STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Greenskies Clean Energy, LLC petition for a declaratory ruling for the proposed construction, maintenance and operation of a 3.0-megawatt-AC solar photovoltaic electric generating facility on two parcels at the Elmridge Golf Course located to the east and west of North Anguilla Road at the intersection with Elmridge Road, Stonington, Connecticut, and associated electrical interconnection.	**Petition No. 1410** **September 24, 2020**

PRE-FILED TESTIMONY OF STEVEN D. TRINKAUS

Q1. Please state your name for the record.

A1. My name is Steven D. Trinkaus. I am the owner of Trinkaus Engineering, LLC.

Q2. What is your involvement with this project?

A2. I was engaged by Proponents for Responsible Emplacement of Stonington Solar ("PRESS") to assess the plans and reports submitted by petitioner Greenskies. I did a technical review of the erosion/sedimentation control plan, stormwater management plan, and overall site plans for compliance with the requirements of the 2004 Connecticut Stormwater Quality Manual ("2004 Manual"), the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control ("2002 Guidelines"), the Connecticut General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities ("General Permit"), or the recently proposed updates to the General Permit, including Appendix I, which is specific to the installation of solar arrays, as well as compliance with civil engineering standards of care for design work. That technical review is attached as Exhibit A. I was engaged to offer my opinion with respect to whether Greenskies' plans comply with the water quality standards of the State of Connecticut and general standards of good practice for this type of site development. That review is attached to this testimony. I also examined the assumptions made in the decommissioning plan

by conducting research including telephone inquiries and a literature review. The results of that examination are included in this testimony.

Q3. What degrees and professional licenses do you hold?

A3. I earned a B.S. in forest management from the University of New Hampshire. I am a professional engineer licensed in Connecticut since 1988 and Maryland since 2017.

Q4. What professional affiliations do you have?

A4. I am a member of the American Society of Civil Engineers, the Connecticut Society of Professional Engineers, the Soil and Water Conservation Society of America, and the International Erosion Control Association.

Q5. Please briefly describe your experience as a civil engineer.

A5. Prior to opening my civil engineering business in 1990, I worked for John W. Fuller, PELS from January 1981 to December 1987, performing land surveying, design of roads/driveways, grading plans, erosion control plans and stormwater designs. I also appeared before municipal land use agencies to obtain approvals of the projects. I then worked for Groundworks, Inc. for two years, designing roads/driveways, grading plans, erosion control plans, on-site sewage disposal system and appearing regularly before municipal land use commissions. Since 1990, I have been self-employed as the principal of Trinkaus Engineering, LLC. I perform the same work as I did at Groundworks, Inc. and I have also become an expert in the field of Low Impact Development, which focuses on water quality and volume of runoff from development projects. I have appeared in Superior Court in Danbury, Stamford and New London as an expert witness in land use cases. My CV provides more detail on my experience and is attached to this testimony as Exhibit B.

Q6. What is the purpose of your testimony?

A6. This testimony summarizes my findings and opinions with respect to Greenskies' submissions to the Council, which are listed in more detail in my attached technical review.

Q7. Please summarize your findings and opinion.

A7. Generally, I found that Greenskies' submissions do not satisfy the requirements of the 2002 Guidelines, the 2004 Manual, or the General Permit, including proposed Appendix I for Stormwater Management of Ground Mounted Solar Arrays. The proposed project therefore does not comply with the water quality standards of the State of Connecticut or with general professional standards applicable to professional engineers.

Q8. What is your most significant finding?

A8. As the Council is aware, Appendix I, proposed by DEEP as an update to the General Permit, provides that developers must meet several requirements in order to consider the solar panels impervious in their design. This project does not satisfy three of the four requirements of section (1)(c) of Appendix I, and also does not appear to satisfy section (1)(a), meaning the panels must be considered impervious for purposes of calculating the Water Quality Volume (WQV). My most significant finding is that despite that fact, Greenskies' engineer did not consider the solar panels to be impervious in designing the site.

Q9. What does that mean for the project?

A9. The assumption that the solar panels are pervious is such an egregious error that it means the entire site design will fail, because that underlying assumption is the basis for all of the pre- and post-development condition calculations with respect to stormwater. The panels are in fact impervious structures. Water will hit them and run off of them in predictable ways, yet Greenskies has not accounted for that increased runoff volume, velocity, or flow path. That

underlying erroneous assumption is a fatal flaw, and not one that can be corrected in the "details" of a development and management plan after the project is approved. That assumption means that the amount of runoff both in terms of rate and volume are under-estimated, so that the post-development peak rates will be higher than the pre-development peak rates and the channel protection volume will not be met. That means that all of the stormwater control features designed by GRE to handle runoff will be overwhelmed and will fail, resulting in erosion below each basin proposed by Greenskies, as well as deposits of sediments into the wetlands located near Basin #1.

Q10. What are your findings based on?

A10. My findings are based on my review of Greenskies' submissions, my more than 40 years of experience in civil engineering in the land development field, my specific experience reviewing and preparing reports on the stormwater design failure of the Antares solar field in East Lyme, Connecticut, which was also proposed and constructed by Greenskies, and my review of other ground-mounted solar array proposals before the Council, including my work in Petition Nos. 1347 and 1347A.

Q11. What happened at the Antares project?

A11. The Antares project was approved by the Council in May 2013 (Petition No. 1056). It was located on a site adjacent to an unnamed tributary to Cranberry Meadow Brook, a tributary to the Niantic River. During construction of that project, the stormwater protections failed to such a degree that DEEP issued a Notice of Violation and the East Lyme Inland Wetlands Agency (ELIWA) issued a Cease and Desist Order due to the pollution of offsite wetlands and watercourses. I was hired by the owner of a neighboring property in connection with a lawsuit he brought against GRE/Greenskies due to damage to his property caused by the discharge from the Antares project. In connection with that work, I reviewed the site plans and related stormwater

and erosion control plans, visited the site, and issued several reports. My review of that project revealed that the stormwater design failed because (1) the solar panels were not considered to be impervious in the design process; (2) a large portion of the site was regraded, and the Soil Class used for post-development conditions was not stepped down at all from pre-development conditions; (3) runoff did not occur as overland flow perpendicular to the panel rows on the majority of the site, but instead as concentrated flow parallel to the panel rows; (4) topsoil was removed from the site and not brought back to facilitate the establishment of grass; and (5) no soil testing of any kind was conducted on the site. All of these errors resulted in stormwater controls that were overwhelmed by rain events and led to off-site pollution.

Q12. How does the design of this project compare to the design of the Antares site?

A12. The design of this project is unfortunately similar. (1) The solar panels are not considered impervious; (2) Greenskies assumes the runoff will occur as overland flow perpendicular to the panel rows rather than concentrated flow parallel to the panel rows; and (3) although GRE has conducted soil testing, that testing was inadequate in the areas at the eastern end of both basins and was also inadequate to capture the soil properties of the site.

With respect to #1, Greenskies apparently has decided that the solar panels are not impervious because there will be vegetation under the panels, so the panels will not change the runoff patterns. That is false. The solar panels are set upon a metal racking system that places the panels between 3 feet and 10 feet above grade. The elevated solar panels are no different than a car port, which is a roof supported by four or more posts and open on all four sides. The roof of the car port is impervious. Thus, the elevated solar panels are impervious, and to pretend otherwise simply ignores reality and means that the post-development peak rates and volumes of runoff are under-estimated by about 40% based upon my review of other large ground-mounted solar array projects. Also, for the larger section of the area, the land slope goes

to the west and not south, so runoff from a panel row will follow the natural slope to the west concentrating as more runoff falls off the row of panels. In addition, although the newly proposed Appendix I to the General Permit has not yet been adopted by DEEP and therefore is not entirely relevant here, Greenskies has not complied with Appendix I because under that proposed language, calculations of Water Quality Volume must consider the solar panels to be impervious (absent meeting several conditions, which this project does not meet, as discussed below).

With respect to #2, at Antares there was clear evidence that runoff from the solar panels was not infiltrating at all, but occurring as concentrated flow, causing erosion and resultant sedimentation. (See Figures 1 and 2 below.) Despite the evidence from the Antares project, Greenskies has still assumed in its design of this new project that rain will run off of the solar panels as a sheet and will fall to the ground in the same way and drain into "vegetated surfaces," meaning Grass in Good Condition, rather than running off into concentrated channels. Changing the drainage patterns of this site from overland flow to concentrated flows will lead to erosion. In addition, the grass should be considered Grass in Fair Condition, as it can take two to three years of growing seasons for the grass to become fully established. Using Fair Condition will have the effect of increasing the peak rate and volume for post-development conditions.

Figure 1 – Eroded path of concentrated Flow from runoff off solar panel (East Lyme)

Figure 2 - Sedimentation of eroded material within area of array (East Lyme)

With respect to #3, it is my professional opinion that the soil investigation conducted by Greenskies was inadequate for understanding the geological conditions of several areas of the site. In the eastern ends of both basins, the deep test pits were not deep enough to confirm

whether the vertical separation from groundwater or from bedrock will comply with the 2004 Manual. There is also no support for Milone & MacBroom's statement that there were no semi-conforming layers of silt or clay with the sub-soil that would impede downward flow through the soil profile. They did two sets of holes, one by hand dug to a depth of 24 inches, and a second by machine to an average depth of 5.5 feet, and no infiltration testing. Those depths were not deep enough to know that the vertical separations in the 2004 Manual have been met They did two sets of holes, one by hand, a second by machine, the machine holds were an average depth of 5.5' deep, but not deep enough to know that the vertical separations in the manual have been met

Q13. Are there other aspects of the design concern you?

A13. Yes. The design of the two basins is of significant concern. First, I cannot determine from the plans what kind of basins Greenskies is proposing. They do not conform to any type of basin found in the 2004 Manual. Second, despite their size, they each contain a singular outlet that discharges onto an upland slope, which will result in erosion of the slopes. Basin #1's outlet discharges onto an upland slope that is above a delineated wetland area, so the wetland will receive deposits of sediment. The riprap at the outlet of the spillway for each basin was not designed in accordance with the 2002 Guidelines and so will result in concentrated flow. Third, portions of both arrays are not being directed to the basins, so there will be no reduction in peak rate or volume from those portions of the arrays. Fourth, nearly all of the berm on the western side of Basin #2 and a portion of the berm on the western side of Basin #1 are more than 4 feet above grade. While I understand that DEEP's dam safety division classified Basin #2 as being of negligible hazard because it would not cause harm to people or structures if it failed, failure of those berms will cause serious erosion of the soils. I believe that where physical damage can be avoided by designing something as a dam, a professional engineer has

an obligation to do so, regardless of the classification provided by DEEP. Fifth, runoff from the arrays will not be perpendicular to the panel rows but parallel, resulting in concentrated, rather than overland, flow. Finally, an earth diversion berm is shown south of Basin #2 to divert runoff to the basin, but Greenskies did not provide any detail for its construction, show any grading for it, detail its construction or provide hydrologic calculations demonstrating that it can divert the runoff without overtopping.

Q14. How does the project fail to comply with Appendix I to the General Permit?

A14. As detailed in my technical review, Appendix I provides that developers can consider the panels impervious if they meet conditions (1)(a) through (e), titled "Design and construction requirements." It does not appear to me that the project meets (1)(a) or (1)(b), and it certainly does not meet three of the four requirements of (1)(c).

Condition (1)(a) requires that "[t]he vegetated area receiving runoff between rows of solar panels … is equal to or greater than the average width of the row of solar panels draining to the vegetated area." It does not appear to me that Greenskies has complied with this provision when I measure the width of the panel rows and the vegetated area between them on the site plans, and no dimensions were provided on the plan to confirm compliance with this section.

Condition 1(b) requires that "[o]verall site conditions and solar panel configuration within the array are designed and constructed such that the runoff remains as sheet flow across the entire site." This condition has not been met except for a portion of the western site. For a majority of the entire array, the land slopes to the west and not to the south, so runoff will occur as concentrated flow going to the west.

Condition (1)(c) contains four subparts. Below is the language of each subpart with my comment about compliance following in bold italics.

- For slopes less than or equal to 5%, appropriate vegetation shall be established as indicated in Figure 1, below; and
    - ***This condition is met.***

- for slopes greater than 5%, but less than 10%, practices including, but not limited to, level spreaders, terraces or berms as described in Figure 2, below, shall be used to ensure long term sheet flow conditions; and
    - ***This condition has not been met, as many portions of the array are on slopes greater than 5% and less than 10%, but no level spreaders, terraces or berms have been provided. Only a small berm has been provided to divert runoff from a small portion of the array which is south of Basin #2. There are no other berms, level spreaders, or terraces provided, so the condition has not been met.***

- for sites with slopes greater than or equal to 8%, erosion control blankets or stump grindings or erosion control mix mulch or hydroseed with tackifier shall be applied within 72 hours of final grading, or when a rainfall of 0.5 inches or greater is predicted within 24 hours, whichever time period is less; and
    - ***This condition has not been met based upon a review of the plans. There are no erosion control blankets, stump grindings, erosion control mix mulch or hydroseed with tackifier specified on the plans.***

- for slopes equal to or greater than 10% and less than 15%, the Plan includes specific engineered stormwater control measures with detailed specifications that are designed to provide permanent stabilization and non-erosive conveyance of runoff to the property line of the site or downgradient from the site.
    - ***This condition has not been met for the reasons which were stated in the review of sheets LA-1, LA-2, and LA-3 in my technical review and summarized above in my critique of the basins.***

Since the above conditions have not been met, the area of the solar panels themselves must be considered impervious for the calculation of the Water Quality Volume (WQV) which has not been done by the petitioner.

Q15. Are you concerned about anything else?

A15. Yes. The slope lengths from the top of the array to the basins in each project area are 300 and 460 feet, yet there are no intermediate barriers to slow the runoff down along those slopes. There are also no pretreatment for the basins, which is required for all types of basins by the 2004 Manual. It also appears, based on the narrative of this petition, that Greenskies plans to

construct the stormwater basins first and to use them as temporary sediment traps during construction. The 2004 Manual strongly recommends that post-development basins not be used as temporary sediment basins, as it is difficult to get proper vegetation established in the basin when runoff is being directed to it Greenskies did not provide sizing computations for those traps or detail for an outlet control structure.

