

IN THE MATTER OF

MARION STONE  
Scarborough, Cumberland County  
STONE REVETMENT  
L-24089-4H-A-Z (denied)

) NATURAL RESOURCES PROTECTION  
) SAND DUNE ALTERATION  
) APPEAL  
) FINDINGS OF FACT AND ORDER

Pursuant to the provisions of 38 M.R.S.A. Sections 344 and 341-D(4), 480-A et seq., Chapter 355 (Coastal Sand Dune Rules), Chapter 310 (Wetland and Waterbodies Protection Rules), and Chapter 2, Section 24 (B) of the Department of Environmental Protection's regulations, the Board of Environmental Protection has considered the appeal of the MARION STONE, its supportive data, the response of the applicant and other related materials on file and FINDS THE FOLLOWING FACTS:

1. PROCEDURAL HISTORY:

Marion Stone (the appellant) owns 238 feet of frontage at the southerly end of Scarborough Beach in the Town of Scarborough. The property contains a wooden bulkhead seawall that was damaged in a 2007 storm event. Approximately two thirds of the wall was destroyed in the storm; the remaining wall sustained damage but is still in place. On March 18, 2008, Marion Stone filed a Natural Resources Protection Act (NRPA) application to replace the timber bulkhead with a stone revetment seawall. According to the application, the purpose of the revetment is to provide additional protection to her property and to reduce future maintenance requirements.

Staff from the Department and from the Maine Geological Survey (MGS) reviewed the application materials and supplemental memoranda, and also conducted several office meetings and site visits with the appellant during the course of the project review. MGS staff also reviewed archival information on the coastal geologic history of the project site and submitted three review memoranda on the project. During the course of the project review the Department letters from six direct and indirect abutters to the project who expressed concern that the proposed revetment's significant differences in size and design from the adjoining seawalls could cause damage to their abutting walls or could have other adverse effects. Three property owners on Harmon Street wrote in support of the proposed revetment. After evaluating the material submitted by the appellant, the review comments from MGS, and the observations from the site visits, the Department determined that the appellant's proposal would have a larger footprint than the previous structure, would displace a significant amount of functional dune area, and could increase the potential for erosion. Based on those findings, the Department found that the appellant's proposal for a 200 foot long stone revetment would unreasonably interfere with the natural supply or movement of

sand within or to the dune system and that it would unreasonably increase the erosion hazard to the sand dune system. The Department issued a denial of the application in Department Order #L-24089-4H-A-N, dated January 13, 2010. A corrected order with minor formatting changes was issued on January 15, 2010.

On February 12, 2010, the appellant filed an appeal of the Department's decision to the Board. The appellant initially requested that the Board hold a public hearing but later withdrew that request.

2. PROJECT DESCRIPTION:

The applicant proposed to construct a 200 foot-long stone revetment to replace an existing vertical timber bulkhead seawall that was damaged during a storm event in April of 2007. The proposed revetment would be composed of three layers of stones, anchored with toe stones up to four and one half feet in diameter and weighing up to five tons. Above the anchor layer, the revetment would be constructed with a layer of bedding stones, an under layer of 1-1/2 foot stone, and would be topped with a fitted layer of armor stones measuring 3 to 4 feet in diameter. Total thickness of the stones would be approximately six feet and the structure would extend approximately 24 feet in width from the seaward toe to the landward edge. The proposed revetment would occupy a surface area of 4,800 square feet and would consist of approximately 1,110 cubic yards of stone in total. To transition the stone revetment into existing timber bulkhead structures on abutting properties, the applicant proposed to install two thirty foot-long sections of curved fiberglass sheet pile, driven 20 feet into the dune. The sheet pile would be faced with 2 inch x 10 inch pressure treated timbers backed with a 15 foot-wide layer of reinforcement stone and topped with sand and beach grass. The proposal is shown on a plan set entitled, "Stone Property Beachfront Protection" drawn by Baker Design Consultants, dated May 31, 2007 and last revised October 28, 2009.

3. STANDING:

Because the appeal was filed by the applicant for the permit, the Board finds that the appellant is aggrieved and may bring this appeal before the Board.

