SCONSET BEACH NOURISHMENT PROJECT

Proponent Responses Following Conservation Commission Meeting #9 (held December 10, 2007)

The information included herein is intended to directly respond to questions asked at the Nantucket Conservation Commission meeting held on December 10, 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: Shorebird and Waterbird Survey Update (Les Smith and Dr. Bob Kennedy)

1. Question (Sarah Oktay): You said your survey speed is 20 kph; is that speed typical for waterbird surveys? Do you know what the accuracy is for these surveys?

(Kennedy): That speed is slow enough that we can identify birds but not so slow that it inhibits making progress in the surveys. A lot of surveys are conducted on ocean-going vessels that vary in speeds, but we chose 20 kph as appropriate. There are standard estimates for survey accuracy, and in January we will be testing some of those. In general, however, accuracy decreases as the number of birds increases; when dealing with 10's of birds, accuracy is quite good. I have been estimating birds using these methods for many years, with many species, in locations around the world. Many different inventories, including the Christmas Bird Count, use these methods, and the typical pattern is simply for accuracy to decrease as bird numbers increase.

2. (Oktay): I noticed you had one common loon, which is the only state-listed bird?

(Kennedy): Yes, one common loon was sighted outside the Borrow Site.

3. (Oktay): Is the common loon a threatened bird?

(Kennedy): It is a state-listed threatened bird.

4. (Oktay): The greatest waterbird concentrations are just nearby the Borrow Site. In-filling will occur after the Borrow Site is excavated, presumably involving sediment from adjacent locations. Do you think that could affect the areas that are populated by these waterbirds?

(Kennedy): I am not really qualified to answer that question. I would, however, be concerned about waterbird populations if the shoals were somehow destabilized.

As explained previously, all of the best available scientific data consistently indicate that Borrow Site excavation will not destabilize the shoals. State-of-the-art modeling results have shown the Project will not materially affect sediment transport, wave transformation, or tidal currents.

The minimum distance from the Borrow Site to the -10-foot MLW contour associated with the shoals is 2,750 feet, or 0.52 miles. The water depth at this particular corner of the Borrow Site is -41 feet MLW, which equates to an average slope over the entire distance of approximately 1.1% (i.e., 1V:89H). Excavating this closest corner of the Borrow Site to a proposed depth of -54 feet MLW would increase the slope to 1.6% (1V:63H). This excavated depth and resulting slope, however, is based on the assumption that dredging will excavate all of the suitable sediment within the Borrow Site. In reality, the Project construction volume is 1.8 million cubic yards and the Borrow Site contains 2.91 million cubic yards of potential nourishment material. Thus, actual Project dredging will not deplete the Borrow Site supply, and the slope will likely remain shallower than 1.6%. To provide some context and perspective for these slopes from the Borrow Site to Bass Rip Shoal, it is useful to note that the slope of the Project beach at the MLW line varies from 11.1-16.7% (i.e., 1V:9H to 1V:6H). Approximately 500 feet offshore, the beach slope ranges from 1.51-2.86% (i.e., 1V:66H to 1V:35H).

Furthermore, the Borrow Site was initially designed in consideration of both cutterhead and hopper dredge capabilities. The shape of the southeast corner of the Borrow Site, however, will preclude a hopper dredge from efficiently dredging that particular area; this additional factor will prevent significant steepening of any slope leading to Bass Rip Shoal.

Ms. Oktay asked a very similar question during Commission Meeting #4, held on September 26, 2007. A discussion of stability based on modeling of the Borrow Site was provided in response. The Proponent provided a thorough written response as well, which was submitted to the Commission on November 14, 2007; please see Meeting 4 Question/Response 9.

5. (Andrew Bennett): If you were to look at the offshore waterbirds around the whole island, would you say the shoals off Sconset are the most populated?

(Kennedy): There are several areas of highly-concentrated waterbirds around Nantucket. Certainly offshore Sconset and up to Great Point is an area of concentration. Madaket Harbor is a significant location for common eiders, where these waterbirds feed on blue oysters. Somewhere around 10% of the world's long-tailed ducks occur near Nantucket. Certainly the Sconset rip is an unbelievable location for waterbirds.

6. (John Smith): Is it true that these birds are transients, moving where the food is? What do they feed on?

(Kennedy): Yes, that is true, and if the birds were to deplete the food resources here then they would move to a different location. From November through February or March, the waterbird populations tend to be very large. Common eiders and scoters feed primarily on shellfish, although may also feed within the water column; long-tailed ducks feed predominantly on what is in the water column. The birds can dive more than 60 feet deep.

7. (Oktay): Does your report contain all seven boat surveys so we can see reproducibility between times and dates? It would be nice to see how they compare with one another.

(Kennedy): All data are presented, but we do not have a comparative graphic. Basically the pattern is almost identical from one time to another. We did record changes in water depth throughout the survey, and we could provide an analysis correlating waterbird populations with depth.

In addition to the graphs already provided to the Commission to document the individual results from each of the seven boat surveys, Figure 7A shows the average density of waterbirds along the survey route during the seven surveys. Note that each kilometer shown on the graph is the data for a 1-kilometer range (i.e., data graphed as "km 15" is waterbird density from km 14.01 to km 15.00).

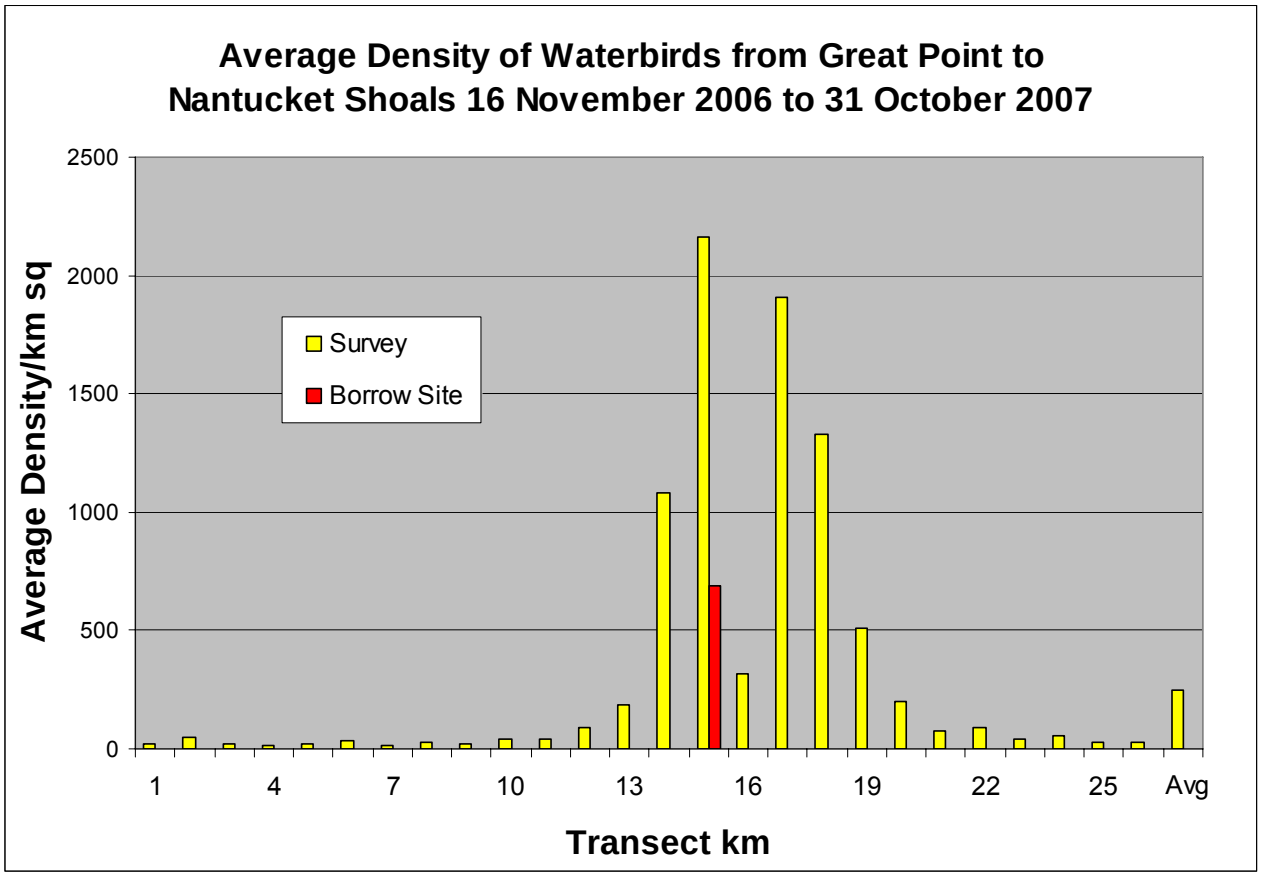

Figure 7A: Average waterbird density from all seven surveys.

