Rec'd 11/8/2011

TETRA TECH

November 7, 2011

John S. Sklenak, Chairman
Conservation Commission
Town of Sudbury
275 Old Lancaster Road
Sudbury, MA 01776

Subject: Residences at Johnson Farm (the "Project")
Supplemental Porous Pavement Information

Dear Chairman Sklenak:

In response to your request at the October 24th Conservation Commission hearing, we are providing additional information pertaining to the proposed use of porous pavement within the Project. Specifically, this letter includes the following additional information, in response to the issues raised:

1. Summary of key benefits to the use of porous pavement on the site;
2. Examples of Federal, State and Local policies of governmental agencies and local conservation organizations recommending or encouraging the evaluation and use of porous pavement as a recognized Low Impact Development (LID) design technique and best management practice (BMP);
3. Local and regional examples of projects using porous pavement and studies indicating associated long-term, proven environmental benefits; and
4. Proposed maintenance protocols to be employed on the site to ensure longevity of this LID technique.

Further information on each of these topics is set forth below for the Commission's consideration:

1. Benefits of Use of Porous Pavement on the Site:

   It is significant to note that all paved areas associated with the Johnson Farm project, i.e., site access drives, parking areas and walkways are proposed as porous asphalt (and aesthetic interlocking permeable pavers on sidewalks in front of the buildings). Since porous pavement serves as a stormwater management system that provides significant reductions in runoff volumes, peak discharges and pollutant loads through its ability to capture, treat, store and infiltrate rainfall, there is no need for the

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conventional-type drainage systems consisting of catch basins, drain pipe and large detention basins that

necessitate significant additional tree clearing and earthworks. The porous asphalt pavement, unlike impervious pavement with a conventional drainage system, reduces environmental site impacts and replicates more closely the natural, pre-developed ability of a site to manage rainfall. Studies of sites on similar soils have shown volume and pollutant load reductions of as much as 95%. This results in enhanced protection of numerous interests protected under the Wetlands Protection Act and for these reasons, early in the design process, we dismissed the use of impervious pavement on this site, despite the considerable cost savings that would result from implementation of a more conventional stormwater management system.

2. Porous Pavement as a Recognized LID Technique and Best Management Practice:

Permeable pavement is recognized for its significant environmental benefits at state and federal levels. It is endorsed by MassDEP as a recommended BMP for stormwater management (Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook); by the Massachusetts Smart Growth/Smart Energy Toolkit as a desired LID technique; and by the US EPA as a desirable Green Infrastructure/LID approach. The 2008 National Research Council report on Urban Stormwater Management identifies infiltration/filtration strategies including permeable pavements as central to watershed protection.

Additionally, numerous local environmental organizations recommend the use of porous pavement as a LID technique for sensitive environmental areas. For example, the Charles River Watershed Association (CRWA) has focused a great deal of research on LID/BMPs and "is advocating communities and private developers to look for every opportunity to capture and treat stormwater prior to its entry into local surface waterways". CRWA is building a database of information on techniques and methods used to manage stormwater. The first LID BMP techniques listed on their website are Permeable Pavement and Permeable Pavers. Similarly, the Sudbury Assabet & Concord River Stewardship Council "promotes the use of LID techniques in any new project proposals that may affect the river", and states that "LID is an approach to environmentally friendly land use planning."

Furthermore, Sudbury's Stormwater Management Bylaw and Regulations "require the evaluation and implementation of LID practices"; Appendix D of the Bylaw lists porous pavements and rain gardens (proposed in the Johnson Farm design) among the

strategies with beneficial stormwater management objectives. These objectives, specifically listed in Appendix D and incorporated into the Johnson Farm stormwater design, for rain gardens are "to remove suspended solids, metals and nutrients" and "reduce peak discharge rates and total runoff volume"; and for porous pavement are to "reduce stormwater runoff volume from paved surfaces"; "reduce peak discharge through infiltration"; and "reduce pollutant transport through direct infiltration".

3. Examples of Porous Pavement Applications and Studies:

Porous pavement has proven, long-term environmental benefits, having been successfully used and maintained in environmentally-sensitive areas. For example, locally, it was installed 34 years ago at Walden Pond in Concord, Massachuetts as a "demonstration project by MassDEP and MassDEM". Today, a sign posted at Walden Pond states, "These parking areas are paved with Porous Pavement--Pavement That Leaks. Since 1977, it has raised the water table while reducing erosion, pollution and the need for storm drains or road salt". Permeable pavement was also implemented by the Massachusetts Department of Conservation and Recreation (DCR) in 2006 at the Silver Lake Beach parking lot in Wilmington, Massachusetts. As noted by the DCR, "porous asphalt was ideal for this parking lot abutting a popular swimming, fishing and boating lake."

As you are aware, the University of New Hampshire has been testing porous asphalt, as well as other types of permeable pavements, for several years at their UNH Stormwater Center testing facility on campus. In 2004 a porous asphalt parking lot was installed adjacent to a standard impervious dense-mix asphalt lot for comparison testing and monitoring. The porous asphalt has been monitored and analyzed for water quality filtering showing tremendous treatment performance, storage capacity and infiltration rates and compared to the standard pavement for effectiveness and functionality with regards to surface runoff, water quality and ambient temperature, structural durability, safety, particularly in wet and winter conditions, and operation and maintenance requirements. The results for porous asphalt are very favorable, relative to impervious surfaces.

