STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

GRE GACRUX LLC petition for a declaratory ruling for the proposed construction, maintenance and operation of a 16.78-megawatt AC solar photovoltaic electric generating facility in Waterford, Connecticut. Reopening of this petition based on changed conditions.	**Petition No. 1347A**
	June 18, 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 Save the River-Save the Hills, Inc. ("STR-STH") to assess the plans and reports submitted by petitioner GRE GACRUX LLC ("GRE") back in 2018, in connection with GRE's first attempt to get this project approved by the Council. I reviewed the submissions regarding stormwater discharge, erosion and sediment control and forestry and submitted my opinions about the inadequacy of those plans and the impacts of clear cutting such a large tract of core forest to the Council with STR-STH's other concerns. When GRE asked the Council to re-open its petition, I again provided 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. I have continued to review GRE's submissions in this petition and to offer my opinion with respect to whether GRE's

plans comply with the water quality standards of the State of Connecticut and general standards of good practice for this type of site development, and to apply my knowledge of forestry as well. That review led to my submission of 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 an exhibit.

Q6. What is the purpose of your testimony?

A6. This testimony described my findings and opinions with respect to GRE's submissions to the Council.

Q7. Please summarize your findings and opinion.

A7. Generally, I found that GRE's submissions, including all revisions it has made in this proceeding, 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. GRE has also misrepresented the site conditions and has minimized the impact this project will have on the site and the surrounding properties, which include tributaries to the Niantic River.

Q8. What is your most significant finding?

A8. My most significant finding is that GRE's engineer did not consider the solar panels to be impervious in designing the site. 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 GRE 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 and sedimentation of the brooks and tributaries that lead directly to the Niantic River.

I frankly cannot understand why GRE would propose to construct a ground-mounted solar installation on this environmentally sensitive parcel without assuming that the panels in the array are impervious, especially since my own experience in designing a ground-mounted array showed that changing that underlying assumption, which would protect the wetlands and watercourses of the state, including the heath of the Niantic River estuary, would not be cost-prohibitive.

Q9. What is that finding based on?

A9. My finding is based on my review of GRE's submissions, my more than 40 years of experience in civil engineering in the land development field, and 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 GRE/Greenskies.

Q10. What happened at the Antares project?

A10. 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.

Q11. How does the design of this project compare to the design of the Antares site?

A11. The design of this project is unfortunately very similar. (1) The solar panels are not considered impervious; (2) large portions of the site will be regraded and the soil class is adjusted down only one level, rather than two, for calculating post-development conditions; (3) GRE assumes the runoff will occur as overland flow perpendicular to the panel rows rather than concentrated flow parallel to the panel rows; and (4) although GRE has conducted some soil testing in connection with the re-opening of original petition for this site, that testing was inadequate to capture the soil properties of the site.

With respect to #1, GRE 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. 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, GRE 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).

With respect to #2, GRE has provided for a single step down/loss in soil class for all areas in its post-development condition assessments. That is appropriate for those areas of the site that are being cleared and stumped, but not graded. However, based on my knowledge of soils from my forestry degree and from my observations in the field, particularly at the Antares site, that is not adequate for the areas of the site to be cleared, stumped, *and* graded. Areas where the grade is being changed by cutting or filling of 2 feet or more will have little to no infiltrative capacity because the soil porosity (void spaces within the soil profile) is eliminated by that grading, so that there is no ability for runoff to infiltrate the soil profile. When I visited the Antares site for a site walk, the ground was as hard as concrete, such that it would be considered a Class D soil. That site started with a Class B soils. There is every reason to expect that the same will be true of this site based on GRE's plans. Therefore, for those areas of this project site that will be stumped, cleared and also regraded, the step down needs to be two soil classes to account for the compaction that will occur during construction.

With respect to #3, 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, GRE 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" (which will *not* be vegetated because the grass likely will not even have been established at that point),

rather than running off into concentrated channels. Changing the drainage patterns of this site from overland flow to concentrated flows will lead to erosion.

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 #4, many areas of the site have no test holes, primarily in the area of the proposed solar panels, and in my professional opinion, the soil investigation conducted by Terracon and VHB is therefore inadequate for understanding the geological conditions within the large areas of the solar panels. In addition, the locations of the soil testing are only shown on a reduced scale map of the site and are not shown on the actual site plans reflecting the locations of the stormwater basins and solar panels, making it difficult to relate the soil test locations to those of the stormwater basins and the solar array – which are the areas where soil investigation is most important.

Q12. Are there other aspects of the design concern you?

