Epsilon
ASSOCIATES INC.

Projects:\21597\2013 Emergency Project\Monitoring and Work Reports\2020 Annual Report

PRINCIPALS

Theodore A Barten, PE
Margaret B Briggs
Dale T Raczynski, PE
Cindy Schlessinger
Lester B Smith, Jr
Robert D O'Neal, CCM, INCE
Michael D Howard, PWS
Douglas J Kelleher
AJ Jablonowski, PE
Stephen H Slocomb, PE
David E Hewett, LEED AP
Dwight R Dunk, LPD
David C Klinch, PWS, PMP
Maria B Hartnett
Richard M Lampeter, INCE
Geoff Starsiak, LEED AP BD+C
Marc Bergeron, PWS, CWS

ASSOCIATES

Alyssa Jacobs, PWS
Holly Carlson Johnston
Brian Lever

3 Mill & Main Place, Suite 250
Maynard, MA 01754
www.epsilonassociates.com

978 897 7100
FAX 978 897 0099

May 7, 2021

Mr. Jeff Carlson
Natural Resources Director
2 Bathing Beach Road
Nantucket, MA 02554

Subject: DEP File No. SE48-2824 | 2020 Annual Report Review Comments

Dear Mr. Carlson:

We received the memorandum written by Mr. Greg Berman dated April 16, 2021 presenting his review on the 2020 Annual Review. Thank you for sending that along. Upon review of his comments, we offer the following responses to his review. The major topics that he identified are paraphrased or copied verbatim and presented in italics followed by responses is in normal typeface.

Executive Summary / Key Conclusion

Mr. Berman's memo presents a comprehensive review of the 2020 Annual Review, commenting on the major elements of: sand delivery, bluff monitoring, shoreline monitoring and underwater video monitoring. His major comments are on the topic sand delivery to the template, with the implication that the reported shortfall in sand delivered to the template is depriving the fronting and adjacent beaches of sand. As we describe below it is not. Spring 2020 sand deliveries were halted by order of the Commission because of the perceived poor sand quality (which turned out not be the case after two rounds of testing and over 5 months of review) plus delays related to COVID-19. However, because a large volume of sand was stored in the template, the delivery deficit only effected the volume of sand on top of the template. That large stockpiled volume provided adequate sand to re-cover exposed geotubes after all erosion events (i.e. contribute sand to the littoral system). The tubes were re-covered after each erosion event in 2020. Sand was delivered to the template in December 2020 to rebuild the stockpile volume and is being used to re-cover exposed geotubes presently.

During the preceding seven years approximately 14.3 cy/lf/yr of sand was contributed off the template to the littoral system as designed when sand washes off the face of the template during erosion events, and that volume exceeds the site-specific historical

annual average contribution rate of 12.0 cy/lf/yr of sediment from the pre-construction unprotected bluff. The materials in the 2020 Annual Review, quarterly reporting by the Woods Hole Group ("WHG"), and summaries presented herein show that sand off the template has contributed more sand to the littoral system than the unprotected bluff would have contributed based on the pre-construction retreat rate. See Table 1 below and Figure 1 attached.

Following are our responses to Mr. Berman's review comments.

Section 4.1 Sand Delivery:

1. *… Line 13 of Table 1 that there is **26,637 cy of sediment deficient** from the required volume as of 01/15/2021. Similar to last year, the report also indicates on Line 14 of Table 1 that if the applicant were only required to fill the template to 22 CY/LF then would currently be a surplus instead of a deficiency. However, this type of adaptive management has not been approved, and the surplus in the template combined with a deficit in nourishment volume may indicate that the template may not be providing sediment to the beach system during non-storm periods. …*

The volumes delivered to the template are not in dispute, neither is the deficiency from the permit volume new information nor disputed. In terms of deficits, one needs to distinguish between permit volume and natural bluff contribution volume (coastal process perspective). As has been stated many times, the permit volume is 1.83 times the natural pre-construction bluff contribution rate, 22 cy/lf/yr versus 12 cy/lf/yr. As summarized in Table 1 below, the sand delivered to the template annually and cumulatively has exceeded the unprotected bluff contribution volume.

