

**Eric K. Durling, P.E.**  
Registered Professional Civil Engineer  
8 Orchard Terrace  
Maynard, Massachusetts 01754

February 5, 2010

Mr. Steven Calichman, R.S., C.H.O.  
Director of Public Health  
41 Cochituate Road  
Wayland, Massachusetts 01778

RE: Michael Road Conservation Cluster Subdivision

Dear Mr. Calichman:

At your request, a review of the drainage design for the subject subdivision was completed. Documentation provided for this review consisted of the following:

1. A report entitled "Hydrologic Analysis, The Subdivision at Michael Road" dated September 2009, prepared by MetroWest Engineering Inc.
2. A set of plans (13 sheets) entitled "Conservation Cluster Plan, The Subdivision at Michael Road" dated September 25, 2009, by MetroWest Engineering Inc.

The following comments are provided for your consideration:

1. An exfiltration rate of 8.270 inches/hour was used throughout the calculations for natural material under the roof infiltration galleys, the surface material within the rain garden, and the porous pavement material at the end of the driveways. While this rate might be valid for on site underlying material, the design should be based on the most restrictive material layer (loam/vegetation, pavement). Documentation to support the exfiltration rates should be provided.
2. The paved roadway is designed with a reversed crown; meaning runoff/snow melt/etc. is directed to the center of the paved travel way and in effect makes the road a paved swale. This is not standard practice and should be carefully considered. The nuisance of driving in water running down the street, the potential ice build up from refreezing snow melt, the accumulation of street debris in the center of the street instead of on the sides, and the difficulty of clearing snow with a straight edge plow bridging across a "v" shape road are factors that would suggest that this design not be allowed. The town's public works personal should be consulted on this issue.

Michael Road Cluster

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3. If I understand the calculations correctly, runoff into the porous pavement is basically instantaneously similar to an open detention basin. The water is then stored (see detail sheet 11 of 13) in the pavement and sub base and released over time as it would in a detention basin. The engineer should provide clarification on this point in the calculations on just how the porous pavement works hydraulically. Perhaps more design/specification literature on porous pavement should be submitted.

4. There are several practical considerations with regard the porous pavement. How does the runoff, particularly in a downpour, flowing across the sloped pavement infiltrate downward through the pavement? How does the water infiltrate through pavement and sub base under frozen conditions? Would repeated freezing and thawing of intentionally entrapped water in the pavement ultimately break up the pavement as it does with standard pavement? A leaching basin (proven technology) at the end of each driveway is suggested as an alternative that would accomplish the same goals of reduction of runoff and recharging the water table.

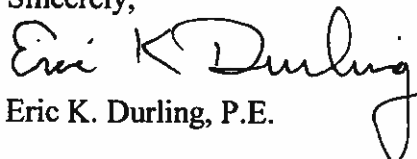
5. If porous pavement is still desired then the engineer should provide references and specific examples where porous pavement has been used successfully in the New England environment and in this manner (on sloped pavement).

6. Likewise there is a concern that under frozen conditions, frost in the ground under the rain garden will prevent infiltration and the rain garden will not function as designed. It is suggested that a "wick" consisting of a 24 inch diameter pipe filled with 1 1/2 inch stone extending below frost line and covered with domed landscape basin cover raised above grade be added to allow for infiltration during frozen conditions. Otherwise calculations showing how the rain garden functions under frozen conditions should be provided.

7. Figure Two "Pre Development Basins" is missing from this copy of the submission and should be furnished to make the file complete.

I trust that the above will be helpful. Please let me know if I can be of further service.

Sincerely,

Eric K. Durling, P.E.

**Eric K. Durling, P.E.**  
Registered Professional Civil Engineer  
8 Orchard Terrace  
Maynard, Massachusetts 01754

February 14, 2010

Mr. Steven Calichman, R.S., C.H.O.  
Director of Public Health  
41 Cochituate Road  
Wayland, Massachusetts 01778

RE: Michael Road Conservation Cluster Subdivision

Dear Mr. Calichman:

A letter dated February 9, 2010 by Metro West Engineering, Inc was provided in response to my letter of February 5, 2010, which outlined concerns regarding the above subject subdivision proposal. The following comments are in reply:

Comment 1: From the attachment to the MetroWest letter, it appears that the porous pavement and its supporting sub base has a higher permeability than the natural on site soils. As such the permeability of the on site soils will govern. This concern has therefore been addressed.

Comment 2: Providing a cross slope to the paved travel way, which directs the runoff to one of the gutters, is a satisfactory response to the concern of a swale in the center of the travel way.

