, Coastal Dune samples collected at the southern portion of Baxter Road and Codfish Park had a mean grain size similar to the overall Coastal Beach. Historically, the Coastal Beach is the main sediment source for these low-lying dune areas. Since the beach is composed of well-sorted sand and does not contain a significant amount of fine material, the adjacent dune is composed of sediment that is very similar to what is on the beach. Coastal Bank may occasionally contribute sediment (containing gravel and other poorly-sorted material) to the landward portion of dune during significant rainfall events, when there is substantial surface runoff-generated erosion. Any coarse material will, over time, be covered by additional windblown sand from the beach. As naturally occurs, sediments on the beach will be sorted in a cross-shore direction, with the gravel fraction concentrating within the breaking zone following construction (similar to the concentration of gravel that currently exists in the breaking zone).

Table 53A: Sediment characteristics of the native beach and Borrow Site.

Location	Mean Grain Size (mm)	Mean Grain Size (phi)	Sorting	% Silt
Native Beach	0.86	0.22	1.61	4.2
Borrow Site	0.86	0.21	1.55	1.0

The potential for flowing water to suspend and transport a given grain of sediment is typically evaluated using the empirically-derived Hjulström diagram (see Figure 53A). This diagram shows the threshold flow velocity required to entrain and transport quartz grains along a planer bed at a water depth of one meter. Although this representation is not ideal for sediment entrainment and transport in highly-turbulent flow characteristic of the nearshore environment, it does provide insight into the flow required to suspend and transport sediments of a given grain size. The Hjulström diagram shows the following associations between flow velocity and sediment transport: sediments with a grain size of 0.8 mm will be transported as bedload (i.e., near-bottom sediment transport) by current velocities of 5-32 cm/second; sediments with a grain size of 0.9 mm will be transported as bedload by currents flowing 5-35 cm/second; and sediments with a grain size of 1.0 mm will be transported as bedload by currents flowing 6-38 cm/second.

Since the mean grain size of sediments at the Borrow Site as well as on the native beach range from 0.86-0.92 mm, it is anticipated that material from both locations would be suspended and transported under nearly identical flow regimes. Therefore, it is anticipated that this miniscule difference in grain size will not change the overall transportability of material along the nourished shoreline.