Table 1. Cumulative Sand Contributed 2015 - 2020

Sand Year	A Sand Volume Delivered (cy)	B Sand Volume at 12/cy/lf/yr (cy)	Difference (A-b) (cy)	Sand Volume at 22 cy/lf/yr (cy)
2015	23,951	10,224	+13,727	18,744
2016	38,380	20,448	+17,932	37,488
2017	53,465	31,812	+21,653	58,322
2018	68,603	43,176	+25,427	79,156
2019	76,755	54,540	+22,215	99,990
2020	100,090	65,904	+34,186	120,824

This is also presented graphically in Figure 1, attached.

Regarding sand contributed off the template during non-storm periods that has nothing to do with template sand volume. As described numerous times, there are two

components to the template: (1) the face – from which sand is contributed to the beach and littoral system when waves erode sand from the face; and (2) the top of the template – an on-site stockpile used to replenish the face after erosion events. SBPF contracts to have eroded sand replaced from the sand atop the template after erosion events, and that is performed.

Sand can be washed off the face whenever waves lap against the toe of the template slope, and that can occur during storms or during non-storm times if the surf is high enough. Just like the natural bluff, sediment is only contributed off the natural bluff and carried to the beach and littoral system when waves lap against the bluff toe. Therefore, the template is contributing sand as effectively as the bluff, that occurs whenever waves wash against the template face and erode sand off the face.

2. *The 2020 sand year is much closer to the calendar year (1/1/2020 to 1/15/2020) and is a positive step towards a less confusing reporting system. … despite irregular time periods used in defining the Sand Years, it does not appear to significantly impact the surplus or deficit for a given year.*

Comment acknowledged

3. *The project site has received the required volume of sand in only one of the sand years since 2015. While there is some fluctuation, the net deficit has been increasing over time and the current deficient volume is 26,636 CY (significantly more than one year's requirement). While the deficit was somewhat reduced from 2018-2019, it has increased even more in 2020. The trend of increasing deficit nourishment volumes is concerning and should be addressed. As the trendline in the graph above shows, continuing this trend will lead to a potential deficit of >50,000 CY by 2025. Reexamining the appropriateness of the required mitigation volume is not part of this review. Assuming the required volume is appropriate, then there is a significant disruption in the supply of sediment to this region.*

Please see response to #1 above. The deficits referred to in the comment are relative to the permit volume. The actual volume delivered to template has exceeded the volume that would have been contributed off the unprotected bluff.

4. *The nourishment sand does not need to be placed on the template. Some of this material could be placed at the ends of the geotube array (an area of noted erosion) or immediately seaward of the array. This material would be transported away from the site more quickly than if placed on the template, but would serve its purpose as compensatory nourishment providing sediment to downdrift beaches and dunes.*

The nourishment sand serves several functions: (1) it is used to keep geotubes covered with sand to protect them from UV damage and physical damage, (2) the sand atop the template is an on-site sand stockpile so there is an adequate supply of sand to re-cover exposed geotubes after erosion events (this limits truck deliveries to a few concentrated

times per year), and (3) to contribute to sand to the littoral system to compensate for the placement of the geotubes in front of the bluff.

The purpose of placing sand (an expensive commodity on Nantucket) on top of the template is to receive the benefit of all three functions. Placing sand on either side of the template would not achieve all the functions of mitigation sand. Additionally, placing excess sand in front of the template would narrow the fronting beach, something the OOC seeks to avoid.

