



## ***Technical Workshops***

**Sunday, August 12, 2018**

**8:00 a.m. – 12:00 p.m. - \$195.00**

### ***Green Infrastructure and LID Practice Construction Workshop***

**Make Sure Your BMPs are Constructed Properly: Green Infrastructure and LID Construction Inspection Training**

**Instructors:** Jason Wright, PE; Dan Christian, PE; Troy Dorman, PE; Brad Wardynski, PE, *Tetra Tech*; Bill Hunt, PE; Mitch Woodward, *North Carolina State University*; Karen Bishop, *San Antonio River Authority*

**Purpose:** Design of green infrastructure or Low Impact Development practices are only a part of properly managing stormwater runoff. If the practices are not properly constructed and maintained they will not function as they are designed. Maintenance of green infrastructure and LID practices been widely discussed and training has been provided by ASCE with a workshop offered at a previous EWRI LID Conference. Little guidance has been provided on properly constructing or inspecting the construction of green infrastructure or LID practices.

There are many variables, including construction practices and materials, that can have a significant impact on the performance and function of green infrastructure practices. For example, compaction of the subgrade can have a significant impact on infiltration and overall performance of bioretention areas and permeable pavement and should be avoided. Materials used in the construction can also have a significant impact. It is important to have a trained person onsite who can determine if gravel has been washed and free of fines and if the bioretention soil media contains the amount and quality of organic material specified in the construction documents.

This workshop will discuss the proper phasing of construction, inspection of materials upon delivery, a multitude of proper construction practices, and field testing and verification to



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ensure green infrastructure and LID practices are properly constructed and function as they are designed.

## **Some of the topics to be discussed include:**

1. an introduction to LID
2. LID site management
3. bioretention construction
4. permeable pavement construction
5. stormwater wetland construction and
6. cistern construction.

Tetra Tech, in cooperation with NC State University staff, has developed a program for the San Antonio River Authority to certify contractors in the construction of green infrastructure and LID practices. This workshop will be based on materials used to develop SARA's program and condensed to 4 hours. Case studies from construction projects across the country will be incorporated to provide specific examples of lessons learned, the impacts of improper construction techniques, and how to ensure that the practices function as they are designed.

## **Course Objectives:**

- Provide guidance on how to prepare detailed construction phasing.
- Discuss methods for verification of construction materials including bioretention soil media, structural stone, mulch, and pervious concrete mixes.
- Review common construction mistakes and the impacts those mistakes can have on the performance of a green infrastructure or LID practice.
- Present construction techniques to ensure proper performance.
- Review field testing to verify performance after specific construction milestones and when construction is complete.

## **Target Audience:**

Landscape and construction contractors; BMP designers including architects, engineers, and landscape architects; permanent stormwater BMP inspectors; MS4 managers/coordinators; stormwater maintenance personnel; property managers; homeowner's association managers; private BMP owners



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## ***Incorporating Green Infrastructure into Integrated Planning: Approaches and Tools to Achieve System Resiliency and Efficiency Workshop***

**Instructors:** Scott Struck, M.ASCE; Adrienne Nemura, P.E., M.ASCE; Andrea Braga, P.E., M.ASCE; Kevin Koryto, EIT, A.M.ASCE; Geosyntec Consultants, Inc.

**Purpose:** Municipalities engaging in integrated planning can leverage the multiple benefits of comprehensive solutions such as green infrastructure to address both wastewater and stormwater programmatic objectives. However, integrated planning efforts can be a daunting task due to a lack of precedent and uncertainty in approach and anticipated outcomes. This workshop geared towards municipal and design professionals, will provide attendees with and understanding of integrated planning approaches and tools to consider when thinking about whether an integrated plan is right for you.

**This interactive workshop will address the following:** Should integrated planning be pursued? The recently developed WERF interactive tool, Users' Guide for Integrated Planning for Wastewater and Stormwater, will be presented along with municipal examples to highlight critical considerations for communities considering integrated planning. How does green infrastructure fit into integrated planning? Achieving flood control and water quality benefits often requires thinking outside the realm of normal green only or gray only infrastructure approaches.

This portion of the workshop will provide municipal tools and examples to demonstrate the ways in which green infrastructure can be included into integrated plans to better achieve goals. How are disparate project types prioritized? A critical component of integrated planning is comparing project types that typically fall into separate capital improvement project silos. Examples of prioritization methodologies and available tools to compare flood control and water quality project benefits will be described with example municipal projects. Familiarity



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with multiple approaches and tools can help to justify selection of key projects for integrated planning acceptance.

**Who Should Attend:** Municipal and state officials; stormwater regulators; planners; environmental scientists; engineers; architects; and developers.