4. FINDINGS & CONCLUSIONS OBJECTED TO:

The appellant objects to the Department findings and conclusions relating to the following:

- A. Sand Movement, Erosion Hazard and Mitigation– Finding 2(D) and Conclusions B and G: that the proposed project would unreasonably increase the erosion hazard to the sand dune system and that the mitigation measures proposed by the appellant do not adequately mitigate for the proposed project's potential to interfere with the natural supply and movement of sand and gravel;
- B. Damage to the Dune System and to Abutting properties - Finding 3 and Conclusion A: that the applicant has not demonstrated that the proposed project

will be less damaging to the coastal sand dune system and to adjacent properties, including existing uses of those properties.

The appellant contends that, based on the objections to the Findings and Conclusions listed above, the Department erred in finding that the proposed revetment was not less damaging to the coastal sand dune system and adjacent properties than the existing vertical wooden bulkhead.

5. REMEDY REQUESTED:

The appellant requests that the Board reverse the January 13, 2010 Department denial and approve the construction of the proposed stone revetment.

6. RESPONSE TO APPEAL:

In an analysis of whether a proposed project meets the criteria of the NRPA regarding the reasonableness of the impacts of the activity, the Board considers whether an applicant demonstrated to the Department that the standards of the regulations are met. The regulations interpret the statutory criteria and in some aspects set forth the extent of impacts the Board will consider to be unreasonable. Chapter 355, the Coastal Sand Dune Rules, apply to this project because a coastal wetland would be impacted. Certain aspects of Chapter 310, the Wetlands and Waterbodies Protection Rules, also apply to the analysis.

Sand Movement

The applicant retained Woods Hole Group (WHG), coastal engineering consultants, to evaluate beach erosion and sand transport resulting from two design alternatives, an engineered vertical wall and the proposed revetment. The analysis predicted that a sloped revetment alternative would result in increased windborne transport of sand from the beach to the dune. However, the appellant states in Supplemental Memo #5 (pages 5 and 6) that, "due to the low crested nature of the revetment and bulkhead alternatives, it is expected that the amount of material exchanged during a significant storm event will be approximately the same for the existing bulkhead" and the proposed revetment.

The frontal dune on the appellant's property contains a timber bulkhead wall between development on the lot and the beach that has sustained storm damage. There is a continuous wall in front of adjacent properties and extending approximately 1/3 mile along this stretch of beach to the north of the project site. The bulkhead is a continuous structure which extends through several properties; it is of similar construction throughout with a footprint approximately one foot in width. Behind the bulkhead is a band of natural vegetated dune up to 100 feet in width separating the beach from development on the lots. The yards on the ocean side of all the properties along this stretch of beach have maintained the original natural frontal dune vegetation, in contrast to most other developed beachfront locations in southern Maine. Dune and seawall overtopping is a process required for the natural transfer

of sand from the beach into the dune system. Sand transport been documented by MGS as far as 130 feet landward of the existing bulkhead on the Stone property.

In a review memorandum dated June 28, 2008 MGS staff concluded that “the proposed highly engineered structure will most likely prevent any future frontal dune sediment from reaching the beach in a storm.” MGS commented that, “if many contiguous properties were involved in the project, the potential for reducing reflectivity and improving beach function may be realized, however the sediment exchange between the dune and beach is even less likely to occur in the future”. The 4,800 square feet of sand underlying the proposed structure would be trapped and immobilized indefinitely under any future coastal geology scenario.

The NRPA, 38 M.R.S.A. §§ 480-D(7) requires that an activity in a sand dune “not unreasonably interfere with the natural supply or movement of sand or gravel within or to the sand dune system or unreasonably increase the erosion hazard to the sand dune system.”

Based on the review comments from MGS, and the large footprint of the proposed structure, the Board finds that the proposed stone revetment would unreasonably interfere with the natural supply and movement of sand.

### Mitigation

Chapter 355 contains a provision for mitigation and enhancement for on site project impacts that interfere with the natural supply or movement of sand or gravel or may increase the erosion hazard to the sand dune system. These measures may include restoring the dune topography and elevating the crest of the sand dune to at least one foot above the 100 year flood/wave run up level and provisions to enhance with native vegetation the portions of the lot not covered by buildings or parking areas.

The proposed 200 foot-long revetment would replace 4,800 square feet of natural sand dune area. The structure would contain 1,100 cubic yards of rock and boulders up to 4-1/2 feet in diameter. The applicant proposed to mitigate the impact of the structure by adding sand and dune grass plantings to build a sand crest above the 100 year flood elevation at the landward edge of the revetment. The appellant contends that the proposed mitigation measures would adequately mitigate for the proposed project’s potential to interfere with the natural supply and movement of sand and gravel within the sand dune system.