Q16. Do you have any other comments on Greenskies' site plans or stormwater management report?

A16. Yes. They are detailed in my technical review.

Q17. What is your opinion with respect to Greenskies' claims of complete compliance with state water quality standards?

A17. My opinion is that those claims cannot be true so long as Greenskies continues to make the same faulty underlying assumptions that resulted in failures of other solar array projects. I have reviewed the stormwater designs for solar arrays in East Lyme, Old Lyme, Pomfret, Waterford, and now Stonington (Elmridge), and in each case, the developer did not consider the solar panels to be impervious, which is a faulty assumption that will result and has resulted in the stormwater management systems being insufficient to handle the runoff that is actually generated by the solar array.

All of the stormwater management designs for these solar arrays provide only the bare minimum protections to address the runoff. The bare minimum does not comply with the water quality standards of this state or with good civil engineering practices. The bare minimum results in failures like that at the East Lyme Antares site, with cease and desist orders issued, and at the Woods Hill Solar, LLC site in Pomfret, with orders that eventually resulted in a 2018 consent decree with DEEP for violation of the General Permit that included a civil penalty of $575,000 and a requirement to fund a supplemental environmental project for another $287,500.

Many of the stormwater designs are based upon incorrect assumptions that the runoff will flow occur in a certain manner as overland flow or will simply infiltrate into the ground. In reality, infiltration is minimal if at all and runoff is flowing as concentrated flow. The faulty "underlying assumptions" made by solar developers include the following: (1) solar panels are not impervious because there is grass growing under the panels; (2) runoff will always occur as overland flow and not become concentrated; (3) grading has no effect on the porosity of the soil and thereby, the infiltrative capacity of the soil; (4) the post-development vegetative cover under and between the rows of solar panels is in good hydrologic condition.

I will also note that Appendix I to the General Permit, which has not yet been adopted by DEEP and which Greenskies is not even following, on its face provides *minimum* standards for the design of stormwater management systems for ground-mounted solar arrays. Therefore, in addition to the terms and conditions of the general permit, registrations for construction of a Solar Array "… shall, *at a minimum*, adhere to the conditions listed below. Depending on site-specific conditions for a particular solar array construction project, *additional analyses may be required*. (Appendix I at 1 (emphases added).) That is why when I recently designed a stormwater management system for a ground-mounted solar array, I did so to exceed the requirements of Appendix I. Design engineers also have the responsibility to design sites to meet the civil engineering standard of care under their professional license. A professional engineer in Connecticut must perform his or her work in accordance with Section 20-300-12 of Title 20 – Professional and Occupational Licensing, Certification, which states the following:

> (1) The engineer or land surveyor shall at all times recognize his or her primary obligation to protect safety, health, and welfare of the public in the performance of his or her professional duties. If his or her professional judgment is overruled under circumstances where the safety, health and welfare of the public are endangered, he or she shall inform his or her employer of the possible consequences and notify such other proper authority of the situation, as may be appropriate.

This section obligates the professional engineer to design systems that protect public health, safety and welfare, which means that a minimal compliance with state water quality standards, and with Appendix I in whatever form it is eventually adopted, is not the sole concern of a design engineer, and should not be the sole concern of this Council.

Q18. Do you have any other opinions or concerns about this project?

A18. Yes. I reviewed the decommissioning plan submitted by GRE, and made inquiries and did a literature review to test the assumptions in that plan. Based on my research, the assumptions in that plan are simply not supported by facts, and Greenskies' assumptions about how inexpensive decommissioning the site will be could leave Stonington in a very difficult position down the road.

Q19. Please explain your findings with respect to the decommissioning plan.

A19. Greenskies' decommissioning plan states makes assumptions regarding the costs associated with the decommissioning of a ground mounted solar array, including that "fencing, electrical cabinetry, solar racks, solar panels, wiring and all other equipment are one hundred percent recyclable, therefore, the primary cost of decommissioning is the labor to dismantle and load as well as the cost of trucking. The concrete pads will be broken up at the site and hauled to a nearby facility where it will be accepted, most likely without charge." (Petition Exhibit D.) Those assumptions are inaccurate, based on my research.

First, there is a trucking cost and a drop off cost associated with common construction debris, which includes concrete. There is simply no basis for Greenskies' claim that any nearby facility will accept such debris free of charge. Second, at the present time in the northeast, there are few facilities which will accept and recycled solar panels. One company that I contacted in Massachusetts, Complete Recycling Solutions, does recycle solar panels, but no for free. The cost is $40 per panel, so for this site with 9,600 panels, the cost to the owner of the solar array to

recycle the panels would be $384,000 at today's rate. Any value of the recycled materials is retained by the recycling company, along with that fee. I also note that based upon a literature review of the recycling of solar panels, not all components of a panel are recyclable, though that is dependent upon the original materials used in the manufacture of the solar panels. Until Greenskies selects the panel it wants to use in its project and provides the Council and the parties with the specifications from the manufacturer, no one can say whether the panels are actually recyclable or how much it will cost to recycle them.

Greenskies also grossly underestimated the expenses of excavating equipment with an operator. Current rates in the construction field are much higher. Below is a comparison of Greenskies' numbers and the quotes I got from a local excavator.

Item	Greenskies	Local excavator
Bobcat:	$250/day, labor at $28/hour	$95.00/hour ($760/day)
Trucking:	$72/hour	$90/hour
Backhoe:	$1,000/week	$115.00/hour ($4,600/week)
Grader:	$2,500/week	$150/hour ($6,000/week)
Front End Loader:	$1,000/week	$130/hour ($5,200/week)
Excavator:	$1,000/week	$130/hour ($5,200/week)

Given that many of these three, four or even five times higher than the numbers used by Greenskies, the costs of decommissioning this site should be multiplied by the same factors. That means the expense of decommissioning this site likely exceeds $1 million.

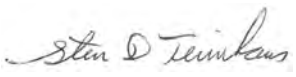
Q20. What are your conclusions regarding Greenskies' proposed project?

A20. The ground mounted solar array as proposed will cause adverse environmental impacts, such as erosion of upland soils and deposition of sediment, possibly in wetland areas associated with increased rates and volumes of runoff from post-development conditions. The

hydrologic analysis uses favorable assumptions which significantly under-estimate the actual runoff characteristics for post-development conditions.

The design of the stormwater management practices is not in compliance with the 2004 Manual. The basins do not the address water quality or the increased runoff volume which will be generated from the site. The erosion control plan is inadequate to protect the site from erosion and resultant downgradient sedimentation during the construction period. The erosion control plans are not in compliance with the required approaches defined in the 2002 Guidelines. The project does not comply with the requirements of the General Permit, including proposed Appendix I. The stormwater management plan does not meet Connecticut's water quality standards, as reflected in the 2004 Manual, the 2002 Guidelines, and the General Permit. Nor does it comply with the General Permit as proposed to be amended by Appendix I.

The statements above are true and accurate to the best of my knowledge.



Steven Trinkaus

9/24/202
Date

ATTACHMENTS

Exhibit A – Technical review of Steven Trinkaus

Exhibit B – CV of Steven Trinkaus

CERTIFICATION

I hereby certify that a copy of the foregoing document was delivered by e-mail to the following service list:

Lee Hoffman
Pullman & Comley LLC
90 State House Square
Hartford, CT 06103-3702
lhoffman@pullcom.com

Jonathan E. Friedler
Michael S. Bonnano
Geraghty & Bonnano, LLC
38 Granite Street
P.O. Box 231
New London, CT 06320
jfriedler@geraghtybonnano.com
mbonnano@geraghtybonnano.com

Gina L. Wolfman
Senior Project Developer
Greenskies Clean Energy, LLC
127 Washington Avenue West Building,
Garden Level
North Haven, CT 06473
gina.wolfman@cleanfocus.us

/s/ Emily A. Gianquinto
Emily Gianquinto

EXHIBIT A

Trinkaus Engineering, LLC
114 Hunters Ridge Road
Southbury, Connecticut 06488
203-264-4558 (ph & fax)
E-mail: strinkaus@earthlink.net
http://www.trinkausengineering.com

September 24, 2020

Ms. Melanie Bachman
Connecticut Siting Council
Ten Franklin Square
New Britain, Connecticut 06051

Re: Proposed Photovoltaic Installation
229 Elm Ridge Road/North Anguilla Road
Stonington, Connecticut
CT Siting Council Petition No. 1410

Dear Ms. Bachman and Members of the Connecticut Siting Council,

I have been retained by Proponents for Responsible Emplacement of Stonington Solar, Inc. to review submitted documentation for the above referenced project. In addition to being a licensed Professional Engineer in Connecticut and Maryland, I am an expert in the field of Low Impact Development which has a major focus on stormwater, particularly water quality and runoff volume. I also have a Bachelor of Science in Forest Management from the University of New Hampshire. I submit this technical review as an exhibit to my prefiled testimony in this matter.

I. Site Plans by Milone and MacBroom:

Sheet LD:

1. Under Survey Notes, #3 states "Boundary lines shown hereon were taken from plans & deeds of record and monuments found." This implies that an accurate boundary survey to Class A-2 standards was not actually prepared by a licensed land surveyor and therefore, the information shown may not be accurate.
2. Under Survey Notes, #4 states that the topography was taken from Lidar information distributed by NOAA. Was the topographic information verified by field survey to confirm the accuracy of the Lidar mapping?
3. Under Survey Notes, #9 states the wetlands were delineated by Milone and MacBroom. Were the wetland flags located by field survey?
4. Under Grading notes, #7 states that "grading will be completed to 95% compaction per the specifications." Does this requirement only apply only those areas being regraded or all portions of the soil array?

5. Under Sediment & Erosion Control Notes, #6 states that "the sediment control plan shall be modified by the contractor at the direction of the owner's representative…". It is not appropriate to allow the contractor to have responsibility for modification of the erosion control plan. The design professional must prepare and fully responsible for the development and implementation of the erosion control plan.
6. Under Sediment & Erosion Control Notes, #8 states "all dewatering waste waters shall be discharged in a manner which minimizes the discoloration of the receiving waters." How will this be accomplished?

Sheets EX-1, EX-2, and EX-3:

1. Were these maps prepared by a licensed land surveyor? Was the location and accuracy of the boundary verified by field survey?
2. No soil types are shown on these plans.

Sheet LA-1:

1. It is unclear what type of stormwater practice is Basin #1 as it does not comply to any type of basin found in the CT DEP 2004 Storm Water Quality Manual.
2. There is singular outlet from Basin #1 onto an upland slope above a delineated inland wetland area, so concentrated runoff from Basin #1 will be discharged where the existing ground has not experience concentrated flow. This discharge will cause erosion of the upland soil surface above the wetland and any eroded material will be deposited in the delineated inland wetland area.
3. The bottom of Basin #1 is at 52.5'. This will require a 5.5' cut at the eastern end of the basin and the deep test pits performed in this area (TP-1, & TP-2) were only to the approximate bottom of the basin elevation so it cannot be confirmed that the required vertical separations to seasonal ground water or bedrock found in the 2004 Manual for the stormwater practice have been met.
4. A portion of the berm at the western end of the basin is more than 4' above existing grade, while this is a limited portion of the entire length of the berm, a failure at this point would result in a concentrated discharge or runoff which would damage the environment by causing erosion of the soils below the basin.
5. A portion of the array is not being directed to Basin #1. Therefore, there is no reduction in the peak rate or volume from this portion of the array.
6. Runoff from many portions of this section of the array will not occur as overland flow which is perpendicular to the panel rows. This runoff will be shallow concentrated flow and will become more concentrated as it reaches the perimeter of the array.

Sheet LA-2:

1. It is unclear what type of stormwater practice is Basin #2 as it does not comply to any type of basin found in the CT DEP 2004 Storm Water Quality Manual.
2. There is singular outlet from Basin #2 onto an upland slope above a moderately steep slope (14.7%). This concentrated discharge will cause erosion of the slope and result in downgradient sedimentation.

3. The bottom of Basin #2 is at 130.5'. This will require a 4.5' cut along the eastern end of the basin and the deep test pits performed in this area (TP-3, & TP-4) were only to the approximate bottom of the basin so it cannot be confirmed that the required vertical separations to seasonal ground water or bedrock found in the 2004 Manual for the stormwater practice have been met.
4. Virtually the entire length of the berm at the western side of the basin is more than 4' above existing grade, thus it is considered a dam under DEEP standards and must be designed as such. While the Dam Safety Division at DEEP stated in Exhibit E that the berm would be classified as hazardous classification of AA (negligible hazard potential dam) as it would not cause harm to people or structures, a failure of the berm would cause serious erosion to the downgradient area and fairway, which is physical damage which can be avoided by designing the berm as a dam. The role of the design engineer is to create designs which protect the public health, safety, and welfare under their license, so this requirement trumps the DEEP opinion from a professional point of view.
5. The southern portion of the array is not being directed to Basin #2. Therefore, there is no reduction in the peak rate or volume from this portion of the array.
6. Runoff from the entire area of this portion of the array is not perpendicular to the panel rows but is parallel to the panel rows. This will result in concentrated flow and will cause erosion like what occurred in East Lyme (see figure 1 and 2 below).
7. There are 3:1 side slope just above the eastern side of Basin #2. How will these areas be protected from the concentrated runoff from the solar panels?
8. An earth diversion berm is shown south of Basin #2 to divert runoff from the area of the panels immediately south of Basin #2 to the basin. However, no grading is shown for the berm. No detail has been provided for its construction. No hydrologic calculations have been provided to demonstrate that it can divert the runoff without overtopping.

Sheet LA-3:

1. Runoff from all the solar panels shown on this sheet as well as the gravel access runoff is not being directed to a stormwater basin at all. This will result in higher runoff rates and volumes being discharged to the steep slopes found to the west of the array limit.
2. Runoff from the entire area of this portion of the array is not perpendicular to the panel rows but is parallel to the panel rows. This runoff will occur as concentrated flow and will cause erosion as noted under sheet LA-2.

Sheet SE-1:

1. The construction entrance shown on this plan is only 30' in length and not the minimum 50' as required by the CT DEP 2002 Guidelines for Soil Erosion and Sediment Control.
2. The soil stockpile is shown in the middle of the array. Is the topsoil being stripped from the area of the array?
3. How will the array be installed in the stockpile is shown in the middle of the panels?