A12. Yes. The multiple types of stormwater basins proposed by GRE are not in compliance with the design standards found in the 2004 Manual. None of the proposed stormwater basins contain the required components required by the 2004 Manual to address water quality. The missing components include forebays, long flow paths from inlet to outlet, micro-pools and appropriate vegetation. GRE has conceded that point in response to interrogatories issued by STR-STH and the Town, as it has stated that will be providing revised plans. As of the date I am preparing this testimony, I have not seen those revised site plans, and I do not know when GRE will be providing them; but GRE's responses, by themselves, demonstrate that its plans do not comply with the water quality standards of the state or with good engineering practices. I also believe, based on the photo log/map recently submitted by GRE to the Council, that GRE misrepresented the pre-development conditions of the site by using "woods in fair condition" rather than "woods in good condition" or "brush in good condition." GRE also did no assessment of the pollutant loads to be generated by this project, which is especially important given the environmentally sensitive nature of the site.

Q13. How are the stormwater basins not in compliance with state standards?

A13. They do not comply in many ways. GRE is using ponds, infiltration basins and sand filter basins. By its own words, GRE claims to have designed the site so that "the infiltration basins will infiltrate the water quality volume into the ground; the sand filters will filter the water quality volume through a sand bedding; and, each pond will contain a stable settling medium for sediment to filter out into." However, its designed basins will not work as intended.

The site plans contain infiltration basins that do not have pre-treatment systems containing a minimum of 10% of the water quality volume (WQV), in violation of the 2004 Manual. In response to interrogatories, GRE conceded that its proposed infiltration basins do not meet those requirements, and stated that it would revise its plans to include pre-treatment forebays upstream of the proposed infiltration basins. However, that will not solve the problems with infiltration basin #5, where the bottom of the basins is below seasonal high groundwater, which will prevent infiltration, meaning it will not work as intended. GRE *admitted* that this basin is within a seasonally high groundwater line and proposed in its response to interrogatories to remove the basin entirely from that line "if the Connecticut Siting Council so desires." Frankly, whether the Council desires that is immaterial – it is the professional engineer's responsibility to design a system that complies with state standards, and GRE is admitting that the design does not comply.

The site plans also include sand filter basins without pre-treatment systems, in violation of the 2004 Manual. GRE appears to have admitted that its plan for sand filter basin #10 does not comply with the 2004 Manual by stating that it would revise its plans to include the addition of a pre-treatment basin for #10. However, the sand filter basins suffer from additional deficiencies. The vertical separation to groundwater in basin #3 and basin #10 does not comply with the requirement of 36" contained in the 2004 Manual; this means that the basins will not

actually work as designed. Sand filters are infiltrative practices and *must* provide a 3-foot vertical separation to groundwater to work. GRE appears to have admitted that the basins will not work "during the wet season," i.e., at the times of seasonally high ground water, as evident by its response to STR-STH's interrogatory where it offered to "include an impervious liner around the basin to prevent seasonal groundwater seepage into the sand filter." Adding a liner does not solve the problem, however, it compounds it because adding a liner will not allow infiltration to occur, which means the basins will not be acting as infiltrative practices. And once again, GRE is offering to so this "is the Connecticut Siting Council desires," which is wholly inappropriate and inconsistent with civil engineering standards of care for design work.

Given that the infiltrative practices planned will not actually work as designed – which GRE has admitted -- GRE should never have proposed them, and it certainly should not continue to claim, as it did in those same interrogatory responses, that the 15 basins it has proposed "have been designed and strategically located throughout the Project Site to mimic existing runoff collection areas that convey runoff to adjacent wetlands and watercourses." As I have not seen GRE's revised plans, I cannot comment on whether those revisions will bring the infiltration and sand filter basins into compliance with the 2004 Manual, but unless GRE changes its underlying assumptions in the design of this project, including the fact that the panels are impervious, it certainly will not achieve pre-development drainage conditions post-development. I am also concerned that GRE has proposed to use the post-development stormwater basins as temporary sediment traps during construction, but has not provided any information about the process that will be used to restore the basins to function as intended post-development. Again, GRE stated in response to interrogatories that it would revise its plans to describe that conversion, but has not done so to date.

Q14. Do you have any other comment on the stormwater basins proposed by GRE?