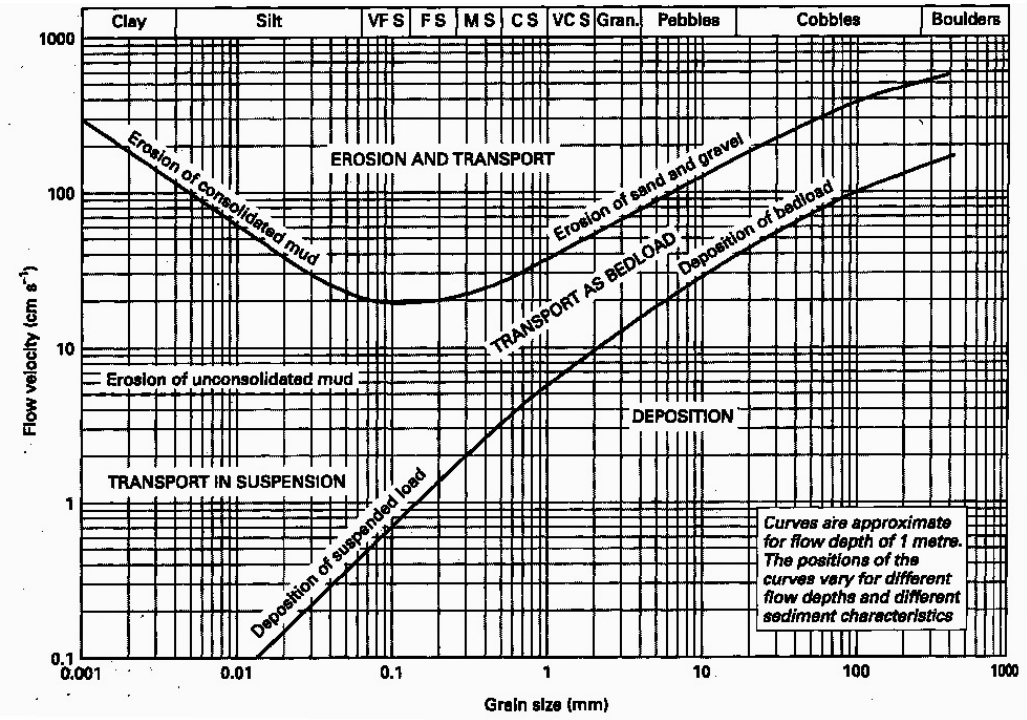

Figure 53A: Hjulström diagram showing critical velocities required to move quartz grains on a plane bed at a water depth of 1 meter.

54. (Bennett): American beach grass does not like salt water. How well does it perform in salty sediment?

(Smith): Beach grass usually gets nutrients from salt water blown inland, so it performs quite well.

55. (Bennett): Are the sewer beds heavily-vegetated?

(Smith): Existing vegetation is relatively dense near the sewer beds, but decreases in density towards the beach.

56. (Oktay): Codfish Park vegetation is not a monoculture containing only American beach grass. It would be beneficial to place all native vegetation types back in the areas.

Based on previous observations of the Coastal Dune at Codfish Park, the majority of vegetation is American beach grass with a significantly smaller amount of other species present as well. The Proponent will perform a survey of existing vegetation prior to constructing the actual nourishment, and this survey will record the extent, type, and density of native vegetation. Upon completion of beach and dune nourishment, a mix of species comparable to the existing vegetation will be replanted within the footprint of the existing vegetation.

57. (Oktay): I do not recall seeing any trace metal data for the Borrow Site material. If there is any kind of leftover metal signature from military ordinance or shipwrecks, that might cause some pollution to be introduced into the water column during dredging.

(Smith): We have performed magnetometer surveys, which would detect large metal objects; our surveys did not detect any such objects.

(Spadoni): You may have noted that in Monday's presentation I mentioned the dredge's drag arms will have a grid to prevent the entrainment of any metal objects.

58. (Oktay): I am concerned about trace metals, not necessarily metal objects. Dredge projects often mobilize trace metal into the water column. Do you have data for what is in the dredged material? It might not be a problem, but I was wondering if the NOI included any chemical testing and not just physical characteristics.

(Smith): State and federal requirements for dredged material testing exist for dredging fine-grained sediments such as those involved in navigational dredging projects; these are often applied to projects involving offshore dredged material disposal. When dealing with clean sands, state and federal standards do not require those tests. We are dealing with clean, predominantly sandy material, and our analyses are entirely aligned with federal and state standards.

59. (Oktay): For LUO and land containing shellfish, with the exception of waterbirds you seem to be excluding marine mammals and any other wildlife.

As Les Smith explained at the Commission meeting, the Proponent prepared a Biological Assessment (BA) for the National Marine Fisheries Service (NMFS) pertaining to the Marine Mammals Protection Act. A copy of this document is being submitted to the Commission along with the recent Biological Opinion issued by NMFS after the agency's review of the BA.

60. (Ernie Steinauer): You mentioned the Project will create ~110 acres of suitable habitat for shorebirds. What are the boundaries of that area, and is that at the Project's maximum extent?

Roughly 110 acres of shorebird habitat will be present immediately after construction, while the acreage of shorebird habitat within the Project area (not including the sewer bed dune at Low Beach)

will be approximately 84 acres one year post-construction. The Proponent has calculated how the area of suitable shorebird habitat between Mean Low Water and the landward limit of nourishment fill will change over a five-year period following nourishment (see Question/Response 64 for additional details).

61. (Ernie Steinauer): Did you perform any rare plant surveys?

On July 25, 2006, Don Schall of ENSR International performed a habitat assessment for the portion of Coastal Bank and Coastal Dune located between 53 and 65 Baxter Road. Results of this survey characterize this portion of Coastal Bank as a maritime shrubland community; the results are being provided to the Commission. It is anticipated that adjacent portions of the bank will support a similar vegetative community type due to comparable environmental conditions.

62. (Ernie Steinauer): Did that plant survey extend up near Sesachacha Pond? I spoke with someone who found a state-listed plant near the cut at the pond; I will provide you with additional information.