4. In many locations, the parallel rows of compost sock and siltation fence are shown being perpendicular to the existing contours. This is not in compliance with the 2002 Guidelines which require that erosion control measures be parallel to the contours. Barriers which are perpendicular to contours will allow concentrated flow along them, which causes erosion of the soil surface.
5. The slope length from the top of the array to Basin #1 is approximately 300' and there are no intermediate barriers to slow the runoff down along this slope.

Sheet SE-2:

1. The construction entrance shown on this plan is only 30' in length and not the minimum 50' as required by the CT DEP 2002 Guidelines for Soil Erosion and Sediment Control.
2. The slope length from the top of the array to Basin #2 is approximately 460' and there are no intermediate barriers to slow the runoff down along this slope, except for the area immediately below the proposed regraded areas where a compost sock is shown.

Sheet SE-3:

1. The erosion controls for this area are shown on or near the bottom of a steep slope which is well below the limit of the solar array. This means that runoff from the area of the array which is occurring perpendicular to the panel rows will occur as concentrated flow and will erode the steep slope below the array and above the erosion control measures.
2. The soil stockpile is shown in the middle of the array. Is the topsoil being stripped from the area of the array?
3. How will the array be installed in the stockpile is shown in the middle of the panels?
4. The slope length from the top of the array to the bottom is approximately 320' and there are no intermediate barriers to slow the runoff down along this slope, so the runoff will have higher velocities which translate into much higher potential of erosion of the soil surface.

Sheet SD-1:

1. The construction sequence on this sheet not adequate for this solar project. It is extremely generic and is not in compliance with the 2002 Guidelines. This lack of compliance with the Guidelines will result in the discharge of turbid runoff during the construction period.

Sheet SD-2:

1. There is a conflict between the detail of the Outlet Weir Wall and the Weir Wall Schedule. The detail shows that the invert of the lowest weir will be set 6" above the bottom of the basin. For Basin #1, the bottom is at 52.5', and the lowest weir is specified at 54.0' (1.5' higher than the bottom of the basin), while the detail would have the weir at 53.0. Which elevation is correct?
2. There is only a small pad of modified riprap at the outlet of the spillway for each basin, but it has not been designed in accordance with the 2002 Guidelines. When

a discharge is occurring onto an upland area, a fan shaped outlet pad is required to spread the flow out and convert it from concentrated to overland.

II. Compliance with Draft Appendix I to the CT General Permit

Comments on compliance with Appendix I are shown in bold italics after each section of the Appendix I below. Draft Appendix I states the following:

Design and construction requirements

(1) Roadways, gravel surfaces and transformer pads within the solar array are considered effective impervious cover for the purposes of calculating Water Quality Volume (WQV). In addition to these impervious surfaces, all solar panels in the array shall also be considered effective impervious cover for the purposes of calculating the WQV if the proposed post-construction slopes at a site are equal to or greater than 15% or if the post-construction slopes at a site are less than 15% and the conditions in (a) – (e), inclusive, below have not been met:

(a) The vegetated area receiving runoff between rows of solar panels (see Figures 1 and 2, below) is equal to or greater than the average width of the row of solar panels draining to the vegetated area; ***This plan does not appear to comply with this standard when measuring the width of the panel rows and the vegetated area between them on the plan. No dimensions are provided on the plan to confirm compliance with this section.***

(b) Overall site conditions and solar panel configuration within the array are designed and constructed such that the runoff remains as sheet flow across the entire site. ***This condition has not been met except for a portion of the western site. For a majority of the entire array, the land slopes to the west and not to the south, so runoff will occur as concentrated flow going to the west.***

(c) The following conditions are satisfied regarding the design of the post-construction slope of the site:

- For slopes less than or equal to 5%, appropriate vegetation shall be established as indicated in Figure 1, below; and ***This condition is met.***

- for slopes greater than 5%, but less than 10%, practices including, but not limited to, level spreaders, terraces or berms as described in Figure 2, below, shall be used to ensure long term sheet flow conditions; and ***This condition has not been met as many portions of the array are on slopes greater than 5% and less than 10%, but no level spreaders, terraces or berms have been provided.***

- for sites with slopes greater than or equal to 8%, erosion control blankets or stump grindings or erosion control mix mulch or hydroseed with tackifier shall be applied within 72 hours of final grading, or when a rainfall of 0.5 inches or greater is predicted within 24 hours, whichever time period is less; and ***This condition has not been met based upon a review of the plans. No erosion control blankets, stump grindings, erosion control mix mulch or a hydroseed with tackifier has been specified on the plans.***

- for slopes equal to or greater than 10% and less than 15%, the Plan includes specific engineered stormwater control measures with detailed specifications that are designed to provide permanent stabilization and non-erosive conveyance of runoff to the property line of the site or downgradient from the site. ***This condition has not been met for the reasons which were stated in the review of sheets LA-1, LA-2, and LA-3 above.***

Other comments on Appendix I:

1. Since the above conditions have not been met, the area of the solar panels themselves must be considered impervious for the calculation of the Water Quality Volume (WQV) which has not been done by the petitioner.

III. Stormwater Report by Milone and MacBroom

1. On page 10, it is noted that five test pits were dug by hand on November 26, 2019 to a depth of approximately 24" below existing grade. Yet, on page 14, it states that five deep test pits were dug on March 31, 2020. Were both the hand holes and the deep test pits excavated in the same location?
2. On page 11, it is stated that there no observations of any semi-confining layers of silt or clay with the sub-soil that would impede downward flow through the soil profile. However, since the test pits were only dug by hand to a depth of 24" and no infiltration testing was done, this statement has not been supported by factual evidence.
3. It is noted on page 14 that this project will require a CT DEEP General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The GP requires that the plans be following the CT DEP 2020 Guidelines for Soil Erosion and Sediment Control and the CT DEP 2004 Storm Water Quality Manual. As stated above, the plans are not in compliance with these two documents and thus the General Permit cannot be granted by the CT DEEP when applied for.
4. It is stated on page 16, that runoff from the panels will drain directly onto the grass below where it can infiltrate and travel over the grassed area. However, this statement is only applicable to a portion of the northern section of the solar array which drains to Basin #1. Other sections in this area drain parallel to the panel rows and perpendicular to the contours and are not directed to Basin #1. The statement does not apply at all to the southern section of the array as runoff from the panels will not occur perpendicular to the panels, it will occur as parallel concentrated flow along the downhill edge of the panels and will not have the opportunity to infiltrate.
5. It is further stated on page 20 that the basins will trap sediment from the upgradient area in the volume below the outlet weir. This is not correct as there is no pre-treatment for the basins which are required under the 2004 Manual for all types of stormwater basins.
6. In section 6.2 on page 20, it states that the stormwater basins will be constructed first and appears that they will be used as temporary sediment traps or basins by the language in the narrative. No sizing computations have been provided for the

sizing of these basins to be used as temporary sediment traps. No detail for an outlet control structure for a temporary sediment trap or basin has been provided.

7. It is stated on page 19 that the solar panel arrays are unconnected impervious areas that allow runoff from each individual panel array to contact the ground directly below and dissipate over the surrounding grassed surface. This is not an accurate statement. As stated above, this is only applicable to one portion of the northern solar array and not the entire solar array.
8. Section 7.9 on page 24 lists many types of non-stormwater discharges which could occur on the site, such as uncontaminated air conditioning or compressor condensate, and foundation or footing drains where flows are not contaminated with process materials such as solvents. Where might these activities be located on the site plan?
9. On page 27, there are maintenance requirements for Grass Swales, but there are no grass swales shown on the site plans. Are the swales missing from the plans or are the maintenance requirements in error?
10. None of the contours are labelled on the watershed maps which makes it different to verify the accuracy of the watershed delineations shown on these plans.
11. The watershed area to Basin #1 as shown on sheet WS-PR1 is incorrect. The western portion of the array area to the north of Basin #1 drains directly to the west and not Basin #1, there the analysis of Basin #1 will be incorrect as well as the conclusions concerning peak rate attenuation.
12. The watershed boundary between PR-1B and PR-1C to the west of Basin #2 does not appear to be correct. The dividing line between these two watershed areas is not perpendicular to the contour lines.
13. The Water Quality Volume (WQV) computations found in Appendix E are invalid as the panels were not considered impervious as required by Draft Appendix I (CT DEEP) as three of the four conditions in (1)(c) have not been met by the petitioner.
14. The petitioner states that the full WQV will be contained below the lowest weir invert, this statement is not valid as the WQV has been under-estimated as noted in comment #14 above.
15. The Groundwater Recharge Volume (GRV) per the 2004 Manual has not been provided.
16. Under the stormwater analysis for post-development conditions, the petitioner has not considered the panels to be impervious which is significantly under-estimating both the peak rate and runoff volumes for all analyzed storm events. For a majority of the panels, runoff will not travel perpendicular to the panel rows and across the full width of the grass strips between them and will travel parallel to the panel rows in a northwest to west direction. Because of this condition, there will not be an opportunity for runoff to flow across the grass strips and potentially infiltrate into the ground. Based upon other technical reviews of ground mounted solar arrays, not considering the panels impervious is under-estimating the peak rate and volume of runoff for post-development conditions by a minimum of 40%.

17. As the panels have not been considered impervious, the hydrologic modeling results are completely invalid as the post-development runoff used by the petitioner is substantially lower than it should be.
18. The petitioner is also considering the vegetation under and between the panel rows to be Grass in Good Condition. This is not realistic as it can take two to three years of growing seasons for grass to become fully established to be considered in Good Condition. The grass between the rows of panels should be considered in Fair Condition which will have the effect of increasing the peak rate and volume for post-development conditions.
19. The petitioner has not provided any information which demonstrates that the soil surface under and between the rows of panels will infiltrate runoff.

Figure 1 - Concentrated flow from Solar Panels (East Lyme)

Figure 2 - Sedimentation of eroded soil from concentrated flow (East Lyme)

IV. Greenskies Response to the August 6, 2020 Interrogatories Directed to Greenskies Clean Energy, LLC by Douglas Hanson

1. Response #4: The response by Greenskies is not correct. The Draft Appendix I requires the solar panels to be considered impervious for the calculation of the Water Quality Volume, as the petition is not in compliance with the conditions which allow the panels to be considered pervious. (See my comments regarding compliance with Appendix I above.) Considering the solar panels impervious is much more conservative than the dropping the soil classification down by one class.
2. Response #38: Response is not correct. The design of the stormwater management does NOT comply with the requirements found in the 2004 Manual at all. No analysis has been provided by the petition that demonstrates that non-point source pollutant loads will be reduced by the proposed stormwater basin.
3. Response #39: Response (b) is not correct. Sheet flow will only occur on a portion of the western array section. For all the other sections, the runoff will occur as shallow concentrated flow or actual concentrated as all runoff is occurring parallel to the panel rows and not perpendicular to them. Therefore, the panels must be considered as impervious for the calculation of the Water Quality Volume per Appendix I.
4. Response #40: Second paragraph: Just because the DEEP Dam Safety Division does not consider the berm of Basin #2 to be a dam worthy of a permit, does not mean that the berm should not be designed as a dam. The berm is a minimum of 5' above the existing grade and will impound water. As such, from a civil engineering perspective, the berm needs to be designed as a dam.
5. Response #41: Response is not correct. As the proposed basins (type unknown) will have a permanent pool, they must have a forebay per the design requirements of the 2004 Manual. Simply having a grass cover does not mean that infiltration will occur.

V. Greenskies Response to Town of Stonington Comments (CLA Engineers, Inc.)

1. Response #1: The Greenskies response is not correct. As noted above, the erosion narrative is not in compliance with the 2002 Guidelines in many aspects. Additionally, there are no phasing plans that limit site disturbance to 5 acres or less at one time.
2. Response #2: Contrary to the statement by Greenskies, the areas in the east side of the project will experience site disturbance by the in and out movements of equipment used to install the racking system.
3. Response #4: How much of erosion control measure will be stockpiled on the site in case of an emergency? No information has been provided.
4. Response #7: The submitted calculations do not state which weir notch was used for the volume computation. To adequately trap sediment during

a construction period, the permanent pool must be a minimum of 3' in depth. This has not been provided. Additionally, temporary sediment basins require a different outlet system to only take runoff from the top of the water surface so as not to discharge turbid water.

5. Response #10: CLA Engineers are correct in their statement that the two stormwater basins will pond water. As designed, the permanent pool is located below the invert of the lowest outlet weir, so the depth of the permanent pool will be 6-12" in depth.
6. Response #11: I concur with CLA Engineers' concerns about waste management, hazardous products and refueling of equipment to be used on site, as portions of the site are in the in the Groundwater Protection Overlay zone. Except for a narrative in Section 7.0, of the stormwater management report, there are no provisions shown on the site plan that address the handling of waste management, hazardous products and refueling issues, so there is a high potential for an adverse impact to the groundwater from a spill on this site.

VI. Conclusion

The ground mounted solar array as proposed will cause adverse environmental impacts, such as erosion of upland soils and deposition of sediment, possibly in wetland areas associated with increased rates and volumes of runoff from post-development conditions. The hydrologic analysis uses favorable assumptions which significantly under-estimate the actual runoff characteristics for post-development conditions.

The design of the stormwater management practices is not in compliance with the CT DEP 2004 Manual. The basins do not the address water quality or the increased runoff volume which will be generated from the site. The erosion control plan is inadequate to protect the site from erosion and resultant downgradient sedimentation during the construction period. The erosion control plans are not in compliance with the required approaches defined in the CT DEP 2002 Guidelines. The project does not comply with the requirements of the General Permit, including proposed Appendix I.

Please contact my office with any questions. A copy of my professional CV will also be submitted for the record.

Sincerely,
Trinkaus Engineering, LLC

Steven Trinkaus, PE

EXHIBIT B

Steven D. Trinkaus, PE
Trinkaus Engineering, LLC
114 Hunters Ridge Road Southbury, Connecticut 06488
Phone: +1-203-264-4558
Website: http://www.trinkausengineering.com
Email: strinkaus@earthlink.net

Qualifications	B.S. / Forest Management/1980 University of New Hampshire
Licenses/Certifications	Licensed Professional Engineer- Connecticut (1988) Licensed Professional Engineer – Maryland (2017)
Professional Societies	American Society of Civil Engineers Connecticut Society of Professional Engineers Soil and Water Conservation Society of America International Erosion Control Association
Professional Awards	Steve was named an Industry Icon by Storm Water Solutions in July 2015 http://editiondigital.net/publication/?i=263831&p=16 for his work in the Low Impact Development field.