Figure 7A and the graphed data from individual surveys clearly and repeatedly show that most waterbirds are concentrated in the shallower areas north, east, and south of the Borrow Site; these areas are the waterbirds' primary habitat, and the birds found in the Borrow Site at various times have usually drifted there or are flying over the site en route to preferred habitat areas. Actual density measurements during each of the seven boat surveys are presented in Table 7A.

Table 7A: Waterbird density (#/km^2) at 1-km intervals during boat surveys from Great Point Rip to Nantucket Shoals in 2006 (November 16, December 5 & 22) and 2007 (February 1 and October 31).

	Distance (km)	16 Nov06	5 Dec06	22 Dec06	1 Feb07	22 Feb07	31 Oct07	Avg.	Standard Deviation	Avg Depth
1	0-1	16.3	48.8	30.0	20.0	13.8	5.0	22.3	15.3	27
2	1-2	3.8	13.8	22.5	15.0	210.0	21.3	47.7	79.8	26
3	2-3	2.5	51.3	26.3	30.0	15.0	6.3	21.9	18.0	32
4	3-4	5.0	20.0	20.0	6.3	25.0	8.8	14.2	8.5	35
5	4-5	11.3	23.8	17.5	42.5	16.3	12.5	20.6	11.6	37.5
6	5-6	35.0	16.3	10.0	52.5	85.0	3.8	33.8	30.8	45.5
7	6-7	28.8	21.3	7.5	3.8	13.8	7.5	13.8	9.6	60
8	7-8	0.0	15.0	10.0	41.3	68.8	11.3	24.4	25.7	65
9	8-9	1.3	10.0	17.5	35.0	62.5	6.3	22.1	23.0	61.5
10	9-10	1.3	8.8	45.0	90.0	30.0	70.0	40.8	34.6	55
11	10-11	3.8	6.3	13.8	47.5	35.0	146.3	42.1	53.8	51
12	11-12	8.8	17.5	42.5	25.0	53.8	388.8	89.4	147.6	41
13	12-13	22.5	143.8	76.3	80.0	131.3	651.3	184.2	232.9	41.5
14	13-14	5.0	53.8	3,331.3	20.0	1,041.3	2,021.3	1,078.8	1,362.9	47
15	14-15	8.8	1,617.5	2,972.5	6,432.5	1,901.3	43.8	2,162.7	2,382.5	46.5
BS		138.8	643.2	1,037.8	1,411.3	900.9	20.0	692.0	536.8	
16	15-16	213.8	32.5	585.0	510.0	373.8	205.0	320.0	208.0	15.5
17	16-17	497.5	776.3	3,025.0	5,013.8	1,645.0	490.0	1,907.9	1,802.4	37.5
18	17-18	390.0	2,632.5	1,135.0	198.8	1,963.8	1,651.3	1,328.5	938.4	50
19	18-19	12.5	333.8	105.0	1,781.3	220.0	623.8	512.7	656.6	59.5
20	19-20	313.8	107.5	88.8	500.0	163.8	5.0	196.5	180.6	52
21	20-21	10.0	100.0	100.0	55.0	182.5	15.0	77.1	64.8	48
22	21-22	6.3	17.5	62.5	286.3	132.5	17.5	87.1	108.2	62.5
23	22-23	3.8	17.5	141.3	22.5	45.0	6.3	39.4	52.0	52.5
24	23-24	2.5	43.8	101.3	10.0	167.5	8.8	55.6	66.1	45
25	24-25	2.5	32.5	41.3	2.5	106.3	0.0	30.8	40.9	40
26	25-26	6.3	6.3	46.3	0.0	97.5	27.5	30.6	37.0	54.5
Overall #/km^{2*}		*62.0*	*236.8*	*464.4*	*589.3*	*338.5*	*248.2*	*323.2*	*185.6*	

* Values do not include Borrow Site row data.

The goal of the offshore waterbird surveys was to document waterbird densities at one-kilometer intervals along the transect lines and within the proposed Borrow Site. Reporting results in densities per square kilometer, as opposed to raw numbers, allows for a direct comparison between waterbird abundance in the Borrow Site versus within each kilometer along the transects. This method advances the objective of understanding the relative importance of the Borrow Site as waterbird habitat.

Although recording water depths was not initially included in the survey design, Dr. Kennedy and the research team recorded depths at each 1-kilometer point along the transects (Figure 7B) and also continuously monitored the depth categories ranging from 0-30 feet, 31-60 feet, and over 60 feet (Figure 7C).

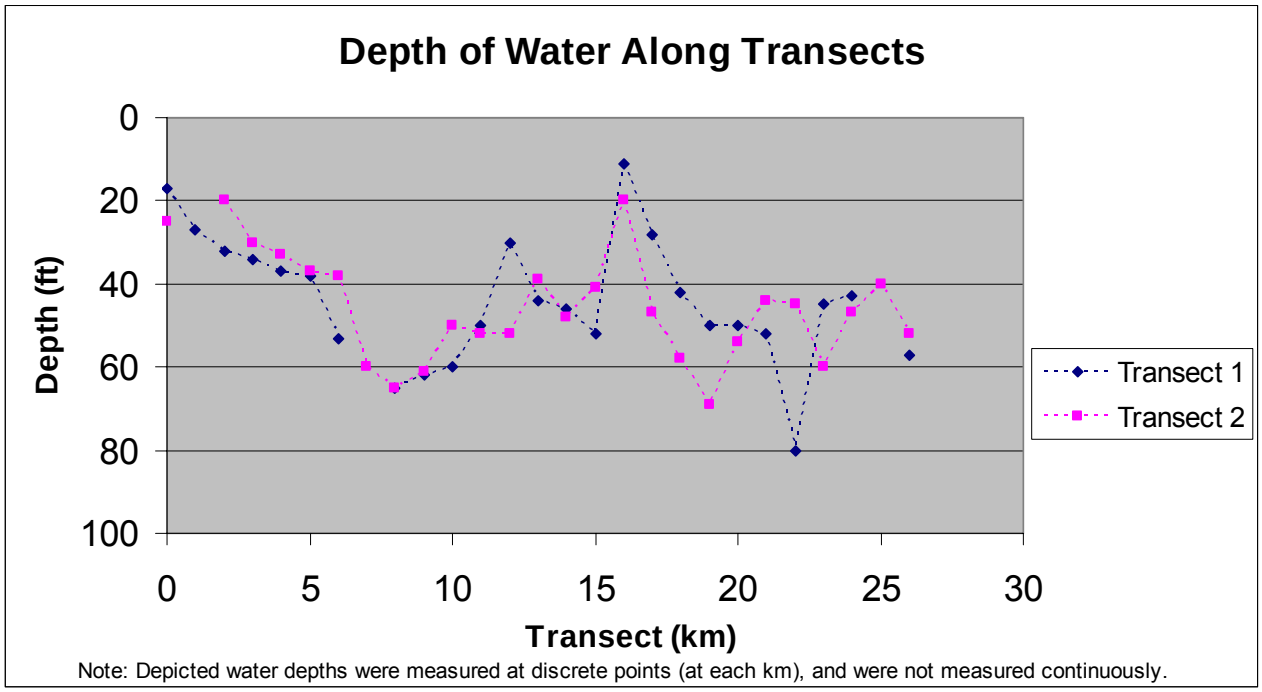

Figure 7B: Water depth at 1-km intervals along waterbird survey transects.