(Rits): I do not believe the survey went up that far. Most Project work will occur in actively-eroding areas where there is not much vegetation. All Project activities will be south of the cut at Sesachacha Pond.

63. (Rudin): Relevant to an earlier presentation, you spoke about modeling sediment transport north and south of the nourishment. I would be interested in learning more about the model itself: how it has been used in the past, validated, other projects for which the model was used and its accuracy assessed, etc.

Project engineers used three computer models to design the Project: Delft-3D, the Generalized Model for Simulating Shoreline Change (GENESIS), and the Storm-Induced Beach Change Model (SBEACH). While modeling played a crucial role, however, it is important to recognize that other coastal engineering principles were indispensable in developing the Project design and predicting its performance.

Delft-3D was developed by WL Delft and is considered one of the preeminent hydraulics models in the world. As a result, it has been employed on coastal engineering projects worldwide, including "The World" island creation in Dubai. The model has been applied to a variety of projects involving beach nourishment and coastal structures, channel realignments, water circulation, river flows, contaminant studies, flood analyses, etc. Data inputs to Delft-3D include but are not limited to conditions related to waves, wind, tides, bathymetry, bottom friction, and grain size; the model accounts for processes such as breaking, shoaling, refraction, diffraction, and wave-current interaction. A key element of Delft-3D is that it reconsiders altered bathymetry with each time step: the model calculates changes to bathymetry based on wave- and current-induced sediment transport, and then incorporates the revised bathymetry into the next time step of modeling such that waves and current patterns are continuously updated.

For the Sconset project, Delft-3D predicted shoreline changes, Borrow Site infilling, and shoal movement. The FEIR describes model calibration, verification, and results. As with all models, the quality of input data is a determining factor of model accuracy; for this Project, wave and current data were collected as part of the design. Furthermore, SBPF has generated a valuable dataset by collecting shoreline data for more than a decade. Historic bathymetric data, however, were not readily available for model verification.

Initially developed by the USACE in the late 1980s, GENESIS has been updated several times over the subsequent decades. Although a slightly older model, GENESIS is heavily utilized in the coastal engineering industry and is the model favored by the USACE; it is applied to most federal beach nourishment projects, and is generally used for nourishment projects located away from inlets. Capable of modeling the effects of coastal structures, GENESIS was used to investigate the longshore movement of sediment in the Project area. Since GENESIS does not consider a variable bed or wave refraction, output from Delft-3D's SWAN (Simulating Waves Nearshore) module was used to transform waves from the offshore wave station to the nearshore. Model calibration, verification, and application were discussed in detail in Appendix D of Attachment A in the FEIR.

SBEACH was also developed by the USACE and for more than two decades has been used primarily for calculating cross-shore profile changes in response to storm events. For this Project, engineers employed SBEACH to determine the width of the design beach necessary to protect the vulnerable Coastal Bank during a 50-year storm. Model calibration was achieved using pre- and post-Hurricane Wilma profiles since SBPF had deployed wave and current measurement devices as the storm passed over the Project area; calibration and model application were discussed in detail in Appendix C of Attachment A in the FEIR.

64. (Emily Moulden): Regarding the 110 acres of shorebird habitat creation, in addition to the general location I would like to know whether that habitat estimate reflects conditions immediately following nourishment or whether that was calculated for the start of the subsequent nesting season.

Immediately after construction, the Project will provide approximately 104.4 acres Coastal Beach habitat suitable for shorebirds (see Table 64A). As the beach equilibrates and erodes, this area of Coastal Beach will naturally decrease over time. Table 64A shows how the total area of beach available for shorebirds will change over the projected renourishment interval. After five years, 63.6 acres of Coastal Beach habitat will be available to shorebirds between Mean Low Water and the landward limit of fill at elevation 16 feet MLW.

Table 64A: Beach area between Mean Low Water and the landward limit of fill (i.e., 16.0 feet MLW).