Civil Engineering Services

Low Impact Development

- Review of existing municipal land use regulations to identify barriers to the implementation of Low Impact Development
- Preparation of regulatory language changes to facilitate the adoption of Low Impact Development
- Preparation of design manuals for the implementation of Low Impact Development strategies and processes with an approach that simplifies the design process
- Application of environmental site design strategies to focus development concepts on land most suitable for development while enhancing the protection of environmentally sensitive areas
- Design of Low Impact Development treatment systems, such as Bioretention areas, wet/dry swales, vegetated level spreaders, vegetated filter strips, subsurface gravel wetlands, constructed wetlands and/or pond systems, infiltration basins & trenches
- Hydrologic analyses of current and post-development conditions to assess impacts of proposed development on storm water flows

- Design of storm water control systems including detention and water quality basins and appropriate planting plans

- Perform hydrologic modeling of stormwater management systems to demonstrate compliance with regulatory benchmarks

- Prepare Pollutant loadings analyses to evaluate the effectiveness of stormwater treatment designs in reducing pollutant loads

Wastewater Management:

- Soil testing to determine suitability of land to support on-site sewage disposal systems for residential and commercial projects and assistance with identifying optimal location for both small and large scale system

- Perform necessary calculations to model and design large scale subsurface sewage disposal systems under CT DEEP criteria and State Department of Public Health

- Design of on-site sewage disposal systems in accordance with state and local health codes

- Perform construction oversight of both small and large scale subsurface sewage disposal systems and provide certifications of compliance

Site Engineering:

- Development feasibility studies

- Layout concepts to maximize development, while preserving environmentally sensitive areas

- Design of horizontal and vertical road geometry

- Preparation of grading, drainage and erosion and sedimentation control plans

- Use AutoCAD Land Development, Civil3D, HydroCAD and Pondpack software packages

- Layout and design of sanitary sewers

- Bid estimates

- Construction oversight

- Third party technical reviews

- Expert testimony

Professional Committees

- Chairman and primary author of EWRI/ASCE LID Model Ordinance Task Committee (goal is to create a National LID Guidance document to further the adoption of LID)

- Chairman of EWRI/ASCE LID Task Committee on Filter Strips and Bioswales (goal is to review & evaluate literature and design specifications for filter strips and Bioswales and create uniform design standards for different geographical regions)
- Member of EWRI/ASCE LID National Guidelines Task Committee

Published Articles

- **"Easier Said Than Done – Overcoming common errors when installing bioretention systems"** – October 2018 edition of Storm Water Solutions by Scranton Gillette Communications.
- **"Large-scale LID Design for urban expansion in South Korea**" with co-author, Dr. Kyung Hak Hyun of South Korean Land and Housing Institute – Volume 3/Issue 4, August/September 2015 – Worldwater Stormwater Management by the Water Environmental Federation.
- "**Research team leads LID deployment in South Korea**" – Volume 2/Issue 1, Spring 2014 – Worldwater Stormwater Management by the Water Environmental Federation.
- "**Low Impact Development, Sustainable Stormwater Management**" – English article converted to Chinese and published in the Chinese Edition of Global Water Magazine, July 2013.
- "**A Case Study: Southbury Medical Facility and Low Impact Development**" - January/February 2014 issue of Land and Water.
- "**A True Pioneer of Low Impact Development – Member Spotlight**" – January/February 2014 Issue of Erosion Control – Official Journal of the International Erosion Control Association.
- "**Low Impact Development: Changing the Paradigm**" published in the March 2012 edition of PE, The Magazine for Professional Engineers by the National Society of Professional Engineers. Article was also republished in the Spring 2012 addition of EWRI Currents (with permission of NSPE).
- "**Stormwater Retrofit of Existing Detention Basins**" published in the March/April 2012 Land and Water, The Magazine of Natural Resource Management and Restoration with co-author Sean Hayden of the Northwest Conservation District.
- "**Out in the Open; Creating a Stormwater Park in the Heart of a Community**" published in the April 2013 issue of WaterWorld by Pennwell Corporation.
- "**Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut**" published in the July/August 2013 edition of Land and Water

LOW IMPACT SUSTAINABLE
LISD
DEVELOPMENT
TRINKAUS ENGINEERING

LOW IMPACT SUSTAINABLE DEVELOPMENT PROJECTS

LID and LISD Regulations and Design Manuals

- **Town of Tolland. CT –** Prepared amendments to Town of Tolland Zoning, Subdivision, Inland Wetland regulations and Road Design Manual to incorporate Low Impact Development standards. Wrote "Design Manual – Low Impact Development – Storm Water Treatment Systems – Performance Requirements – Road Design & Storm Water Management" prepared for the Town of

Tolland; October 2007. The Town of Tolland was awarded the Implementation Award by the CT-APA for the LID regulations and design manual in December 2008.

- **Town of Plainville, CT –** Planimetrics was the lead consultant on this project. This office performed the technical regulatory audit to identify barriers to the implementation of LID. These barriers were removed from the regulations to provide for the implementation of LID. A LID design manual was written by Steve Trinkaus to address specific development/stormwater issues for the Town of Plainville. The regulatory changes and LID manual were adopted by the Planning and Zoning Commission in September 2010. This work was funded by the Farmington River Enhancement Grants from CT DEP.

- **Town of Harwinton, CT –** In conjunction with Planimetrics of Avon, CT, the existing land use regulations were evaluated for barriers to the implementation of Low Impact Development (LID). The project team suggested changes to the land use regulations to encourage the application of LID in the community. Steve Trinkaus defined design processes and strategies to encourage the implementation of LID in the town. This work was funded by the Farmington River Enhancement Grants from CT DEP.

- **Town of East Granby, CT –** Planimetrics was the lead consultant on this project. This office performed the technical regulatory audit to identify barriers to the implementation of LID. These barriers were removed from the regulations to provide for the implementation of LID. Steve Trinkaus prepared a LID Design Manual and LID Educational document for the town working with Gary Haynes, the town planner. This work was funded by the Farmington River Enhancement Grants from CT DEP.

- **Town of Morris, CT** - This office performed the technical regulatory audit to identify barriers to the implementation of LISD. These barriers were removed from the regulations to provide for the implementation of LISD. A LISD design manual was written by Steve Trinkaus to address specific development/stormwater issues for the Town of Morris. The regulatory changes and LISD manual were adopted by the Planning and Zoning Commission in January 2020.

LID Projects

- **Garden Homes Management –** Westport, Connecticut – 19 unit residential apartment building being developed under 8-30g (affordable housing) on 1 acre site directly tributary to West Branch of the Saugatuck River. All construction activities are located outside regulatory setbacks to tidal wetland and 100-year flood boundary. Stormwater management system was designed to fully infiltrate the runoff for all storm events up to and including the 100-year event and reduce pollutant loads to existing levels as wooded parcel.

- **Jelliff Mill, LLC** – New Canaan, Connecticut: Redesigned the site layout to create ten single family residential units on a site overlooking the restored historic Jelliff Mill dam on the Noroton River. The site design uses two sections of permeable pavement and a Bioretention system to infiltrate the runoff from the proposed impervious areas on the site. Due to the presence of sand and gravel soils, all runoff from the impervious areas will be infiltrated up to and including the 25-yr storm event (5.7" of rain/24 hrs). Fully constructed and occupied.

- **SRG Family, LLC** – Southbury, Connecticut: Design final site grading for 38,000+ sq.ft. Medical services building and approximately 225 parking spaces in order to maintain overland flow patterns. Designed multiple LID treatment systems consisting of bioswales with weirs, Bioretention systems

and Permeable Pavement (asphalt) to handle runoff from all impervious area on the project site. The LID treatment systems are capable of fully infiltrating the runoff from a 50-yr storm event will virtually eliminating the discharge of any pollutants to the adjacent wetland area. Currently pending before Inland Wetlands Commission for modification of original approval.

- **Farmington River Watershed Association** – Winchester, Connecticut: Designed stormwater retrofit for existing 1 acre paved parking area at the science building of the Northwest Community College to treat runoff prior to discharge into the Still River. Retrofit consists of forebay and Bioswale to treat runoff from parking area and building roof. Currently at Bid stage.

- **Garden Homes Management –** Southport, Connecticut: Designed site to support 96 unit apartment building and 115 parking spaces. Site contains both freshwater and tidal wetlands. Stormwater management design required to provide Groundwater Recharge Volume & Water Quality Volume in addition to reducing the post-development peak rate of runoff from the 10-yr rainfall event to the pre-development peak rate of runoff from the 2-yr rainfall event. The stormwater management design includes grassed swales, Bioretention systems and underground concrete galleries to meet all of these stormwater requirements. Due to favorable soils on the site, the site will likely be a zero discharge site. Court Approved.

- **Garden Homes Management** – Milford, Connecticut: Designed site to support 257 unit apartment building with 295 parking spaces. Stormwater management design required to provide Groundwater Recharge Volume & Water Quality Volume in addition to reducing the post-development peak rate of runoff from the 25-yr rainfall event to the pre-development peak rate of runoff from the 25-yr rainfall event. The design utilizes a Bioretention system, two underground galleries systems as well as a small detention basin to meet all of the stormwater requirements. Court Approved.

- **Garden Homes Management** – Milford, Connecticut: Designed site to support 21,888 sq.ft. building (three stories) containing 36 studio apartments and 45 parking spaces. Permeable pavement and Bioretention will be used on the site to treat runoff for water quality improvements along with reducing runoff volume from the 1-yr to 100-yr storm event. Construction complete and project occupied.

- **Quickcomm, Inc. –** Newtown, CT**:** Design a parking facility for approximately 140 vehicles to serve an existing corporate use. Runoff from the entire parking facility will be directed to one of seven Bioretention systems. Water quality of the runoff will be improved by the filtration through a specialized soil media and will then infiltrate into the underlying soils. Due the presence of sand and gravel soils, the Bioretention systems will fully infiltrate all runoff up to and including a fifty-year design storm (6.5" of rain/24 hours). Land use approvals obtained in the fall of 2012 and work completed in the fall of 2013.

- **Garden Homes Management** – Fairfield, Connecticut: Designed site to support 32,592 sq.ft. building (three stories) containing 54 studio apartments and 68 parking spaces. Permeable pavement will be used for majority of parking facility. Roof drains will also be directed to permeable pavement system for water quality improvement. Reservoir layer was sized to fully contain 1.7" of runoff from contributing impervious area. By using a raised underdrain an anaerobic condition will be maintained in the bottom of the reservoir, thus providing denitrification of Total Nitrogen prior to discharge to tidal section of Rooster River. Construction complete and occupied.

- **Garden Homes Management** – Oxford, Connecticut: Design site plan for 126 units of manufactured housing on 41+ acres. Stormwater management is achieved by the use of linear

Bioretention systems (Bioswales) along both sides of all interior roads. After treatment in Bioswales, all runoff is directed to standard detention basins to provide peak rate attenuation from the 2-year to 100-year rainfall event. Approved by Inland Wetlands Agency, Denied by Planning and Zoning Commission. Court Approved and under construction.

- **Compton Family Trust** – New Hartford, Connecticut: Design two wet swales systems to convey and filter runoff from road which is currently discharged into West Hill Lake via a paved swale. West Hill Lake has very good water quality and the owner desires this work on this property to become a template for other homeowners on West Hill Lake to prevent adverse impacts of stormwater on the water quality of the lake. Received all necessary land use approvals. Construction to commence in the summer of 2012.

- **Highwood Estates** – Thomaston, Connecticut: Design retrofits for two existing failing detention basins serving existing 50 lot residential subdivision. Retrofits were designed using LID techniques to improve water quality reaching Northfield Brook, an impaired waterway. The larger basin was converted to an Extended Detention Shallow Wetlands to significantly reduce pollutant loads. Due to a limited area, only a forebay and deep pool could be designed for the smaller basin, thus providing measurable improvements in water quality.

- **Farmington River Watershed Association** – Winchester, Connecticut: Design stormwater retrofits consisting of a Bioretention system at the Town of Winchester Wastewater Treatment Plant and a Bioswale at the Town of Winchester Public Drinking Supply facility. These projects are being funded as LID demonstration projects to increase public awareness of LID. The systems were installed in June 2012 and were featured in articles in the Republican American and Register Citizen newspapers.

- **Harwinton Sports Complex** – Harwinton, Connecticut: Redesign stormwater management system for indoor sports facility to use vegetated swales and Bioretention systems. Redesign site grading to eliminate all structural drainage in parking facility. Client saved over $ 40,000 on infrastructure costs by the use of LID treatment systems.

- **Holland Joint Venture, LLC –** Bridgewater, Connecticut: Prepared site plan for 28,000 sq.ft. industrial/light assembly use and 140 parking spaces on 10.94 acres. Utilize Environmental Site Design strategies to preserve large portions of site in natural condition, minimize impacts due to site disturbance, and minimize impacts to wetland/watercourse system by access driveway. Designed five Bioretention systems for storm water management and pollutant removal from all impervious areas.

- **Goodhouse Flooring, LLC** – Newtown, Connecticut: Design site to accommodate 8,800 commercial building and associated driveway and parking areas on 1.0 acre site. Designed eight Bioretention systems to handle runoff from all impervious surfaces. Analyze and demonstrate that State of Connecticut water quality goals will be achieved for the site design.

- **Trade Winds Farm** – Winchester, Connecticut: 24 lot Open space subdivision on 104+ acres of land. Performed all civil engineering design work for project. Notable feature of project is the preservation of 64+ acres of the site as dedicated Open Space. Many LID strategies such as Environmental Site Design, site fingerprinting, volumetric reduction and water quality improvements were incorporated into site design. Storm water treatment systems utilized vegetated basins, vegetated swales with gravel filter berms, emergent marsh, Bioretention systems, linear vegetated level spreader, and meadow filter strips.