During the pre-application process MGS recommended building a mound of “sacrificial sand” up to the 100 year flood level as part of any seawall repair or replacement project. Dune nourishment and plantings are routinely used to provide additional natural protection to structures located on coastal properties and expedited approval for such activities may be obtained pursuant to Chapter 305 of the Department’s rules, Permit by Rule. Supplemental sand placement and dune grass plantings have been a component of recently approved timber bulkhead repairs and replacements on three properties located immediately north of the project site. The appellant’s proposal to add sand and plantings would offer a measure of

additional protection to the property and would benefit the dune but those measures are considered as normal preventative maintenance in coastal locations to replace sand which has been transported landward or to the beach during storm events.

The appellant also offered as potential mitigation the possibility of securing a deed restriction to prevent new construction on a separate lot located between the appellant's house lot and the Prout's Neck Bathing Association property to the south, however this second lot owned by the appellant is not under threat from development because it does not meet the requirements for new construction in a frontal dune. New building construction is generally not approvable on an undeveloped a front dune lot. Chapter 355, Section 6(B)(5)(b) of the Sand Dune Rules does allow new buildings on an undeveloped front dune lot in certain very limited circumstances, and only when the adjacent lots on both sides contain residential buildings located within 100 feet of the lot line. The lot to the south of the lot proposed for protection with the deed restriction is not occupied by a residential building.

Given the limited development potential on the vacant lot proposed for protection and the fact that, while supplemental sand and plantings are endorsed by the Rules and MGS, this recommended but ordinary mitigation measure does not compensate for the permanent immobilization of sand trapped under the 4,800 square foot area occupied by the proposed revetment, the Board finds that the appellant's proposed mitigation measures do not adequately mitigate for the proposed project's potential to interfere with the natural supply and movement of sand and gravel within the sand dune system.

#### Damage to the Coastal Sand Dune

Under Section 5(E)(1) of the Sand Dune Rules, a replacement seawall of a different design or location must be less damaging to the coastal sand dune system, existing wildlife habitat and adjacent properties. Over the course of the project review, the appellant submitted supplemental memos and several reports including calculations to support her contention that the proposed stone revetment would be less damaging to the coastal sand dune system and abutting properties than would a structure with vertical wall, such as an in-kind replacement of the existing timber bulkhead, which would be allowed under Section 16 of Chapter 305, Permit by Rule.

The Rules also contain a Note which states that "The department encourages landowners to consider removing a seawall or similar structure and covering the area with sand and dune vegetation, or replacing the structure in a more landward position to reduce its influence on the beach and sand dune system." Portions of the proposed wall would be further landward than the existing wall and other portions would be more seaward.

To interpret the meaning of "less damaging", the language must be considered in light of the spirit, intent and goals of the Rules and the note above. The Introduction to the Sand Dune Rules states, in part:

“Coastal sand dune systems are fragile, dynamic resources that comprise only about two percent of Maine’s overall coastline. These sandy stretches are considered resources of state significance since they act as natural barriers that protect the shoreline from storm events. In addition, they have great scenic beauty and unique characteristics. They provide vital habitat for a variety of wildlife and they provide unsurpassed recreational opportunities. Many of the sandy beaches and dunes along Maine’s coastline are eroding, in part, due to a scientifically documented rise in relative sea level. In addition, attempts to prevent erosion and flooding through the construction or enlargement of seawalls harm the beach and dune system. Seawalls reflect waves onto the beach causing sand to be scoured away and they cut off the natural supply of sand to the beach from the sand dune behind the wall.

The department recognizes the dynamic nature of coastal sand dune systems in response to the changing conditions of water levels, waves, and winds. The extent to which sea level will change in the future is uncertain. However, the department anticipates that sea level will rise approximately two feet in the next 100 years. Under any scenario of increasing sea level, the extensive development of sand dune areas and the construction of structures increase the risk of harm, to both the coastal sand dune system and the structures themselves.”

To implement the NRPA’s prohibition of unreasonable harm to this fragile resource, the Sand Dune Rules provide that the Department will not generally approve new permanent structures within the frontal dune with some allowances for boardwalks, fire escapes and handicap access ramps and replacement of existing houses and construction of new structures on certain types of undeveloped lots which are located between adjacent residential buildings,. Under the Rules, new seawalls and similar structures generally do not meet the NRPA criteria and will not be approved. Under the Rules, new piers, docks, concrete slabs, piles, retaining walls, full foundations and patios are generally not approvable under the Rules.