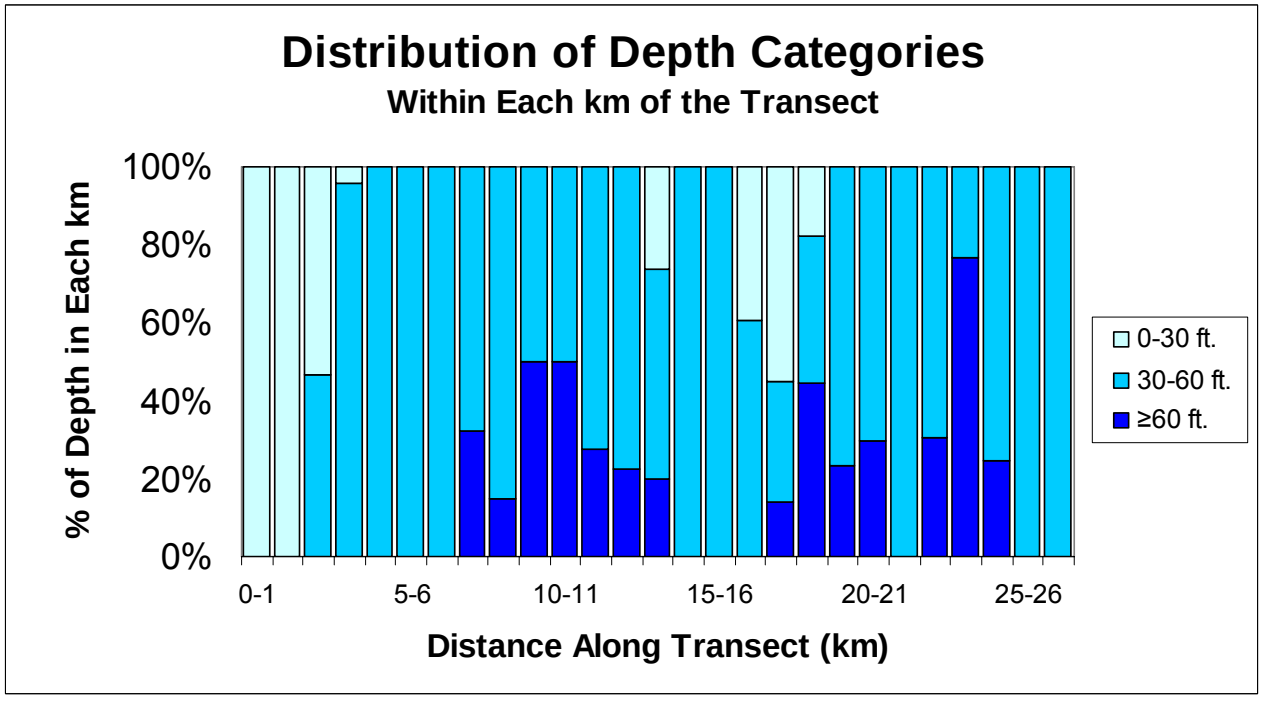

Figure 7C: Distribution of water depths throughout the waterbird survey transects.

In general, the waterbird densities shown in Figure 7A and the water depths shown in Figures 7B and 7C show that the Borrow Site is deeper than the preferred habitat areas to the north and south which exhibit maximum waterbird usage.

8. (Edie Ray): I was out looking off the bluff Sunday afternoon, and I noticed a large group of common eiders (perhaps 28,000 birds). One of the interesting things is that it is very difficult to predict when the birds will be present. I know that when you go out to survey, you try to pick a calm day. By surveying only in certain favorable conditions, are you skewing the data?

(Kennedy): The conditions for each survey are different, with the only consistent factor being the time of day. Tides are generally different every time we go out, and we collect detailed weather data along each of the survey transects. Our surveys record a cross-section of the population.

9. (Ray): I know when you drive a boat through waterbirds, they tend to take flight. In looking at some other studies on sea ducks, many scientists use aerial surveys that produce data they then overlay onto charts. I understand you considered aerial surveys but were unable to select that method? Would aerial surveys give you better data?

(Kennedy): I do not think that aerial surveys would significantly change the data we have or our understanding of it. Granted, if we could fly at 500 feet then we could certainly collect good data, but the rate of speed would make observations quite difficult. When we did identify a pilot who was willing to fly for some of our surveys, the pilot was willing to fly at 800 feet; at 100 mph, we could not accurately see scoters on the surface. Boat surveys are a valid, tested method. Many pilots do not want to fly over the Atlantic Ocean at 500 feet during the winter due to safety concerns.

10. (Ray): I have spoken to several pilots who felt that a two-engine plane could be used to perform the surveys, and that a photographic record coupled with a computer program could be a valid method.

Neither the Proponent nor Dr. Kennedy disagrees that an aerial waterbird survey could conceivably produce high-quality data. However, the legitimacy of an aerial survey in no way detracts from the scientific viability of the boat-based surveys performed by avian experts in the waters off Nantucket. In fact, due to the site-specific environmental conditions, these experts deemed boat-based surveys most practical since they generated a greater window of opportunity in which to perform the actual survey work. As Dr. Kennedy has previously explained to the Commission and members of the public (see Meeting 4 Question/Response 27), winter aerial surveys over the Atlantic Ocean can be quite dangerous, even in a twin-engine plane. Surveyors have encountered pilots who have refused to fly winter surveys over the ocean at the altitudes required for gathering meaningful waterbird data.

11. (Bennett): What time of day did you perform the surveys? What is the activity level at night?

(Kennedy): We left the dock around 8am, so we started surveying around 9am. Generally speaking, waterfowl are diurnal, which means they are chiefly active during the daytime. Long-tailed ducks move along the south shore, crossing along Tuckernuck and Smith's Point, to spend the evenings somewhere near Nantucket Sound.

12. (Trey Witham): The tail end of dredging would be the only time the construction window would coincide with birds using the shoals. Would the dredge have any impact?

(Kennedy): Regarding habitat impacts I would defer to my colleagues. I can say that generally, birds tend to adapt to activities in their environment. If a boat is present when the birds arrive, they could very well become used to it. If birds are already there when dredging begins, they might be less likely to adapt. I cannot say with a 100% certainty the birds will adapt, but I can say such adaptation would be likely.

The Project will not have any permanent adverse effect on waterbird habitat, and even temporary impacts will be minimal. Borrow Site excavation will temporarily disrupt the benthic community, but recovery is expected to occur within 1-3 years. During this recovery period, waterbirds will be able to utilize habitat that is abundantly available in adjacent areas; please see Meeting 4 Questions/Responses 28 and 44. As Dr. Kennedy has explained to the Commission, the waterbirds off Nantucket are highly mobile, opportunistic feeders; please see Meeting 4 Question/Response 17.

13. (Oktay): Do you have any idea why we have 10% of the world's population of long-tailed ducks?

(Kennedy): My theory is that it relates to the large concentrations of amphipods that occur in the waters off Nantucket. When specimens of long-tailed duck were collected off Nantucket Shoals, it was found they had gorged on amphipods. I believe it is the abundance of these amphipods that attracts the long-tailed ducks, and interestingly that is probably what attracted whales to the area historically.

Furthermore, it is worth noting that amphipods typically dwell at the interface between the substrate and water column, and regularly utilize the water column throughout the day and night for feeding activities. Due to these organisms' mobility, they should not be materially impacted by the excavation of sediment from the Borrow Site.

PRESENTATION 2: Cobble Habitat Mitigation and Monitoring (Mark Rits and Chris Vaccaro)

14. (Bennett): You seem to be leaving out the Borrow Site from the mitigation discussion. NMFS has identified the Borrow Site as habitat for juvenile fish. There isn't any mitigation for potential impacts at the pumpout stations, either. I would like to see impact calculations.

(Rits): In terms of mitigation for the Borrow Site, it is important to understand that no habitat conversion will occur there: dredging will remove the surface layer of sand, leaving behind a similar sandy substrate. Given the best available scientific data, we expect to see rapid soft-sediment benthic recolonization. The Proponent is not required to mitigate for such temporary impacts that are not associated with any conversion of habitat type. We do anticipate trying to harvest clams from the Borrow Site prior to excavation. In terms of the pumpout locations, we are still refining the methods that will be used (e.g., anchoring, tugboats, propeller action, etc.). What we are presenting tonight is a conceptual mitigation design.

15. (Bennett): Is there any concern that your mitigation area could be filled in?

As Project engineers have presented at several previous meetings and in submitted Project materials, sediment will diffuse north and south out of the Project area. The beach near the Sesachacha Pond opening may widen by a maximum of 40 feet due to these diffusion losses from the Project. Monitoring the mitigation areas will be critical for evaluating success and ensuring the mitigation cobble remains

exposed, but since diffusion losses will be spread over such large areas, the Proponent does not expect any significant burial of mitigation to occur. Please see Meeting 7 Question/Response 52.

16. (Bennett): Regarding your benthic recovery literature, what energy level is typical for the areas affected by ice scour events?

(Vaccaro): The ice rafting and associated scouring events occurred in the Maritimes of Canada, in the Pacific Northwest, and off the coast of Maine, which are all high-energy environments. These areas contained open coastal *Chondrus crispus* beds, algal turf, or related genera, which recovered within two years of the disturbance.

17. (Oktay): Regarding past precedence and your three different citations for benthic recovery, the first paper showed 50% recovery after two years; the second one looked at 3-21 months. My point is that a one-year time interval [as proposed for the pilot mitigation project] may be insufficient.

As Ms. Vaccaro explained at the Commission meeting, scientific literature shows that 25% benthic recovery is an appropriate benchmark for a one-year period. After one year the pilot mitigation area may not necessarily be 25% colonized by *Chondrus crispus*, but instead it is reasonable to expect to see community succession beginning with a general 25% benthic coverage. This benchmark takes into consideration the stochastic nature of an open coastal environment, where there is significant variability in the frequency and intensity of natural disturbances that may be encountered over the course of one year.