- **Northern View Estates** – Sherman, Connecticut: Five lot subdivision with private road. Design has no direct wetland impacts and only minor intrusions into defined 100' upland review area. Low Impact Development systems, such as vegetated swales and Bioretention were used to treat post-development runoff while maintaining existing drainage patterns to the maximum extent possible.

- **Mill River** – New Milford, Connecticut: Designed 14 lot open space subdivision on 68 acre site. Performed all civil engineering services for project. .LID treatment systems such as a permanent pond/emergent marsh system, linear biofiltration swale, and rain gardens were designed for the site.

- **Byron Avenue Cluster Development** – Ridgefield, Connecticut: Seven lot cluster subdivision on 4 acres. The Stormwater management system consisted of a road with no curbs, grassed swales and constructed wetland with detention to reduce pollutant loads and increases in the peak rate of runoff.

- **The Estates on the Ridge** – Ridgefield, Connecticut: 32 lot open space subdivision on 152+ acres. Over 80 acres of the site will be preserved as Open Space as part of this project. Stormwater will be treated by the use of rain gardens for roof drains, infiltration trenches for footing drains, emergent marsh systems and vegetated swales for conveyance and treatment of road runoff. Designed over 1 mile of proposed road for project. Designed bottomless culverts over several wetlands crossing to minimize direct impact on wetland areas.

- **G & F Rentals, LLC** – Oxford, Connecticut: By utilizing LID stormwater concepts such as grass filter strips, Bioretention in parking islands, Bioretention for roof drains, and infiltration trenches, a total of 54,000 sq.ft. of commercial office space along with 140+ parking spaces was placed on 10 acre site. The project also restored previously degraded inland wetlands on the site.

- **Dauti Construction – Edona Commons** – Newtown, Connecticut: Designed 23 unit affordable housing plan to minimize impacts on delineated wetland areas. Designed three construction wetland systems for the treatment of storm water runoff for water quality renovation.

- **American Dimensions, LLC** – New Milford, Connecticut: Redesigned the storm water treatment systems for a 7 lot residential subdivision. Rain gardens were designed to handle the runoff from all roof areas and proposed driveways. Each rain garden provided the required Water Quality Volume and Groundwater Recharge Volume as specified in the 2004 Storm Water Quality Manual. A Subsurface Gravel Wetland was designed to treat the full Water Quality Volume for runoff from adjacent roads network which drained through the subject property.

- **Molitero Residence** – New Fairfield, CT: Designed five Bioretention systems to mitigate both volumetric increases of runoff and address water quality issues for large building addition to single family residence on Candlewood Lake. Also designed landscape filter strip above lake edge to filter runoff from up gradient lawn area. Bioretention systems fully infiltrated 5" of rain in 24 hours from Hurricane Irene in August of 2011. Project was featured in newsletter of Candlewood Lake Authority to demonstrate the effectiveness of LID treatment systems in a lake environment.

- **Multiple single family residences** – Design Bioretention systems to mitigate volumetric increases of runoff due to increases of impervious cover on the lot for large building additions and new construction including the reduction of volumetric increases up to the 25-yr event (5.7" of rain in 24 hours).

Residential Subdivisions

- **Stone Ridge Estates**, 59 lot residential open space subdivision, Ridgefield, Connecticut (Town of Ridgefield)
- **Oak Knoll**, 14 lot open space subdivision, Ridgefield, Connecticut (Mike Forbes)
- **Ward Acres Farm**, 12 lot open space subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Horblitz Subdivision**, 13 lot open space subdivision, Ridgefield, Connecticut (John Sturges)
- **McKeon Subdivision**, 14 lot conventional subdivision, Ridgefield, Connecticut (McKeon Family Trust)
- **High Ridge Estates**, 5 lot subdivision in historic district, Ridgefield, Connecticut (Scandia Construction)
- **Millstone Court**, 7 lot conventional subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Cricklewood Subdivision** – 12 lot conventional subdivision, Redding, Connecticut (Jay Aaron)
- **Spruce Meadows Subdivision** – 12 lot conventional subdivision, Wilton, Connecticut (Piburo Builders)
- **Noroneke Estates** – 12 lot open space subdivision, Ridgefield, Connecticut (John Sturges)
- **Lynch Brook Lane** – 7 lot open space subdivision, Ridgefield, Connecticut (Sturges Brothers, Inc.)
- **Ledgebrook Subdivision** – 27 lot conventional subdivision, Southbury, Connecticut (Conte Family Trust, LLC**)**
- **Seven Oaks** – 19 lot open space subdivision, Ridgefield, Connecticut (Basha Szymanska)
- **Applewoods** – 29 lot conventional subdivision, Bethel, Connecticut (Gene & Joe Nazzaro)

Third Party Engineering Reviews

- **Groton Open Space Association** – Wal-Mart Super center, Mystic Woods Age Restricted Development, and changes to stormwater standards in the Town of Groton regulations – Groton, Connecticut. Focus of review was on stormwater management plans to address water quality and runoff volumes per the CT DEP 2004 Storm Water Quality Manual as well as the adequacy of the erosion and sedimentation control plan for the proposed development. Project approved with modifications to stormwater management system to address water quality.
- **Town of Tolland Planning & Zoning Commission** – Star Hill Athletic Complex with focus on water quality impacts on existing impaired waterway. Focus was on suggesting changes to stormwater management system to comply with recently adopted Low Impact Development requirements in the Town of Tolland. Project approved and built with modifications to stormwater management system to address water quality of post-development runoff.
- **Town of Newtown Inland Wetlands Commission** – Sherman Woods – 38 lot residential Subdivision with focus on stormwater management and water quality. Review stormwater management plan for compliance with CT DEP 2004 Storm Water Quality Manual to address water quality issues being directed to high quality wetland systems. Also review erosion & sedimentation control plan for adequacy and compliance with CT DEP 2002 Guidelines for Soil Erosion & Sediment Control. Project withdrawn and not resubmitted.
- **Town of Winchester Inland Wetlands Commission** – 30,000 sq.ft. Commercial building with grading and stormwater management within 100-yr flood plain. Plan reviewed focused on impacts to floodway and 100-year flood plain as a result of the placement of significant fill within the flood plain. Project approved with modifications to stormwater management system.
- **Town of Southbury Inland Wetlands Commission** – 35,000 sq.ft. Medical office building proposed in close proximity to inland wetlands & watercourses. Review focus on the adequacy of the stormwater management plan to address water quality and runoff volumes prior to discharge into on-site wetland areas.

- **Friends of Litchfield** – Stop & Shop proposal on existing retail site proposing an increase of impervious area of 1 acre directly draining into an aquifer protection area. Focus of review was on adequacy of stormwater management system to address water quality of runoff and prevent further off-site adverse impacts. Project approved with minor modifications to stormwater management system.
- **The Regency at Ridgefield** – Proposal for contractor's yard on steep slope immediately uphill of existing pond and wetlands. Project proposed removal of over 45,000 cubic yards of earth and rock to facilitate construction of building. Focus of review was on adequacy of erosion control and stormwater management plan to prevent discharges of pollutants to receiving pond. Project denied citing impacts of stormwater on existing pond.
- **Friends of Oswegatchie Hills Nature Preserve, Inc. and Save the River, Save the Hills, Inc**. – Review of preliminary site plan for 840 unit of affordable housing on a 230+ acre site directly adjacent to the Niantic River submitted for a zone change to the Planning and Zoning Commission. Focus of review was on stormwater management and impacts to down gradient wetlands, including the Niantic River. Preliminary site plan approval granted with conditions of approval requiring final plans to address stormwater issues raised by Trinkaus Engineering, LLC.
- **Save the River, Save the Hills, Inc**. – Review of the erosion control plans and stormwater management plans for 90-acre solar array proposed on core forest in Waterford, Connecticut which drained directly to first order cold water fishery streams. Provide written comments to Connecticut Siting Council on behalf of Save the River, Save the Hills (Intervenor). Siting Council denied project citing erosion and stormwater management issues with the plan.
- **Town of Brookfield Inland Wetlands Commission** – The Enclave at Brookfield, an affordable housing project with 187 units on 9.8 acres proposing filling of wetland, locating stormwater basin within inland wetland area and a significant increase of impervious. Review focused on adequacy of stormwater management system to address water quality, runoff volume and peak rate changes due to development in accordance with CT DEP 2004 Storm Water Quality Manual and local land use requirements; review of erosion & sedimentation control plan for compliance with CT DEP 2002 Guidelines for Soil Erosion & Sediment Control and local land use requirements. Offer modifications to plans to address water quality and runoff volume which applicant accepted resulting in approval of project.
- **Town of Brookfield Inland Wetlands Commission and Zoning Commission** – The Renaissance, an affordable housing project with 156 units of 5+ acres adjacent to the Still River replacing existing development on the site. Review focused on adequacy of stormwater management system to address water quality, runoff volume and peak rate changes due to development in accordance with CT DEP 2004 Storm Water Quality Manual and local land use requirements; review of erosion & sedimentation control plan for compliance with CT DEP 2002 Guidelines for Soil Erosion & Sediment Control and local land use requirements. Additionally, reviewed issues of development in the floodway and 100-year flood plain of the Still River. Provided modifications to plans to address water quality and runoff volume which applicant accepted resulting in approval of project.
- **Town of Brookfield Inland Wetlands Commission** – Brookfield Village – Phase II – 12/23 Station Road proposing commercial space and residential apartments in the "Four Corners of Brookfield"; 70 Stony Hill Road proposing 26 units of affordable housing served by private water and on-site sewage disposal systems; 468 Federal Road – 280-unit affordable housing project. In all applications, the review focused on the probable adverse impacts to inland wetlands and watercourse as well as the adequacy of the erosion control plan and stormwater management plan to treat non-point source pollutants and runoff volumes to minimize adverse impacts to the receiving inland wetlands and watercourses. Original application withdrawn after initial review. Provide sketch of modifications to improve water quality of post-development runoff and minimize direct impacts on inland wetlands. Application not resubmitted at this time.

- **Town of Salisbury Inland Wetlands Commission** – Review of multiple applications for residential development and/or improvements on existing lakes. Issues reviewed were stormwater management to ensure that water quality of post-development runoff was improved prior to entering lake and that erosion control plans were appropriate and adequate to prevent eroded material from reaching the lake or shoreline wetlands.
- **Branford Citizens for Responsible Development** – Review of development plans for Costco Store and other commercial development on 45 acres in Branford, CT. Review focuses on stormwater management issues, particularly increased runoff volumes and pollutant loads to be generated by development and whether the proposed stormwater management proposal would adequately address the impacts of these two issues. Both the 2004 CT DEP Storm Water Quality Manual and the Branford Inland Wetland Regulations were used to determine if the plans were compliant with the applicable standards. The erosion control plan was evaluated for compliance with the CT DEP 2002 Guidelines for Soil Erosion & Sediment Control. Project withdrawn and not resubmitted.
- **Save our Shelton** – Review of development plans for large-scale mixed-use development on 120+ acre site on Bridgeport Avenue. Site contained core forest and high-quality wetland/watercourse systems. Review focused on stormwater management issues, particularly increased runoff volumes and pollutant loads to be generated by development and whether the proposed stormwater management proposal would adequately address the impacts of these two issues. Both the 2004 CT DEP Storm Water Quality Manual and the Shelton Inland Wetland and Stormwater Regulations were used to determine if the plans were compliant with the applicable standards. The erosion control plan was evaluated for compliance with the CT DEP 2002 Guidelines for Soil Erosion & Sediment Control. Project still in land use process.
- **Concerned Citizen Group - Roxbury, CT** – Review of proposed residential 12-lot subdivision on steeply sloping site with high quality wetlands and watercourses. Review of all aspects of civil engineering (site layout, grading, erosion/sediment control, stormwater management, stream crossing methodology) using the CT DEP 2004 Storm Water Quality Manual and CT DEP 2002 Guidelines for Soil Erosion and Sediment Control as well as the Town of Roxbury land use regulations and ordinances and evaluate impacts to wetlands and watercourses. Stormwater management system and erosion control plans were found to be inadequate to protect the high-quality wetlands and watercourses from adverse impacts by the Inland Wetlands Commission. Project denied by Inland Wetlands Commission citing findings from the Trinkaus Engineering, LLC review and other consultants.
- **Par Arbors, LLC – Bloomfield, CT –** Review of truck storage and dispatch center on agricultural land with numerous delineated inland wetland/watercourses on the site. Focus of review was on stormwater management and the adverse effects of increased pollutant loads and runoff volumes on wetland. Also review adequacy of erosion control plans. Provided testimony at two public hearings in front of Inland Wetlands Commission. Application to conduct regulated activities was denied by the commission in July 2019.

Ground Mounted Solar Arrays

- **Lodestar Energy – Winchester, CT:** Performed all civil engineering for an eight acre solar array on 100 acre parcel. This work included the access driveway, two wetland crossings and the design of a stormwater management system for the project. Notable aspects include: All solar panels are considered impervious area, Soil Class for hydrologic model was dropped down by 1 to account for compaction by the movement of vehicles, grass swales with check dams were proposed on the two sides of the array to collect runoff and convey to a constructed wetland basin which met the requirements of the channel protection volume (DEP Manual). All designed comprehensive erosion and sedimentation control plan with multiple phases. The design of the erosion control plans

and stormwater management plans exceed the requirements found in the CT DEP 2004 Storm Water Quality Manual and the CT DEP 2002 Guidelines for Soil Erosion and Sediment Contol.

- **GRE – Waterford, CT:** Retained by Save-the-River, Save-the-Hills to review the erosion control plan and stormwater management plan on an environmentally sensitive site with runoff being directed to cold-water fishery streams which support native trout populations and drain to Niantic River. Provide civil engineering technical review in pre-filed testimony to Connecticut Siting Council and testify at Siting Council public hearing on application.

- **GRE – East Lyme, CT**: Retained by adjacent property owner to evaluate stormwater impacts from 30 acres ground mounted solar array in legal case for adverse impacts to wetlands and watercourses. Finding showed that runoff from the site was significantly under-estimated by the design professional as the panels were not considered impervious and the changes to soil conditions due to regrading were not considered in the design which resulted in the failure of the stormwater basins during construction as well as after the construction was complete.

