SITEC
ENVIRONMENTAL
Civil and Environmental Engineering, Land Use
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449 Faunce Corner Road
Dartmouth, MA 02747
(508) 998-2125 FAX (508) 998-7554

769 Plain Street - Unit C
Marshfield, MA 02050
(781) 319-0100 FAX (781) 834-4783

LETTER OF TRANSMITTAL

DATE	JOB NO.
3/30/07	SE03-3008

ATTENTION: Scituate Conservation

RE: Herring Brook Meadow LLC
DEP File # SE068-1988

TO

Scituate Conservation Commission

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
9	3/29/07		letter report & supporting plan from Peter Rosen, Ph.D re coastal flooding (Plan title, "GIS Plan - Topography & FEMA Flood Zones.

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
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APR 02 2007
TOWN CONSERVATION COMMISSION

REMARKS

Dear Commissioners

This report & plan are provided as the first in a series of technical responses we will be providing to address all issues raised in March 9, 2007 Horsley Witten Group review letter. This report & plan are provided to respond specifically to "Item 3, "Land Subject to Coastal Storm Flowage" in the Horsley Witten letter. Dr. Rosen & I will be available at the 4/2/07 hearing to present this information.

COPY TO J Stearns, ESQ.

Rod 6454

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ENVIRONMENTAL
Civil and Environmental Engineering, Land Use
Planning, Hazardous and Solid Waste Consulting

SITEC ENVIRONMENTAL, Inc.
769 Plain Street, Unit C
Marshfield, MA 02050
Tel. (781) 319-0100 FAX (781) 834-4783

12 Welby Road
New Bedford, MA 02745
Tel. (508) 998-2125 FAX (508) 998-7554

March 29, 2007

Scituate Conservation Commission
Scituate Massachusetts

Re: Herring Brook Meadow Project

Commissioners:

This letter is in response to concerns raised by the Office of Coastal Zone Management in an email from Rebecca Haney to Michael Clark, Acting Chair, Scituate Conservation Commission, regarding clarifications of the proposed project, Herring Meadow Brook Residential Community, Scituate, Massachusetts. While the project submission in the Notice of Intent contains full documentation for the project, a composite of site conditions, which overlays an aerial photo, topography, flood boundaries, and property boundaries, and proposed area of development, is submitted to further clarify the issues.

1.0.0 Topography: At the request of CZM, the site topography has been extended on this composite by adding information from the Town topographic base. The area of the project is on the lower portions of a topographic slope which rises to a peak west of Rt 3A and a smaller peak south of the site east of Rt 3A. These slopes are composed of glaciofluvial kame and ground moraine. North of the kame deposits (roughly above 10 ft elevation) is a large flat portion of the site (the open field) that consists of Outwash Plain deposits.

2.0.0 Flooding Issues: Flooding on the site occurs from two independent sources, upland flooding and coastal flooding. The FEMA Flood Insurance Study (1986) concludes that most flooding in Herring Brook is from storm surge flow (coastal flooding) though New Inlet which is driven landward. This conclusion is consistent with the relatively small drainage area and the dominance of tidal flow and estuarine vegetation in the Brook.

2.1.0 Coastal Flooding: First Herring Brook flows through an opening in the abandoned railroad embankment near the east end of the site. The Brook, then called Herring River, flows into the mouth of the North River near New Inlet, which opens into Massachusetts Bay. The 100 year flood elevation is 14 feet at the railroad embankment. It is mapped as Velocity Zone (V-zone), indicating that storm waves having a minimum height of 3 feet are being driven up the channel.

The 14 foot elevation V-zone extends as a tongue-shaped area through the opening in the embankment to the margin of the project property. This V-zone) is surrounded Zone AE, elevation 11 feet, throughout the project site and most of lower First Herring Brook.

None of the proposed project, with the exception of part of the proposed conservation area, is in the V-zone. This boundary, consistent with FEMA practice, is plotted by transferring the boundary from FEMA FIRM maps to the project plan. The shape of the V-zone is consistent with the landwardmost portion of waves moving up the river. The limit of the V-Zone identifies the position where three foot waves, identified by the National Academy of Science as the size that can cause damage to structures, no longer exist or can be supported.

The tongue-shaped area of three foot waves moving through the opening in the railroad embankment creates a setting where the waves are not growing,

but progressing on existing and decaying energy. The progressive loss of wave energy as waves move inland from the V-zone is affected by several factors:

2.1.1 Wave Breaking Criteria: Waves need a certain depth of water to support them. In general, a wave will break when water depth is less than 1.28 x wave height. So, a three foot wave breaks when water depth is less than 3.84 feet; a two foot wave breaks when water depth is less than 2.56 feet. These criteria are very close to storm surge conditions in this area. As progressively smaller waves break as the waves move inland, the energy is dissipated.

