March 17, 2010

Scientists, Engineers & Environmental Planners Designing Innovative Solutions for Water, Wetland and Soil Resource Management

Michele Donato, Esq.
P.O. Box 145
106 Grand Central Avenue
Lavallette, NJ 08735

Re: Twin Ponds 2009 Revised Plans
Block 2173 Lots 18, 19, 20 and 21
Hamilton Township, Mercer County, NJ
Princeton Hydro Project No. 0527.009

Dear Ms. Donato:

This letter reports on the storm water management plan for the above development. This letter report will address the revisions prepared by the Applicant for the above referenced project and several documents prepared by Maser Consulting on behalf of the Applicant. In addition, I have reviewed the Planning Board file and other documents, including a report by Emerald Environmental Solutions.. The documents reviewed are as follows:

- Letter Report: Referenced "Twin Ponds 2009 Revised Plans, Block 2173 Lots 18, 19, 20 and 21", addressed to Michele Donato, Esq., prepared by Margaret Snyder, P.E. of Emerald Environmental Solutions, dated January 25, 2010.
- Letter: Referenced "Maser Correspondence of January 14, 2010, Twin Ponds 2009 Revised Plans, Block 2173 Lots 18, 19, 20 and 21", addressed to Michele Donato, Esq., prepared by Margaret Snyder, P.E. of Emerald Environmental Solutions, dated January 26, 2010.
- Report: "Stormwater Management Report, Twin Ponds, Block 2173 Lots 18, 19, 20 & 21", July 27, 2009 and prepared by Maser Consulting, P.A.
- Plans: "Preliminary and Final Major Site Plan for Twin Ponds, Lots 18, 19, 20 and 21, Block 2173, Township of Hamilton, Mercer County, New Jersey" revised to July 27, 2009 and prepared by Maser Consulting.
- Report: "Stormwater Management Facilities Operation & Maintenance Manual for Twin Ponds, Block 2173, Lots 18, 19, 20, 21, Hamilton Township, Mercer County, NJ" revised to July 27, 2009 and prepared by Maser Consulting.
- Report: "Report of Preliminary Subsurface Exploration Infiltration Evaluation, Twin Ponds Development, Block 2173, Lots Nos. 18 to 21, Township of Hamilton, Mercer County, New Jersey", prepared by Maser Consulting, dated November 29, 2004.
- Report: "Report of Preliminary Subsurface Exploration Foundation Evaluation, Twin Ponds Development, Block 2173, Lots 18 to 21, Township of Hamilton, Mercer County, New Jersey", dated February 17, 2006 and prepared by Maser Consulting.
- Letter: Referenced: "Twin Ponds, Block 2173, Lots 16 & 21, addressed to Mark Roselli, Esq., prepared by Julia Algeo, P.E. of Maser Consulting, dated January 14, 2010.

- Memorandum: Referenced "Application No. 05-02-011C, Owner: Crestwood Ventures, LLC "Twin Ponds", Applicant: Crestwood Ventures, LLC "Twin Ponds", Location: "Yardville Hamilton Sq. Rd.", addressed to Michael Guhanick, Land Use Coordinator (Hamilton Township), prepared by Richard S. Williams, Township Engineer, dated September 4, 2009.

- Report: "Geomorphic Assessment, Pond Run at Veterans Park, Hamilton Township, Mercer County, New Jersey", prepared by Princeton Hydro, LLC, dated May 2009 (copy attached).

1.0 Duty of the Zoning Board of Adjustment

The Zoning Board of Adjustment has jurisdiction to review this application for compliance with the New Jersey Department of Environmental Protection ("NJDEP") Stormwater Management Regulations, the Residential Site Improvement Standards, and the Township's adopted Stormwater Management Ordinances. The Zoning Board has an affirmative duty to assure compliance with these regulations and ordinances. The Board, under the MLUL, is not entitled to rely on a stormwater management review conducted by an outside agency. The Applicant cannot claim that any outside agencies have reviewed the application with regard to stormwater management in order to by-pass a detailed municipal review.