- **Other Ground Mounted Solar Projects:** I have also reviewed the erosion and stormwater management plans for ground mounted arrays in Old Lyme, Brooklyn/Canterbury, New Milford, North Stonington, and East Hampton for compliance with the standards found in the CT DEP 2004 Storm Water Quality Manual. In all cases, the stormwater management designs were not in compliance with the DEP Manual.

Commercial Site Plans

- **Cannondale Corporation Headquarters** - Bethel, Connecticut
- **Village Bank Headquarters** – Danbury, Connecticut
- **Newtown Hardware -** Newtown, Connecticut
- **Amicus Healthcare Living Centers –** Rocky Hill, Connecticut
- **Nathan Hale Office Building** – Fairfield, Connecticut
- **Ridgefield Recreation Center** – Ridgefield, Connecticut
- **Silver Spring Country Clubhouse & Pool house renovations -** Ridgefield, Connecticut
- **Tiger Hollow Athletic Complex at Ridgefield High School -** Ridgefield, Connecticut

On-site sewage disposal systems

- **Candle Hill Mobile Home Park** – Design Subsurface Sewage Disposal Systems for individual mobile home units. New Milford, Connecticut.
- **Hemlock Hills Camp Resort** – Expansion of campground, design of gravity sanitary sewer and design of subsurface sewage disposal system to handle 4,800 gpd. Litchfield, Connecticut.
- **Old Field Condominiums** – long term inspection & reporting on the condition of multiple subsurface sewage disposal systems serving 40 unit condominium complex with design flows in excess of 15,000 gpd. Southbury, Connecticut.
- **Thorncrest Farm** – Design of on-site sewage disposal system to handle wastewater from milking operation. Goshen, Connecticut.

- **Silver Spring Country Club** – Design of multiple subsurface sewage disposal systems for private country club with average daily flow of 7,000 gpd during peak usage season.
- **Richter Park Golf Course** – Design subsurface sewage disposal system to replace existing failed system for golf club house and year round restaurant with average daily flow of just under 5,000 gpd.
- **Redding Country Club** - Performed soil testing to design a repair to an existing wastewater management system that was experiencing periodic effluent discharges during high use on very marginal soil conditions. Utilized oversized grease tanks for kitchen waste and septic tanks to increase the clarity of the effluent which was discharged by force main to the subsurface sewage disposal system increase the long term functionality of the system. Discharge rate 4,900 gpd.

General Civil Engineering Projects

- **Montgomery Residence**, 10,000 sq.ft. residence with 2.5 acre pond, Redding, Connecticut.
- **Neils Different,** Design 1 acre pond, Ridgefield, Connecticut.
- **Anthony DeLuca**, Design 2 acre pond**,** Redding, Connecticut.
- **Barrett Cram**, Design 0.5 acre pond, Redding, Connecticut.
- **Jay & Eileen Walker Residence**, 27,000 sq.ft. residence, Ridgefield, Connecticut.

Athletic Facilities

- **Kingdome – East Fishkill, NY,** Prepare comprehensive site plan for the construction of an air-supported structure covering 7.96 acres of land area. Project also includes the design of 303 parking spaces, two full size artificial turf baseball fields and three 54-80 artificial turf baseball fields. Designed all site grading and stormwater management facilities to address water quality volume, channel protection volume as well as peak rate attenuation for the 1-yr, 2-yr, 10-yr, 25-yr, 50-yr and 100-yr rainfall events.
- **Tiger Hollow – Ridgefield High School – Phase I**, Design and site artificial turf competition field and track complex. Design access road to provide access to new building containing locker rooms, concessions, media room, and equipment storage areas. Design all utility connections and obtain local permits.
- **Tiger Hollow – Ridgefield High School – Phase II**, Prepare Conceptual Development plan for reconfiguration of existing athletic fields adjacent to the Tiger Hollow stadium.
- **Joel Barlow High School – Redding, CT**, Provide preliminary Master Plan on pro bono basis for reconfiguration and improvement of existing athletic fields at Joel Barlow in response to Falcon Pride stadium proposal. Plan was provided to Region 9 Board of Education for general discussion purposes.

International Experience

South Korea – July 2017, June 2016, April 2015, October 2014, April 2014, October 2013 and June 2013

- Steve was invited by Dr. Leeyoung Kim of Kongju University to make a presentation at the Seoul International Symposium for water cycle held on July 27, 2017 at Seoul City Hall. Steve's presentation was entitled "Sustainable Urban Water Cycle Management, Low Impact Development Strategies for Urban Retrofits". Steve also made a presentation to Master and PhD Engineering students at Kongju University on designing LID treatment systems. He also visited the research office of Land & Housing Institute

in Daejeon to inspect recent LID retrofits consisting of Bioretention systems, Bioswales and Permeable Paver systems.

- Steve was invited by Dr. Shin to visit the Korean GI/LID research center in July of 2017. The purpose of the visit was to inspect the LID research systems which had been in place for a year to observe how well they were functioning and also to observe the current research on infiltration of LID systems and evaportranspiration of green roof systems.
- Steve was an invited attendee to the official opening of the Korean GI & LID Research Center recently constructed at the Yangsam Campus of Pusan National University. Steve was a consultant on the design of the research center for Dr. Hyunsuk Shin of Pusan National University.
- Steve was an invited presenter at the World Water Forum by Dr. Hyunsuk Shin of Pusan National University. He presented case studies of GI/LID applications in the United States.
- Steve was invited by Dr. Yong Deok Cho of Kwater to participate in the Water Business Forum at the World Water Forum. Steve presented an overview of his business and expertise in Low Impact Development.
- Steve was invited by Dr. Hong-Ro Lee of Kunsan National University and made a presentation entitled "Understanding Low Impact Development in the Urban-Rural Interface" for the **Ariul Brainstorming Working Group** on April 16, 2015 in Gunsan, South Korea. He also toured portions of the proposed land reclamation area to assess how Low Impact Development strategies could be incorporated to address water quality issues from the proposed agricultural, residential, commercial and industrial land uses for this area.
- Steve was a Contributing Author as well as an Advisory Reviewer for a report prepared by Land & Housing Institute (LHI) entitled " Pyeongtaek Godeok New City Low Impact Development techniques (LID), A study on the introduction of measures (I) " dated: January 2015. This report by LHI also cited the Town of Tolland LID Design Manual as a foreign LID Manual to be used as a reference document.
- Steve was an invited presenter at the International Water Forum 2014 held in conjunction with the Nakong River International Water Week in Gyeongju, South Korea sponsored by DaeGyeong Water Foundation & the International Hydrologic Environmental Society. His presentation focused on urban stormwater and the benefits of LID in these areas.
- Steve was an invited presenter at the IWA Water Reuse & Energy Conference 2014 held in Daegu, South Korea. His presentation was on the regulatory barriers to implementation of LID and how to overcome these barriers. He also participated in a panel discussion with other presenters.
- He also made a presentation at The 1st GI & LID Technical Education Workshop held at Pusan National University on October 22nd on an overview of LID and the application of LID concepts. He was invited by Dr. Kyung Hak Hyun of Land & Housing Institute (LHI) to make two presentations of LID case studies at Sangyung University and at a seminar hosted at LHI along with Kwater.
- Steve met with Jong-Pyo Park, Director and Kyoung-Do Lee, CEO of HECOREA, a water resource consulting firm to discuss LID in dense urban areas. Steve signed a MOU with HECOREA to provide consulting services on LID monitoring approaches and maintenance protocols for the Go-Deok International Planning District near Pyeongtaek, South Korea.

- Steve was invited by Dr. Kyung Hak Hyun of Land & Housing Institute to present at the 2nd Low Impact Development Forum in Daejeon, South Korea on October 31, 2013. He also inspected the site of Asan-tangjeong which is an expansion of residential housing for the city of Asan. This expansion will incorporate LID stormwater strategies.
- Steve was invited to make a presentation of the implementation of LID on commercial sites by Dr. Reeho Kim of the Korea Institute of Construction Technology in Seoul.
- Steve met with Dr. Sangjin Lee of Korean Water and Dr. Woo Young Heo, CEO of LID Solution Co, Ltd to review the initial concept plans for the Eco-Delta City project. Eco-Delta City is a new city located near the Gimhae International Airport of 13 square kilometers and will incorporate LID concepts throughout the new city.
- Steve signed a MOU with Dr. Shin of Pusan National University to provide consulting services for the Smart GI/LID Research Facility at Pusan National University. Steve was asked by Dr. Shin to review the design plans for the GI/LID research facility to be constructed at Pusan National University with a focus on the exterior LID research facilities. He provided a written comprehensive review for consideration by PNU.
- Steve was invited by Dr. Hyunsuk Shin of Pusan National University in South Korea to present a workshop on Low Impact Development on June 24, 2013. The presentation was made to research professors, graduate engineering students and practicing engineers at K-water headquarters in Daejeon, South Korea. He also met with representatives of other agencies tasked with the development of a new city, called Eco-Delta City which will implement LID practices from the ground up and comprises approximately 3,500 acres.

Nanjing, China, September 2018
Steve was invited by the organizing committee for the third China Sponge City International Exchange Conference to make three presentations on LID. The presentations were entitled: "LID: The Good, the Bad and the Ugly", "Permeable Pavement Case Studies" and "The regulatory framework to adopt LID". The conference was held September 27th and 28th in Nanjing, China.

Beijing/Zhenjiang, China – August 2017
Steve was invited to make a presentation entitled "Urban LID in China and South Korea" at the 2017 Second China Sponge City International Exchange Conference held in Beijing on August 16-1, 2017. He also made a presentation for Dr. Nian She, Director of Smart Sponge City Planning and Construction Research Institute in Zhenjiang, China on modeling approaches for LID treatment systems as well as inspecting some recent LID retrofits currently under construction in Zhenjiang.
Steve also made a presentation at Reschand entitled "LID Case Studies from US" at the request of Yuming Su of Reschand.

Nanjing, China – September 2016
Steve was invited to present at the 2016 First China Sponge City International Exchange Conference held in Nanjing, China. The presentation focused on several case studies of LID systems in the US.

Zhenjiang, China – June 2015

Was retained by Dr. Nian She to design Urban LID retrofits for a 2.5 hectare (6.5 acres) dense residential area in the city of Zhenjiang. The LID retrofits had to fully treat runoff from the existing impervious areas (building roofs, driveways and parking areas) for 65 mm (2.6") of rainfall in 24 hours. The LID systems also had to attenuate the peak rate of runoff for a rainfall event of 150 mm (5.9") rainfall event. A combination of Bioretention systems, and permeable pavers with a filter course and reservoir layer were used to meet these stormwater requirements.

Zhenjiang, China – May 2015

Steve was invited by Professor Nian She of Shenzhen University to make a presentation entitled "Using LID to Attenuate Large Rainfall Events and Reduce Flood Potential" at the 2015 First Sino US Sponge City LID Technology Practice Conference held on May 4-5, 2015 in Zhenjiang, China organized by Zhenjiang Water Supply and Drainage Management Office. (http://www.c-water.com.cn/2015lid/en/index_e.html). In addition to the presentation, field inspections were made of several new LID installations in the city consisting of Bioswales, permeable pavement systems and rainwater harvesting.

Guangzhou, China – December 2012

- Steve was an invited attendee at the 15th Annual Guangzhou Convention of Chinese Scholars in Science and Technology in Guangzhou, China on December 17 – 21, 2012 to present a project narrative on how Low Impact Development and sustainable development can be applied to address water quality issues in urban and rural areas of China to implement sustainability concepts and conservation of resources. He attended with Dr. Jim Su, PE of Golder Associates of Mt. Laurel, New Jersey. While at the convention he met with representatives from Sichuan University, Chang'an University, Guangdong University of Technology, Shenzhen University and the South China Institute of Environmental Sciences, MEP to discuss LID being incorporated into their engineering programs.
- Steve also met Dr. Hongbin Cheng of New China Times Technology which is located in Stellenbosch, South Africa. Steve has signed a three year partnership agreement with New China Times Technology to introduce LID concepts to the west cape area of South Africa.

Taiwan – December 2011

- Steve was invited by Hung Kwai Chen, Director of the Water Resources Planning Institute, Water Resource Agency, Ministry of Economic Affairs of Taiwan and Dr. Yong Lai of the US Bureau of Reclamation to present a 12-hour presentation on Low Impact Development on December 8th and 9th, 2011 in Taichung, Taiwan. The presentation focused on applying LID strategies in both urban and rural environments to address runoff volumes and water quality issues.
- Steve is an invited consultant to a project team headed up by Xiaoyan Zhou, PhD of the Institute for Taiwan Water Environment Research (TIIWE) along with The National Taiwan Ocean University, Hohai Engineering Professor Liao Chaoxuan, Ting Engineering Consultants Co., Ltd and University of Colorado professor Guo Chunyuan to develop a LID demonstration project in New Taipei City along with LID policy strategies to further the use of LID in New Taipei City, Taiwan.

Volunteer Organizations

- President (elected 11/2013) and Connecticut Representative to the Board of Directors for the Northeast Chapter of IECA,
- Alternate member of Inland Wetlands Commission Town of Southbury (served three years),
- Northwest Conservation District Board of Directors (served 18 months)

Software Development

Developed a proprietary software application called **A**ssessment of **P**ollutant **L**oads and **E**valuation of **T**reatment **S**ystems (**A.P.L.E.T.S.**). This application calculates the pollutant loads for current and future land use conditions for the seven most common pollutants in non-point source runoff (TSS, TP, TN, Zn, Cu, TPH, & DIN) for a total of twenty two different types of land uses. The application then allows the evaluation of the effectiveness of thirty-four Conventional and Low Impact Development treatment systems in removing these pollutants. Up to four treatment systems can be used in a row as a treatment train to achieve water quality goals.

Invited Speaker Presentations:

- Steve made two presentations at the IWA Dipcon 2019; The 19th IWA International Conference on Diffuse Pollution and Eutrophication being held in Jeju, South Korea in October 2019. The presentations were entitled "How Low Impact Development strategies can mitigate high intensity rainfall events" and "If LID is so easy to implement, how come we keep getting it wrong". (http://iwadipcon2019.org/dipcon/about.asp)

- Steve made the following presentations at **St. Andrews University in Scotland** on October 19th , 2017 for the Sustainable Development program. The first presentation is entitled "Improving the environment with Low Impact Sustainable Development Strategies". The second presentation is entitled "Addressing Water Quality and Runoff Issues in a changing weather world".