Furthermore, the Proponent's ongoing scientific research and literature reviews recently identified a relevant study performed in Washington state's dynamic, high-energy Puget Sound/Strait Juan de Fuca region. The report, prepared by the Puget Sound Partnership, documents benthic recovery associated with a natural boulder substrate (established with rocks 1-2 feet in diameter) that was deployed as mitigation for a nearby dredging project.[1] Monitoring focused on recolonization by red, brown, and green species of macroalgae. When evaluating the mitigation, the benchmark of success used by Washington state environmental agencies was the maintenance of 25% benthic coverage over a five-year period. Macroalgal coverage far exceeded the 25% threshold after just seven (7) months post-deployment, and this coverage was maintained over the course of the subsequent several years documented in the report.

18. (Oktay): But you could say that if there are frequent disturbances, you may get stuck in an early-successional state. I am not 100% convinced that a single year of monitoring will be sufficient, because we will not know for certain that a diverse benthic community will return to the area.

It is important to remember that natural disturbances should be expected to occur, and that such disturbances will affect not only mitigation areas but control areas as well. Any benthic habitat undergoes disturbance and subsequently progresses through the processes of recolonization and

[1] Wyllie-Echeverria, T.; Duggins, D.O.; and Wyllie-Echeverria, S. 2003. Evaluation of an artificial rock reef for colonization by macroalgae. www.psat.wa.gov/Puglications/03_proceedings/PAPERS/POSTER/p8_wyllie.pdf.

recovery; the rate, extent, and exact characteristics of this recovery depend on environmental conditions including, for example, the frequency of disturbance. In the context of the proposed pilot mitigation, if one season of benthic growth occurs as anticipated, it is reasonable to expect colonization to continue absent an abnormally-large disturbance. There is no scientific basis for expecting that typical natural seasonal variation, excepting devastating storms, would only support the growth and development of a benthic community in a state of perpetual primary succession under the conditions prevailing at the site in question. Indeed, isolated areas of cobble bottom in the vicinity of the proposed pilot mitigation exhibit hard-bottom macroalgal and sponge community structures very similar to the cobble habitat offshore from Sconset.

Furthermore, pilot mitigation monitoring will include post-storm surveys of experimental plots and control plots. Control plots will be located in existing cobble areas within the nourishment Project footprint that will be buried under nourishment material; they will be comparable to the experimental plots in terms of water depth, distance offshore, and density of exposed cobble. Resulting ecological data will enable the Proponent to assess benthic colonization of mitigation areas in the context of natural disturbance events, and to modify expectations accordingly. It is important to note that mitigation areas will not be disturbed by subsequent renourishment activities, thus allowing community succession to continue undisturbed by Project-induced interruptions. To most effectively assess early colonization, the Proponent hopes to install the pilot mitigation project at the beginning of April 2008, prior to the early spring season when most marine vegetation and sessile animals release spores and larvae into the water column. Colonization coverage of 25% after the benthic growth season is reasonable to provide assurance that colonization is progressing.

19. (Oktay): In a lot of your calculations for determining mitigation area, I understand that replicating a 20% cobble coverage may be easier than exactly replicating the existing range of cobble densities. However, I am concerned that you are still under-estimating acreage for mitigation. I think a 1:1 replication ratio would be more valuable.

(Rits): Existing cobble bottom densities vary considerably, so we are attempting to identify density bins that are representative of the larger habitat matrix. Most sporadic cobble (10-20%) is close to shore, and we are trying to provide slightly higher density (20%) over a slightly smaller area because it is more feasible from a logistical perspective; for denser cobble, we feel 30-40% is representative of what occurs offshore. In addition, we are trying to provide mitigation as close to the impact area as possible so conditions are very similar. Our goal at the end is to have similar amounts of cobble bottom present offshore Nantucket as currently exist.

Please also see Question/Response 28.

20. (Oktay): I am just concerned that compressing the acreage of cobble might not replicate the habitat loss as it affects a number of different organisms.

Please see Question/Response 28. Furthermore, as Ms. Vaccaro explained at the Commission meeting, highly mobile organisms do not limit their activities to single plots or discrete areas of cobble; rather, they move through the larger habitat matrix, which comprehensively provides certain ecological functions and values. Past studies indicate that habitat density, rather than vertical habitat relief, is the

most important factor in reducing juvenile fish mortality (Lindholm, Auster, and Kaufman 1999[2]); therefore, creating slightly denser areas of cobble habitat within the mitigation design may enhance the resulting habitat quality. Dense, bare cobble will provide ample interstitial space between cobbles for refuge and foraging by fish and crustaceans feeding on microscopic organisms. Eventually, as epibiotic growth begins to colonize the substrate, habitat functions and values will increase further. In addition, comparable studies performed in eelgrass and other biogenic habitats have determined that habitat density provides the most effective predator refuge for small fish and invertebrates (Graham et al., 1998[3]; Hughes et al., 2002[4]). A functioning predation refuge typically concentrates prey populations and subsequently attracts larger predatory fish to a given foraging site, fostering a complex habitat with many trophic levels.

The Massachusetts Division of Marine Fisheries has also acknowledged the important function of dense cobble habitat: the agency indicated that cobble habitat complexity was an important consideration when deploying cobble habitat mitigation for lobsters in relation to the Boston Hubline project, since this attribute is important to macroinvertebrate and finfish life histories[5]; the agency has encouraged recreational diving and fishing at these cobble habitat mitigation areas. See also Question/Response 34.

21. (Oktay): Resource agencies survey for varying organism densities and specific species.

At the Commission meeting Ms. Vaccaro explained that while this is true, efforts at habitat replication should recognize that many of the organisms involved are highly mobile species. The intent of mitigation is to ensure that habitat functions and values are maintained and not materially changed by the Project. The proponent expects to observe mobile finfish and crustaceans within the replicated habitat, and monitoring will not only evaluate the resulting benthic community but will also assess the general success and evolution of the community structure by identifying and sampling mobile species in the mitigation areas. This component of the monitoring will begin during the pilot mitigation project to provide empirical data on the general success of introducing bare cobble to the benthic system.

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[2] Lindholm, J.B.; Auster, P.J.; and Kaufman, L.S. 1999. Habitat-mediated survivorship of juvenile (0 year) Atlantic Cod (*Gadus morhua*). Marine Ecology Progress Series. Volume 180. Pp. 247-255.

[3] Graham, S.; Davis, J.; Deegan, L.; Cebrian, J.; Hughes, J.; and Hauxwell, J. 1998. Effect of eelgrass (*Zostera marina*) density on the feeding efficiency of mummichog (*Fundulus heteroclitus*). Biological Bulletin. Volume 195. Pp. 241-243.

[4] Hughes, J.; Deegan, L.; Wyda, J.; Weaver, M.J.; and Wright, A. 2002. The effects of eelgrass habitat loss on estuarine fish communities of southern New England. Estuaries. Volume 25, Number 2. Pp. 235-249.

[5] Glenn, Bob; Barber, Julie; and Whitmore, Kelly. 2007. Enhancement of Important Bottom Sediments for American Lobster and Other Marine Species in Massachusetts Bay. Mass. Division of Marine Fisheries. www.mass.gov/dfwele/dmf/programsandprojects/hubline/sediment.htm.

22. (Oktay): Different types and sizes of fish utilize cobble bottom for varying purposes, so it is a complicated issue. We must ensure we replicate the habitat being lost.

The Proponent agrees with this characterization of the goal of mitigation, which is to avoid any loss in habitat functions and values. As such, mitigation has been designed to replicate the cobble bottom that exists within the equilibrium fill footprint. To adequately replicate the cobble bottom that will be buried, mitigation strategy and site selection have been designed to roughly mimic the conditions within the impact area; these include environmental conditions such as water depth, energy regime, water temperature, and bathymetry. Habitat mitigation will occur proximal to but outside of the Project footprint, and will also occur at comparable distances from shore (relative to impact areas). Furthermore, extensive monitoring will verify mitigation success and ensure that replicated cobble bottom is not buried beneath sand. Please see Questions/Responses 28, 40, and 43.

23. (Oktay): Regarding your site selection criteria, I know the state had some ideas. Were they happy with your mitigation plan?

(Smith): We just gathered this habitat information, and are discussing it with you first. We will be presenting data to the USACE and resource agencies (e.g., DMF and NMFS) in January.

24. (Ginger Andrews): Have you noticed any seasonal variation in the benthic habitat in the nourishment area or Borrow Site?

As Ms. Vaccaro explained at the Commission meeting, survey data from September to December have not indicated significant changes in the benthic habitat, but evaluating seasonal variability is one of the purposes of performing additional surveys over time. A number of locations will be revisited during the winter to identify any changes. The Proponent's ongoing monitoring will assess the progress of succession and how natural disturbances affect the benthic environment.

25. (Smith): Did you perform a dive survey last week as well?

A dive survey is scheduled for the week of January 7th. Results from this survey will be submitted to the Commission under separate cover.

26. (Rudin): In the area offshore Quidnet where you have identified pilot mitigation and a mitigation area, how much space is available in case more mitigation is needed?