As you are familiar with, the UNH Stormwater Center conducts a Porous Pavement Tour and Workshop. In addition to the porous asphalt test site, there are other locations on the UNH campus and vicinity that are part of this program, including parking, access driveways and sidewalks successfully using porous asphalt, pervious concrete and interlocking permeable pavers. Similarly, in Greenland, NH, the Great Bay Discovery Center installed permeable pavements as a LID retrofit of an old

gravel parking area using environmentally sensitive site design. Also, the Greenland Meadows Shopping Center, consisting of Lowe's, Target and a supermarket (designed and permitted by Tetra Tech) is the largest porous pavement installation in New England and a prime example of an environmentally beneficial LID technique functioning well as both a stormwater management system and a transportation system.

A porous asphalt installation in 2009 for a multi-unit condominium community in Pelham, NH features the state's first porous asphalt road and is a design and use very similar to the proposed Johnson Farm. The Pelham development was built on 14 acres of previously undeveloped land and includes a total of 5 buildings, a community well and a private septic system. In addition to 1,300 linear feet of roadway, all of the driveways and sidewalks in the development are composed of porous asphalt. The LID design reduced the need for stormwater infrastructure that would have included two large detention basins, resulting in 1.3 acres of reduced land disturbance.

Other examples of proven and functioning porous pavement installations include a portion of State Highway near the Maine Mall in South Portland by the Maine DOT; a parking lot expansion at the hospital in New London, NH; and a new parking lot at the Porter and Chester Institute in Canton, MA. Compared to adjacent paved areas with impervious dense-mix pavements, these installations have all proven to have substantial reductions in surface runoff and to be safe and effective during the most extreme winter snow and icing conditions.

Based on UNH testing, porous pavement is proven to be a better surface for dealing with winter conditions than impervious pavement. Winter maintenance of porous asphalt was found to achieve up to 75% reductions in salt usage. Snow on porous asphalt is plowed the same as standard pavement, however sunshine acts quickly to melt snow and ice sooner than on frozen standard pavement. The melting snow infiltrates from the surface directly through the open-graded porous asphalt into the stone sub-base. The result is a safer, cleaner pavement surface that clears faster than standard pavement, does not cause black ice that typically occurs on impervious surfaces from the constant freeze-thaw cycles and therefore dramatically reduces the need for salt deicing. For any deicing required in shady areas that don't receive as much sunlight, calcium chloride, rather than environmentally unfriendly sodium chloride, will be used as necessary to maintain safe site conditions, as may be authorized by the Commission.

4. Maintenance of Porous Pavement within the Project:

   Maintenance of the porous asphalt is performed four times per year using a regenerative air vacuum truck that picks up large particles such as leaves and debris, as well as smaller particles such as sand and sediments. As stated previously, since the melting snow infiltrates down from the surface, there is very little, if any snow and ice buildup, and therefore the cleaner, dryer porous paved surface does not require winter sanding. It is undesirable and not recommended since sanding would clog the pores of the asphalt and reduce its effectiveness to infiltrate. The On-Site Property Manager, who will be responsible for implementing the submitted Stormwater Management Operations & Maintenance Plan, and posted signage will ensure that snowplow operators on this private property do not apply sand as part of winter maintenance.

   The proposed Johnson Farm rental apartment community is an ideal property use for maximizing the environmental benefits of porous pavement and minimizing the potential for occurrences of accidental spills of hazardous materials or contaminants.

   With on-site property management providing accountability and coordinated control over the trained maintenance staff doing the lawn mowing, snow blowing, house painting and staining, this significantly reduces the chance for potential spills that might otherwise occur by residents performing these tasks. In addition, the proposed private access and loop drive to be used primarily by residents (it is not a cut-through road) promotes slow driving speeds designed for 25 mph posted speed limits, which also minimizes the potential for spills or leaks caused by vehicle accidents. However, should a spill ever occur on the porous asphalt, the spill response procedure plan is to apply Oil-Dri granular absorbent and then dispose properly of the used product. If necessary, the area of porous asphalt can be cut out and the dirty stone removed, replaced and pavement patched. Compared to impervious pavement and a conventional closed drain pipe conveyance system, the spill in porous asphalt stays in one area and does not runoff, potentially spread downstream and get discharged to basins.

Finally, to ensure a successful porous pavement design and installation, Dr. Robert Roseen, Director of the UNH Stormwater Center who heads up the Porous Pavement Tour and Workshop, has been added to the design team for Johnson Farm and

will be attending the Conservation Commission hearing next week. Robert has been instrumental in providing quality assurance as a reviewer of porous pavement designs, porous asphalt mix productions and construction inspections for many of the installations mentioned in this letter, and he has assumed that role for this project as well.

For these reasons, we have designed the project to include porous pavement as a proven LID technique, consistent with the Town's Stormwater Bylaw and Best Management Practices.Based on review of this information, we believe the Commission has sufficient information to conclude that, comparatively, the use of impervious pavement and a conventional stormwater management system in the Project would be far less preferable under the Sudbury Bylaw and other applicable environmental policies, due to the significantly greater potential environmental impacts, as summarized above. We trust this information is helpful for your review and we will be prepared to respond to any further questions that you or other members of the Commission may have at the next Commission hearing.

Very truly yours,
TetraTech

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