- Steve was invited by Dr. Jae Ryu of the University of Idaho Water Center to make a presentation entitled "Designing Low Impact Development treatment systems for **Urban & Agricultural Environments" at the Annual US-Korea Conference on Science, Technology, and Entrepreneurship** being held in Atlanta, Georgia on July 29 to August 1, 2015. (http://www.ukc.ksea.org/UKC2015/)

- Steve was invited by the Lake George Waterkeeper to make a presentation entitled "Applying LID Concepts in the Real World" at the 5th Annual Low Impact Development Conference being held in Lake George, NY on May 7, 2015. (http://fundforlakegeorge.org/2015LID)

- Steve was invited by Dr. Hyunsuk Shin and made a presentation entitled "Real Adaptation and Implementation of GI and LID Technology in USA" at the **World Water Forum** (http://eng.worldwaterforum7.org/main/) being held in Daegu, South Korea on April 14, 2015.

- Steve prepared a presentation for a workshop to civil and environmental engineering students at **Pusan National University** (http://www.pusan.ac.kr/uPNU_homepage/kr/default.asp) in Busan,

South Korea on April 17, 2015 entitled "Designing LID System, What do you need to know and why".

- Steve was invited by Dr. Hong-Ro Lee of Kunsan National University and made a presentation entitled "Understanding Low Impact Development in the Urban-Rural Interface" for the **Ariul Brainstorming Working Group** on April 16, 2015 in Gunsan, South Korea. It will focus on how Low Impact Development concepts can be applied to made land areas filled in off the west coast of South Korea to address water quality issues.

- Steve was an invited speaker at the **2014 Low Impact Development Conference** sponsored by the Lake George Waterkeeper and the Fund for Lake George in Lake George, NY on May 1, 2014 for land use professionals and regulatory agencies. He will be presenting case studies focusing on the application of LID concepts for commercial and residential projects.

- Steve was invited by Justin Kenney, Green Infrastructure Coordinator of the Vermont Department of Environmental Conservation Watershed Management Division to present an eight hour workshop entitled "From Bioretention to Permeable Pavement: An In-depth Introduction to Low Impact Development and Green Stormwater Infrastructure" in Montpelier, Vermont on December 5, 2013. The presentation was hosted by the **Vermont Green Infrastructure Initiative** with support from the following Vermont Agencies and Divisions; **Building and General Services, Ecosystem Restoration Program and Agency of Transportation.**

- Steve was invited to attend and present on the Application of LID Concepts for the Urban Environment and LID Case Studies at the 2nd Low Impact Development, Stormwater Management Forum hosted by the **Land & Housing Institute, Korean Land & Housing Corporation** to be held in South Korea in on October 31, 2013. He also made presentations at the **Korean Institute of Construction Technology** and **Pusan National University** on various aspects of LID during this time.

- Steve was an invited speaker at the **2013 Low Impact Development Conference** sponsored by the Lake George Waterkeeper and the The Fund for Lake George in Lake George, NY on May 2, 2013 for land use professionals and regulatory agencies. Over 80 design professionals and regulatory people were in attendance. He made a presentation entitled "Barriers to the implementation of LID".

- Steve was an invited presenter at a closed-meeting of the **National Association of Home Builders (NAHB) and the Water Environment Federation (WEF)** on October 10, 2012 focusing on progressive stormwater management. The presentation focused on the application of LID strategies on actual development projects and discussed the hydrologic performance and cost effectiveness of LID design.

- Steve was the invited presenter for a 1-hour long webinar presented by **Stormwater Solutions and Stormwater USA** on Low Impact Development and the Basics of Bioretention held on September 18, 2012. Over 760 individuals watched the webinar.

- Steve was an invited speaker at and **EPA/WEF Stormwater Technical Meeting** on July 18, 2012 in Baltimore, MD to discuss the application of Low Impact Development strategies for actual projects with a focus on cost effectiveness when compared to conventional stormwater management as well as field performance of the LID designs. The purpose of this meeting was to assist EPA in the development of a National Stormwater Rule.

- Site Design using Low Impact Development Strategies and What are the impacts of Impervious Cover on Water Quality and Quantity were presented at a workshop entitled "Challenges and Solutions using Low Impact Development", sponsored by the **Lake George Waterkeeper** in Lake George, NY on May 5, 2011 for land use professionals and regulatory agencies. 90 design professionals and regulators in attendance.

- Steve was an invited speaker at the **2012 Low Impact Development Seminar** sponsored by the Lake George Waterkeeper in Lake George, NY on April 25, 2012 for land use professionals and regulatory agencies. 100 design professionals and regulatory people were in attendance. He made a presentation entitled "The Hydrologic Benefits of Vegetation in Site Design".

Conference Presentations:

- Steve made one presentation at UKC 2019 by The Korean-American Scientists and Engineers Association in Chicago, IL in August 2019. The presentation is entitled "Designing Low Impact Development Treatment Systems for Agricultural Environments". (https://ukc.ksea.org/ukc2019/about/about-ukc-2019/)

- Steve made two presentations at the 2019 Annual Conference of IECA being held in Denver, CO in February 2019. The presentations were entitled "A Study on Introduction Plan of Low Impact Development Techniques for Widespread Application in South Korea" and "If LID is so easy to implement, how come we keep getting it wrong".

- Steve made a presentation entitled "LID in China and South Korea" at the 2018 Annual Conference of the Northeast Chapter of IECA in Concord, NH on October 1, 2018.

- Steve made a presentation entitled "If LID is so easy to implement, how come we keep getting in wrong" at the **2018 International Low Impact Development** conference being held in Nashville, TN on August 12 – 15, 2018. The conference is sponsored by ASCE and EWRI. (https://www.lidconference.org/)

- Steve made two presentations at the **2018 TRIECA Conference** being held on March 21 & 22, 2018 at the Pearson Convention Center in Brampton, Ontario. The presentations are entitled "Addressing Stormwater in China with Low Impact Development" and "Implement Low Impact Development in South Korea." This conference is sponsored by the Toronto and Region Conservation Authority and the Canadian Chapter of the International Erosion Control Association.

- Steve made the following presentations at the **2018 IECA Annual Conference** being held in Long Beach, CA in February of 2018. The presentations are entitled "How Low Impact Development strategies can mitigate high intensity rainfall events" and Designing Low Impact Sustainable Development treatment systems for Agricultural Environments".

- Steve was invited by the Dylan Drudul, President of the Mid-Atlantic Chapter of IECA to present the keynote address at a one day event called "Sediment Control Innovations Roadshow on July 14th in Columbia, Maryland. The keynote is entitled **"A Worldwide Perspective on Municipal Stormwater Issues".**

- Steve made a presentation entitled **"Designing LID Systems: What do you need to know and why"** at the 27th Annual Nonpoint Source Pollution Conference being held in Hartford, CT on April 20-21, 2016 as sponsored by the New England Interstate Water Pollution Control Commission.

- Steve will be presenting four one-hour long webinars through Halfmoon Seminars on Low Impact Development. The first entitled **"Introduction to Low Impact Development"** will be on May 10, 2016 at 12 pm. The second entitled **"Bioretention System Design"** will be offered on May 10, 2016 at 1:30 pm. The third entitled **"Applying LID Concepts to Residential Development"** will be offered on May 12, 2016 at 12 pm. The fourth entitled **"LID Case Studies"** will be offered on May 12, 2016 at 1:30 pm.

- Steve will be making a presentation entitled **"Designing LID Systems: What do you need to know and why**" at the UKC2016 conference, sponsored by KSEA (Korean-American Scientists and Engineers Association) at the Hyatt Regency DFW in Dallas, Texas, August 10 – 13, 2016.

- Steve made five presentations at the **2016 Environmental Connection** conference by IECA (www.ieca.org) being held in San Antonio, Texas on February 16 – 19, 2016. The presentations were entitled "Designing LID Systems: What do you need to know and why", "Construction Site Stormwater: The Ignored Problem", "Solving Construction Stormwater Problems in the Field", "Developing Effective LID Municipal Regulations", and "LID Demonstration Projects in Connecticut, a study of Contrasts".

- Steve made two presentations at the **EPA Region Stormwater Conference 2015** (http://epa.gov/region6/water/npdes/sw/ms4/2015conference/index.html) being held in Hot Springs, AR on October 18-23, 2015. The presentations are entitled "Designing LID systems: What do you need to know and why" and "Designing LID treatment systems for Urban and Agricultural Environments."

- Steve made a presentation entitled "Applying LID strategies to residential and commercial developments to address water quality and runoff volumes" at the KSEA Northwest Regional Conference 2015 held at the Idaho Water Center in Boise, Idaho on October 11, 2015.

- Steve made a presentation entitled "Solving Construction Stormwater Problems in the Field" at **WEFTEC 2015** (http://www.weftec.org) in Chicago, IL on September 29, 2015.

- Steve made three presentations entitled: "Korean GI/LID Research Facility", Applying LID concepts to High Density Residential Developments, and Municipal LID Regulations" at the 2015 Environmental Connection IECA Annual Conference being held in Portland, Oregon on February 16 – 18, 2015. He also presented a half day workshop entitled: "Designing LID Projects". He moderated an Expert Panel on Low Impact Development with Seth Brown, (Water Environment Federation), Bob Adair (Construction Ecoservices, Inc.) and Roger Sutherland (AMEC)

- Steve made two presentations at International Low Impact Development Conference 2015 in Houston, Texas which is sponsored by ASCE-EWRI. The presentations are entitled "Korean GI/LID Research Facility", and "LID Demonstration Projects in Connecticut: The Good and the Bad".

- Steve made presentations entitled "Overview of Low Impact Development" and "The Application of Low Impact Development Strategies for Land Development Projects" along with Dr. Jae Ryu of the University of Idaho and Dr. Hyun-Suk Shin of Pusan National University at the annual meeting of the **American Water Works Association** in Tyson Corners, VA on November 6, 2014.

- Steve made two presentations entitled "Construction Site Stormwater: The Ignored Problem" and "Applying LID Concepts to High Density Residential Development" at the **2014 Annual Conference and Trade Show of the Northeast Chapter of IECA** held at Lake Morey, Vermont on November 4 – 5, 2014.

- Steve made the following presentations entitled: "A Case Study – Southbury Medical Facility and Applying LID concepts on undeveloped land and in the urban environment" at Municipal Wet Weather Stormwater Conference, hosted by the **Southeast Chapter of IECA** in Charlotte, NC on August 18th and 19th, 2014.

- Steve made the following presentations: "The Incorporation of LID on Affordable Housing Projects, A Case Study – Southbury Medical Facility and LID' and Municipal LID Regulations" at the **16th Annual EPA Region 6 Stormwater Conference** sponsored by the South Central Chapter of IECA in Fort Worth, TX on July 27th through August 1st, 2014.

- Steve made oral presentations at the **2014 Environmental Connection** sponsored by the International Erosion Control Association in Nashville, Tennessee on February 25 – 18, 2014. The presentations were entitled "A Case Study – Southbury Medical Facility and LID", "The Implementation of the Highland Estates Detention Basin Retrofit water quality impairment in Northfield Lake", and "Creating Effective Municipal LID Regulations".

- Steve co-presented an all day workshop on Low Impact Development with Jamie Houle of the University of New Hampshire Stormwater Center at the **2013 International Erosion Control Association Northeast Chapter Conference and Trade Exposition** on November 19 – 21, 2013 in Warwick, RI.

- Steve made three oral presentations at the **2013 International Low Impact Development Symposium** held at the Saint Paul RiverCentre in Saint Paul, Minnesota on August 18 – 21, 2013. The presentations were entitled "A Case Study – Southbury Medical Facility and LID", "LID regulations in Connecticut: The Long and Tortured Road", and "Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut."

- Steve presented two papers at the **2013 EWRI World Environmental and Water Resources Congress** held in Cincinnati, Ohio on May 19- 23, 2013. The papers are entitled: "Municipal LID Regulations - What is important to include to be successful?" and "Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut". http://content.asce.org/conferences/ewri2013/index.html

- Steve made a presentation at the **Soil and Water Conservation Society Winter Conference** held in Berlin, Connecticut on February 15, 2013. The presentation focused on erosion and sedimentation control issues with Low Impact Development treatment systems.

- Steve presented two papers at the **2013 Environmental Connection** held in San Diego, CA on February 10 – 13, 2013. The papers are entitled "LID Demonstration Project for Seaside Village in Bridgeport, Connecticut" and "Creating a Stormwater Park in the City Meadow of Norfolk, Connecticut". He also presented a full day LID workshop entitled "Next Generation Low Impact Development and Meet Today's Needs" and a half day workshop on Low Impact Development covering Environmental Site Design, Water Quality Issues, Pollutant Loading Analyses, Designing different types of LID treatment systems and actual case studies.

- Steve made three presentations at the **2012 Annual Conference of the Northeast Chapter of IECA** in Fishkill, NY on November 7, 8, & 9, 2012. The presentations are entitled: "LID Demonstration Projects in Connecticut, A Study of Contrasts, Environmental Site Design and LID Hydrologic Issues, and Siting and Designing LID Treatment Systems with Case Studies"

- Steve made two oral presentations entitled "Applying Environmental Site Design Strategies to Design a Residential Subdivision" and "The incorporation of LID on Affordable Housing Projects" at the **2012 Ohio Stormwater Conference** in Toledo, Ohio sponsored by the Ohio Stormwater Association on June 7th and 8th, 2012.

- Presented two papers at the **ASABE Watershed Technology Conference** in Bari, Italy, May 28 – 30, 2012. The papers were entitled "LID Demonstration Project for Seaside Village in Bridgeport, Connecticut" and "The creation of a Stormwater Park in the City Meadow of Norfolk, Connecticut".

- Steve made one oral presentation entitled "LID Demonstration Project for Seaside Village in Bridgeport, Connecticut" and presented one poster entitled "The Incorporation of LID on Affordable Housing Projects" at the **2012 World Environmental & Water Resources Congress** in Albuquerque, New Mexico sponsored by EWRI/ASCE on May 20 - 24, 2012.