This requirement was affirmed in Save Hamilton Open Space v. Hamilton Tp. Planning Board, 404 N.J. Super. 278 (App. Div. 2008). In this landmark decision, the court found that a local land use board has the duty to review and approve the stormwater management design. The court concluded that the Phase II Stormwater "*...regulations do not provide for [NJ]DEP review to determine such compliance*. Instead, it is the responsibility of the municipal land use agency to determine compliance with the Phase II regulations."

Generally speaking, if a stormwater management plan is not adequately reviewed by a municipal land use board against the mandatory state requirements, or if the land use board's validation of a stormwater management plan is incorrect, the three most likely adverse consequences are flooding, erosion, and water pollution. Other adverse consequences can include mosquito infestation and an attractive nuisance, both resulting from deep and long-standing water. The extent to which these adverse consequences occur and their impact on the adjoining community is directly related to the extent of non-compliance by a stormwater management plan and its design deficiencies.

2.0 Existing Township Planning Documents and Ordinances to Protect the Public's Health, Safety, and Welfare

2.1 *Flood Damage Prevention Ordinance, 1979*

In recognition of the potential for flooding caused by land development, if storm water management is not properly implemented, as well as an understanding of historical land use management devoid of stormwater management or control of development in the floodplain, Hamilton Township enacted an ordinance titled "Chapter 157, "Flood Damage Prevention Ordinance of the Township of Hamilton". Under the Statement of Purpose (Section 157-6), it specifically states the following:

> *It is hereby found that the Assunpink Creek, Miry Run, **Pond Run** and other waterways in the Township of Hamilton are **subject to recurring flooding**, most recently in 1971 and 1975; that such flooding damage endangers life and public and private property and facilities; that this condition is aggravated by development and encroachments in the floodplain; and that the most appropriate method of alleviating such conditions is through regulation of such developments and encroachments. It is, therefore, determined that the special and paramount public interest in the floodplain justifies the regulation of property located therein as provided in this chapter, which is in the exercise of the police power of the municipality; for the protection of the persons and property of its inhabitants; and for the preservation of the public health, safety and general welfare.*

This ordinance was enacted in 1979, ahead of the NJDEP Flood Hazard Area regulations (previsouly known as the Stream Encroachment). In fact, Princeton Hydro completed a geomorphic (science of stream formation) assessment of Pond Run (see attached report) and found that this stream is severely impacted by historic uncontrolled stormwater runoff from development. Pond Run has experienced down-cutting, erosion and loss of habitat throughout its reach and specifically downstream of the subject property under this application. Therefore, it is imperative that all new development applications be scrutinized to ensure protection of Pond Run from further degradation.

2.2 Reexamination Report of the Master Plan, Hamilton Township, 2008

Hamilton Township, in their most recent revision of the Master Plan specifically identified stormwater and its State mandated ordinances as critical in the overall planning of land development throughout the municipality. In fact, on page 10 of this Master Plan it states the following:

> *As required under the new stormwater management rules, the Township prepared a Municipal Stormwater Management Plan (MSWMP). The goals of the MSWMP include reducing flood damage, minimizing increases in stormwater runoff from new development, reducing soil erosion, assuring the adequacy of culverts and bridges, maintaining groundwater recharge, preventing an increase in nonpoint source pollution**, maintaining the integrity of stream channels, minimizing pollutants in stormwater runoff, and protecting public safety through proper design and operation of stormwater basins.** To achieve these goals, the plan outlines specific stormwater design and performance standards for new development and proposes stormwater management controls to address impacts from existing development. The plan also includes preventative and corrective maintenance strategies to ensure long-term effectiveness of stormwater management facilities and outlines safety standards for stormwater infrastructure.*

2.3 NJDEP Mandated Municipal Stormwater Ordinances

Either through adoption of the NJDEP Model Ordinance for non-residential developments, or via the Residential Site Improvement Standards (NJAC 5:21 or RSIS) the municipality has ordinances in place that will allow for the enforcement of proposed land development to not only comply with State mandated local standards, but also assist Hamilton Township to allow the previously mentioned Flood Damage Prevention Ordinance to live up to its full potential, if

enforced correctly. In the case of this application, such opportunity is immediately before this Zoning Board of Adjustment, and it is imperative that that action be taken and a detailed assessment and corrections required, as is necessary, to prevent all the negative impacts of increased stormwater runoff as a result of land development practices.