Comments 3, 4 and 5: The theory behind the use and construction of the porous pavement is explained in these comments and the information attached to the MetroWest letter. The engineering concerns regarding the porous pavements have therefore been addressed. Both the response letter and attachment make the case of successful use of porous pavement primarily for sidewalks and parking lots not as a drainage system (as indicated by the letter this section of porous pavement functions as a "trench drain"). This raises an ownership issue. The private driveway apron is located in the public right of way and is an integral part of the street's/site's drainage system. The sealing or replacement of the pavement by the home owner in the future is a potential problem. Who has the responsibility for its maintenance and what is the "fall back" position if it does not function as anticipated? This is not to say that the use of porous pavement should not be approved. But its use as a drainage facility should be recognized as somewhat of an experiment and therefore the Town needs to not only address administrative/ownership

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details but also establish a monitoring system to monitor the effectiveness of the use of porous pavement so that future proposals can be evaluated based on experience.

Comments 6 & 7: These issues have been addressed.

One additional comment. In accordance with the attached information, only certified installers are authorized to install the porous pavement specified in the plans. The Town needs to make this a condition of approval and alert the Town inspectors to insure compliance. A note on the plans to this effect would also be appropriate.

Sincerely,



Eric K. Durling, P.E.

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TOWN OF WATLAND  
BOARD OF HEALTH



**TOWN OF WAYLAND**  
MASSACHUSETTS  
01778  
**PLANNING DEPARTMENT**

Sarkis Sarkisian  
Wayland Town Planner

TOWN BUILDING  
41 COCHITUATE ROAD  
TELEPHONE: (508) 358-3615  
FAX: (508) 358-3606

## Memo

**DATE:** January 5, 2010

**TO:** Planning Board

**FROM:** Sarkis Sarkisian  
Town Planner

**SUBJECT:** **Michael Road Extension Definitive Subdivision  
Planning Board Action Items**

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1. Use of two foot existing and proposed contours (Section III-3i).
  2. Technical memorandum prepared by traffic engineer (Section III-5).
  3. Elimination of the rounding radius at the entrance to the proposed road (Section IV).
  4. Reduction in pavement width from 24 feet to 18 feet (IV-B2).
  5. No street light fixtures (Section V-13).
  6. No proposed sidewalk (Section V-4).
  7. The water main from Michael Road to Plainview Road shall be looped and connected.
  8. The developer has agreed to provide \$10,000.00 to the Conservation Commission as a gift for improvement on the Conservation land.
  9. Conveyance of the 9.27 acres on Parcel C shall be transferred to the Conservation Commission.
  10. The right of way width shall be reduced from 50 feet to 40 feet.
  11. The developer shall be required to relocate the eighteen feet of paved road northerly to the Michael Road layout.
  12. A landscape plan shall be provided on the no-disturb zones of house #26 and house #25 Michael Road and shall be approved by the Planning Board for final review.

13. A comprehensive Operations and Maintenance for the drainage and storm water structure must be provided and a Home Owners' Association must be created to maintain the drainage system. Staff is still concerned regarding the size of the 8" outfall.
14. The existing cul-de-sac of Michael Road shall be landscaped with a curved island and approved by the Planning Board.



MetroWest Engineering, Inc.

February 9, 2010

Mr. Steven Calichman, R.S., C.H.O.  
Director of Public Health  
41 Cochituate Road  
Wayland, MA 01778

Re: Engineering Consultant Review  
Michael Road Conservation Cluster

Dear Mr. Calichman:

In response to the peer review report submitted by Eric Durling, P.E., for the above referenced project, I offer the following comments:

1. The exfiltration rate used for the site is 8.27 inches per hour and is based on the extensive soil testing performed. The percolation rates found throughout were uniformly 2-minutes per inch. The bottom of the proposed infiltration systems will be located within the "C" horizon, which is sand/gravel. Therefore the design uses the most restrictive exfiltration rate according to the Rawls Table. The same holds true for the porous pavement and the rain gardens. The bottom of each of these systems will extend into the "C" horizon soil, where the Rawls table sets the permeability/infiltration capacity at a conservative 8.27 inches per hour. All of the stormwater management systems have been designed in strict accordance with MADEP Stormwater Management policy and standards, and we are confident that the design parameters accurately reflect the field conditions in which the systems will be installed.

2. Since the paved roadway does not contain any structural components to collect stormwater, the design intent is to keep the runoff from draining down the driveways located on the south side of the road. We will, however, revise the grading along the roadway to pitch the runoff toward the north side gutter of the roadway which will still direct runoff toward the Rain Garden. The crown or reversed crown will thus be eliminated as recommended.