(Rits): We are still analyzing sidescan data, but have determined that the depth change in the mitigation area is more gradual than in the Project area. Therefore, in longshore and offshore directions we feel we can find appropriate space for mitigation.

27. (Rudin): Do you anticipate the pond opening would have any affect on sweeping sand into the mitigation area?

(Rits): A small ebb tidal delta does form when Sesachacha Pond is opened, but the associated sediment transport is relatively small and the opening occurs over a finite period of time. Monitoring will document how much coverage, if any, occurs.

28. (DeCosta): I have an issue with this mitigation site. We discussed a preferred mitigation site extending from the pond to south of where the map shows the northern margin of mitigation.

The area to the north contains high-quality fishing grounds. The second preferred mitigation site was near Coskata Woods; the depth and currents are similar, and there is sandy bottom. That said, the mitigation as currently proposed is unacceptable. A 1:1 mitigation ratio is unacceptable, and I am concerned about condensing the area of existing cobble into a smaller location. You need to spread out the mitigation area to provide fish with enough space and to enable fishermen to utilize the area without colliding with each other. After one year, we will only have algal growth; how long will the benthic habitat take to recover to its current characteristics?

The Proponent selected the preferred mitigation site based on multiple considerations, including the desire to identify a site with adequate space for the mitigation of all Project-related impacts to cobble habitat. The goal of such mitigation is to maintain a functionally consistent amount of both cobble and soft sediment habitats within the general Project area such that the Project does not materially alter habitat functions or values. To achieve this goal, mitigation must be provided near the Project impact area; deploying mitigation immediately adjacent to the Project effectively maintains the overall assemblage of habitat types. To maximize the effectiveness of this habitat mitigation, the Proponent has selected a design that is intended to closely replicate the characteristics of cobble habitat within the impact footprint. Thus, cobble habitat mitigation must occur at a site with similar bathymetry, shoreline orientation, wave and current regimes, light penetration, and water temperature.

Dense cobble bottom habitat extends a significant distance offshore from the Project into water that is too deep to support a macroalgal community; therefore, the area seaward of the Project is not suitable for mitigation. Areas south of the Project (i.e., offshore Codfish Park and Low Beach) contain predominantly sandy bottom and exhibit significant tidal currents, a different shoreline orientation, and more abrupt bathymetric changes, which collectively make these areas unsuitable for mitigation. The selected mitigation area offshore Quidnet is immediately north of the Project, has a similar shoreline orientation, water depth, soft sediment substrate, wave and current regimes, light penetration, and water temperature; these characteristics make the area ideal for mitigation. Deploying mitigation in areas further to the north would not serve the purpose of maintaining the overall habitat matrix within the Project area. Furthermore, northern areas have different wave and current regimes, shoreline orientation, bathymetry, and a finer-grained soft sediment substrate.

Mitigation has been designed to replicate cobble bottom that exists within the equilibrium fill footprint. Since the objective of mitigation is to avoid any loss in habitat functions and values, replicated habitat should roughly mimic the conditions within the impact area. As a result, the Proponent has performed extensive cobble bottom surveys to assess not only environmental conditions but also the varying densities of exposed cobble bottom. To materially provide comparable habitat functions and values while at the same time allowing for feasible mitigation deployment logistics, the proposed mitigation will replicate two varying densities of cobble bottom: nearshore mitigation areas will contain sporadic 10-20% cobble exposure, while more seaward mitigation areas will exhibit higher-density 40-50% cobble exposure (please see Question/Response 19). This pattern of increasing exposed cobble density with increasing distance offshore mimics existing conditions within the equilibrium fill footprint.

Benthic recovery is an issue the Proponent has thoroughly addressed in multiple Commission meetings. As Ms. Vaccaro explained, growth rates can vary significantly and hence the specific amount of time a given benthic habitat requires to recover completely is dependent upon the particular benthic system and actual environmental conditions. Based on her scientific judgment, Ms. Vaccaro

offered an estimate that perhaps two years would be needed for benthic recovery in the Project area, although she explained that total recovery could conceivably take five years.

29. (DeCosta): That is why we should get a 5:1 mitigation-to-impact ratio. I am also concerned about potential damage from barge offloading. I am very concerned about mitigating after-the-fact, because we need very detailed underwater surveys regarding what currently exists.

The Proponent has designed a pilot mitigation project that will demonstrate the quality of the mitigation design and its likelihood for successful habitat replication. As explained during the Commission meetings and in supporting documentation, Project mitigation is designed to avoid any net loss in habitat functions and values. Thus, the mitigation design is intended to replicate the cobble bottom habitat within the Project's equilibrium footprint and thereby maintain roughly the same localized habitat matrix. Since extensive monitoring will be used to verify mitigation success, a 1:1 mitigation-to-impact ratio is appropriate because habitat functions and values will be maintained without materially changing the habitat matrix. Proposed monitoring will include pre- and post-Project surveys in the areas of the pumpout stations, which will enable the Proponent to quantify any impacts in those areas and, if present, to provide appropriate mitigation. See Questions/Responses 22, 28, 40, and 43.

30. (Oktay): With the preliminary site assessment, are you worried that winter conditions might expose more cobble and that more 2008 data will be necessary?

Generally speaking, a survey performed in the late summer or fall will show the maximum amount of exposed cobble since sands will be contained within wide summer beaches rather than offshore. A winter or early spring survey, in contrast, will be more likely to depict a state of maximum cobble bottom coverage, because sand will have moved offshore from the winter beach. Therefore, the Proponent's late summer-fall survey shows conservative (i.e., relatively abundant) cobble exposure. Furthermore, the recent storms have not generated tremendous losses in beach elevation along the eastern shore of Nantucket, so the latest survey data are still conservative. Additional monitoring in association with the proposed pilot mitigation will provide more data and may illustrate the transition from a summer beach condition to a winter beach condition.

31. (Ray): We have had a steady influx of cobble that occurs naturally as it comes out of the bank. How might you mitigate for removing the bank as a source of this cobble?

As Mr. Rits explained at the Commission meeting, cobble is only introduced to the system as the island erodes, and it is only introduced at the point of erosion. Beach nourishment will stabilize the shoreline, and the Coastal Bank will no longer be a source of cobble. However, Project design and proposed mitigation will maintain the extent of existing exposed cobble bottom either by avoiding impacts or mitigating for areas that are buried beneath nourishment fill. Outside of the equilibrium fill footprint, the Project will not impact any exposed cobble bottom. Since mitigation will replicate any cobble bottom buried beneath nourishment fill, stabilization of the bank will not in any way reduce the extent of cobble available for habitat. Please see Meeting 7 Questions/Responses 50-52.

32. (Ray): When do you propose to install the cobble? I think the dark area in the upper third of the mitigation area is Squam Pond; I know there is an active least tern colony and several piping plovers that nest along that shoreline. You may want to consider that during your scheduling for mitigation.

(Rits): We have not finalized the mitigation installation schedule, and will take that into consideration.

33. (Ray): Will you allow fishermen and pleasure craft to navigate through the mitigation area during installation?

As explained at the Commission meeting, mitigation material will be deployed from a single, slow-moving barge. As a result, mitigation installation activities will occur at a single location at any given point in time. Although the Proponent hopes that the barge will be granted safety and courtesy buffers typically afforded to any navigating craft, other vessels will certainly be free to utilize the area.

34. (Ray): Has this type of mitigation ever been performed in the northeast? If so, are you following an established path or is this an experiment?

Comparable mitigation efforts have occurred in similar environmental conditions, and the results have provided a framework for the Proponent's mitigation plan. One example is the habitat replication effort performed in Washington state and described in Question/Response 17. Although not in New England, the area involved in that study is comparable to the Project area: high-energy wave energy and ambient tidal currents characterize the area and are particularly dynamic during the stormy winter months. Monitoring of the boulder habitat mitigation area revealed that macroalgal regrowth within seven (7) months of deployment exceeded the 25% coverage benchmark established by Washington state environmental agencies (Wyllie-Echeverria, Duggins, and Wyllie-Echeverria, 2003[6]).

New England waters also contain examples of comparable habitat mitigation efforts: cobble and boulder substrate was created in Massachusetts Bay as mitigation for the Central Artery/Tunnel (CA/T) Project in 1999 and the Boston Hubline project in 2006. In collaboration with the National Marine Fisheries Service and the U.S. Army Corps of Engineers, the CA/T project deployed an artificial reef in Boston Harbor near Sculpin Ledge to provide habitat for blue mussels and other shellfish as mitigation for habitat conversion.[7] This constructed habitat covers approximately 13,000 square feet and is composed of reef modules and cobble/boulder patches. As of 1999, this reef was the northernmost artificial hard-substrate habitat in the United States. While the proposed mitigation in the Project area will not constitute an artificial reef given its low relief and related objectives, there are nonetheless some similar considerations with regard to habitat mitigation.