3.0 Review of Existing Documentation

In order to provide a comprehensive review, while not duplicating effort in the review of this application, Princeton Hydro has relied on third party documents as listed above, including the detailed and comprehensive stormwater review conducted by Ms. Margaret Snyder, P.E. Princeton Hydro has independently reviewed the applicant's most recent stormwater management plan and reports and reviewed Ms. Snyder's report. Based on this analysis, I concur with her findings and recommendations regarding this application, and therefore, I incorporate Ms. Snyder's findings by reference.

Regarding the documentation of the applicant's engineer, I offer the following:

3.1 Letter of January 14, 2010 from Ms. Julia Algeo (Maser) to Mr. Mark Roselli

The letter prepared by the applicant's engineer, Maser Consulting was prepared as a response to our request that additional subsurface investigation work be completed to determine the legitimacy of the existing infrastructure regarding conformance to the RSIS and NJDEP Best Management Practices Manual. The questions were related to the minimum vertical clearances between the infiltrative surface of the subsurface basins.

- *Applicant's engineer claims that the site is too disturbed to determine existing seasonal high ground water conditions.*

  The statement that the site is "too disturbed" to investigate seasonal high groundwater is unfounded and not based in fact. Clearly, if groundwater clearances were observed in the design and construction of the on-site basins, then evidence of seasonal high groundwater would still exist. If there is concern about disturbance of the site due to excavated test pits, then soil borings could be easily progressed with a hole diameter of 4 inches at each location.

- *Applicant's Engineer claims that all clearances were met based on the test pits completed in 2004.*

  As will be discussed, below, such a claim is unfounded as, for example, test pit TP3 was not excavated to a depth that would allow for such assessments as clearance determination. The bottom of the test pit was completed at elevation 84, while the infiltrative surface of the basin was proposed (and presumed to be constructed) at elevation 85.65. The NJDEP Best Management Practices Manual (BMP Manual) specifically requires a two (2) foot vertical separation, while the applicant was only able to assess a vertical distance of 1.65 feet. As will be discussed below this is significant with regard to an analysis of the overall soil conditions of the site, and I will describe how they most likely did not meet the two (2) foot separation requirement.

- *Applicant's engineer claims that there is no design guidance on the vertical separation distance between sand filters and groundwater.*

  I disagree with this statement as the requirement is that there must be a separation of one (1) foot (as opposed to 2 feet for infiltration basins) below the detention basin and seasonal high groundwater. The sand filter is also considered a part of the detention structure and, therefore, would require such vertical separation.

- *Applicant's engineer claims that there have been no complaints from the residents; therefore, the system is functioning adequately.*

  This statement, in my opinion, is attempting to distract the reader into the point of view that "no news is good news". In fact, the basin could be functioning by draining out correctly, however, the systems is designed in the event of a failure to be by-passed, for example if the sand filter becomes clogged. It is doubtful that the residents are opening the monitoring ports or manholes to take a look to see if the basins are functioning.

- *Applicant's engineerclaims that as the development's system was approved by Hamilton Township and the Mercer County Soil Conservation District, the design is adequate.*

  As it was determined by the Courts, the prior approval of this application was remanded back to the Zoning Board of Adjustment and is to be viewed as "de novo". The statement that the designs were approved in accordance with the municipal process has no merit or bearing on this new review.