According the Department’s analysis, the proposed revetment would contain the equivalent mass of 20 full house foundations, or 75 truckloads of stones and boulders up to 4-1/2 feet in diameter and weighing up to 5 tons.

The appellant’s argument that the proposed stone revetment is less damaging to the dune system and adjacent properties than a vertical replacement alternative would be is based largely on a report from WHG. The WHG report contrasts the effect of sloped and vertical replacement alternatives on predicted scour at the base of the structures. Sloped revetments are assumed to reduce wave reflection and subsequent wave energy by approximately 35% compared to a typical vertical bulkhead alternative. The analysis states that “Scour at the toe of sloping structures is a function of structure shape, porosity, water depth, grain size and incident wave conditions. Despite considerable research into wave-induced scour at sloping structures, no empirical estimation method has been proposed. Presently, there are no generally accepted techniques for estimating scour at a sloping structure; however the Coastal Engineering Manual (USACE, 2006) provides some simple rules of thumb for

providing engineering guidelines related to the scour at the toe of sloping vertical structures.” Based on the rule of thumb referenced by the applicant’s consultant, the report concludes that the vertical bulkhead alternative would result in increased beach erosion when compared to a sloped revetment alternative.

Actual scour at the project site is mitigated by a protective cobble stone apron which is deposited naturally by wave and current action. This cobble apron is present in front of the remaining timber bulkhead on the appellant’s property and along all of the bulkheads to the north. The cobble stones are covered by depositional sand in the summer months, with the beach elevation at the toe of the bulkhead varying two to three feet or more in a typical season. The cobble apron is in place most of the year and is visible in many photographs of the existing and abutting timber bulkhead in the application materials and review memoranda. It is not clear whether sand grains or cobble stones were used as grain size values in the appellant’s prediction of sand loss calculations, however the predicted sand loss must be viewed in the context of the conditions documented at the site. The documentation shows many cubic yards of depositional material accumulating at the base of the bulkhead every season.

The appellant also contends that the increased durability of the proposed structure would lessen the need for future dune disturbance to conduct repairs compared to the repair history of the existing wooden bulkhead. However, according to the WHG evaluation of the proposed revetment, significant damage and complete failure are expected in 10-year and 50-year storms at high tide. Thus repair or replacement of any structure, even the proposed stone revetment, will be required in the future.

MGS commented that the longevity of the structure, damaged in the Patriot’s Day Storm in 2007, was likely compromised by a bulge or bump out in the structure that acted as an “attack point” focusing storm energy on one section of the wall and leading to a failure at this point along the wall during the storm event. The feature can be seen on Sheet C-1 of the appeal document near the area labeled “2+00” and in Figures 1 and 2 of the June 28, 2008 MGS memorandum. MGS recommended eliminating this bulge in any reconstruction scenario. The applicant’s consultant, WHG, concurred that this was a vulnerable point in the existing wooden bulkhead. The protective natural apron of cobble stones described above, is absent from this bump out area in all pre-damage photos. It is reasonable to expect that the lifespan of a timber bulkhead replacement structure would be improved without this design flaw which left the bump out vulnerable from incoming waves and prevented the natural formation of the protective cobble apron at this point along the bulkhead.

Considering the damage anticipated to the revetment in a severe storm event and the design flaw built into the damaged bulkhead, the Board finds that the stone revetment alternative is not less damaging than a maintained, properly designed replacement timber wall in the location of the present structure.

#### Damage to Abutting Properties

The appellant contends that the proposed revetment would also be less damaging to abutting properties than would a replacement wall similar to the existing structure based on information in the WHG report referenced above. The WHG report analyzes impacts on abutting properties expected from the placement of proposed revetment between two abutting properties with vertical walls. Because the footprint of the proposed revetment would be twenty times the width of the abutting timber bulkhead walls, connecting to those abutting walls requires transition sections connecting the wider revetment sections to the existing abutting walls. The proposed revetment utilizes vertical sheet pile, curved into an arc and backed with stone armoring, to make the transition to the narrow timber bulkhead walls on abutting properties. MGS expressed concern that in a storm event, water splashing over the proposed revetment may become concentrated by the curved sections and cause damage to the adjacent walls or property. Overtopping, or overwash, of any revetment or vertical wall is anticipated during significant storm events and results in water flowing seawalls and similar structures and into the landward interior of the coastal properties. MGS reviewed the WHG report and in a review memorandum dated September 2, 2009, it commented that the WHG calculations addressing abutting property impacts are based on a linear model and do not account for water flowing back from the curved sidewalls of the transition areas at abutting properties. With overwash extending well into the property, it is not clear how splash over that was once perpendicular to the shoreline will not become more concentrated in the direction of the abutting lots with a curved transition wall. MGS staff expressed concern that increased hydraulic loading from returning waters could result in increased damage to abutting properties.