Timeframe	Acres
Immediately post-Construction	104.4
1 year post-Construction	84.1
2 years post-Construction	73.6
5 years post-Construction	63.6

65. (Emily Moulden): When will the new vegetation on the bank and dune take root? Will that occur prior to the oncoming winter season? If the areas will remain unvegetated during the winter, what kind of sediment losses do you expect?

American beach grass has two planting seasons: the first is in the fall when the plants enter a relatively dormant state, and the second is in the early spring before the plants emerge from dormancy. Shrubby vegetation on the Coastal Bank is ideally planted in the early spring to allow the plants a full growing season to take root. The timing of the overall construction sequence of the bank terraces will depend

on the location at which nourishment is initiated and the direction of nourishment. Since the terraces will be constructed with material delivered from the Borrow Site, they will be built concurrently with or immediately following beach nourishment along northern Baxter Road. If construction along this portion of the Project shoreline is completed early enough in the fall, the Proponent will attempt a fall planting; otherwise, planting will occur in the early spring. The nourished beach and dune will protect the toe of Coastal Bank against a 50-year storm event, so no significant loss of sediment from the toe of bank is anticipated. Upper Coastal Bank terraces will be constructed of biodegradable jute fabric wrapped around beach-compatible sand. Since the jute fabric will protect terrace sediment from surface runoff, losses associated with runoff-generated erosion are expected to be minimal.

66. (Emily Moulden): Is it necessary to bury that much of the currently-vegetated dunes?

The Project proposes to construct two primary sections of dune: the first will have an elevation 16 feet above MLW and a width of approximately 50 feet, and will extend from Sesachacha Pond to Codfish Park; the second, seaward of the Town Sewer Beds, will have an elevation of 16 feet above MLW and a width of 125 feet. To construct these dunes, a portion of the Coastal Dune north of Codfish Park and a portion of the Coastal Dune seaward of the Sewer Beds must be buried under nourishment material. Prior to burial, the Proponent will perform a detailed survey of the existing vegetation extent, type, and density. After construction is complete, the Proponent will replant the impacted dune to mimic the pre-burial vegetation type and density. Plantings will occur within the burial footprint.

67. (Emily Moulden): Do you anticipate discussing your pursuit of waivers at future meetings?

(Smith): We have already requested waivers in writing, but will also discuss them orally.

68. (D. Anne Atherton): I want to clarify the nourishment plans for the existing Coastal Dune at the southern end of the Project. You have explained the purpose is to protect the Sewer Beds, and I am wondering if we have received a request from the Town to provide such protection.

Peggy Fantozzi intervened and explained that nourishment in front of the Sewer Beds was suggested as mitigation for the Project, although it was not specifically requested. Pursuant to a Consent Order, the Town must maintain an area extending at least 100 feet from the wire fence; if encroachment occurs into this area, the Town must relocate the Sewer Beds. Thus, protecting the Sewer Beds would be a benefit from this Project.

(Smith): The Town was very happy to hear we were planning to place a dune in front of that area.

69. (Arthur Gasparo): Could you provide additional information regarding the recovery of land containing shellfish? You referenced NRC's 1995 Beach Nourishment Protection paper; do you have any local data regarding recovery time, and could you speak to the details of that particular paper? My concern is that the recovery time may be different in this area.

Recovery times cited in the NRC report[7] are for sand mining sites in both sheltered bays as well as the open ocean. In that report, the NRC notes that benthic community recovery after dredging has been studied in multiple locations including Florida, South Carolina, and Virginia, with results indicating that the duration of recovery can be quite variable; recovery periods ranged from a few months to several years. Most often, however, benthic fauna abundance and diversity within dredging footprints returned to pre-dredging (or reference) levels within one year of disturbance. In study areas where dredging caused a compositional change to the benthic habitat, the composition of the recolonizing community often differed from pre-dredging conditions. For this Project, the contractor will dredge a broad, shallow cut across the Borrow Site that will not result in any habitat conversion or cause deep incisions or holes; the post-dredging substrate will be geologically similar to the pre-dredging substrate.

In sheltered bays, benthic recovery tends to be more protracted due to the relative lack of hydraulic energy and associated dominance by more persistent, slower-colonizing marine communities. In contrast, high-energy environments like the Project area undergo natural, regular disturbance and are therefore inhabited by organisms that are rapid colonizers.