3.2 Soils Data and Impacts on the Stormwater Management System

Of primary importance to the operation of a detention basin is its elevation related to groundwater. Impacts to the function of detention basins from high groundwater include the ability of the basin to infiltrate runoff to groundwater, the ability to filter water as the water infiltrates to groundwater, and actual hydraulic functioning of the basin. As is widely known, groundwater can fluctuate in elevation due to seasonal variations as well as during wet or dry periods (i.e. significant rain events or droughts). For the Northeast, in the winter groundwater elevations rise as a result of the lack of foliage on vegetation that tend to place a high demand on groundwater, as well as wetter weather during the late winter and early spring. Once trees "leaf-out", they draw heavily upon interflow and intercept water that would contribute to groundwater rise. As a result of the rising and falling of groundwater through soil, groundwater has a tendency to dissolve and then precipitate minerals. Evidence of such chemical activity can be observed through what soil scientists call "mottling". Mottling is the appearance of soil to contain areas of grey or gleyed areas and areas of reddish colored areas. Such mottling is evidence of the movement of iron throughout the soil column. Iron, one of the most abundant metals in soil, is the metal most associated with accurate representations of groundwater elevations. Where the soil is gleyed, these are areas of iron depletions (iron has been stripped out of the soil) and where there are reddish areas, these are locations of iron accretion (oxidized). The combinations of these differing colored areas create a mottled look. The upper limit of visual evidence of this mottling is commonly accepted as the seasonal high groundwater elevation. It is at this elevation that much be matched to the minimum separation distance. The mere observation of groundwater in a test pit is not necessarily an indication of seasonal high groundwater, especially if the test pits are observed at any other time of year than March through early May.

Other factors than can negatively influence the ability of stormwater to be infiltrated is the layers of soil or rock commonly called "restrictive horizons", whereby the soil (or rock) contains physical characteristics that would otherwise limit infiltration. For example, if a soil at the surface was sandy and was underlain by a much finer soil matrix, such as silty or clayey soils, these finer soils would be considered restrictive. Once infiltrating water came in contact with such a fine grained material, its vertical movement or rate of infiltration would be reduced, potentially by an order of magnitude. Such restrictive horizons can cause an infiltration basin to fail. Usually, seasonal high groundwater is associated with restrictive horizons as water is perched and remains at its location

To ensure the adequacy of an infiltration or detention basin, NJDEP has prepared recommendations for minimum vertical distances between the basin surface and seasonal high groundwater. Through the BMP Manual, the NJDEP specifies that infiltrations must maintain a minimum vertical separation of two (2) feet between the bottom of a basin (infiltrative surface) and seasonal high groundwater. It also specifies that detention basins (as opposed to infiltration basins) must maintain a minimum of one (1) foot of vertical separation between seasonal high groundwater and the bottom of the basin. For infiltration basins, the primary reason for such separation distances is to maintain a difference in hydraulic head that promotes infiltration. For both infiltration and detention basins, the separation is also to protect groundwater from contamination as well as maintaining a dry basin bottom during non-storm events.

3.2.1 Twin Ponds Site Specific Data

As was discussed above, the NJDEP requires a minimum vertical separation distance between seasonal high groundwater and bottom of infiltration structures. In the case of Basin A within Phase 2 of this site, the applicant had only progressed test pit TP3 to elevation 84, whereby the bottom of the proposed (and presumably built) basin is located at elevation 85.65; only a 1.65 foot difference. Therefore, there is currently no information that provides evidence that seasonal high groundwater or a restrictive horizon is at least two (2) feet below the bottom of the basin.

It is noted that the Soil Survey of Mercer County (USDA) was recently revised with regard to Dragstown/Woodstown soils to a classification that is less conducive to infiltration. Each soil type identified on the soil survey has a designated hydrologic soils group (HSG). HSGs are identified as A, B, C, D; A having the highest propensity for infiltration and D having the worst (close to 0 inches per hour). Dragstown/Woodstown soils were previously identified as HSG B, but were changed to HSG C due to findings that this soil was more restrictive with regard to infiltration. This is a clear indication that the soils on site could be considered marginal for infiltration.

To evaluate the potential for seasonal high groundwater or a restrictive horizon below the site, Princeton Hydro evaluated all of the test pit information as provided by Maser Consulting. As a result of our review of the data, the site has a trend of restrictive horizons containing silts and clays at elevations between 82 and 85. In the case of the closest other test pit completed near TP3 (within Basin A) was TP8. TP8 exhibited a restrictive horizon of silt and clay at elevation 84, which would correspond to an elevation at or just below the elevation of the bottom of test pit, TP3. In my professional opinion, there is a high probability that if test pit TP3 has been progressed to the appropriate minimum depth of two (2) feet below the bottom of Basin A, silts and clays would have been encountered.