2.1.2 Friction: Friction along the bottom in shallow water diminishes wave energy as it progresses. Waves moving over areas of upland vegetation, such as the project area, will cause further progressive loss wave energy. The present agricultural field has high bushy vegetation on its north side, adjacent to the roadway, which would effectively dissipate residual wave energy. The FEMA estimates do not appear to incorporate these vegetation factors on the site. The seaward limit of the area to be filled may also be planted with bushy vegetation to both serve as a wetlands buffer and to dissipate any residual wave energy during extreme events.

2.1.3 Diffraction: Most importantly in the vicinity of this site, diffraction causes a geometric loss of wave energy near this site. The lobate shape of this V-zone indicates that energy is being lost by diffraction, or spreading and reduction in energy as it moves out in all directions from the opening.

2.2.0 Upland Flooding: There is Isolated Land Subject to Flooding on the project site that reflects flooding from surface runoff. The runoff is from the small areas of topographic rise to the west and south. The runoff reaches the property

through a small dug channel that passes through the stone wall at the south border of the property and accumulates in a topographic low on the agricultural field. There is no visible connection between the ILSF and First Herring Brook, by overland flow. However, the entire field can flood if coastal flooding exceeds elevation 7-8 feet. In this situation, the area would function as coastal flood conditions. In the proposed project, the ILSF will be relocated to the east in the area within the proposed conservation restriction. This proposed relocation of the ILSF will have 1) the same hydraulic connection to the surface runoff, 2) the same or greater flood storage capacity, and 3) will receive less contributing runoff from post-development conditions. Hence, there will be no diversion of upland floodwaters and the increased storage relative to contribution can diminish the magnitude of higher-frequency upland flooding.

The A Zone in the vicinity of the proposed project receives flow from upland runoff as well as coastal flooding This upland flow will not increase the height of flooding in the areas of coastal flooding because of the characteristics of coastal flooding. Coastal flooding is due to a sloping water surface at the coast (*i.e.* storm surge) which will cause water to flow landward as long as the slope exists. When the slope of the water surface is reduced, which can be due frictional effects, to the mass of water being contained, or to changes in tide, the water held against the shore is also reduced. When runoff flows into a coastal flooding setting, it becomes part of the coastal flooding system, which is an infinitely large basin.

The railroad embankment may appear to create a partially separated flood basin distinct from the coastal basin on the east. However, this embankment is quite low (elevation 5-6 feet). Since mean high tide is about 4.5 foot elevation, even minor coastal storm surges will overtop the embankment. The Stillwater FEMA flood elevation is 11 feet. So when there are flood events even well below 100 year levels, it is overtopped and thereby creating a complete hydraulic connection between both sides of the embankment. It is important to also

recognize the ILSF on the project site is elevation 8 feet. If the capacity of this area were to be overtopped, the water elevation would be greater than 8 feet, a situation when there is a complete hydraulic connection between the east and west sides of the railroad embankment.

Collectively, the project is not in a V-zone. Part of the project is in an A zone of coastal flooding. The limit of the A-zone in the project area, the 11 foot contour line, closely corresponds to the limit of the A-zone limit as mapped by FEMA.

2.3.0 Impacts from Fill: The project includes filling a portion of this A zone. The area of proposed filling is not in any type of floodway. The area is a slight cove in terms of both topography and is surrounded by resistant vegetation (bushes and trees), so there is no potential for flow to be diverted laterally.

Filling in a coastal flood zone does not displace floodwaters, so there is no increase in flooding in adjacent areas, as may be the case in upland or riverine flooding. This is because the flood basin for coastal flooding is the ocean, which is an infinitely large basin that is not affected by small changes in shape or volume. This characteristic of coastal flooding is well established in DEP Adjudicatory case law, as best exemplified by the 1988 Whoriskey decision (SE 42-249) nearby in Marshfield, which is based largely on the testimony by DEP (then DEQE) staff that coastal flooding does not displace floodwaters. Further, the Town of Scituate and DEP has recently based its approval of the proposed Fire Station on fill in an A-zone at 468 Hatherly Road on this same principle. MassCZM participated in this proceeding. The Hatherly Road project is surrounded by residences, most of them within the flood zone. By comparison, the dwellings adjacent to the area to be altered in the Herring Brook Meadow project are not in the flood zone.

While the proposed project is designed so there will be no impact on flooding, it should be pointed out that even filling in a V-zone, which does not occur at this site, does not necessarily have a negative impact to adjacent properties. The DEP Longo decision (date) in New Bedford established that fill in a V-zone would have the effect of causing a focus of waves on a mound of fill, which would both trigger wave breaking and dissipation, and reduce wave impacts in adjacent areas.

It should be noted that the proposed Herring Brook Meadow project is designed to cluster most development in the western half of the site, leaving the eastern half of the site as open space with a Conservation Restriction. This layout is consistent with the principles of low impact development.

Yours truly,

Peter S. Rosen, Ph. D.
Coastal Geologist
SITEC Environmental, Inc. Co-Consultant

Enc: SITEC Envrionmental, Inc. plan entitled, "GIS Plan-topography and FEMA Flood Zones", dated 2/21/07