A14. According to the site plans, only a singular spillway will be used to control the flow of runoff out of all basins and the invert (bottom) of the spillway is located an average of three (3) feet above the bottom of the basin. This will result in the nominal water surface in the basin being located at the invert elevation, so that the storage volume below the invert is not available to runoff. Only the volume above the invert of the spillway to the top of the berm will be available for the storage of runoff, thus the actual available storage volume for runoff is actually substantially less than what GRE claims. This is true for all stormwater practices which are not proposed as infiltration basins. There are also issues with the infiltration basins which reduce their functional storage volume, such as using percolation test data and not double ring infiltration tests. Double ring infiltration tests only measure the vertical infiltration rate into the soil which is used for the design of stormwater infiltration practices. Percolation tests measure both the horizontal and vertical movement of water into the soil, thus over-estimating the vertical infiltration of water into the soil. *All of this means that the water quality of the non-point source runoff is not being addressed.*

Additionally, GRE's stormwater management design uses swales to collect overland flow and redirect it to one of the stormwater basins. Each basin has a spillway as an outlet, which is point discharge; thus, concentrated flow will occur. While GRE's site plans show a 40-foot-wide energy dissipator at the end of the spillway, the dissipator is basically a hole lined with riprap, which will not spread the flow out across the 40-foot length. Runoff will find the lowest point on the downhill side of the dissipator and this is where the majority of runoff will go, because the low point becomes the point of least resistance for the movement of water. None of the discharge points except basin #8 are located where there is currently a topographic condition, which would see slightly concentrated flow. In a natural undisturbed environment, runoff from rainfall will

flow in perpendicular to the contour of the land until it reaches a wetland or stream. On flatter slopes, some of the rainfall may infiltrate depending upon the ground cover, thus reducing the amount of surface runoff. On steeper slopes, little if any infiltration will occur, thus most of the rainfall becomes runoff. When concentrated flow is discharged onto a slope that has not previously (under natural conditions) experienced concentrated flow, as will happen at 14 of the 15 discharge points at basin spillways, erosion and downgradient sedimentation will always occur. There are also no intermediate erosion control barriers to break up the slope length (the longer the runoff goes without hitting a sedimentation barrier, the faster it moves, so that it has more force to move soil, thus causing erosion).

The 2004 Manual also strongly recommends that infiltration basins be designed as off-line systems to only accept runoff generated by the water quality storm with a by-pass system for larger rainfall events. None of the proposed infiltration basins are designed as off-line systems with a bypass. The result of these infiltration basins being subject to the runoff from all rainfall events is that they will prematurely fail due to clogging of the surface of the infiltration soil surface.

Q15. What are the implications of GRE using "woods in fair condition" for pre-development conditions?

A15. Misrepresenting the pre-development conditions means that GRE's claim to be ensuring equivalent post-development conditions with respect to stormwater is even weaker than I believed it to be, and means that the stormwater design is even more likely to fail. Good condition means a healthy groundcover vegetative layer and the beginnings of a shrub layer; fair condition means a lack of a green ground cover or shrub layer under the trees; poor condition would be leaves on the ground with no ground cover. Photos #8 to #22 in the photo log/map provided by GRE to the council on June 11, 2020 show a great herbaceous ground

cover layer. Therefore, under pre-development conditions for use in a stormwater analysis and design, this should be considered either "woods in good condition" or "brush in good condition." Instead, GRE used "woods in fair condition" for pre-development conditions in its stormwater analysis.

This has serious implications for the stormwater analysis. For example, the Runoff Curve Number (RCN) for woods in fair condition is 60 and for woods in good condition is 55; for brush in good condition, the RCN is 48. By using a higher RCN value for the pre-development condition, GRE represented in its stormwater report that the runoff from the site under the current conditions (today) is higher than it actually is. That means if the designed stormwater management system returned the site to what GRE claims was pre-development condition, it would actually *not* be doing so, but would result in an increased level of runoff post-development than pre-development.

Misrepresenting the pre-development conditions also has implications for the peak rates analyses. If the pre-development peak rates are actually lower than what GRE submitted, then the bar to meet the Channel Protection Volume is also lowered. That means that when GRE considers the panels impervious, the post-development peak rates will be significantly higher than it assumed in its submissions to the Council, so that GRE's basin designs will not be anywhere close to providing the channel protection volume.

Q16. What is your concern with respect to pollutants?

A16. GRE claimed that neither the panels nor the concrete pads will produce any pollutants. That is a false statement. Atmospheric deposition of pollutants on impervious surfaces is a substantial component of the discharge of non-point source pollutants. According to published literature, anywhere between 27% and 40% of nitrogen in non-point source runoff is from atmospheric deposition. This is a significant concern on this site because both Stony

Brook and Oil Mill Brook discharge to the Niantic River, a tidal estuary. It is well-documented that increased nitrogen loading in estuarine waters often results in adverse impacts to rooted aquatic vegetation such as eelgrass, including large-scale die-offs. Additionally, particulate bound trace metals such as chromium, lead, and zinc are also found in atmospheric deposition. No evaluation of the pollutant loads to be generated by this site has been provided. Also, there is no assessment as to how well the proposed stormwater treatment practices will reduce these non-point source pollutant loads which will occur on this site.