5. *The uncertainty in the volume is now shown and is very helpful in putting the data in context. It would also be helpful if the Total Bluff Erosion for Adjacent Unprotected Areas, reported as 4,623 CY, also had the uncertainty provided (ex. 4,623 CY ±??? CY). Using the equation ((802'+138')*+0.19 cy/lf) the Total Bluff Erosion for Adjacent Unprotected Areas is estimated as 4,623 CY ±179 CY. For the next report I would still urge the Gain/Loss map to provide a different color for the range of uncertainty (for 2020 this was ±2.3 cm).*

Comment acknowledged. We will confer with the GIS specialist to ascertain if this visual presentation as suggested will be legible at these scales.

Comments on Section 4.3 Shoreline Monitoring:

6. *The Conservation Commission may want to request a different representation of the shoreline monitoring data. The excerpt of the WHG report represents the change in position of Mean Low Water (MLW) over time, however concerns about the geotube array are based on a potential reduction in the volume of Longshore Sediment Transport (LST). It is feasible to construct a sediment budget (example below) that illustrates the volume flowing past points along the shoreline. Then updrift, geotube, and downdrift rates can be compared over time. If there is a reduction in flow downdrift of the geotubes then negative impacts might be inferred regardless of the overshadowed signal. The data to perform this analysis is not readily available and this level of effort is outside the scope of this review.*

The underlined themes in this comment will be addressed out of order. First, the WHG monitoring program is the long-term shoreline program that was started in 1994 and is the method that is prescribed in the OOC (SE42-2824). An amendment to the OOC would be needed to change the monitoring program. Second, the purpose of the mitigation sand is to compensate for the sediment that can no longer be contributed from the eroding bluff into the littoral system because the geotube array prevents bluff erosion. The use of the standard compensatory sand volume calculation (length x retreat rate x height) is a practical and pragmatic method to provide an adequate volume of mitigation sand to compensate for the erosion prevention. The basis for this mitigation approach is to ensure there is no net loss of sediment to the littoral system because of a CES. As demonstrated above in Table 1 and depicted on Figure 1, the existing geotube project has

provided more sand to the littoral system than the unprotected bluff would have based on this standard calculation.

Third, this project is but a very short segment of the Nantucket shoreline and the sand within this reach of shoreline is but a very small proportion of the total sand volume moving within the littoral drift system, which is comprised of the entire shoreline plus nearshore and offshore shoals off the east coast of Nantucket. Any changes of sand migration throughout the entire littoral system would overshadow any signal generated from this short stretch of shoreline. Examination of the WHG data[1] shows that the study area was experiencing erosion (reduced volume in most profiles during the periods 1994 - 2001 and 2001 - 2013 and retreat of the MLW position for the periods 1994 – 2020 and 2001 – 2020). Since the geotubes were installed, that trend is generally observed, but due to shorter timeframes, i.e., 7-years, 1-year and 1-quarter, some variation is observed, that is some profiles exhibit accretion while others exhibit erosion. I'd posit that the overall trend of erosion as evidenced in the WHG data back to 19914 is due to the conditions in the larger system than the installation of the geotube array.

Comments on Section 4.4 Underwater Video Monitoring

7. *While this type of video surveillance is adequate for ground truthing, Sidescan (backscatter) sonar images would provide a much more complete picture of the bottom. This has been mentioned in previous reviews, but is not a requirement of the Order of Conditions. The migration of the large (several feet high) underwater sand forms in the area overshadow any potential impact from the geotube sand contribution. One survey (06/2018) shows more cobble/boulder than any of the other surveys. There does not appear to be a significant difference between any of the remaining surveys. It is possible that the bottom type varies too abruptly to allow for fine scale parsing using this method. If the areas were more simply classified (>50% or <50%) there would likely be little to no significant change between the maps. An expert in fisheries could be consulted to determine the minimum acceptable percentage of Cobble/Boulder. It should also be noted that no June 2019 survey was provided.*

We agree this is the monitoring method prescribed in the OOC. The purpose of this monitoring was to ascertain if increased sand off the template (1.8 times the pre-construction unprotected bluff contribution rate) might cover the offshore cobble habitat with sand contributed off the template. The monitoring shows there has been no discernable change in cobble coverage.