Regarding Basin B, located in Phase 1, a restrictive horizon was observed on the log of test pit TP11 at elevation 85.5, whereas the bottom of the proposed (and presumably built) basin is located at 85.12. Based on this observation, it is highly probable seasonal high groundwater is located within or just above these restrictive horizons and, therefore, Basin B and its sand filters do not meet the minimum vertical separation requirement of one (1) foot as stipulated in the NJDEP BMP Manual.

In fact, Maser's stormwater report contradicts the geotechnical report. Wherein the stormwater report makes the claim that groundwater is not an issue, the geotechnical report states that groundwater will impact utility installation and dewatering will be required (page 4, subsection 6.3):

> *Based upon Maser's review of the test pit and test boring data, the presence of seasonal high groundwater table indicators and shallow seepage, building foundations, basements, and underground utility installations will be impacted. Dewatering of excavations should be anticipated to maintain water levels a minimum of 18 inches below footing or slab bottoms.*

Based on our conclusions regarding the existence of seasonal high groundwater and restrictive horizons below the site, it is strongly recommended that a mounding analysis be performed. A mounding analysis is a model/calculation that estimates the height of the groundwater table as a result of infiltration impacts; thus the groundwater "mounds" below the area of infiltration.

A final concern regarding the existence of seasonal high groundwater impacting the stormwater system is with regard to the last sentence on page 4 of the geotechnical report that states:

> *Basement walls should be waterproofed and perimeter drains installed with connections to the stormwater system.*

If a perimeter drain is or was installed and connected to the stormwater system, such continuous or event periodic loading of groundwater to the sand filter and infiltration systems could create a hydraulic overload to the system causing the stormwater system to fail.

3.3 Issues Regarding Subsurface Detention System at Twin Ponds

3.3.1 Water Quality Treatment Issues of the Subsurface Detention System

The stormwater detention/infiltration system is comprised of a subsurface gravel bed that utilizes plastic arches to create additional volume of storage. As water enters the detention system from the site's stormwater pipe conveyance system, it is routed to a weir chamber that allows some of the stormwater runoff to be directed to a subsurface sand filter, while larger flows will by-pass the sand filter and be discharged directly to the underground detention basin. The sand filter is also comprised a crushed stone with a plastic arch for additional storage. Water flowing through the sand filter would then discharge to the main detention system. As a measure of additional alleged treatment, the Applicant's engineer is routing flows from the by-pass system into what is called an "isolator system" whereby several of the arches are wrapped in a geotextile fabric.

The sand filter does not conform to the requirements of a subsurface sand filter as provided in the NJDEP BMP manual. Specifically, subsurface sand filters must have a pre-treatment chamber and a baffle to keep oils and floatable debris out of the sand filter area. As this system does not

conform to the NJDEP standards, there can be no claim for the required minimum 80% TSS reduction prior to discharge to the stormwater systems.

Regarding the isolator row that is provided within the detention system, this treatment method is not approved by NJDEP as an acceptable manufactured treatment device, and therefore, has no rating for the removal of pollutants (total suspended solids).

Based on our review of the plans, the proposed stormwater system in not in compliance with the NJDEP BMP Manual or Stormwater Management Regulations.

3.3.2 Maintenance and Access Issues

As for any subsurface system, access for inspection and maintenance is paramount in ensuring its longevity as a treatment and management means for stormwater. When a stormwater management system is acting effectively at pollutant removal, it can clog and require maintenance from time to time. The fact that such a system is clogging is also a good indication that it is working. It is similar to an analogy about a vacuum cleaner with a filter bag. Every once in a while the filter bag must be removed and cleaned or disposed of. If the filter never clogged, this means that it is not removing dust from the floor or rug. It is the same concept for a stormwater management designed to filter and then convey stormwater runoff.