- "Stormwater Retrofit of Highwood Estates Detention basins to address Water Quality Issues and How the application of Environmental Site Design Strategies can provide a resource for carbon sequestering" were presented at the **2011 International Erosion Control Associated Northeast Chapter Annual Conference** on December 1 – 3, 2011 at the Crowne Plaza Hotel in Natick, Massachusetts.

- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits; A Low Impact Development (LID) Model Ordinance and Guidance Document and The Farmington River Enhancement Grants: A tale of three towns and the path to Low Impact Development were presented at the **Philadelphia Low Impact Development Symposium "Greening the Urban Environment"** in Philadelphia, PA (September 2011) sponsored by EWRI, Villanova University, North Carolina University and the University of Maryland.

- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits; The Farmington River Enhancement Grants: A tale of two towns and the path to Low Impact Development and A Low Impact Development (LID) Model Ordinance and Guidance Document was presented at the **EWRI/ASCE 2011 World Environmental & Water Resources Congress** in Palm Springs, CA (May 2011).

- Stormwater Retrofit of Highwood Estates Detention Basins to enhance Water Quality Benefits was presented at the "Annual Nonpoint Source Pollution Conference", sponsored by the **New England Interstate Pollution Control Commission** in Saratoga Springs, NY, on May 17-18, 2011.

- Stormwater Pollutant Load Modeling presented at the **Northeast Chapter of IECA Annual Conference** at the University of New Hampshire Stormwater Center in Durham, NH (December 2010).

- How the application of Environmental Site Design Strategies and Low Impact Development Storm Water Treatment Systems can mimic the Natural Hydrologic Conditions in a watershed and provide a resource for carbon sequestering and The Importance of Assessing Pollutant Loads from Land Development Project and the Design of Effective Storm Water Treatment Systems at the **EWRI/ASCE Watershed Management Conference** in Madison, WI (August 2010).

- The Tolland Low Impact Development Design Manual: The Changing Paradigm for Land Development, The application of Environmental Site Design Processes to design a residential subdivision and A Low Impact Development (LID) Model Ordinance and Guidance Document at the

ERWI/ASCE 2010 World Environmental and Water Resources Congress in Providence, RI (May 2010).

- The application of Form-Based Zoning and Low Impact Development for the Revitalization of the Town Center of Simsbury, Connecticut and The Integration of Low Impact Development to enhance the application of Smart Code Zoning to create a Gateway District to the Historic Town Center of Tolland, Connecticut at the **EWRI/ASCE 2010 International Low Impact Development Conference** in San Francisco, CA (April 2010).

- The application of Environmental Site Design Processes to design a residential subdivision and Assessing Pollutant Loads and Evaluation of Treatment Systems to achieve Water Quality Goals for Land Development Projects at the **EWRI/ASCE 2009 World Environmental & Water Resources Congress** in Kansas City, Missouri (May 2009).

- Ahead of the Curve – Tolland, CT adopts Low Impact Development Regulations and Preparing a Pollutant Loading Analysis for Land Development Projects at the **Urban Water Management Conference** in Overland Park, KS sponsored by National Association of Clean Water Agencies (NACWA) and the City of Independence Water Pollution Control Department (March 2009).

- Ahead of the Curve – Tolland, Connecticut adopts Low Impact Development Regulations and Trade Winds Farm – Winchester, Connecticut – How to create a LID subdivision along with the preparation of a poster on Preparing a Pollutant Loading Analysis for Land Development Projects at **EWRI/ASCE 2008 International Low Impact Development Conference** in Seattle, WA (November, 2008).

- Trade Winds Farm – Winchester, Connecticut – How to create a LID subdivision and Preparing a Pollutant Loading Analysis for Land Development Projects at the **IECA Northeast Chapter's Annual Conference & Trade Exposition** in Portland, ME (October, 2008).

- The Preparation of a Valid Pollutant Loading Analysis at the **National StormCon 2008 Conference** in Orlando, FL (August, 2008).

- Panelist with Linda Farmer, AICP for Profiles of Partnerships for Addressing NPS Pollution at **NEIWPCC Annual Non-point Source Pollution Conference** in Groton, CT (May, 2008).

Workshop Presentations:

- Steve presented a 2-hour webinar entitled "How to Design Stormwater Management for Ground Mounted Solar Arrays" on July 14, 2020. This webinar is hosted by Halfmoon Seminars.

- Steve presented a two-day webinar encompassing 6.5 hours entitled "Low Impact Development" on July 15, 2020 and July 16, 2020. The webinars are hosted by Halfmoon Seminars.

- Steve presented an all-day workshop on Low Impact Development for continuing education for design professionals in Little Rock, Arkansas on February 28, 2020 which is sponsored by Halfmoon Seminars.

- Steve presented an all-day workshop on Low Impact Development for continuing education for design professionals in Nanuet, NY on December 19, 2019 which is sponsored by Halfmoon Seminars.

- Steve presented a webinar entitled "Construction Stormwater Regulation Strategies: Best Practices to Assure NPDES Compliance" on Thursday, November 12, 2015 at 2:00 pm to 3:00 pm eastern time. The webinar is sponsored by Business and Legal Resources.

- Steven presented a full day workshop entitled "Stormwater Management 2015" in Columbia, Maryland on August 13, 2015 which focused on applying the State of Maryland Stormwater Manual. The workshop was sponsored by Halfmoon Seminars, LLC and 113 people attended the workshop.

- Steve presented a full day workshop on "Stormwater Regulations in Connecticut", sponsored by Halfmoon Seminars, LLC in North Haven, Connecticut on June 25, 2014. More than 30 engineers and landscape architects attended the workshop.

- Steve was the facilitator in a live chat as part of the Stormwater Solutions Virtual Trade Show on April 2, 2014. The topic of the live chat will be LID with a focusing on Bioretention systems.

- Steve made a presentation entitled "What is Low Impact Development and how do you apply it to residential projects" for the Connecticut Chapter of the American Institute of Architects in New Haven, Connecticut on April 22, 2014.

- Steve made a presentation entitled "Wastewater to Stormwater; Designing a subsurface flow gravel wetlands" at the annual meeting of the Connecticut Association of Wetland Scientists on March 20, 2014 in Southbury, Connecticut.

- Steve made a presentation entitled " Low Impact Development and the Connecticut General Stormwater Permit" at the annual meeting of the Southern New England Chapter of the Soil and Water Conservation Society on March 14, 2014 at Eastern Connecticut State University.

- He co-taught an ASCE Short Course entitled, "Introduction to Low Impact Development" with Mike Clar at the 2013 Low Impact Development Symposium held in St. Paul, Minnesota on August 18, 2013.

- Steve presented a workshop on Low Impact Development to the Town of Naugatuck Inland Wetlands Commission on June 5, 2013 to demonstrate how the implementation of LID can reduce stormwater impacts in the urban area of the community.

- Steve presented a webinar entitled "The Basics of Low Impact Development on Wednesday, April 17, 2013.

- Steve presented a webinar entitled "Changing the Regulatory Framework to Adopt LID Strategies" on Thursday, March 7, 2013 and on Thursday, August 8, 2013 from 11:30 am to 1:00 pm through **ASCE and EWRI.** Link for more information.

- Steve presented a three-hour workshop on Low Impact Development on June 5, 2012 at the Oxford town hall for municipal land use staff and officials at the request of the **Oxford Inland Wetlands and Watercourses Commission**. Approximately 20 individuals attended the workshop.

- Steve presented an eight-hour short courses on Low Impact Development at the **EWRI/ASCE 2011 World Environmental & Water Resources Congress** in Palm Springs, CA (May 2011). The following topics will be covered: Understanding and Implementing Principles of Low Impact Development, Applying LID Strategies to a Site, Low Impact Development Hydrologic

Considerations, The Regulatory Framework and LID, LID Integrated Management Practices, Erosion and Sedimentation Controls for the Implementation of LID Practices and Case Studies (Applying LID and Regulations). 12 attendees took the course, including professors from Mississippi State University, Oklahoma State University, Adelaide University (Australia) and Pusan National University (South Korea).

- Understanding and Implementing Principles of Low Impact Development, Applying Low Impact Development to a Site, Low Impact Development Hydrologic Considerations, Low Impact Development Integrated Management Practices, Erosion and Sediment Control for the Implementation of Low Impact Development Practices, and Case Studies of LID (Residential and Commercial) at workshops on Low Impact Development sponsored by **HalfMoon, LLC** (https://www.halfmoonseminars.com) in Albany, NY, Ronkonkoma, NY, North Haven, CT, Manchester, NH, Nanuet, NY, Cleveland, OH, Natick, MA, Portland, ME Fort Washington, PA, Springfield, MA, Wilmington, DE, White River Junction, VT, Somerset, NJ, and White Plains, NY for continuing education credit for design professionals. A total of 322 land use professionals have attended these workshops.

- Pollutant Loads and the Design of Effective Stormwater Treatment Systems was presented at the Virtual H2O conference on February 22, 2011 as presented by **PennWell Publishing**. 25 professionals in attendance.

- LID Stormwater Treatment Systems: Siting, Design and Installation for Maximum Environmental Benefit. What are the aesthetic, financial and maintenance implications? presented at a seminar for the **AIA Connecticut, Committee on the Environment** in New Haven, CT (December 2010). 70 architects in attendance.

- Low Impact Development and the Environmental Site Design process to create sustainable sites at a seminar for the **AIA Connecticut, Committee on the Environment** in New Haven, CT (September 2010). 40 architects in attendance.

- Workshop entitled Using Environmental Site Design Strategies and LID stormwater systems for commercial development at the **Connecticut Conference on Natural Resources** at the University of Connecticut (March 2010). 10 design professionals and regulatory staff in attendance.

- Implementing Low Impact Development in Your Community for the **Connecticut Technology Transfer Center** in Glastonbury, CT (November, 2009). 40+ professionals in attendance.

- What towns can do to encourage LID at the "Low Impact Development Forum" presented by the **Housatonic Valley Association** in Shelton, CT. (October 2009). 12 professionals in attendance.

- Town of Tolland, CT; Low Impact Development Regulations and Design Manual at the **Community Builders Institute** for the workshop entitled: "Swift, Certain & Smart: Best Practices in Land Use" (May 2009). 30+ professionals in attendance.

- Low Impact Development, Environmental Site Design and Water Quality issues and strategies to local municipalities (**Greenwich, and Old Lyme**) to provide an educational opportunity about the many benefits of Low Impact Development in 2009. 30+ design professionals, regulatory commissioners and staff in attendance for each presentation.

- Low Impact Development, Environmental Site Design and Water Quality issues and strategies to local municipalities (**Bolton, Farmington, and Guilford** to date) on a pro bono basis to provide an educational opportunity about the many benefits of Low Impact Development in 2009. 25+ design professionals, regulatory staff and commission members in attendance for each presentation.

- Workshop entitled Using Environmental Site Design Strategies to create a residential subdivision at the **Connecticut Conference on Natural Resources** at the University of Connecticut (March 2009). 20 design professionals and regulatory staff in attendance.

- The Need for Pollutant Loading Analyses for Land Development Projects to storm water engineers at **CT DEP** (March 2009). 6 DEP staff in attendance.

- A review of existing land use regulations and storm water management issues for the Middle Quarter Districts in Woodbury, CT and how the implementation of Environmental Site Design and Low Impact Development strategies can improve water quality of storm water runoff for the Woodbury land use agencies (August 2008). 15 regulatory commission members in attendance.

- Low Impact Development at meeting of the **Connecticut Association of Zoning Enforcement Officers** (October 2007). 30+ professionals in attendance.

- Low Impact Development and adoption of LID regulations by municipalities at workshops of the **Land Use Leadership Alliance (LULA)** (2007, 2010 and 2011). 20+ professionals in attendance at each presentation.

- Stormwater management and Low Impact Development at workshop sponsored by the **Northwest Conservation District** held for land use officials (March 2006). 20+ professionals in attendance.

Conferences Attended

- Bioretention Summit: Ask the Researcher – Annapolis, MD by the University of Maryland (Dr. Alan Davis), North Carolina State University (Dr. Bill Hunt) and Villanova University Stormwater Partnership (Dr. Rob Traver) – (July 2010).

- Workshop at the University of New Hampshire Stormwater Center on permeable pavements. This full-day training included field visits to a variety of on-the ground porous pavement installations throughout the region. Participants learned key design principles necessary to successfully design, evaluate, specify, and install porous pavement for stormwater management. (December 2009).

- Two workshops at the University of New Hampshire Stormwater Center in Durham, NH to observe conventional and Low Impact Development storm water treatment systems in operation. The Stormwater Center is independently verifying the effectiveness of the various treatment systems to remove pollutants from runoff and reduce impacts associated with storm flows. (March 2006 and May 2007).

- 2^{ND} National Low Impact Development Conference – North Carolina State University held in Wilmington, NC, (March 2007).

- Designing Bio/Infiltration Best Management Practices for Stormwater Quality Improvement – University of Wisconsin (Madison, WI) (November 2005).

- Stormwater Design Institute – Center for Watershed Protection (White Plains, NY), (December 2004).

- Engineering and Planning Approaches/Tools for Conservation Design – University of Wisconsin (Madison, WI) (December 2003).

- Law for Design Professionals in Connecticut – Lorman Education Services in Trumbull, CT (September 2002).

- On-site Wastewater Facility Design – University of Massachusetts in Amherst, MA (May 2002).

- The Northeast Onsite Wastewater Short Course & Equipment Exhibition – New England Interstate Water Pollution Control Commission in Newport, RI (March 2002).

- Designing On-site Wetland Treatment Systems, University of Wisconsin, (Madison, WI) (October 1999).

- Cost Effective Drainage System Design – University of Wisconsin (Atlanta, GA) (November 1997).

- Treatment Wetlands, University of Wisconsin, (Madison, WI). "Creating and Using Wetlands for Wastewater Disposal and Water Quality Improvement" (April 1996).

- Alternative On-site Wastewater Treatment Systems, New England Intrastate Pollution Control Commission's On-Site Wastewater Task Force in Westford, MA (November 1994).

- Stormwater Quality, University of Wisconsin, (Portland, ME). "Designing Stormwater Quality Management Practices" (June 1994).