Monitoring was required to demonstrate the project resulted in no adverse effect on grain size distribution in accordance with 310 CMR 10.25(6)(c). There was no assessment

[1] Southeast Nantucket Beach Monitoring 84th Survey - Tables 2. and 3.

of habitat quality before the geotube array was constructed and none is needed now. The performance is no adverse effect from the pre-construction condition and that standard has been met, as demonstrated by the video monitoring.

Comments on Section Annual Drainage System Report

8. *Previous Epsilon Reports have included professional determinations regarding accumulated sediment in the drainage system. In the past the system has been likely performing as designed, however there is no mention of the drainage system in the 2020 Epsilon Report.*

It was my understanding the drainage system was presently monitored and maintained by the department of public works as municipal stormwater infrastructure. We will have an engineer inspect and report on the drainage system.

Key finding for this independent review of the 2020 Epsilon Report:

9. *In the 2020 Sand Year less than the required amount of sediment was provided to the project area resulting in a current net deficiency of 26,637 cy. This continues a disturbing trend of increasing deficits which may lead to negative impacts, although the current reporting requirements have not shown such an impact. A more direct look at potentially changing volumes in longshore sediment transport may of use in determining downdrift impacts. The annual volume of sediment eroded from a coastal bank can vary greatly along this section of shoreline, therefore there might be some leeway in providing the exact volume each year (at least from a coastal processes point of view, if not the Order of Conditions). However, over the long-term more sediment will need to be provided to average out these years of deficit.*

The themes summarized by Mr. Berman were addressed above, but are summarized below

(a) The deficit cited by Mr. Berman is the deficit from the permit volume, while there has been a surplus contributed off the template as compared to the unprotected pre-construction bluff contribution rate (i.e., the coastal process point of view). See Table 1 above and Figure 1 attached. As Mr. Berman writes, "… *there might be some leeway in providing the exact volume each year (at least from a coastal processes point of view, if not the Order of Conditions).*"

(b) The WHG monitoring program is the monitoring program prescribed in the OOC. Data presenting the MLW position and volume along each profile are direct measures of downdrift beaches, the coastal landform of concern, and from which one can assess downdrift impacts. The MLW position plots submitted with our response to Mr. Berman's comments on the 2019 Annual Report demonstrate the beaches are not experiencing accelerated erosion (landward movement of the MLW line) post-construction. The difference along the Sconset shoreline, however, is the

bluff landward of the geotube has been stabilized, while the adjacent unprotected bluff continues to erode.

This project meets the performance standards established for CES's which were established to protect the interests of the Wetlands Protection Act and the interests of Nantucket Wetlands Bylaw. The interests presumed significant to Coastal Bank are storm damage prevention and flood control. The geotube system has positively affected the ability of the Coastal Bank to protect those interests. Secondly, the regulations require that CES's have no adverse effect to downdrift beaches. As stated many times, the data shows there has been no adverse effect to fronting and adjacent beaches attributable to the geotube system. See Table 1 above and the plots of MLW position previously submitted to the Commission.

We appreciate you taking these responses into consideration when reviewing Mr. Berman's review. In accordance with the OOC we expect to discuss the 2020 Annual Review with the Commission at the meeting scheduled for May 17, 2021.

Contact me at ddunk@epsilonassociates.com or by phone at 978.461.6226 with any questions regarding this correspondence.

Sincerely,
EPSILON ASSOCIATES, INC.