In the case of the Twin Ponds application, the sand filter provides very little room for access and the filter fabric used in the "isolator system" is wrapped around the outside of the plastic arches, rendering them impossible to remove and replace.

Regarding the sand filter, there are several issues. First and foremost is that the arches are only 16 inches from the bottom of the arch to the top. The interior of the arch has a maximum height of less than 14 inches. Second, the sand filter within the filter is overlain by a layer of crushed stone, six (6) inches thick. The combination of these factors makes the arch not accessible by a person to inspect or clean out, and renders it impossible to remove the gravel layer and then the sand. With the isolator system, the only way to remove the fabric and replace it would be to remove the pavement and excavate out the arches to replace the fabric.

Based on the above observations and conclusions, the Applicant must be required, at minimum, to provide a bond to the Township that includes the cost of total replacement, including the excavation into the parking lot that will be necessary. In fact, it is important that the Township ensure that the designer of this detention system is responsible in the event of failures as they have stated in their Operations and Maintenance Manual that:

> *I hereby certify that I have reviewed this report which in on record at the Hamilton Township Engineer's Office and take full responsibility for the design and contents shown hereon.*

4.0 Conclusions and Recommendations

Based on our review of the current application before the Hamilton Township Zoning Board of Adjustment, we offer the following:

- The Zoning Board of Adjustment, as required by case law and existing regulations, has a duty to review this application and ensure that the health, safety and welfare of the community are protected. This emphasis of concerns about flooding and its impacts are reiterated in the Township's various ordinances and guidance documents, including the Flood Damage Prevention Ordinance, the Stormwater Ordinance, and the Reexamination Report of the Master Plan.

- We strongly disagree that the site is too disturbed to obtain accurate evidence of seasonal high groundwater and it is my professional opinion that soil borings could be progressed that would not damage existing infrastructure or disrupt the residents.

- This application currently lacks sufficient data to determine if the proposed/existing stormwater management system complies with the NJDEP Stormwater Management Regulations. Specifically, the soil log below Basin A (in Phase 2) does not extend to a depth that ensures two (2) feet of separation between the bottom of the basin and seasonal high groundwater. Basin B (in Phase 1) appears to be situated in a restrictive horizon that would discourage infiltration, and additionally, may be the location of seasonal high groundwater. If seasonal high groundwater is at or above the elevation of the bottom of Basin 1, then the requirement to have one (1) foot (for non-infiltrating basins) of vertical separation between seasonal high groundwater and the bottom of the detention basin. A decision of approval or denial of this application cannot be reasonably made unless a complete understanding of the site's subsurface conditions is understood.

- The stormwater management system as proposed (and constructed) cannot be readily or easily maintained. There is not enough clearance within the sand filter to allow inspection or removal of clogged sands. The sand filter was not designed in conformance with the requirements of the NJDEP BMP Manual. Additionally, the "isolator system" is not a NJDEP approved manufactured treatment device, and therefore, cannot be used to calculate pollutant removal efficiencies.

- I concur with the findings and recommendations contained in the report prepared by Ms. Margaret Snyder, P.E.

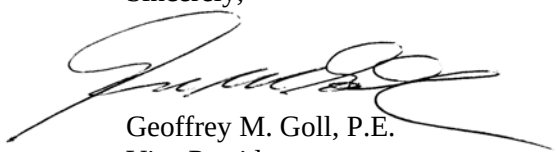
- If is determined that this site's design does not meet the intent of the Stormwater Management Regulations and protect the public's health, safety and welfare, remediation of conditions must be made. Such corrections could include:

    - Conditioning this approval by not allowing the construction of Phase 3. The elimination of Phase 3 would reduce the deficit of recharge and burden of the existing infiltration bed to infiltrate such volume (i.e. less impervious equals less recharge volume deficit).

- The creation of a BMP within the area that is proposed as Phase 3 that would compensate for the lack of infiltration, if so determined, within the already constructed infiltration bed.

If you have any questions, please contact me at your convenience. I will be available to provide testimony regarding this application, if requested. Thank you.

Sincerely,



Geoffrey M. Goll, P.E.
Vice President

c: Pond Run Association