3. Attached with this letter is the Flexi-Pave system engineering documentation provided by the porous pavement manufacturer, KB Industries Inc. The design does allow for water to be stored within the stone layer beneath the pavement under larger storm events. Two feet of stone is provided beneath the porous pavement. Since the sub-grade and parent material have high infiltration rates, and since the porous pavement is several feet above the high water table, the stormwater will rapidly exfiltrate through the soils and frost will not develop under the porous pavement. The water is retained within the stone void spaces for only very brief periods of time, and only for the largest of storm events. Given that the 24-hour storm has a total rainfall volume of 6.7 inches, and that base infiltration capacity for a 24-hour period is 198.5 inches, storage within the stone media is quite brief. In the rare event that a freeze does occur, the porous pavement, which is

## Michael Road Conservation Cluster Subdivision

comprised of recycled rubber tires, is flexible and will not crack under a freeze/thaw condition according to the manufacturer.

4. In practical terms, the porous pavement driveway apron performs similar to a trench drain during an intense storm event. Sheet flow running over the pavement hits the porous section and is immediately intercepted and directed to the porous stone sub-grade section. The porous pavement itself has a nearly infinite infiltration capacity, over 4000 inches per hour; the infiltration capacity of the underlying soil will, however, limit the infiltration to the MADEP approved rate of 8.27 inches per hour for sand-type soils. The stone media thus serves as a temporary holding reservoir.

Porous pavement is a green Low Impact Development (LID) technology that is strongly advocated by MADEP. The University of New Hampshire has a test center where both porous asphalt and porous concrete parking lots have been in place for several years and have suffered no adverse impacts from winter weather. In fact, the porous pavement generally does not freeze, does not develop frost under the pavement, and requires significantly less quantities of de-icing compounds.

The specific product that we have specified for this project, Flexi-Pave, has been used in winter applications in Connecticut, Syracuse, New York and Pittsburg, Pennsylvania. It has also been used in the Boston Area this past year, although the local applications have not yet completed a winter season.

The Flexi-Pave product has unique properties that make it appropriate for winter applications. First, the rubber membrane serves as an insulator, and it restricts the development of frost below the pavement. Second, its flexible nature allows it to move up and down with the ground surface, so even if a frost does develop, it will not adversely impact the pavement surface.

5. The flexi-pave system has been successfully installed in the New England area. As mentioned above, it has been used in winter applications throughout New York, Connecticut and Pittsburg, Pennsylvania.

6. We will revise our plans and details to include the "wick" for the rain garden in the event of frost forming on the ground surface.

7. An extra copy of Figure Two will be submitted along with this review letter.

In summary, the project and the proposed stormwater management system has been designed to utilize Low Impact Development (LID) and Green Technology approaches in accordance with the Best Management Practices suggested by MADEP in its latest Stormwater Handbook. Given that the site lies in close proximity to a wetland resource area and a cold-water fishery, it is our opinion that the proposed LID/Green Technology applications are appropriate and will enhance environmental protection. While rain gardens and porous pavement may not have been used extensively in previous applications with the Town of Wayland, in our opinion they are an appropriate choice to foster sustainable development in an environmentally sensitive area.



Michael Road Conservation Cluster Subdivision

If you have any questions or require additional information please feel free to contact me at your convenience at (508) 626-0063. Thank you for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read 'R. Genama', with a long horizontal flourish extending to the right.

Robert A. Genama  
President, P.E., P.L.S.



**TOWN OF WAYLAND**  
MASSACHUSETTS  
01778  
**CONSERVATION COMMISSION**

TOWN BUILDING  
41 COCHITUATE ROAD  
TELEPHONE: (508) 358-3669  
FAX: (508) 358-3046

To: Sarkis Sarkisian, Town Planner  
Planning Board Members

From: Brian J. Monahan, Conservation Administrator

Re: Proposed Conservation Cluster – Michael Road

Date: March 16, 2010

The following comments are being provided on behalf of the Conservation Commission regarding the proposed conservation cluster being proposed at the end of Michael Road.

- It is desirable to have the land go to the Town of Wayland to be managed for conservation purposes. It is understood that this will be the case for the proposed open space on this property and the Commission's favorable recommendation on the project is based upon this premise.
- There should be clear access to the protected land from the development.
- Ideally there may be a complimentary Conservation Restriction taken by another entity as well as having the land owned by the Town.
- Compliance with Chapter 193 is required. There is no formal permit at the present time however there is a need to have a sediment and erosion control plan as well as maintaining existing hydrologic characteristics in the post development conditions and no increase in post-development discharge from storm drainage systems or any other changes in post-development conditions that alter the post-development watershed boundaries;
- Work within 200 feet of the streams and/or within 100 feet of the wetland shall be subject to review by the Conservation Commission.
- Stormwater should be treated to the maximum extent possible before discharge towards a resource area. (For discharge to a wetlands or stream not less than 80% total suspended solids removal.)

The Commission also noted that there is outstanding litigation between the current owner and the Town regarding the status of the two streams on and/or adjacent to the site. The proposed conservation cluster plans appear to address the matter and might result in an end to the litigation.

The protection of a portion of this property is consistent with the last adopted Open Space Plan.

Thank you.

Cc File  
Conservation Commissioners