With regard to land containing shellfish, the shellfish species found at the Borrow Site are primarily surf clams and blue mussels. Surf clams can reach sexual maturity in as little as three months, but sexual maturity can also be delayed for as long as four years (Cargnelli et al., 1999[8]); therefore, with reproductive age as the measurement of recovery, recovery can be achieved during the life of the Project. Similarly, blue mussels settle and attach to disturbed substrate within six months and reach sexual maturity within two years (Newell, 1989[9]).

The Proponent's physical and biological monitoring will measure the progress of recovery and provide data to inform future renourishment events.

70. (Emily Moulden): What are your plans for the previously-permitted terraces that will be pre-existing when the nourishment construction period begins?

The Proponent anticipates that Coastal Bank toe terraces will be in place when nourishment begins. These terraces will consist of jute fabric, clean beach-compatible sand, non cca/ccx-treated wooden posts, jute line, and duck-billed anchors. Where existing terraces are in place, all duck-billed anchors and wooden posts will be removed prior to nourishment of the immediately-seaward beach. The

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[7] National Research Council (NRC). 1995. Beach Nourishment and Protection. Marine Board & Commission on Engineering and Technical Systems. National Academy Press, Washington DC. http://books.nap.edu/openbook.php?record_id=4984&page=118. Pp. 118-121.

[8] Cargnelli, Luca M.; Griesbach, Sara J.; Packer, David B.; Weissberger, Eric. 1999. *Atlantic Surfclam, Spisula solidissima, Life History and Habitat Characteristics*. Essential Fish Habitat Source Document, NOAA Technical Memorandum NMFS-NE-142. U.S. Department of Commerce (National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Research Center). http://www.nefsc.noaa.gov/nefsc/publications/tm/tm142/tm142.pdf.

[9] Newell, Roger I.E. 1989. *Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North and Mid-Atlantic) – blue mussel*. U.S. Fish and Wildlife Service Biological Report 82 (11.102). U.S. Army Corps of Engineers, TR E1-82-4. 25 pages. http://www.nwrc.usgs.gov/wdb/pub/species_profiles/82_11-102.pdf.

remaining jute fabric terraces will be covered by the nourishment material; after burial, the jute fabric will biodegrade in 1-3 years.

71. (Bam LaFarge): I would like to tell you that I will report back to the Town's Marine Department about possibly involving the Town Biologist in discussions about surf clam harvesting. Please involve the Marine Department in any future activities involving surf clams or shellfish.

The Proponent will continue to work with the Town's Marine and Coastal Resources Department and the Massachusetts Division of Marine Fisheries to ensure that the surf clam relay is implemented in the most effective manner.

72. (Oktay): Regarding land containing shellfish compliance, we asked earlier about the range in surf clam sizes collected in your survey and whether you were limited by the equipment. You are proposing to monitor at six months and one year post-construction, but perhaps more frequent monitoring would tell us more about how that habitat may change. Are there better methods you could use?

As explained at the Commission meeting, the Project's biologist clarified that since sampling occurred with a commercial dredger, the survey probably did not capture the smaller-sized shellfish. However, assessments of population characteristics and general abundance are often based on commercial catch information from commercial clammers, since this is often the most common data available. For the Project's harvesting program, the Proponent will modify the dredge to limit spacing and thus ensure that second-year shellfish are collected efficiently.

73. (Andrews): When you were checking in the area for rare and endangered species, did you just rely on the bird studies or did you perform specific studies (targeting tiger beetles, for example)?

(Smith): We did not perform any additional surveys, but have obviously performed many bird studies. Tiger beetles were not listed in the state standards.

74. (Oktay): Is there any way to quantify how much of each resource area (e.g., Coastal Beach, Coastal Dune, etc.) will be covered with nourishment material? It is hard to tell from the graphics.

Page 4 of the NOI Form 3 quantifies the spatial extent of the 2.6-million-cubic-yard Project's effects on each resource area, including Land Under the Ocean, Coastal Beach, Coastal Dune, Coastal Bank, Land Containing Shellfish, and Land Subject to Coastal Storm Flowage.