In its comments, MGS emphasized the loss of frontal dune which would result from the construction of the proposed structure : “If you consider the frontal dune landward of the former or existing wooden seawall part of the “resource”, then the sloped riprap covers a relatively significant area of this pre-existing resource. The surface of sandy, vegetated frontal dune is reduced even if some of the dune sand is redistributed on remaining dune surfaces.”

During the course of the review the Department received letters from Prout’s Neck Bathing Association and Andrew Rockefeller, direct abutters to the project site, expressing concern about potential damage that could result from construction of the proposed revetment.

Based on the large size of the footprint of the proposed structure and the area of dune resource that it would eliminate, the uncertainty of the erosion reduction predictions, and the potential adverse effects on adjacent properties, the Board finds that the proposed structure would not be less damaging to the coastal sand dune system and adjacent properties than would a replacement of the existing structure.

#### Coastal Wetland Impacts - Avoidance and Minimization

38 M.R.S.A. Section 480-B(2) defines coastal wetlands in part as “all tidal and subtidal lands” and “any...beach, flat or other contiguous lowland that is subject to tidal action during the highest annual tide level (HAT) for the year in which an activity is proposed as

identified in the tide tables published by the National Ocean Service” and “may include portions of coastal sand dunes”. According to the MGS memorandum of Feb 25, 2009, the HAT at the project site is approximately 7 feet. Therefore nearly half of the proposed revetment would be located in a coastal wetland and therefore the Board’s analysis of this application under the NRPA criteria is guided by Chapter 310, the Wetlands and Waterbodies Protection Rules (Wetland Rules).

Section 5(A) of the Wetland Rules interprets the licensing criteria of the NRPA and provides that a proposed activity will be considered to result in an unreasonable impact to a protected resource if the activity would ““cause a loss in wetland area, functions or values, and there is a practicable alternative to the activity that would be less damaging to the environment.” In this case is the evidence that the appellant has a practicable alternative that would be less damaging to coastal wetland and the coastal sand system. The WHG report and MGS memoranda are in agreement that the bulge or “bump out” in the preexisting wall was a source of weakness and a failure point in that structure. Reconstructing a similar structure without the bump out, allowing the protective stone apron to re-form, and adding sand and plantings behind the reconstructed wall would be a practicable alternative to the construction of the proposed stone revetment. The record reflects the Department’s experience with this alternative and that a number of abutting property owners have successfully utilized this alternative.

The proposed activity would cause a loss in wetland functions and values by displacing sand dune area and coastal wetland, and constructing the structure described above. The proposed revetment would expand by 2,000% the footprint of the existing timber bulkhead. In the analysis of the reasonableness of the impacts of a proposed project, the Board considers, pursuant to Section 5(B) of the Wetland Rules whether the amount of wetland to be altered was kept to the minimum amount necessary.

Based on the size of the proposed structure and the availability of a reasonable alternative with a much smaller impact on the resource, the Board finds that the proposed stone revetment represents an unreasonable impact to natural supply or movement of sand or gravel within or to the sand dune system.

The Board has considered all of the information in the record, including evidence provided by the appellant, the documentation resulting from the site visits, and the comments of MGS. Based on this information, the Board finds that the appellant failed to demonstrate that the proposed revetment would be less damaging to the coastal sand dune system and to adjacent properties than replacing the existing structure with a structure of the same dimensions and in the same location.

Based on the above findings, the Board concludes that:

1. The appellant filed a timely appeal.

THEREFORE, the Board AFFIRMS the Department Order denying the application of MARION STONE to construct a stone revetment seawall in Scarborough, Maine and DENIES the appeal of MARION STONE to approve construction of the proposed stone revetment.

DONE AND DATED AT AUGUSTA, MAINE, THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 2010.

BOARD OF ENVIRONMENTAL PROTECTION

By: \_\_\_\_\_  
Susan Lessard, Chair