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## ***Municipal Stormwater Program Development Workshop***

**Implementing Green Infrastructure and LID isn't just about Construction: Developing a Green Infrastructure Focused Stormwater Program from the Beginning**

### **Instructors:**

Troy Dorman, PE; Jason Wright, PE; Jonathan Smith, PE; Mike Clar, PE; Kimberly Brewer, A.I.C.P.; Tetra Tech  
Karen Bishop, San Antonio River Authority Kevin Boyer, City of Raleigh

### **Purpose:**

Green infrastructure and Low Impact Development have been adopted by many communities and municipalities as an effective approach to stormwater management. The communities that have not adopted or integrated green infrastructure or LID into their stormwater programs are often encouraged to by local, state, and federal regulators. Even areas where there is not pressure or requirements from regulators, often the public, and even some developers, are encouraging municipalities to allow or support green infrastructure because of the economic and social benefits.

Effectively implementing green infrastructure at the municipal level requires much more than developing and adopting a design manual. Often there are barriers to implementing green infrastructure or LID in codes and ordinances, planning staff and plan reviewers require some knowledge of green infrastructure and LID practices, a foundation for maintenance will be necessary, and the local design community and contractors benefit from design aids and standard details.

This workshop will provide a comprehensive overview of tasks required to successfully and effectively integrate green infrastructure and LID into an existing stormwater program or to develop a new program.



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## These tasks will include:

**Development of an LID Ordinance:** The development and adoption of an LID Ordinance is the first step for a community that does not have an existing ordinance. The model LID ordinance written by the ASCE-EWRI LID will be the basis for the recommended language.

**Code and Ordinance review:** A review of development-related codes, ordinances, and policies to qualitatively assess the barriers posed by existing regulations that may hinder the use of green infrastructure at the municipal, neighborhood, and site levels. Typical barriers will be discussed along with recommended language and policies that could promote the use of green infrastructure.

**Incentives:** Even with changes in regulations and codes, it is often difficult to implement new programs. One method that may help encourage the use of green infrastructure or LID is to offer incentives. These incentives can take a variety of formats from credits to reduced time to receive a permit. A variety of potential incentives and methods to provide those incentives will be discussed.

**Operation and Maintenance:** For any system to function as intended, some maintenance will be required. Green infrastructure and LID practices often require a multi-disciplined approach to ensure effective and efficient maintenance. A framework for multiple departments, including public works and parks and recreation, to collaborate will help to make sure that the staff with the background, training, and experience most appropriate for the maintenance task is assigned to perform the required maintenance. A basic understanding of the routine, intermediate, and long term maintenance requirements will also be required to develop an efficient and effective maintenance program.

**Design Tools and Aids:** There are a variety of design and modeling tools available that can provide assistance to design engineers in meeting the regulatory requirements. An overview and discussion of these tools will give some examples of the design and decision support tools that are available. Standards details that can be adopted as official standards will be discussed along with fact sheets that can be used to provide general guidance to developers and municipal staff.



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**Training:** To effectively implement a successful green infrastructure or LID program also requires training of municipal staff, designers, and local contractors. This can include plan review, construction certification, and proper inspection and maintenance. Examples of training programs from municipalities across the country will be discussed including details of how the programs were implemented.

Case studies from municipalities across the country that are currently revising or developing their stormwater programs will be used to provide specific examples of ordinance language, barriers identified, incentives developed, tools adopted, and design aids that have been developed in San Diego, CA; San Antonio, TX; and Raleigh, NC.

### **Course Objectives:**

- Provide an overview of tasks and program elements that are required to develop an effective stormwater program that includes green infrastructure and LID concepts.
- Identify common barriers to green infrastructure and LID implementation.
- Provide common language for ordinances and to remove barriers.
- Review available design tools and aids to facilitate green infrastructure or LID implementation.

**Target Audience:** Municipal and state officials; stormwater regulators; planners; environmental scientists; engineers; architects; and developers.



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## ***Quantifying Stormwater Benefits of Urban Forest Systems Using Public-domain Software***

**Instructor:** Eric Kuehler, *USDA Forest Service*

**Purpose:** Urban forest systems are comprised of trees, shrubs, and soil collectively. These systems reduce significant amounts of stormwater runoff volume. Public-domain and on-line tools are available to help quantify the volume reduction by urban forests. This half-day workshop will demonstrate the use of these tools for estimating stormwater volume reduction, discuss the data needs for each tool, and review how the tools calculate these benefits.

### **Course Objectives:**

- To calculate stormwater volume reduction by trees using i-Tree Design, Eco, and Hydro.
- To create basic projects using on-line tools (i-Tree Design and Canopy).
- To demonstrate the functionality of the i-Tree Hydro and Eco GUI (graphic user interface).
- To identify the data needs for more robust, tree-related stormwater calculation tools using i-Tree Eco and Hydro.
- To discuss the calculations used by i-Tree Design, Eco, and Hydro to estimate stormwater runoff reduction.

**Who Should Attend:** Municipal stormwater planners, stormwater managers, design engineers, landscape architects, and developers.