The Boston Hubline project created a need for additional artificial habitat as mitigation for marine construction activities. The Massachusetts Division of Marine Fisheries (DMF) is working to ensure that mitigation replicates any lobster or finfish habitat lost as a result of the Hubline project, and has been working on a protocol for substrate deployment and subsequent monitoring; once complete, this protocol will likely be comparable to the Proponent's proposed mitigation plan. In 2006, DMF deployed six (6) rectangular high-density artificial reefs containing variable-size cobbles and each measuring approximately 4,300 square feet in area; three areas near the constructed reefs have been delineated as controls where the existing sandy-silt bottom has been left uncovered. As with the Project proposed at Sconset, the mitigation site for the Hubline project was chosen based on multiple criteria including proximity to the impact area, sediment type, water depth, current speed and direction, and existing

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[6] Wyllie-Echeverria, T.; Duggins, D.O.; and Wyllie-Echeverria, S. 2003. Evaluation of an artificial rock reef for colonization by macroalgae. www.psat.wa.gov/Puglications/03_proceedings/PAPERS/POSTER/p8_wyllie.pdf.

[7] www.masspike.com/bigdig/background/reef.htm.

benthic community characteristics (the soft-sediment infaunal community exhibited relatively low diversity, and nearby areas of hard-bottom habitat had established floral and faunal communities). DMF has performed monitoring, including seasonal video and dive surveys, to characterize benthic colonization of the artificial reefs, which collectively are twice the size of successful artificial reefs installed in Boston Harbor, Massachusetts and Narragansett Bay, Rhode Island.[8]

35. (Bam LaFarge): Who determines whether mitigation is successful: the Commission, USACE?

Regulatory agencies will be reviewing the proposed mitigation plan as well as subsequent monitoring and reporting. Thus, the Conservation Commission and regulatory agencies have an opportunity to provide input and conditions for this effort. The Proponent's mitigation proposal reflects a reasonable benchmark for "success" as identified using the best available scientific literature and data.

36. (LaFarge): How many tons of cobbles will be needed for a given acre of cobble density? What is the source of the cobble?

The Proponent will obtain clean, natural rock cobbles from a terrestrial (i.e., upland) source. Mitigation material will be of similar size to cobbles that naturally erodes out of the bluff, and will be free of silt or sand. For a calculation of the tonnage of cobble needed to replicate varying densities of cobble coverage, please see Meeting 7 Question/Response 53.

37. (Brian Borgensen): If mitigation is not successful, will a bond be placed to remove the mitigation materials? That material could conceivably attract a colony of dogfish.

The objective of mitigation is to replicate cobble habitat that is within the Project's impact footprint; therefore, mitigation will ensure no net loss in habitat functions or values, but will not significantly alter the habitat matrix in the Project area. Similar to the spatial extent of cobble bottom habitat within the impact area, the area of cobble bottom associated with mitigation will be relatively small in the context of the much more expansive cobble habitat located seaward and immediately adjacent to the Project. As such, there is no scientific basis for expecting that the mitigation area will be a significant attraction for specific species such as dogfish.

38. (Pete Kaiser): The area you have identified as a mitigation site is close in proximity to the area fishermen prefer, but it is much more volatile. I would suggest putting a mitigation site further to the north and a second site near Codfish Park. Also, it is a key variable to identify who declares mitigation is "successful". Mitigation habitat should hold fish and crustaceans before deemed a success.

(Rudin): The Commission will set conditions in the Order of Conditions that speak to that issue.

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[8] Glenn, Bob; Barber, Julie; and Whitmore, Kelly. 2007. Enhancement of Important Bottom Sediments for American Lobster and Other Marine Species in Massachusetts Bay. Mass. Division of Marine Fisheries. www.mass.gov/dfwele/dmf/programsandprojects/hubline/sediment.htm.

39. (Jay Starr): You say you don't want to over-mitigate because it will change the ratio of habitats, but you will be burying 276 acres of cobble bottom.

The Project will impact a total area of approximately 276 acres (i.e., the maximum extent of the 1.8-million-cubic-yard equilibrated footprint), of which only a segment is cobble bottom that will be permanently impacted. Much of this footprint is already sandy bottom habitat and will not undergo habitat conversion as a result of the Project. As discussed previously, a significant portion of this acreage will be buried under a film of nourishment material less than two feet thick, and will only be temporarily covered by nourishment material. The proposed mitigation is intended to replicate an area of cobble bottom habitat equal to the area of cobble bottom that will be permanently impacted. By mitigating for the actual amount of cobble buried, the Project mitigation will maintain the same relative amounts of cobble and sandy bottom habitats in the general Project area, thus maintaining a consistent habitat matrix. Organisms utilizing both of these habitat types will have the same amount of habitat available for use, albeit in slightly different locations. The purpose of mitigation is to recreate any habitat that will be permanently altered by the Project. The objective is not, however, to create additional habitat of a single type or to permanently alter the overall habitat composition of the Project area.

40. (Rick Atherton): I would like a further explanation about the existing cobble area. I have had a sense that a lot of the reason cobble exists is because the area is dynamic. If the mitigation area is not as dynamic, why do you think that over time the cobble will remain exposed?

The Proponent's fall 2007 video and dive surveys were performed to assess existing habitat conditions in an effort to quantitatively delineate the extent of exposed cobble and qualitatively assess habitat impacts. The equilibrium toe of fill will partially bury portions of the cobble bottom within approximately 1,000-1,200 feet of the Project shoreline. The majority of cobble habitat within the equilibrium toe ranges from 10-30% cobble density and is located within 400-800 feet of shore; several small areas of cobble habitat exhibiting 40-50% cobble densities are located 800-1,200 feet offshore. Extending 3,000-3,500 feet offshore, the cobble survey encountered seaward areas of dense, high-quality cobble bottom habitat; beyond approximately 1,200 feet, the Project will not impact any cobble bottom. The majority of cobble bottom within the Project footprint is located in water depths of 15-30 feet and is composed of material ranging in diameter from 4-24 inches. The Proponent has submitted a detailed cobble habitat assessment to the Commission, and this report is available for public review.

To provide this overview with some brief context, long-term shoreline retreat over the past 10,000-12,000 years has formed an offshore lag deposit composed of pebbles, cobbles, and boulders. This lag deposit is exposed on the ocean bottom and extends seaward of the Project to the position of the original post-glacial Nantucket shoreline. This assortment of offshore gravel- to boulder-sized material is collectively referred to as "cobble bottom". In general, the volume, size, and density of cobble bottom materials are highly variable and depend on local environmental conditions. Nearshore, where energy from waves and currents is relatively high, benthic habitat is inundated with sand from the coastal beach and eroding coastal bank, limiting the abundance and density of exposed cobble. Offshore, where greater water depths and distance from the wave-breaking zone tend to lessen wave energy, benthic habitat trends toward higher densities of exposed cobble.

To adequately replicate the cobble bottom that will be buried, the proposed mitigation will occur where environmental conditions such as water depth, energy regime, water temperature, light penetration, and bathymetry are comparable to the impact area. For this reason, mitigation will occur proximal to but outside of the Project footprint, and will also occur at comparable distances from shore. An

extensive monitoring program will be used to verify mitigation success and ensure the replicated cobble bottom is not buried beneath sand.

41. (Witham): Your criteria for mitigation exclude anything with less than 2 feet of burial, but damage will still occur during construction and that habitat will be degraded permanently given the renourishment cycle. I think that area should be included in the mitigation.

It is clear from other beach nourishment projects and modeling efforts that the most seaward portion of the existing seafloor within the equilibrated nourishment footprint is only temporarily covered before the toe begins to recede. Nonetheless, as Mr. Rits explained during the Commission meeting, that area was not excluded from the mitigation proposal. Rather, the Proponent intends to monitor that area to determine the actual extent of burial and then mitigate for the actual impacts. The mitigation proposal is designed in this manner because it is very difficult to precisely predict the boundaries of areas which could conceivably be buried under a thin veneer of fill. The Proponent does not want to convert sandy areas into cobble areas via mitigation if associated existing cobble areas are only temporarily converted to sandy bottom. Please see Question/Response 29.

42. (Witham): I agree that monitoring is very important, but in this format your plan is open-ended with few actual goals or targets. The pilot is important, but I think it is important to have a firm mitigation plan.

The Proponent has a mitigation plan, and the purpose of the pilot mitigation project is to field-test the proposed methodology for replicating cobble bottom habitat. The Proponent is confident that monitoring results will document the success of this methodology and thereby verify the quality of the mitigation proposal and associated monitoring.

43. (Witham): You are missing some of the vertical component of cobble bottom by deploying a single layer of the mitigation material. Some areas near Sconset may have cobbles on top of cobbles. Therefore, you may be missing seasonal changes in the habitat and not entirely replicating the sediment regime.