Dwight R. Dunk, LPD, PWS, BCES
Principal

encl.

cc. J. Posner, SBPF
S. Cohen, Cohen & Cohen Law PC
G. Wood, Rubin and Rudman LLP

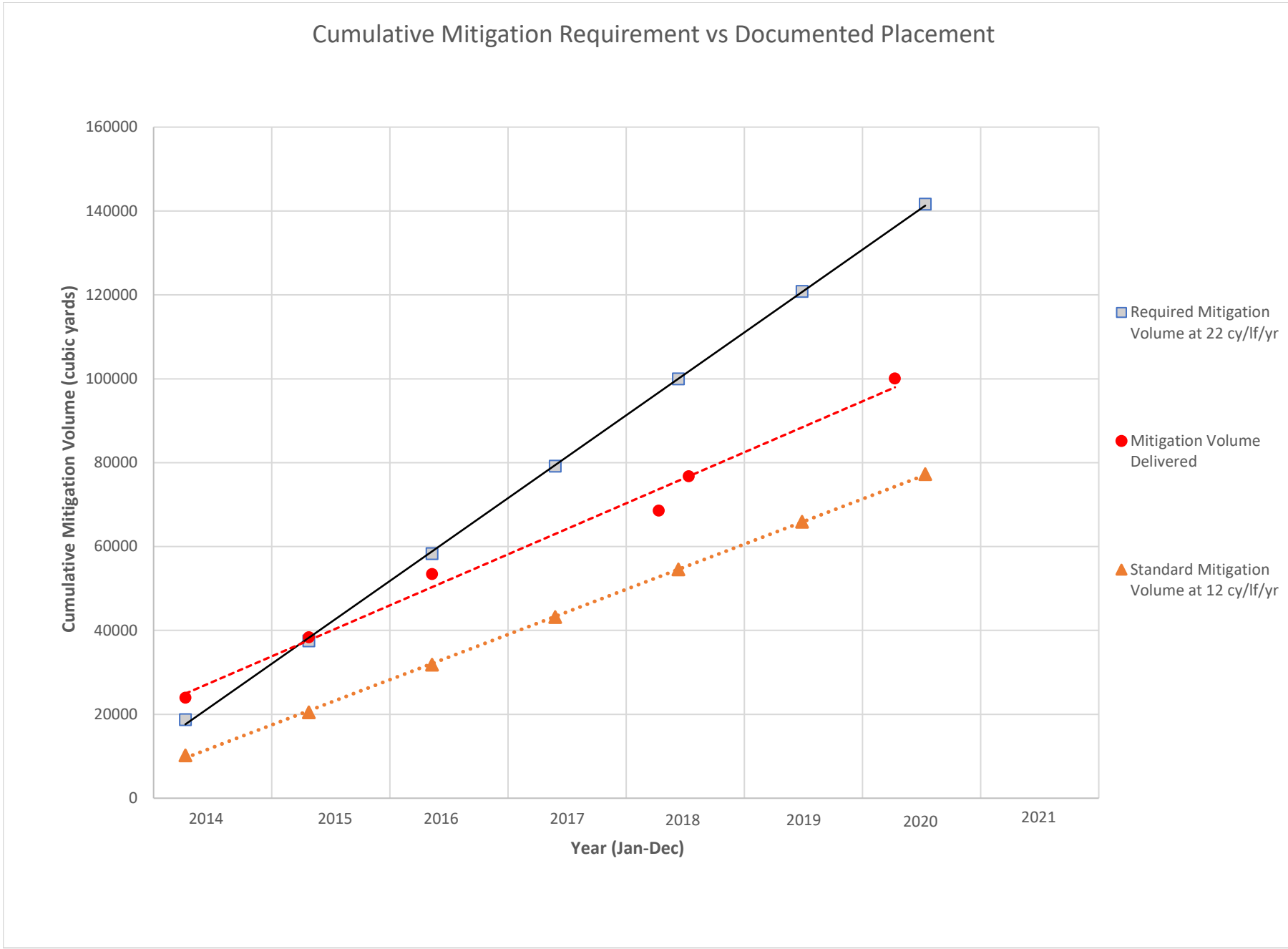

Figure 2 - Cumulative Sand Contribution