Evaluating Dune Performance in the Velocity Zone (the “540 Rule”)

The Federal Emergency Management Agency (FEMA) has developed a criterion for evaluating a dune, to determine if it is considered an effective barrier to base flood storm surges and associated wave action during the base flood event (100-year storm). This criterion is also applied by the MA DEP in determining the landward extent of the base flood event, and has come to be known as the “540 Rule”.

The figure below presents a schematic cross-section of a dune, showing the factors considered in determining dune failure potential, in connection with mapping the “flood zone with coastal velocity (wave action)” (V zones).

To determine if a dune is an effective barrier to base flood surges and associated wave action, the following procedure is applied:

Step 1: Obtain topographic survey of the dune under evaluation, consisting of cross-sections at sufficient intervals to characterize the dune. Generally, cross-sections at 50 foot intervals along the axis of the dune should be obtained, with additional cross-sections at apparent changes in side slopes (perpendicular to axis) or gradient (along the axis).

Step 2: Plot the cross-sections to scale on drawings. The area of the sand reservoir (see the figure below) will be measured from these cross-sections. This may be done directly from a printed scale drawing using a planimeter. Frequently, this measurement is now done on computer, using computer aided drafting software.

Step 3: Determine the 100-year stillwater flood level (SWFL) from the FEMA Flood Insurance Study (FIS) applicable to the area. Plot this elevation on the crosssections developed in Step 2.

Step 4. Determine the peak of the dune at each cross-section, and plot a vertical line from the peak to the SWFL, as shown in the figure below.

Step 5. Measure the area of the “sand reservoir”, comprising the seaward volume of the dune lying above the SWFL and on the seaward side of the vertical line from the peak of the dune.

Step 6. If the cross-section of the dune contains a sand reservoir equal to or exceeding 540 square feet in area, then the dune is considered an effective in attenuating wave action in a coastal flood. (Defuses the term “540 Rule” because of this criterion.) In this case, the landward limit of the V-zone is equal to the inland limit of the frontal dune. The inland limit of the frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope. This point is indicated schematically on the figure below.

Factors to be considered in Determining Dune Failure Potential and V Zone Mapping (the “540 Rule”).