The Proponent has performed extensive surveys of existing cobble bottom habitat within and adjacent to the equilibrium fill footprint, and these surveys have shown the exposed cobble bottom to be low-relief and not visibly a product of cobbles being stacked upon cobbles. Dive surveys are scheduled for January 2008 to ground-truth the instrumental survey data and refine the understanding of this habitat. Based on the best available information, deploying a single layer of natural rock cobbles will effectively replicate the habitat functions and values of cobble within the impact area, and monitoring will allow the proponent to monitor the amount of cobble as well as habitat colonization, ensuring that mitigation is successful.

44. (Ernie Steinauer): Given the open-ended nature of the mitigation plan, is there sufficient area outlined in this particular site to perform the maximum possible extent of mitigation? Do you have secondary sites identified as additional options?

(Rits): As I replied to Mr. Rudin, we feel this general mitigation area provides a sufficient spatial extent.

PRESENTATION 3: Regulatory Update Based on Revised Project (Les Smith)

45. (Cormac Collier): The Nantucket Land Council believes that with regard to the local bylaw concerning 2.01B(7) (Land Under the Ocean), the Project requires a waiver because the Project will have adverse effects on LUO. Every wetland replication and mitigation the Commission has dealt with in the past has been accompanied by a waiver request. The same goes for Coastal Beach under 2.02B(4), since the Proponent has not limited the adverse effects of fill; a 3-year renourishment interval has significant impacts, given the 2-year recovery period that is likely.

Upon further consideration, the Proponent agrees that it is appropriate to seek a waiver for the Project's effects on Land Under the Ocean (LUO). Although the Project's dredging and nourishment components have been designed to avoid and minimize impacts to the extent practicable, and the Proponent has established that remaining impacts will either be temporary or sufficiently mitigated for, it is true that such impacts will still have some degree of an "adverse" effect. Section 2.01B(7) of the Nantucket Wetland Protection Regulations for administering the Town of Nantucket Bylaw Chapter 136 ("Nantucket 2.01B(7)") states:

> *Water dependant projects shall be designed and performed so as to cause no adverse effects on wildlife, erosion control, marine fisheries, shellfish beds, storm damage prevention, flood control, and recreation.*

The Project will have absolutely no adverse effect on erosion control, storm damage prevention, flood control, or recreation; to the contrary, the Project will enhance these functions. However, it is possible that Project activities associated with dredging and placement of nourishment fill will temporarily affect marine wildlife, marine fisheries, or shellfish beds in LUO. It is worth reiterating that dredging will not result in any habitat conversion, and therefore the benthic community is expected to fully and rapidly recover, and while the majority of impacts within the nourishment footprint will be temporary, the Proponent is committed to fully mitigating for any permanent conversion of cobble bottom habitat to sandy substrate. Nonetheless, the regulatory language stipulating "no adverse effects" indicates the Project should seek a waiver from this performance standard.

The existence of some measure of unavoidable adverse effects notwithstanding, the Project satisfies the requisite standards for a waiver as established by several relevant components of the Nantucket Regulations. Nantucket 1.03F(3)(a) establishes that the Commission may grant a waiver when a project *"will not adversely impact the interests identified in the Bylaw and there are no reasonable conditions or alternatives that would allow that project to proceed in compliance with the regulations"*. The Proponent has met its burden to show this is the case. The interests protected by the Bylaw, as identified in Chapter 136 §136-2, include public or private water supply, groundwater, flood control, erosion control, storm damage prevention, water pollution, fisheries, shellfish, wildlife, rare species… recreation and wetland scenic views. As demonstrated previously, the Project will in no way adversely affect water supply, groundwater, flood control, erosion control, storm damage prevention, water pollution, rare species, recreation, or wetland scenic views. In fact, Project activities will enhance storm damage prevention, expand habitat for rare species, and support recreation and wetland scenic views. Although the Project may adversely affect fisheries, shellfish, or wildlife, any such impacts will be temporary and/or fully mitigated.

In addition, the clear language of Chapter 136 §136-2 states that protected interests include but are "not limited to" this explicit list, and such language shows an intent for the Commission to consider a

broad array of interests when evaluating the benefits and effects of a project. This Project, for example, also protects unique historical resources which are irreplaceable in the context of Sconset's historical identity and the historical integrity of Nantucket's community. This notion is further supported by the broad definition of "wetland scenic views" as provided in Nantucket 1.02; the definition explicitly states that scenic wetlands may be characterized by several features including the *"placement and sizing of both natural and man-made features"*. Under this definition, given the unique historic value of the existing homes along and behind the Sconset shorefront, the Project's protection of these resources must be acknowledged as directly supporting the interests of Chapter 136 §136-2.

Furthermore, the Proponent has demonstrated that there is no reasonable alternative to the Project that will satisfy its objectives while avoiding all impacts. The detailed written Alternatives Analysis was extensively reviewed by the U.S. Army Corps of Engineers, Massachusetts Department of Environmental Protection, Massachusetts Division of Marine Fisheries, and National Marine Fisheries Service; it was also thoroughly vetted during the Massachusetts Environmental Policy Act review process, and a copy has been submitted to the Commission. The Alternatives Analysis not only assessed potential alternatives along the Project shoreline (e.g., no-build, retreat, armoring with hard structures, nourishment, etc.), but also evaluated various upland and offshore sediment sources. The Proponent has provided the Commission with voluminous data demonstrating the veracity of the preferred alternative and the extent of any unavoidable adverse effects.

Nantucket 1.03F(3)(d) provides additional justification for granting the Project a waiver from the LUO performance standard:

> *The Commission may grant a waiver from these regulations when the Commission finds that a project will provide a long-term net benefit/improvement to the resource area, provided any adverse effects are minimized by carefully considered conditions. However, no such project may be permitted which could have an adverse effect on rare wildlife species.*

The Project will undeniably enhance the resource area's ability to prevent storm damage and erosive losses from the existing shoreline. As explained previously, nourishment does not prevent erosion itself, but rather allows this natural process to continue without detrimental effects to existing shorelines or landward areas. Furthermore, since the Project has been carefully designed to avoid and minimize habitat conversion, any adverse effects on marine wildlife, fisheries, or shellfish will be localized and temporary; the thorough mitigation plan will ensure any permanent, unavoidable impacts do not result in a loss of habitat functions or values. Extensive engineering design, modeling results, and ecological data provided for the Commission demonstrate and justify the Proponent's position. Furthermore, these data support the conclusion that rather than adversely affect rare wildlife species, the Project will expand and enhance habitat for the threatened Piping Plover and Least Tern. No rare wildlife species will be adversely affected by the Project.

In the context of Nantucket 2.02B(4), the Proponent disagrees with Mr. Collier's suggestion that the Project requires a waiver; this performance standard for Coastal Beach states:

> *Clean fill of similar grain size may be used on a Coastal Beach but not on a Tidal Flat, only if the Commission authorizes its use, and only if such fill is to be used for a beach or dune nourishment project. All possible mitigation measures shall be taken, as determined by the Commission, to limit the adverse effects of the fill.*

The Project proposes to place clean, beach-compatible sand onto the Coastal Beach, and not onto any Tidal Flat. In addition, the Proponent has demonstrated with ample data that the Project has been designed to avoid and minimize any adverse effects from the fill and that any permanent unavoidable impacts will be suitably and demonstrably mitigated.

46. (Collier): Retreat should be reconsidered as a feasible alternative. I clearly remember a question asking how many properties are directly in peril from the eroding shoreline; I seem to recall perhaps 15 properties. We are not necessarily talking about the entire Sconset shoreline, and I know about a number of lots that are available to which these houses could be moved. I think this alternative has been glossed over.

Although average erosion rates are useful for assessing trends in shoreline and coastal bank retreat, short-term erosion is highly variable and dependent upon storm frequency and intensity. For example, a period of relatively calm meteorological conditions could be followed by a single severe storm that causes extensive retreat both at Codfish Park and at the top of the Coastal Bank; in the past, single storm events have been associated with localized losses of as much as 20-25 feet at Codfish Park and 6-12 feet at the top of the Coastal Bank. Such short-term variability makes it difficult to predict precise points in time when a structure will likely be destroyed due to bank collapse. More importantly, however, the proposed Project offers a strategy for erosion management that will preserve architectural and cultural integrity along the existing Sconset shoreline and ultimately within the heart of Sconset Village itself. Given that erosion trends have persisted in Sconset for more than 50 years, there is no reason to believe that these critical features of Nantucket's cultural heritage will survive intact without the proposed Project.

With that said, the Proponent already performed an extensive alternatives analysis in conjunction with U.S. Army Corps of Engineers (USACE) permitting and as part of the Massachusetts Environmental Policy Act (MEPA) review process. The alternatives analysis considered various shoreline protection alternatives as well as possible sources of nourishment material. Please see DEIR Section 2.0, FEIR Sections 3.0 and 4.0, and USACE Permit Application Section 2.0. For specific information related to the retreat alternative, please see Meeting 2 Question/Response 12. The alternatives analysis illustrates that, given the sizes of the homes in question and the limited number of available properties, it is clearly infeasible to adopt a strategy of repeated and prolonged retreat from the ever-receding shoreline.