Q17. Do you have any other comments on GRE's stormwater management report?

A17. Yes. Appendix D to that report, which provides the hydrologic computations for the complete design of the temporary and permanent stormwater basins, raises several issues.

With respect to the temporary diversion swale sizing, GRE claims that its plans are in compliance with the 2004 Manual and the 2002 Guidelines, yet there is a significant amount of information missing from the plans and analyses.

(1) There is no way to correlate the sizing calculation with the site plans as none of the swales are labeled on the erosion control plans.

(2) No boundaries of the contributing area to each swale are provided so GRE's calculations cannot be verified.

(3) GRE uses the CT DOT Manual for sizing of the swales, when the 2002 Guidelines are the controlling document for the design of swales to be used as temporary or permanent diversion systems.

(4) It appears that an average slope was used for the sizing of the swales, but my review of the plans shows that the slope is variable, so the calculations appear to be only applicable to the flattest portion of the swale. This is not correct; if the swale has variable slopes, the swale design must evaluate all conditions to ensure that non-erosive velocities will be achieved in all locations.

(5) No grading for the temporary diversion swales is shown on the plan.

With respect to temporary sediment trap sizing, it appears that again used the CT DOT Manual. The 2002 Guidelines are controlling. Other errors include:

(1) There is no way to correlate the sizing calculations with the site plans as note of the temporary sediment basins are labeled on the erosion control plans.

(2) No boundaries of the contributing area to each temporary sediment trap are provided, so GRE's calculations cannot be verified.

(3) No spillway is shown for the temporary sediment traps. It appears that the spillway for the permanent stormwater basins will be used, and that means many of the traps are not designed with the minimum 2:1 length to width ratio from inlet to outlet that is required by the 2002 Guidelines.

With respect to WQV, it appears GRE again used the CT DOT Manual. The 2002 Guidelines are controlling. Other errors include:

(1) The calculations submitted for each drainage area are not valid. Only the gravel driveway and concrete pads are considered impervious, thus the WQV is grossly under-estimated. The solar panels are impervious and thus must be factored into the WQV calculation.

(2) GRE has separated various soil classifications out for the calculation of the WQV. This is incorrect, as the soil types have no bearing on the calculation of the WQV.

With respect to stormwater basins for post-development runoff, I note the following issues:

(1) The post-development watershed mapping does not show land cover types and associated areas for the determination of peak runoff rates. Based upon the HydroCAD summaries in the report, I cannot verify that even one lower soil classification is being used for those portions of the site where the array will be located, though GRE claims that is the case.

(2) In the analyses of each watershed area which includes portions of the array, GRE used the ground cover, "Grass cover (>75%) in good condition." The area of the array will be stumped and seeded, and then the following year, the array will be installed. This means that newly established grass cover will be driven over by the equipment used to install the racking system, deliver the panels to the racks and equipment to install underground conduit. The movement of this equipment over the grass will adversely impact its growth and thus the extent of cover with the area of the array. In addition to adversely affecting the growth of the grass, this will also result in compaction in some areas of the site, further reducing the infiltrative capacity of the soil. This will have the effect of reducing the amount of infiltration into the ground and increase the volume and rate of runoff. It can take two years or more for a grass cover to become fully established where it covers more than 75% of the seeded area and is stable enough to restrict the movement of vehicles, so the use of the "good condition" is under-estimating the rate and volume of runoff which will occur in the field.

(3) The area of solar panels is not considered impervious in the post-development analysis; thus, the peak rate and runoff volumes are grossly under-estimated.

Q18. What is your opinion with respect to GRE's claims of complete compliance with state water quality standards?

A18. My opinion is that those claims cannot be true so long as GRE 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, and now Waterford, 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 GRE 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.

Q19. What is your opinion with respect to forestry issues?

A19. It is environmentally irresponsible to clear cut 75 acres of deciduous forest for the installation of a solar panel farm. The natural wooded, undisturbed environment provides the following environmental benefits which will be completely lost if this project is approved and constructed as proposed. (1) Deciduous and evergreen trees provide interception of rainfall via branches and leaves, thus reducing the amount of rainfall which directly hits the ground surface. Some of the intercepted rainfall is absorbed by the leaves for use in photosynthesis. Other intercepted rainfall runs the branches and trunk to the ground surface, where it will infiltrate into the forest litter layer found on the ground surface. This environmental benefit will be fully lost by this project over the 75 acres. (2) The velocity of the falling raindrops is greatly reduced by the interception of rainfall by the branches and leaves, and thus when the raindrops reach the ground they do not cause erosion of the forest litter layer. This environmental benefit will also be fully lost by this project over the 75 acres. (3) All growing vegetation (trees, shrubs and herbaceous groundcover species) found in the forest absorb carbon dioxide from the air and release oxygen. Carbon from the carbon dioxide is stored in all woody vegetation and sequestered from being released. This function on 75 acres will be fully lost as a result of this project. (4) As all trees and brush will be removed from 75 acres of the site, so will the stumps and then the soil surface will be disturbed.

Additionally, the submitted plans show that large extents of the site will be regraded to varying degrees. This grading disturbs and changes the natural soil properties which exist on the site. The soft forest litter layer will be removed and the underlying soils will be compacted to varying degrees. This disturbance and regrading of the native soils causes two adverse environmental impacts. First, is the loss of the natural soils ability to absorb and sequester carbon. Second is the significant elimination of the soil to absorb and infiltrate rainfall.

Disturbance of the soils significantly reduces or eliminates the porosity (void spaces within the soil) of the soil. As the porosity is decreased or eliminated, the ability of the soil to infiltrate runoff is also reduced or eliminated. (5) The clear cutting of 75 acres will eliminate significant forest habitat for terrestrial and aquatic species which reside in these areas as well as those who use the wetland and watercourses on the site.

Q20. Do you have any other opinions or concerns about this project?

A20. I have many more concerns, some of which have been addressed in previous submissions to the Council on behalf of STR-STH in the form of comment letters and answers to interrogatories. Among them is the fact that Oil Mill Road would need to be improved to actually construct this solar array, yet GRE has not submitted any information about the work that would need to be done, which would surely impact Oil Mill Brook, which crosses directly under the road. I also am concerned that basin #1 drains to a wetland with a vernal pool and then to an unnamed, intermittent watercourse that runs parallel to Oil Mill Brook and then directly into the Niantic River. GRE has not provided any information about the capacity of that intermittent stream to handle the increased runoff from the Site as it drains through the vernal pool. There is also the problem of the amount of site clearing/disturbance that is planned by GRE. A project of this size, especially on this site, should be cleared in smaller stages, rather than all at one time, to ensure that the soil remains as stable as possible. The 2002 Guidelines and the General Permit provides that site disturbance should be done in areas of 5 acres or less where possible. It is certainly possible to do that here.

Q21. What are your conclusions regarding GRE's proposed project?

A21. GRE's plans fail to comply with Connecticut water quality standards, as GRE itself has conceded in its responses to interrogatories and its plan to revise its site plans yet again. 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. As currently designed, this project will, within a reasonable degree of engineering certainty, lead to pollution of the waters of the state, and will harm the health of the Niantic River estuary. The problems with this petition are so fundamental that they impact every aspect of the design, so that they cannot be fixed in a later development and management plan. The Council had it right when it denied GRE's first petition for this site.

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

Steven Trinkaus

6/15/2020

Steven Trinkaus Date

ATTACHMENT

Exhibit A – CV of Steven Trinkaus

EXHIBIT A

Current Resume of Steven D. Trinkaus, PE of Trinkaus Engineering, LLC

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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.

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 visit 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.

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

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.

Future Presentations

- Steve will be making presentations on the following topics: "LID Retrofits to Address Nutrient Loads in Lake Pocotopaug in East Hampton, Connecticut" and "A Study on the Introduction of Low Impact Development for Widespread Applications in South Korea" at the 2020 International Low Impact Development Conference in Bethesda, Maryland on July 19th to 22nd, 2020. (https://www.lidconference.org/).

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 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. (https://www.halfmoonseminars.org/seminars/133069/low-impact-development-seminar/north-little-rock-ar)

- 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. (https://www.halfmoonseminars.org/seminars/132909/low-impact-development-seminar/nanuet-ny)

- 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 (www.blr.com).

- 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. More information is available at http://www.ieca.org/education/webinar/livewebinars.asp

- 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: http://www.asce.org/Continuing-Education/Brochures/Webinars/ChangingRegulatoryFrameworkLIDStrategies/#Purpose

- 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).

- 2ND 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).

LOW IMPACT SUSTAINABLE DEVELOPMENT PROJECTS

LID 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.

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.
- **Lodestar Energy – Winchester, Connecticut:** Design 8 acre ground mounted solar array, access driveway, stormwater management system and erosion/sedimentation control plan.

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.

CERTIFICATION

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

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