47. (Witham): I have a statement to the Commission. It might be useful for the Applicant to provide a new narrative and plan showing the new proposal in a cohesive document.

The Proponent is assembling a narrative that addresses the comprehensive Project as revised.

48. (Ray): I am curious about whether any of the rules and regulations from the state or local governments allow the Commission to look at impacts outside of the specific Project area?

The Proponent encourages the questioner to confer with the Commission or review the Final Environmental Impact Report, EOEA #13468.

49. (Ray): What struck me by the Project evolution summary is that many of the changes have been triggered by input from the Commissioners and the audience. Therefore, I am not confident in the design proposals from the Applicant's professionals.

The Proponent has chosen to revise and refine the Project design in an effort to be responsive to concerns raised by interested parties, and not because of any perceived deficiencies in design or planning. On the contrary, the Proponent maintains full confidence in the scientific data and engineering considerations upon which the Project design is based. The revised 1.8-million-cubic-yard design has been offered as a compromise to concerned interests that will provide the Project area with much-needed protection while enabling extensive monitoring to verify the accuracy of the Project's impact assessments and the success of attendant mitigation.

The Proponent is confident that its scientific footing is sound and that actual impacts will be consistent with or less than the conservative predictions, but acknowledges the fact that interested parties have ongoing concerns. Thus, the scaled-back design has a three-year renourishment interval and consists of a design beach offering protection from a 25-year storm. This compromise is the only method, albeit expensive, to protect threatened resources while also demonstrating to the Commission, public, and scientific community that the proposed nourishment will achieve objectives in the Project area.

After three years, Project engineers anticipate that the advanced fill will have eroded away and the design beach will be exposed. At that time, the Proponent intends to renourish the Project to the initial 2.6-million-cubic-yard design template; this is contingent upon monitoring results, which the Proponent fully anticipates will be favorable. Therefore, the renourished Project would then have a five-year renourishment interval and consist of a design beach offering protection from a 50-year storm.

50. (Rudin): You have promised to provide some bathymetry showing the relative positions of the Borrow Site and Bass Rip Shoal and to look into historical data on the shape and position of the shoal itself. I assume you have that, and this is just a reminder to provide it.

Bathymetric data from 2006 and 2007 surveys are provided in Meeting 6 Question/Response 52. The Proponent will present historical shoal data directly in an upcoming Commission meeting.

51. (Rudin): In presentation 4, Question 63 (September 26), I was asking for more information on the models which were used. The results of this Project are very dependent upon what happens afterwards, and thus the modeling is quite significant. I asked for information regarding where the models have been used before and how they have been validated. What I mean is what projects have they been used on, and how have their predictions been borne out in actual monitoring results (particularly regarding sediment transport).

The Proponent has attached three reports to this response document that compare Delft-3D modeling outputs with measured results. Three additional reports are included that compare measured results with modeled results from GENESIS and SBEACH models.

The first report, *Validation of Delft-3D* (Walstra and van Rihn, 2005[9]), discusses borrow area infilling based on laboratory tests and a field experiment at Scheveningen, The Netherlands. The field experiment involved a 30-foot-thick dredge cut in 24-foot-deep waters with an average current of 1.2 knots and an average wave height of 4.3 feet. These environmental conditions are comparable to

[9] Walstra, D.J.R. and van Rijn, L.C. 2005. Validation of Delft3D. Sandpit: Sand Transport and Morphology of Offshore Sand Mining Pits. EC Framework V Project No. EVK3-2001-00056. Aqua Publications, The Netherlands.

those at the Borrow Site associated with the proposed Sconset Project, although it should be noted that the Sconset Project proposes a dredge cut of only 10 feet that will be located in deeper water (an average depth of 42 feet below MLW compared to 24 feet for the case study). Since infill rates are higher in shallower water and with deeper dredge cuts, the infilling rate in the Netherlands example is greater than would be expected for the Sconset Project. The report associated with the Netherlands case study concludes, based on a "Brier Skill Score", that performance of the Delft-3D model was "excellent"; to illustrate these results, the reader is directed to Figure 5 and specifically to results from Simulation S07, which uses a varying wave climate (as was done for the Sconset Project's modeling). The report states that infilling rates are sensitive to wave and current conditions. The Sconset Project's modelers are fully aware of this reality and used measured waves and currents during the modeling effort.

An accompanying paper by Walstra et al. (2003[10]) discusses longshore and cross-shore velocities within the water column and compares modeled results to measured values. The paper concludes that morphological predictions should be made using the 3D mode. Investigations into infilling rates for the Sconset Project used the 3D mode.

A paper by Benedet et al. (2006[11]) discusses the effect of wave diffraction and initial bathymetric conditions on beach fill volume changes. It should be noted that Lindino Benedet, the primary author, is an employee at Coastal Planning & Engineering and performed the Delft-3D modeling for the Sconset Beach Preservation Fund. The paper is primarily focused on the need to incorporate diffraction into morphologic models, but Figure 4 compares modeled volumetric changes along the shoreline to measured volumetric changes. The difference between modeled and measured values was less than 10%.

Hanson (1989[12]) discusses development of the GENESIS model. While the paper provides background equations for the model itself, it is cited for its comparison of measured and modeled shoreline change at Lakeview Park in Lorain, Ohio. The paper shows that despite having "little information" on the actual wave climate (i.e., only a representative wave height from five directional bands), the model predicted the volumetric change to within 90% of actual values.

The report by Kraus and Wise (1993[13]) discusses SBEACH modeling at Ocean City, Maryland using beach profiles collected one year apart as well as profiles collected following the January 4, 1992 storm; the paper also encompasses the "Halloween Storm" of October 1991. This paper details the

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[10] Walstra, D.J.R.; van Rijn, L.C.; Boers, M.; and Roelvink, D. 2003. Offshore Sand Pits: Verification and Application of a Hydrodynamic and Morphodynamic Model. Proceedings, Coastal Sediments 2003.

[11] Benedet, L.; Stive, M.J.; Hartog, W.; Walstra, D.J.R.; and Koningsveld, M.V. 2006. Effects of Wave Diffraction and Initial Bathymetric Conditions on Beach Fill Volume Change Predictions. *In* Smith, J.M., Proceedings of the 30th International Coastal Engineering Conference, San Diego, California. Pp. 4103-4115.

[12] Hanson, H. 1989. Genesis – A General Shoreline Change Numerical Model. Journal of Coastal Research. Volume 5, Number 1. Pp. 1-27.

[13] Kraus, N.C. and Wise, R.A. 1993. Simulation of January 4, 1992 storm erosion at Ocean City, Maryland. Shore and Beach. Volume 61, Number 1. Pp. 34-41.

inclusion of an algorithm for simulating overwash but also graphically compares the model run with measured changes in the shoreline profile. The author states that "the technical site inspection indicated that the model predictions were in qualitative agreement with the seaward erosion and the overwash that occurred. It was also interesting that the dune and berm change was much as the model predicted…"

Carroll (2004[14]) is a Master's thesis that compares SBEACH and COSMOS by analyzing two storm events (Hurricane Denis and Hurricane Isabel) at two sites in North Carolina. The author concludes that "the SBEACH model produced good results in all cases analyzed." Due to the length of this thesis, only the abstract is included in the attachment; the full text can be provided upon request, if necessary.

52. (Rudin): I am concerned that the record has a lot of data in it that has subsequently been modified and corrected. As an example, many charts show the Borrow Site as being directly adjacent to the shoal, and yet we have been told that is not the case. In the record is a statement that the barges will not be anchoring but that they will be using thrusters to maintain position; subsequently, comments from the Proponent have indicated a different situation. When the hearing is closed and the Commission sits down to make some decisions, such conflicts in the record will create some challenges.

It is true that some of the Project details have been refined during the Conservation Commission hearing process. Although design updates and supporting data have been provided and explained throughout the process, the Proponent understands the advantage of clarifying the details of the current proposal to avoid any confusion. As such, the Proponent intends to submit a comprehensive document to the Commission reflecting the revised Project design and impact assessment.

53. (Oktay): If you have additional information, please do not assume that we do not want to receive it. I would assume that whatever data you have will be helpful. I would rather have excess information than too little.

The Proponent has provided extensive scientific and anecdotal information related to the Project area, engineering design, alternatives analysis, ecological surveys, mitigation plan, etc. The Project Team appreciates the Commission's dedication to considering sound and verifiable data in its review process.

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[14] Carroll, P.M. 2004. *An Evaluation of Two Cross-Shore Numerical Models in Predicting Subaerial Beach Morphology*. Masters Thesis. North Carolina State University.